3GPP TSG-RAN WG2 Meeting #117e Tdoc R2-22xxxxx

Electronical meeting, February 21st – March 3rd, 2022

Agenda: 8.14.3.2

Source: Ericsson

Title: Feature summary for 8.14.3.2

Document for: Discussion, Decision

# 1 Introduction

In this document the following offline is discussed:

* [AT117-e][046][QoE] Invited tdocs Open Issues (Ericsson)

Scope: Consider the invited input, and tdocs provided under 8.14.3.2 excluding issues handled in R2-2202878, or in the RRC CR, or under 8.14.4 or issues where we are still waiting for input from other groups (there is overlap in some tdocs). For the invited input and non-excluded contents, determine agreeable parts, discussion points and remaining open issues (if any). Determine need for LS outs if any.

Intended outcome: Report

Deadline: W1 Friday (for online CB W2 Monday).

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# 2 Discussion

## 2.1 Mobility for RAN visible QoE

The following proposals are related to mobility for RAN visible QoE:

* Agree to indicate explicit parameters for RVQoE during HO to RRC message relating mobility. e.g., report interval, buffer level and playout delay.[1]
* Discuss what other parameters should be indicated explicitly for RVQoE during HO.[1]
* RVQoE continuity is not supported during handover.[3]
* RVQoE is not supported when UE in RRC\_INACTIVE status in Rel-17.[3]
* The following mobility procedure could be applied to RAN visible QoE.[4]

- Upper layers are informed of the release of RVQoE measurements at RRCSetup during RRC re-establishment and RRC resume procedures.

- At Resume with delta configuration the network indicates possible differences to the RVQoE configurations.

- At mobility with fullConfig, RVQoE configurations should be explicitly provided to the UE. UE should release the stored RVQoE configurations.

* If the UE enters IDLE state, UE should release all of the RVQoE measurement configurations.[5]
* UE should release all of the RVQoE measurement configurations when resumes a gNB not the last serving gNB during RRC resume procedure.[5]
* UE should release all of the RVQoE measurement configurations during HO procedure.[5]
* UE should release all of the RVQoE measurement configurations when resumes a gNB not the last serving gNB during RRC resume procedure.[5]
* UE should release all of the RVQoE measurement configurations during HO procedure.[5]
* If the UE enters IDLE state, UE should release all of the RVQoE measurement configurations.[5]
* RAN2 to discuss whether solutions of legacy QoE mobility could be applied to RAN visible QoE and the specific aspects applied only for RAN visible QoE mobility.[7]
* RAN2 to discuss whether solutions of legacy QoE mobility could be applied to RAN visible QoE and the specific aspects applied only for RAN visible QoE mobility.[8]
* If RAN3 agrees propagation of RVQoE configuration, solutions of legacy QoE mobility are considered as baseline for RVQoE mobility.[8]
* If RAN3 disagrees propagation of RVQoE configuration, there is no need to support mobility for RVQoE. i.e., UE releases old RVQoE configuration when HO and RRC resume.[8]
* FFS for whether RAN visible QoE configuration can be propagated from the source to the target node upon mobility and during context retrieval.[8]
* The handling of QoE at mobility RAN2 has made for non-RAN-visible QoE is applied to RAN visible QoE also.[9]
* Wait for RAN3 to decide whether the RAN visible QoE configuration will be propagated from source gNB to the target gNB.[11]
* RAN2 to discuss whether solutions of legacy QoE mobility could be applied to RAN visible QoE and the specific aspects applied only for RAN visible QoE mobility.[11]
* we propose to allow the target/current serving gNB to indicate the RVQoE metrics to be applied in the RRCReconfiguration msg or RRCResume msg.[12]
* All the existing agreements of legacy QoE mobility can be applied to RAN visible QoE.[14]
* RAN visible QoE metrics configured at the UE are included in RRC container during the handover procedure. There are no further RAN2 impacts to support mobility for RAN visible QoE.[14]
* RAN2 to discuss whether solutions of legacy QoE mobility could be applied to RAN visible QoE and the specific aspects applied only for RAN visible QoE mobility.[16]
* Confirm the RAN3 assumption that the RAN visible QoE metrics configured at the UE is sent from source to target node during handover preparation.[16]
* Nothing new needs to be added in the inter-node message as the RAN visible parameters are part of the UE AS configuration.[16]

The legacy behaviour at handover is that source gNB forwards the UE configuration to the target gNB, which uses the source configuration as input when creating the target configuration in an *RRCReconfiguration* message. The target node decides whether to keep, release or modify the UE configuration. As QoE measurements are done in the application layer some additions related to release of the measurements in certain cases have been agreed and added in the RRC CR. These existing procedures seem to cover also RAN visible QoE at handover.

According to the latest RRC CR the UE stores the application layer measurement configuration in the UE Inactive context and uses the configuration again at resume. The network indicates possible differences in the *RRCResume* message. If “the application layer measurement configuration” includes RAN visible configuration, the existing RRC CR covers also the handling of RAN visible QoE in RRC\_INACTIVE. See RRC CR:

3> store in the UE Inactive AS Context the current KgNB and KRRCint keys, the ROHC state, the stored QoS flow to DRB mapping rules, the application layer measurement configuration, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the NR PSCell (if configured) and all other parameters configured except for:

According to the latest RRC CR the UE releases all radio configurations and the application layer measurements when entering Idle.

So, the proposals above seem to be covered already in the existing RRC CR and by legacy procedures.

Question 1: Do you think anything related to mobility for RAN visible QoE is missing in the RRC CR? If so, please indicate with a text proposal, if possible, of what is missing.

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | We can further check the running 38.331 CR on this part. |
| Nokia, Nokia Shanghai Bell | No | Agree with Huawei, that any potentially missing parts should result from 38.331 CR |
| Ericsson | No | Not that we see now, we will still review the RRC CR. |
| Apple | No |  |
| ZTE | No |  |
| Intel | No | RV QoE mobility should use the same principle as handover procedure for application layer QoE measurement. |
| CATT | No | We need revisit the CR after get RAN3 conclusion at this meeting on the mobility of RVQoE, for example, whether propagate the configuration |
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The following proposals are discussed as part of the RRC CR discussion or await RAN3 feedback:

* RAN2 to discuss the signalling design for RAN visible specific periodicity.[7]
* RAN2 to discuss the signalling design for PDU session ID.[7]
* In RAN visible QoE reports, the Buffer Level is reported as a single value, i.e. the last measured value of the Buffer Level.[16]

## 2.2 Pause/resume

The following proposals are related to pause/resume:

* Agree to Discuss on what scenario current Pause and Resume mechanism cannot fulfill for handover purpose according to the latest CR.[1]
* Discuss whether to add resumeReporting in AppLayerMeasConfig IE or reuse pauseReporting to indicate UE to resume QoE measurement.[1]
* Discuss whether and what other IE apart from resumeReporting could be considered to be add to AppLayerMeasConfig.[1]
* RAN2 confirms that the pause status information shall be added into the UE configuration and UE INACTIVE CONTEXT.[2]
* Target gNB decides whether to send the resume indicator to UE via RRCReconfiguration message after handover completion.[2]
* UE shall release the buffered QoE reports and release the paused status when UE switches to RRC\_INACTIVE status.[2]
* gNB should be able to pause all or resume part of QoE reporting during RRC resume.[4]
* During HO, source node uses pauseReporting in RRCReconfiguration in HandoverPreparationInformation to indicate pause status information to target node.[7]
* When UE goes to RRC\_INACTIVE, UE Inactive AS context includes the pause status information (i.e., pauseReporting).[7]
* During RRC resume, gNB uses pauseReporting in RRCResume to resume or pause QoE configuration.[7]
* Target gNB resumes or pauses QoE reporting during HO.[7]
* During HO, target node uses pauseReporting in RRCReconfiguration in HandoverCommand to resume or pause QoE configuration.[7]
* gNB resumes or pauses QoE reporting during RRC resume.[7]
* Whether and how the gNB resumes or pauses QoE reporting during HO and RRC resume[10]
* The target gNB can decide whether to pause or resume the QoE reporting based on its RAN status after receiving the HO request including QoE configuration.[10]
* As to whether and how the gNB resumes or pauses QoE reporting during HO, no extra stage 3 enhancement is needed from RAN2 perspective.[10]
* RAN2 to decide whether UE shall store the buffered QoE report when UE enters RRC\_INACTIVE.[10]
* The new gNB can decide whether to pause or resume the QoE reporting based on its RAN status after retrieving the UE context including QoE configuration.[10]
* Add the pause status indication in RRCResume message.[10]
* No additional specification changes are required to support handling of QoE pause/resume during HO and RRC resume.[13]
* The UE provides the gNB with QoE pause status to a (source) gNB when its AS buffer is approaching to full.[15]
* The QoE pause status report is passed in the HO to the target node.[15]
* When a UE with paused QoE configuration connects in a new cell (as a result of handover or RRC resume), unless the new gNB releases the QoE configuration, the UE sends any pending QoE reports to the new gNB when/if the new gNB resumes QoE reporting in the UE.[17]
* The UE AS does not forward a received indication to pause or resume RAN visible QoE reporting to the UE’s application layer.[17]
* The UE AS should discard RVQoE reports it receives from the UE application layer while RVQoE reporting is paused for the associated RVQoE configuration.[17]

Whether any pause indication needs to be added in the inter-node message is discussed as part of the RRC CR discussion. The pause indication is part of the UE configuration and is already part of the UE context stored in RRC\_INACTIVE, see extract in chapter 2.1. According to legacy behaviour, the target node decides the target UE configuration at handover and resume, see chapter 2.1.

RAN2 discussed the resume reporting indication in the last CR discussion and concluded that no separate indication for resume is needed.

In the RRC CR it is possible to pause or resume measurements by indicating the *measConfigAppLayerId* of the measurement(s) to be paused or resumed. The pause indication is included in the QoE configuration, which is included in *RRCReconfiguration* and *RRCResume*.

Remaining questions:

RAN2 agreed on a mechanism for pause/resume of QoE measurement reporting, but did not discuss pause/resume of RAN visible reporting. If nothing further is done, the gNB has the option to keep the RAN visible reporting during overload or to release the RAN visible measurements. No buffering will be done in the UE.

Question 2: Is there a need for pause/resume of RAN visible QoE reporting?

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | We think that RAN visible QoE is for real-time optimization purpose for network side. Pause/resume is normally applied when RAN overload happens, and container based QoE reports should not be sent in order to save the resources in Uu interface, however, we see some benefits of sending RAN visible QoE in this scenario:  (1) during RAN overload, user experience will be impacted, and RAN visible QoE reporting will help network timley adjust the scheduling  (2) the overhead of RAN visible QoE is very small, so the reporting of RAN visible QoE reports will not worsen the RAN overload status  In general, we support to let UE send RAN visible QoE reporting to the network even if pause/resume is received. If the network prefers not to receive RAN visible QoE reports during pause, they can be de-configured using existing signalling (i.e. no changes are needed). |
| Nokia, Nokia Shanghai Bell | No | The simple solution is that RVQoE follows the Pause Resume status of QMC with no dedicated handling of Pause/Resume specifically for RVQoE |
| Ericsson | No | We don’t think RVQoE should be paused. It is used for real-time information to the network, and if they cannot be sent real-time the UE doesn’t have to store them and send later as the information is anyhow old by the time of resume. |
| Apple | Yes | We think pause/resume for RVQoE should follow the same behavior as for QMC, no additional signalling is needed. If the RAN is experiencing overload, it may not be able to react to RVQoE anyways. Whether RVQoE reports should be stored or not during pause is a different question, and we would be OK to discard RVQoE during pause. |
| ZTE | Yes | Share the same view with apple.  In addition, there is a logic issue for whether to support pause/resume RVQoE reporting.   1. It is obvious that RVQoE reports are used to optimize the real time user experience. 2. Though there is no exactly definition on the RAN overload in RAN2. I think at least companies believe that when RAN overload occurs, the radio resource is not enough for all data transmission. 3. Hence, if a UE insists transmitting the RVQoE reporting data which shall be used to optimize the real time user experience during RAN overload time, the transmission behaviour will cause the worse condition. 4. From another hand, A gNB can receive RVQoE reports from different UEs during RAN overload period and gNB recognizes that a UE’s QoE is not good. How will the gNB optimize the UE user experience during the RAN overload? By using “*backup Uu resource*”?   One RVQoE report may be small enough, but considering multiple RVQoE reports can be transmitted simultaneously. In addition, it is reasonable to believe that more and more QoE metrics will be added into the RVQoE report. The report will be larger and larger. For future proof in next following releases and simplicity at current stage, we hope companies can support pause/resume RVQoE reporting. |
| Intel | Yes | First of all, the questions is ambiguous: whether it refers to “another pause/resume indication is needed for RVQoE reporting” or “RVQoE reporting needs pause/resume mechanism”.  Based on our understanding, in current RRC running CR, *pauseReporting* is included in *AppLayerMeasConfig* for each *MeasConfigAppLayerId*. Recalling the agreement in RAN2 #116bis-e meeting:   * [029] RVQoE configuration can share the same measConfigAppLayerId and service type RRC IEs with legacy QoE configuration.   The same pause indication for the corresponding *measConfigAppLayerId* can be used for both application layer QoE and RVQoE.  Additionally, we don’t see a reason why RV QoE should still be reported to RAN during RAN overload situation, as RAN is already overloaded. |
| CATT | Yes | Share with ZTE.  Use the same pause indication for legacy QoE and RVQoE is simplest solution. |
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Question 3: According to current RRC CR, if the network pauses the (legacy) QoE measurements and does not resume before any change of state, the UE will store the reports when in RRC\_INACTIVE and discard the reports when entering RRC\_IDLE. Is this the desired behaviour? Should the UE store the reports (for a while) also in RRC\_IDLE?

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | We think that the UE is only required to store and transmit QoE reports in RRC\_Connected state, and the UE is not required to do so in other states. |
| Nokia, Nokia Shanghai Bell | No | We think it is desired behaviour agreed according to WI objectives (no support for RRC Idle) |
| Ericsson | No | We think the existing behaviour is sufficient for now. |
| Apple | No | QoE reports only need to be stored during Connected. If the UE transits to idle/inactive during pause, the reports should be discarded. |
| ZTE | No | Share the same view with above companies. |
| Intel | Yes for the 1st question  No for the 2nd question | We have agreed during RRC\_IDLE, all QoE measurements and configurations will be discarded.   * If the UE enters IDLE state, UE should release all of the QoE measurement configurations.   We don’t think there’s a need to specify special behaviour for pause during RRC\_IDLE. |
| CATT | No | We just support storing the report in RRC\_connected state |
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Question 4: Should the UE indicate to the network when the memory for storing the QoE reports are about to become full?

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | We do not think we need to have optimizations for such cases. |
| Nokia, Nokia Shanghai Bell | No | We are fine to keep the mechanism simpler |
| Ericsson | No | Not needed for now. |
| Apple | No | It can be left to UE implementation how to deal with this |
| ZTE | No | Based on UE implementation. |
| Intel | No | It was agreed in RAN2 #116bis-e meeting, UE will handle how to discard extra QoE paused measurement by implementation:   * At RAN overload scenarios, when the memory reserved for the QoE paused measurements becomes full, the UE is allowed to discard extra QoE paused measurements report. The action of how UE AS layer discards extra QoE paused measurements report is based on UE implementation.   Therefore, network doesn’t need to know whether UE has discarded any QoE report, or the buffer is about to become full. It can be handled by UE implementation by discarding reports if the buffer is full. The network will receive and process whatever it receives from UE as QoE report. |
| CATT | No | left to UE implementation |
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Question 5: Is there any more question related to pause/resume which is not covered in the RRC CR already and not handled in any discussion yet? If further questions are added, other companies are kindly asked to provide comments to the added questions.

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## 2.2 Session start indication and remaining AT-commands

The following proposals are related to the session start/stop indications:

* The QoE measurement session start indication and session end indication should be sent to RAN from UE via report message e.g. MeasReportAppLayer.[5]
* gNB needs to know the QoE configurations for which there are ongoing QoE sessions, e.g. to enable QoE configuration handling upon mobility (pending SA4 reply on the ongoing QoE measurement session continuity requirement).[5]
* Source gNB can send QoE measurement session start indication to target gNB during HO procedure or RRC Resume procedure to inform which QoE measurement session is ongoing.[5]
* Use *UEAssistanceInformation* on SRB1 to send session start or end indication.[6]
* RAN can indicate to UE which QoE configurations require MDT-QoE alignment, and UE only needs to consider these QoE configurations to send session start or end indication.[6]
* UE does not send redundant session start indication to gNB; UE does not send session end indication if there is an ongoing session for a QoE configuration requiring MDT-QoE alignment. Details are FFS.[6]
* Add the QoE session status indication in the RRC container of HANDOVER REQUEST.[11]
* Add the QoE session status indication in the RRC MeasurementReportApplayer.[11]
* RAN visible QoE measurement can share the same status indication with legacy QoE measurement.[11]
* During a handover, source gNB informs target gNB about the QoE measurement sessions which are ongoing at the UE (based on the session start indication received from the UE).[13]
* Send an LS to RAN3 asking them to introduce “session ongoing indication” in XnAP signalling.[13]
* RAN2 to discuss the need to inform CT1 and SA4 about the RAN3 requirement to:[15]
  + identify or specify QMC session start and session stop in NR,
  + forward QMC session start and session stop to access stratum.

The session status indication is part of the open issue discussion and will be discussed in the online session. However, there seems to be a need to inform other working groups of the indication, assuming RAN2 makes some agreements related to it.

Question 6: Which working groups need to be informed of possible RAN2 agreements related to session start/stop indication? What information does RAN2 need to include in the LS in such case?

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| **Company** | **Comments** |
| Huawei, HiSilicon | After RAN2 makes decision on the session start/stop indication, RAN2 can send a LS to CT1 (cc SA4) for their further work (they need to specify how the application layer informs AS layer about the session start/stop). |
| Nokia, Nokia Shanghai Bell | After RAN2#117 agreement:   * Indication of Session start/stop is configurable per QoE configuration.   We send LS, primarily to request SA4 and CT1 to take into account, and feedback if there are concerns.  We believe the question is not valid |
| Ericsson | Need to send LS to CT1 and SA4 about the session start/stop indication and that it is configurable by the network. |
| Apple | We have already decided to send LS to CT1 and SA4. |
| ZTE | Send LS to CT1 and SA4. |
| CATT | Send LS to CT1, SA4.and SA5 |
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CT1 were asked to implement AT-command in LS R2-2202017. AT-commands for session start/stop indications are discussed in question 6. CT1 also needs to be informed of RAN visible parameters, but RAN2 is waiting for feedback from RAN3 related to RAN visible parameters.

Question 7: What is a suitable way of informing CT1 of AT-commands for RAN visible parameters?

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| **Company** | **Comments** |
| Huawei, HiSilicon | We think that RAN2 can firstly get RAN3/SA4 confirmation regarding RAN visible parameters, and secondly RAN2 can summarize a whole picture (configuration and reporting) and then let CT1 know. |
| Nokia, Nokia Shanghai Bell | In our understanding RAN2#116 meeting we agreed to wait for further SA4/RAN3 progress on the RAN visible parameters. RAN2 gave the assumptions |
| Ericsson | We have some concerns that it will be late to send an LS to CT1 in the May meeting with more AT-commands. Perhaps an e-mail discussion between RAN2#117 and the next meeting is needed to agree on an LS to CT1. |
| Apple | OK to wait. |
| ZTE | OK to wait. |
| CATT | OK to wait. |
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## 2.3 Mobility and remaining proposals

The following proposals related to QoE mobility are treated in the open issue discussion:

* Lossless handover for QoE data should be supported.[4]
* RAN2 discusses the following two alternatives to support lossless handover for SRB4. And Alt 1 is preferred for easy standardization.
  + Alt 1: Apply current lossless handover mechanisms (i.e. retransmission, data forwarding, SN status transfer etc.) to SRB4.
  + Alt 2: Introcude retransmission mechanism in RRC layer for SRB4.[4]
* In case of RRC segmentation applied for MeasReportAppLayer message, the source gNB should forward the received RRC segments in RRC layer to the target gNB.[4]
* UE should perform retansmission or transmission of unsuccessfully transmitted RRC segments of MeasReportAppLayer to the target gNB.[4]

In RAN2#116bis, RAN2 discussed and agreed on open issues related to mobility. The agreements cover resume, re-establishment and handover with both delta and legacy configuration. There does not seem to be a need to further discuss it as solutions have already been implemented in the RRC CR. The agreements relate to the following proposals:

* UE should keep QoE configurations when initiating RRC re-establishment procedure.[4]
* Network can re-establish or resume QoE related context using RRC reconfiguration procedure after successful completion of the RRC re-establishment procedure.[4]
* The indication for target gNB to indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure should be in the granularity of per QoE configuration.[5]
* At Resume/handover with delta configuration, the gNB indicates possible difference to the QoE configuration including QoE pause.[9]
* At Resume/handover with fullConfig, UE releases all configured QoEs both in AS layer and in application layer, and apply the new QoE configuration, if any, according to the legacy full configuration.[9]

The following proposals relate to handling of SA4 requirements related to mobility. It is the understanding that these will be handled when SA4 has replied to the LS:

* RAN2 discusses whether to consider the case that multiple QoE sessions running for one QoE configuration. [4]
* If considering multiple QoE sessions running for one QoE configuration, solution of RAN-released with session start/stop indication does not work and should not be atopted for area scope control. [4]
* QoE configuration can be kept in the UE and network side when UE moves outside of area scope, and it is up to network whether to release or keep the QoE configuration. [4]
* UE should be notified whether to move outside of area scope. [4]
* RAN2 discusses which option of the following ones can be atopted to notify UE outside of area scope. [4]

1) Send area scope to the UE by application layer or RRC layer, UE checks whether moving outside of area scope.

2) RAN sends outside of area scope indication to UE during handover.

* Send LS to RAN3 and SA4. [4]

The following proposal will be discussed as part of the UE capability discussion:

* RAN2 can discuss how AS layer obtains application capability.[7]

Question 8: Is there any remaining question that needs to be discussed as part of this discussion? If further questions are added, other companies are kindly asked to provide comments to the added questions.

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# 3 Summary

TBD

# 4 References

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