3GPP TSG-RAN WG3 #114-e R3-216137

Online, 1st – 11th Oct 2021

Agenda Item: 15.3

Source: Qualcomm Incorporated (moderator)

Title: SoD on CB: # QoE5\_RAN Visible

Document for: Approval

# Introduction

**CB: # QoE5\_RANVisible**

**- Further discussion on RVQoE metrics and other open issues**

**- QoE value based solution?**

**- QoE information should be transmitted on F1 for scheduling purpose? F1 impact?**

**- TPs if agreeable**

**- Capture agreements and open issues**

**- LS to other groups?**

(Qualcomm - moderator)

Summary of offline disc [R3-215869](https://qualcomm-my.sharepoint.com/personal/shakrish_qti_qualcomm_com/Documents/Desktop/Dropbox/Pentari%20Systems/RAN3/114-e/CB/CB%20%23%20QoE5_RANVisible/Inbox/R3-215869.zip)

# For the Chair’s Notes

**(BL** **CR for TS 38.473**) R3-215547 rev in R3-216040 rev in R3-216144

(**LS to SA4**) R3-216135 Support for RAN visible QoE metrics

(**LS to CT1**) R3-216136 Support for RAN visible QoE measurements

(**LS to RAN2**) R3-216138 RAN3 agreements on RAN visible QoE

**RVQoE metrics**

Interaction latency or comparable quality viewport switching latency metric is NOT considered as a RAN visible QoE metric in Rel-17

Buffer level is confirmed as a RAN visible QoE metric for DASH and VR service types

Playout delay for media startup is confirmed as a RAN visible QoE metric for DASH and VR service types

**RVQoE configuration**

In split gNB architecture, gNB-CU should generate the RAN visible QoE configuration.

RAN Visible QoE and legacy QoE can be configured together or separately. In case RAN visible QoE is configured separately, it can be configured only after configuring legacy QoE.

NG-RAN can release a list of RAN visible QoE configurations while not releasing the corresponding legacy QoE configurations

If the legacy QoE configuration is released, the corresponding RAN visible QoE configuration is released as well

RAN visible QoE configuration can include at least the RAN visible QoE metrics to be reported, service type and a measurement ID for the RAN visible QoE. Whether existing IEs can be reused for service type and measurement ID and the signaling design is up to RAN2

There is no need to consider Start Time, Duration and Sample Percentage in the RAN Visible QoE configuration in Rel-17

**RVQoE reporting**

RAN3 should discuss whether the existing identified RAN visible QoE metrics (or values if agreed) justifies the need of a separate reporting periodicity for RAN visible QoE

RAN3 should discuss whether having a different reporting periodicity for RAN visible QoE is independent of the RAN2 decision on which SRB to use for RAN visible QoE

Send an LS to SA4 checking the feasibility of supporting a different reporting periodicity for RAN visible QoE metrics, from the application perspective.

**Misc proposals**

NG-RAN can configure RAN visible QoE for only a subset of those metrics which are already configured as part of legacy QoE configuration.

WA: The OAM sends a list of the available RAN visible QoE metrics to the RAN node, outside the legacy QoE configuration container.

WA: If the legacy QoE configuration is paused/resumed, the corresponding RVQOE configuration is paused/resumed as well

The details of alignment between radio-related measurements and RVQoE measurements can be discussed post progress on the corresponding topics for the legacy QoE.

Introduce a new class-1 message for QoE information transfer over F1. Stage-3 IE details can be FFS.

**Liaison statements**

Send an LS to SA4/CT1 informing about our agreements on RAN visible QoE metrics requesting them to provide the necessary specification support.

Send an LS to RAN2 capturing all the latest agreements on RAN visible QoE.

**To be continued:**

FFS whether to include stalling related events during an application session (e.g., number of stalling occurrences) as part of RAN visible QoE. FFS how this is indicated e.g., by counting how many times a stop reason is specified as "rebuffering" in Play List or via indicating Buffer Level as 0. FFS whether to consider this under RAN visible QoE metrics or values.

FFS whether and how to support RAN visible QoE values. If supported, the following is to be clarified:

* **Granularity**: Whether the RAN visible QoE value is calculated based on measurements of multiple metrics or per metric
* **Definition**: Whether the RAN visible QoE value is an objective/qualitative representation of QoE metrics (e.g., on a score of 0-10, poor/medium/good) or derived information from QoE metrics (e.g., the number of stalling events, buffer level alarm)

FFS which entity (UE or NG-RAN or MCE) should generate the RAN visible QoE values

FFS whether the calculation of RAN visible QoE values is pre-defined in SA4 specifications in case it is agreed that UE has to report the RAN visible QoE values

FFS whether NG-RAN can configure a threshold/target for RAN visible QoE values, only upon crossing which UE would report the RAN visible QoE values.

FFS whether to define event triggers in RAN visible QoE configuration.

FFS whether RAN visible QoE and legacy QoE can be reported separately or should be always reported together. Note: This depends on whether a separate reporting periodicity is agreed to be defined in RAN visible QoE configuration.

FFS whether to include any PDU/DRB/QoS flow information in RAN visible QoE report. It is to be clarified whether the Application layer is to be aware of DRB/PDU session ID/QoS flow ID and whether the UE AS needs to be aware of the mapping between an application session pertaining to the QoE reference, and a DRB/PDU session.

FFS whether the RAN visible QoE configuration can be propagated from the source to target node upon mobility and during context retrieval.

# Round-2 Discussion

## Any Comments on proposed agreements?

Please let me know if have any concerns on the proposed agreements or any rewording proposed or any other efficient way forward for any of the specific proposals.

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| **Company** | **Comment** |
| Samsung | We are fine with the agreements proposed by moderator, but we have comment on the following proposal which is not included in the summary.  **Moderator Proposal 6:** The RAN visible QoE report can be signalled from the target to the source node after a successful handover.  Companies’ views are split on this:   * Yes (7/10) * No (2/10) * Not sure (1/10)   No consensus. This can be discussed together with Proposal 19. We already have an FFS from last meeting. No need of a new Proposal.  As moderator summarized, we’ve been discussing this proposal for two meetings, and majority of companies including all the operators said yes. Only 3 companies said no or not sue, but their arguments are not technical issue (e.g. discussed in other WI, related to QoE configuration, or can discuss later).  To make some progress, we think it can be a WA:  WA: The RAN visible QoE report can be signalled from the target to the source node after a successful handover |
| Nokia | Concerning Samsung's comment above on: **Moderator Proposal 6:** The RAN visible QoE report can be signalled from the target to the source node after a successful handover.  We would like to clarify our comment that this functionality is not required in a basic framework. The corresponding signalling may not be straight-forward, taking into account that the RVQOE report may arrive with quite some delay to the target node, typically after the source node has released the UE context. We therefore believe we should focus on the essential mechanisms in Rel-17. |
| **Huawei** | **See comments in the email body.**  ***Moderator: Copied comments from email body***  ***Proposal 4:*** *WA: Stalling related events during an application session (e.g., number of stalling occurrences) can be captured as part of RAN visible QoE. FFS how this is indicated e.g., by counting how many times a stop reason is specified as "rebuffering" in Play List or via indicating Buffer Level as 0. FFS whether to consider this under RAN visible QoE metrics or values.*  *[XD] for this one, we would like to keep the whole proposal as FFS. Seems companies think that stalling is caused by radio transmission, but it is actually questionable…*  ***Proposal 25:*** *Agree R3-215547 rev in R3-21xxxx to introduce a new class-1 message for QoE information transfer over F1. Stage-3 IE details can be FFS.*  *[XD] in general fine, but we have some comments to the draft CR, reflected in the SOD* |
| Qualcomm | Regarding Moderator Proposal 6, although we agree that this topic has been discussed last few meetings, we are OK to discuss this again next meeting together with Proposal 19 as per the moderator’s suggestion.  Regarding Huawei’s comment on Proposal 4, its not clear what is meant by “***Seems companies think that stalling is caused by radio transmission, but it is actually questionable***” 🡪 Can you please clarify which comment is being referred to?  [Huawei reply to QC]: What I meant was, since visible is for the RAN to evaluate and optimize the radio resource usage/scheduling, now if we would like to have stalling visible, my question is, how this stalling could be used by RAN, because stalling could be caused by different reason, even human intervention. Not sure if I made me clearly understood. |
| **China Unicom** | For proposal 19, according to the LS feedback from SA2 and SA4:  *in S2-2106537: In the current mechanism for mapping applications to PDU sessions and slices, when an application requests one or more connections, URSP rules configured in the UE are used to select which PDU session(s) should be used for the application by determining the DNN and the S-NSSAI. This could result in using one (or more) existing PDU session(s) or requiring the establishment of one (or more) new PDU session(s).*  *in S4-211225: The MSH and the MTSI client are able to identify the PDU session and the corresponding S-NSSAI and DNN*  I think the Application layer is aware of PDU sessions and slices, so when it need to report QoE reporting, it can use PDU session and UE application layer ID together with RAN visible metrics, and UE AS is no need to know the mapping between an application session to a DRB/PDU session, just need to transfer the PDU session and UE application layer ID and RVQoE metrics to gNB. gNB can get the mapping for PDU session to DRBs/QoS flows.  **Moderator reply: Agree, but not all companies might be sharing this understanding. So, we propose to discuss this next meeting**  For proposal 20, “What to do with source RVQoE configuration if target node also generates its own RAN visible QoE configuration” I think if proposal 22 can reach consensus, a list of the available RAN visible QoE metrics from OAM need to be transferred to target node in the following scenarios:  1) s-based QoE mobility.  2) m-based QoE mobility, when move out of the area scope.  **Moderator reply: We can first focus on Proposal 22.** |
| **Moderator** | Other comments copied from email thread:  **ZTE**: Agree with HW that QoE value can be kept as FFS in the CR  **Nokia**: My feeling is that it would also be better to keep the DRB list in the message, with an FFS of course. If the DU only receives the UE id, the solution will address the scenario of single DRB per UE but once you have more DRBs the DU will easily get stuck. So keeping the DRB list with FFS will serve as a reminder that more discussion or a solution for multiple DRB case is needed.  **Samsung:** To Nokia, I agree with you, DRB list should be included in the message, otherwise the gNB-DU will not know which DRB should be improved if there're multiple DRB for a UE. If no objections, I'll update it later. If there's no consensus reached on the generation and definition of the QoE values in WI phase, I'll not include QoE value in CR, anyway, the whole stage 3 is FFS, we could introduce QoE value in the next meeting if the solution is clear. |
| **ZTE** | For proposal 3,   * Playout delay for media start-up: Yes (6/9), No (2/9), Not sure (1/9)   We suggest this can be left as FFS. As we commented in the first round, using playout delay as a time budget constraint for scheduling is not suitable and also of high risk due to various DASH client implementations.  For Samsung’s comment on Proposal 6.  We are still not sure about how the RVQoE report can be used by RAN after UE has moved to another node. Could Samsung or other companies provide more clarification or talk more specifically about it? |

## Work plan for 2nd round

Moderator proposes the following work plan to have draft TPs/LSs ready so that companies can take a look before the online time.

1. (TP to 38.473) **Samsung** to provide the revision of R3-215547 based on current agreements (remove QoE values, DRB ID as they are still FFS)
2. (LS to CT1/SA4): **Ericsson** to provide draft LS based on Proposal 26

Please let me know is you have any concerns

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| **Company** | **Comment** |
| Samsung | The revision is uploaded with below changes.   * Remove “QoE values” and “DRB ID” * Add “FFS” above the stage 3 IE   For the LS to CT1/SA4, we should also check whether application can support two different reporting periodicities as we commended in 3.4. |
| **Huawei** | **We think QoE values should be kept, actually we already agreed to introduce values, further discussions are about what kind of value and which entity to generate…** |
| Qualcomm | **Regarding Huawei’s comment**: Although we have discussed RVQoE values in the SI phase, I don’t think we have any agreement yet in the WI phase. We have identified a lot of FFSs concerning RVQoE values only this meeting. So, prefer to not include it yet as part of the F1AP CR. |
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## Security concern on Proposal 22?

In 1st round, one company had the comment that “*Is there a security issue as NG-RAN is informed which legacy QoE metrics were configured by the OAM inside the QoE configuration container? (e.g., that OAM configured QoE metrics 1 and 2 in the above example)”*. Currently OAM configured legacy QoE metrics (i.e., the XML file) is not readable by NG-RAN (not sure if its security protected). But can companies clarify if there is a security issue in NG-RAN knowing what legacy QoE metrics are configured at the UE?

If there is no security issue, can we turn Proposal 22 into an agreement (after removing the FFS part)?

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| **Company** | **Comment** |
| Samsung | We also would like to know what the security issue is and why proposal 22 is needed, in our views, even the QoE metrics are in a Container from OAM, they are still can be readable by NG-RAN as XML is a standard format. NG-RAN can generate reports (e.g. cell trace, UE trace) in XML format, why it can not read a file in XML format?  So we agree NG-RAN configures RVQoE for only those metrics which are configured as part of legacy QoE configuration, but we don’ t think the OAM indication to NG-RAN is needed. |
| **Huawei** | **If there is security issue, then we may not need this mechanism at all? Maybe companies could elaborate a little bit more on the issue. Is this a security issue that the explicitly indicated metrics could be different from the ones contained in the XML file?** |
| Qualcomm | We raised the security concern; not sure if it’s a valid concern yet (checking internally with SA3 colleagues). Wanted to check with other companies if they see a concern in exposing OAM configured legacy QoE metrics to the NG-RAN (till now the legacy QoE metrics configured to UE are only included within the XML container and not exposed to the NG-RAN).  Regarding Samsung’s comment, I think the QoE configuration container, even if readable by some NG-RAN implementations, might not be (or is not mandated to be) decodable by all. If we assume the XML container is decodable, then we don’t even need the concept of RVQoE. |
| **ZTE** | Security issue needs to be discussed in SA3. |

**Moderator summary:** No clarity yet on whether it is a valid security issue**.**

## Proposal 16/17/18

The following has been proposed by the moderator:

**Proposal 16:** RAN3 should discuss whether the existing identified RAN visible QoE metrics (or values if agreed) justifies the need of a separate reporting periodicity for RAN visible QoE

**Proposal 17:** RAN3 should discuss whether having a different reporting periodicity for RAN visible QoE is independent of the RAN2 decision on which SRB to use for RAN visible QoE

**Proposal 18:** FFS whether RAN visible QoE and legacy QoE can be reported separately or should be always reported together. Note: This depends on whether a separate reporting periodicity is agreed to be defined in RAN visible QoE configuration.

In order to make progress on the FFS in Proposal 18, it is proposed to discuss P16 and P17 so that RAN3 can have a common understanding and make an informed decision upon receiving the reply LS from RAN2 on the SRB to use for RVQoE report.

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| **Company** | **Comment** |
| Samsung | From the use cases perspective, we think it is possible that RAN visible QoE can be reported separately from legacy QoE. But from technical point of view, we are not sure whether application support two different reporting periodicities, we should check this with SA4 |
| **Huawei** | **Pure technically, UE AS layer could buffer the metrics, then to report at different time, but not sure what are the benefits?** |
| Qualcomm | Sure, we can check with SA4 whether application can support two different reporting periodicities. But before that, we want to understand whether the RVQoE metrics identified so far (e.g., buffer level, playout delay for media startup) even demands a QoE aware real-time use case and thereby requiring a different periodicity.  In our view, the identified QoE metrics still are catered more towards a non-real time optimization, thereby not needing a separate reporting periodicity. |
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**Moderator summary: Not much discussion. Can be continued next meeting**

## Any other comments

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| **Company** | **Comment** |
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# Round-1 Discussion

## RVQoE metrics

The following RVQoE metrics were discussed in the contributions referenced within and support or not was mentioned.

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| **RVQoE metric** | **Positive** | **Negative** | **FFS** |
| Buffer Level | [1], [3], [7] |  | [10] |
| Play List (simplified version) | [1], [7] | [3], [10] | [12] |
| Playout Delay for Media Startup | [1], [3] |  | [10], [12] |
| Buffer level alarm | [1] |  |  |
| Interaction latency or Comparable quality viewport switching latency metric | [7] | [1], [3] | [12] |

Also [6] proposed that further RAN3 discussion on RVQOE metric definition will need to wait for RAN2's reply. Further, buffer level alarm is considered as part of RVQoE values (see section 3.2.3).

Considering those metrics which received most positive and least negative votes during contribution, the following is proposed:

**Moderator Proposal 1:** Buffer level and Playout delay for Media startup is considered as RVQoE metric for DASH and VR service types

**Moderator Proposal 2:** Interaction latency or comparable quality viewport switching latency metric is not considered as RVQoE metric in Rel-17

**Companies are requested to provide their inputs on the following:**

**Q1: Whether Moderator proposal 1 and 2 are acceptable? If not, please provide your concerns**

**Q2: Whether a simplified version of playlist (e.g., when video representation changes or when stalling occurs) should be considered as RVQoE metric? If yes, please address concerns raised in [3] that this event might happen too often and might cause a lot of overhead**

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| **Company** | **Responses to Q1 and Q2** | **Comment** |
| Qualcomm | Q1 – Yes  Q2 - No | Q2 – Could be too frequent (e.g., wouldn’t video representation change quite often, say from 1080p to 720p) and might cause a lot of overhead |
| Huawei | Q1- In general yes, but,  Q2- not sure | Q1: Ok to Buffer level; not sure to Playout delay for Media startup, can companies further explain the benefits to RAN; According to the discussion in [3], the company think “RAN node can leverage this as a time budget to deliver the requested content without video stalling, while, at the same time, not over-allocating the precious radio resources to that service “. But in our understanding, this metric is used to indicate the playout delay for the previous media start-up. The RAN does not know when the next media start-up will happen and does not know when to use this metric. Not sure how the RAN use it.  Q2: not sure. We need to understand why this simplified version of playlist would helpful for RAN’s resource optimization…According to the discussion in [1], the company think “a simplified version of the playlist, e.g., an indication from the application to the access stratum whenever the video representation switched to a lower quality or the video stalls, would be suitable”. But we does not see how the RAN use it. According to the discussion in [7], the company think the simplified version of playlist is the non user actions such as rebuffering. In our understanding, the rebuffering can be indicated by the buffer level (i.e the buffer level is 0) |
| TMUS | Q1: Yes  Q2: No strong view |  |
| Samsung | Q1-yes.  Q2-yes | In [7], the intension is trying to use simplified version of playlist to calculate the stalling event, as the number of stalling occurrences may be calculated by counting how many times a stop reason is specified as "rebuffering", and we think the stalling is a very important metric directly reflects UE’s experience, if the gNB finds a very critical service has a lot of stallings recently, it can consider schedule the DRBs for this service with higher priority so that to improve UE experience. |
| ZTE | Q1:  Proposal 1, No, but;  Proposal2, yes.  Q2: No | Q1: for Proposal 1, we think the benefit of introducing Buffer level /Playout delay is not clear. As discuss in our R3-215644, introduction of buffer level may cause unfairness for users and using Initial Playout Delay as a time budget constraint for scheduling is not suitable and also of high risk due to various DASH client implementations. But in order to make progress, we can accept introduction of buffer level .  Q2: it is difficult for RAN to evaluate the user experience based on this play list, either the “full” version or the “simple” version. |
| CMCC | Q1: Yes  Q2: Yes but | Q1: We are supportive to introduce Buffer Level as RVQoE metric.  Q2: As commented by Samsung, such simplified version of playlist is mainly used for calculating stalling occurrence, then why not we could just make the calculation at UE APP, and send the stalling count result to NG-RAN directly, which may save overhead dramatically. |
| **Ericsson** | Q1: Yes  Q2: Yes | Regarding the **concerns on buffer level**: we think that its reporting **will not cause unfairness.** The reports will be analyzed by AI/ML algorithms, which are not naïve (so that they would cause unfairness) and will be used to optimize the experience, on both network and individual level.  Regarding the **concerns on startup delay for media playout:** in our view, **long delay for startup is one of the most irritating things** a user can experience. The RAN can use it to realize how to handle media start-up, e.g., whether to “reserve” some resources in advance for (a small number of) future sessions. Anyway, we should not discuss scheduler implementations.  Regarding the **concerns on simplified version of playlist:** are the opponents claiming that **stalling events are not of interest?** We think that stalling is also one of the most irritating events for the end user. Please note that streaming will constitute most of network traffic for a long time to come. If RAN understands that video stalled, it can change scheduling policy, set up CA/DC or even change the number of MIMO layers. Finally, **indicating presence of stalling can be made simple**, e.g., by a binary flag. |
| CATT | Q1:yes  Q2: not sure | We support Buffer level and Playout delay as the start of metrics analysis. |
| Nokia | Q1:  P1: no  P2: yes  Q2: No, offline measurement is sufficient | We are not convinced that AIML can magically solve the mentioned concerns related to unfairness… Some kind of standardized tests/certification of the reported information could be more helpful if we talk about applications deployed for the general public use. Playout delay is an E2E metric and we expect it will mainly reflect resource setup latency at the server side. Playout delay will also be reported as a non-real time metric, and it is not obvious to us how the RAN can identify the media start-up phase based on the received report. And anyway it will be too late - which means that the information could as well be collected by the MCE and sent back to RAN from OAM. Also, RAN-induced delays can be optimized by monitoring the DL PDCP buffer.  On Q2: We believe that stalling information can be used to fine-tune a mechanism for mitigation of high delays in the RAN (leading to stalling), but this sounds more like an activity to be done during feature deployment so offline measurement / OAM configuration seems OK. |

**Moderator Summary:**

* Interaction latency: Yes (0/9), No (9/9)
* Buffer Level: Yes (8/9), No (1/9)
* Playout delay for media start-up: Yes (6/9), No (2/9), Not sure (1/9)
* Simplified Play List: Yes (3/9), No (3/9), Not sure (2/9), No strong view (1/9)

No company showed interest to support Interaction latency in Rel-17, so the following is proposed to be agreed.

**Proposal 1:** Interaction latency or comparable quality viewport switching latency metric is NOT considered as a RAN visible QoE metric in Rel-17

Regarding **Buffer Level,** it was claimed that the introduction of buffer level may cause unfairness for users for which one company replied this won’t be much of an issue with AI/ML algorithms. Another company also said some kind of standardized tests/certification of the reported information would be needed for applications deployed for the general public use.

**Moderator’s view is** that the testing/certification are not in the scope of RAN3 and since majority of the companies (including 1 company who had concerns on unfairness accepted to consider buffer level), it is proposed to support buffer level as a RVQoE metric.

**Proposal 2:** Buffer level is confirmed as a RAN visible QoE metric for DASH and VR service types

Regarding **Playout delay for media startup,** one company claimed that it might not be suitable due to various DASH client implementations, one company pointed out that Playout delay will be a non-real time QoE metric and that RAN can’t do any real time optimizations and instead proposed MCE to indicate this to NG-RAN. Once company clarified the use case further that this QoE metric can be used by NG-RAN to decide whether to “reserve” some resources in advance for (a small number of) future sessions and that we should not discuss scheduler implementations.

**Moderator’s view** is that RVQoE is not just limited to real-time use cases and also enables a mechanism to expose QoE metric to NG-RAN (without the need of NG-RAN implementation to read the XML QoE report or indications via MCE). Considering this use case has been clarified further, it is proposed to take this up also for agreement.

**Proposal 3:** Playout delay for media startup is confirmed as a RAN visible QoE metric for DASH and VR service types

Regarding Play List (simplified version), 1 company showed concern on frequency of video representation changes leading to Uu overhead, 1 company mentioned that the optimization to handle delays due to stalling could be done via offline measurements, 1 company questioned how NG-RAN can even use this. Whereas several supporting companies mentioned the need to support some stalling related information e.g., the number of stalling occurrences

Considering there is interest on capturing stalling related information, **moderator’s view** is that maybe we could compromise to limit Play List to the Stall related counts or occurrences and not consider video representation changes etc. and have the following working assumption.

**Proposal 4:** WA: Stalling related events during an application session (e.g., number of stalling occurrences) can be captured as part of RAN visible QoE. FFS how this is indicated e.g., by counting how many times a stop reason is specified as "rebuffering" in Play List or via indicating Buffer Level as 0. FFS whether to consider this under RAN visible QoE metrics or values.

## RVQoE values

**[10], Proposal 1**: To introduce RAN-visible QoE values to indicate the quality of the ongoing service, where QoE values could be a number range, e.g, 0 to10. where 10 represents excellent quality and 0 represents poor quality, or QoE values could be an enumerated type to indicate the quality, e.g, (poor, medium, good). RAN can receive RAN-visible QoE values for UE or QoE server.

**[3], Observation 1**: Defining a buffer level alarm indication instead of reporting an absolute buffer level seems to be under the scope of RVQoE values where UE can represent qualitative representation of RVQoE metrics.

**[3], Proposal 2:** The discussion on whether to define a buffer level alarm should happen under RVQoE values as this is a qualitative representation of a RVQoE metric and not an absolute value.

**[3], Observation 6:** Qualitative representation of QoE metrics in terms of a numerical value or an objective representation requires a model/function to be defined for each RAN visible QoE metric

### Whether to support RVQoE values

**Q3: Should RVQoE values be supported in addition in RVQoE metrics? If yes, which out of i) and ii) should be considered?**

1. **Qualitative representation of QoE metrics in terms of a numerical value e.g., 0 to 10**
2. **Objective representation of QoE metrics e.g., poor, medium, good**

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| **Company** | **Yes/No**  **(If yes, which out of i) and ii))** | **Comment** |
| Qualcomm | Depends on Q4 | We can first discuss Q4 i.e., who generates the RVQoE values (UE or NG-RAN). If NG-RAN generates the RVQoE value, we are OK to support both i) and ii) |
| Huawei | Yes | We think it was agreed to introduce values, while for concrete way of indicating values, we think either i) or ii) is fine, slightly prefer i). |
| TMUS | Yes | Prefer i) if it can provide more granularity |
| Samsung | Conditional yes | We only support QoE value that generated by NG-RAN, and i) is preferred |
| ZTE | Yes | Both options (i,ii) are ok for us, prefer i. |
| CMCC | Yes | i) is preferred. |
| **Ericsson** | Yes, but | We should discuss this **case-by-case**, we should not have a blank check in advance.  For now, we see two interesting candidates:   * Buffer level alarm * The number of stalling events   We are not sure that any of them fits in poor/medium/good or 0-10 dimensions. |
| CATT | No | Use the metrics SA4 defined |
| Nokia | Yes, but | Agree with Ericsson |

**Moderator’s Summary:**

**Yes (6/9), No (1/9), Only if UE generates RVQoE value (2/9).**

**Since there is not much clarity, the following FFS is proposed.**

**Proposal 5:** FFS whether and how to support RAN visible QoE values. If supported, the following is to be clarified:

* **Granularity**: Whether the RAN visible QoE value is calculated based on measurements of multiple metrics or per metric
* **Definition**: Whether the RAN visible QoE value is an objective/qualitative representation of QoE metrics (e.g., on a score of 0-10, poor/medium/good) or derived information from QoE metrics (e.g., the number of stalling events, buffer level alarm)

### Who should generate the RVQoE values (UE or NG-RAN)?

**[7], Observation 1:** UE performs the QoE value calculation is **not preferred** by SA4 as it has many limitations.

**[7], Observation 2:** **new mechanism is needed** if UE performs the QoE value calculation.

**[7], Observation 3:** RAN visible QoE value can be obtained by RAN visible QoE metrics **without extra specification impact.**

**[7], Proposal 2:** RAN visible QoE value should be **generated in gNB** based on the RAN visible QoE metrics and the existing models defined by SA4.

**[3], Proposal 16:** RAN3 to down select from the 3 options before deciding whether and how to support RVQoE values:

Option 1: Pre-defined formula in SA4 specs (**UE generated**)

Option 2: Configurable by NG-RAN (**UE generated**)

Option 3: Implementation specific to NG-RAN (**NG-RAN generated**)

**Q4: Who should generate the RVQoE values (UE or NG-RAN)? If UE generated, please provide comments to the concerns raised in [7].**

|  |  |  |
| --- | --- | --- |
| **Company** | **UE or NG-RAN** | **Comment** |
| Qualcomm | NG-RAN | If UE has to generate RVQoE value, there will be the following spec impacts:   1. **CT1 impact**: Enhancements to AT commands needed to support RVQoE value 2. **SA4 impact**: The application has to compute the RVQoE value based on the instantaneous/average QoE in the measurement period. Also pre-defined formula in SA4 specs might be needed if there is no configurable RVQoE target 3. **RAN2 impact:** In case we decide to have a configurable RVQoE target, this needs to be configured over Uu   Alternatively, gNB can simply compute the RVQoE value based on the received RVQoE metric and its own QoE target. E.g., if buffer level sent by UE is less than 10 ms, gNB can classify this as “good” or have a RVQoE value as “10/10” etc. We don’t see the need to impact UE and different WGs when this can be easily done by implementation at gNB |
| Huawei | UE | It is preferred that UE should generate the values, since UE is the consumer of radio resource and customer who expresses their experience, while from RAN side, of course gNB should be able to evaluate and judge with the reported value as important reference.  As to the model to calculate the QoE value, it is decided by the SA4. |
| TMUS | No strong view |  |
| Samsung | NG-RAN | Same view as QC.  As we commented many times, SA4 had already studied whether UE can generate QoE value by the model, and the conclusion is that UE generate QoE value is not recommend. We don’t think we have enough time to coordinate with SA4 and RAN2 to define a new mechanism to support generate QoE value by UE. |
| ZTE | UE | UE can calculate the QoE value based on measurements of multiple metrics, the calculated QoE value is used to indicate the level of user satisfaction of the service, but not to indicate scores of some type of metric. Since the QoE value is affected by many factors, and RVQoE is only a small part of the QoE measurement, so only UE can generate such QoE value. (but it is also possible that the QoE server can generate such value and send to RAN?).  The evaluation model of QoE value is up to SA4, if SA4 agrees to provide QoE value (of course, the specific model may be FFS), RAN3 only needs to consider the signaling impact. An AI based RAN can train QoS/QoE correlation by implementation, and use these for network optimization.  In the SI phase, we think it is a common understanding that the design of RVQoE values would need cooperation with SA4. As in 38.890, the definition of RVQoE values is “A set of values derived from QoE metrics data through a model/function defined in collaboration with SA4.” We all know that QoE metrics are measured by App layer in UE, so SA4 would have the most suitable way to calculate the values. This work cannot be taken by RAN, in our understanding. |
| CMCC | UE | UE is the better place to generate such value since UE is the end consumer. And we also acknowledge that such mechanism may involve in many WGs, so we’d better liaise to other WGs as soon as possible if UE method is agreeable. |
| **Ericsson** | UE | We think that the following potential RVQoE values **do not need any formula or new mechanism:**   * The number of stalling events. * The buffer level alarm.   **Qualcomm’s response:**  Currently SA4 only calculates the Play List. Say if we want to include the number of stalling events as part of RVQoE, some entity has to do calculate right? SA4 would need a predefined formula e.g., stalling count = Number of times stop reason is rebuffering in Play List. NG-RAN can of course configure a QoE target on top of this e.g., UE should indicate only when stalling count > X.  Similar with Buffer level alarm, my understanding is that either NG-RAN configures a threshold, or this is predefined in SA4, upon crossing which an “alarm” indicator is sent instead of sending the absolute buffer level.  Regarding QC’s concerns:   * Seems no SA4 impact for now, if the above two values are considered. * We have already generated quite some CT1 impact in the agreements so far, so this addition should not be a problem. * RAN2 impact is straightforward to specify. |
| CATT | UE | See my answer in Q3, I don’t think the value is useful. If we should support the value, the UE may generate the value. |
| Nokia | UE or MCE | From an architectural perspective generation of RVQOE values should be done at the application layer which is aware of SA4's XML definition, which means either the UE or the MCE. And for the use cases mentioned so far, it seems that offline generation in the MCE would be the simplest and actually sufficient. |

**Moderator’s Summary:**

Regarding which entity should generate the RVQoE value,

UE (6/9), NG-RAN (2/9), No strong view (1/9). One Company also said MCE could generate the RVQoE value.

Moderator’s view is that the spec impacts for SA4 are not still clear by some companies if UE has to generate the RVQoE value. It is therefore proposed to keep this as FFS and discuss all the RVQoE proposals as a package in the 2nd round.

**Proposal 6:** FFS which entity (UE or NG-RAN or MCE) should generate the RAN visible QoE values

### Configurability in case of UE generated RVQoE values

[1], Proposal 5: A RAN node can configure the UE to either report the Buffer Level or to report a Buffer Level Alarm based on a **configurable** threshold.

[3], Proposal 16: RAN3 to down select from the 3 options before deciding whether and how to support RVQoE values:

**Option 1: Pre-defined formula in SA4 specs**

**Option 2: Configurable by NG-RAN**

Option 3: Implementation specific to NG-RAN

[10], Proposal 2: To introduce **RAN-visible QoE value target** at RAN side. This RVQoE value target indicates the QoE value that needs to be guaranteed by RAN for UE.

[10], Proposal 3: For Signalling-based QoE, the CN signals the RVQoE value target to NG-RAN together with the QoE configuration. For Management-based QoE, the OAM configures the RVQoE value target to NG-RAN together with the QoE configuration.

An example could be Buffer level alarm e.g., if buffer level is greater or less than a threshold “X”

**Q5: If UE generates the RVQoE value (based on your answer to Q4), whether it should be a pre-defined formula in SA4 specs or configurable by NG-RAN?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Pre-defined formula or Configurable by NG-RAN** | | **Comment** |
| Qualcomm | No need | | UE should not generate RVQoE values (see comments to Q4) |
| Huawei | Pre-defined | We think it is better to ask SA4 to investigate this, since RAN is not fully aware of the media transmission which is an E2E process. | |
| TMUS | NG-RAN | | RAN should be in control of the performance target |
| Samsung | No need | | If we agree UE generates QoE value, imagine the work we have to do next, coordinate with SA4 and RAN2 on the UE capability issue and new mechanism. We don’t think we have enough time. |
| ZTE | Pre-defined | | The RVQoE should be calculated by a pre-defined formula in SA4, not configurable by NG-RAN. |
| CMCC | Pre-defined | |  |
| **Ericsson** | No need for SA4 to do anything | | Configurable by the RAN. Why do we need SA4 to define how to count stalling events or to determine that buffer level is under a certain level? |
| CATT | Pre-defined | |  |
| Nokia | Pre-defined | | Unfortunately we need some work to be done in SA4, because it is not within RAN3's terms of reference to create requirements on the application layer. |

**Moderator’s Summary:**

Pre-defined (5/9), Configurable (2/9), No need (2/9)

**Proposal 7:** FFS whether the calculation of RAN visible QoE values is pre-defined in SA4 specifications in case it is agreed that UE has to report the RAN visible QoE values

**Proposal 8:** FFS whether NG-RAN can configure a threshold/target for RAN visible QoE values, only upon crossing which UE would report the RAN visible QoE values.

## RVQoE configuration

### Basic principles

[9], Proposal 4: In split scenarios, CU should generate the RVQoE configurations.

[3], Proposal 5: RVQoE and legacy QoE can be configured independently i.e., RVQoE can be configured at a later time after configuring legacy QoE by using the same measConfigAppLayerID

**Q6: Do companies agree on the above two proposals on RVQoE configuration?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes to P4, not sure to P5 | P4: We agree that the CU should generate the RAN visible QoE metric configurations.  P5: We think RAN visible QoE metric should be configured only when QoE measurement is configured, and configured together or after configuring legacy QoE to UE; since RAN needs to understand what kind of metrics could be visible and if those visible metrics were configured in the QoE measurement.  **Moderator’s view:** The intention of P5 seems to be to clarify independent RVQoE configuration compared to legacy QoE. The scenario you described has already been agreed  RVQoE collection can be configured only if legacy QoE measurements are configured for the same service type |
| TMUS | Yes to P4 |  |
| Samsung | P4: yes  P5: yes |  |
| ZTE | Yes |  |
| CMCC | Yes |  |
| China Unicom | Yes | P5: We think RVQoE and legacy QoE can be configured together or configured separately. But RVQoE should be configured together or after configuring legacy QoE to UE.  **Moderator’s view:** Agree. The intention of P5 was on the independent case I think. Will refine the proposal. |
| **Ericsson** | Yes, to both |  |
| CATT | Yes |  |
| Nokia | Not sure | For the described use of RVQOE, it seems that offline measurements would be sufficient in which case the configuration doesn't need to be generated in the NG-RAN but in the application layer (application server). If it is concluded that the NG-RAN generates the configuration, P4 and P5 look reasonable from RAN point of view, leading to RAN2/CT1/SA4 impact.  **Moderator’s view:** The following is already agreed last meeting  RAN generates the RVQoE measurement configuration |

**Moderator’s Summary:**

All companies agree on the two proposals. Some rewording is done as follows:

**Proposal 9:** In split gNB architecture, gNB-CU should generate the RAN visible QoE configuration.

**Proposal 10:** RAN Visible QoE and legacy QoE can be configured together or separately. In case RAN visible QoE is configured separately, it can be configured only after configuring legacy QoE.

### RVQoE release

**[3], Proposal 6:** NG-RAN can release a list of RVQOE configurations while not releasing corresponding legacy QoE configurations

**[3], Proposal 7:** If the legacy QoE configuration is released, the corresponding RVQOE configuration is released as well

**Q7: Do companies agree on the above two proposals on RVQoE release ?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/no | Comment |
| **Qualcomm** | **Yes** |  |
| Huawei | Yes | Not sure the difference between P6 and P7, P7 is saying the releasing is triggered from OAM, so corresponding visible metrics should also be released; otherwise, if triggered by RAN, the two releasing behavior could be independent?  **Moderator’s view:** Yes that is the intention. We can agree on both the setup and release procedures independently to be more clear.  Anyway, if QoE measurement configuration is released, how could RAN expect the measurement will continue?  P6: The RVQoE is configured by the RAN. Therefore RAN can release the RVQoE while keep the legacy QoE configuration.  P7: RAN3 has agreed that the RAN visible QoE metric should be configured only when QoE measurement is configured. Therefore we think the corresponding RVQoE configuration should be released if the legacy QoE configuration is released. |
| TMUS | yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| CMCC | Yes |  |
| China Unicom | Yes | RVQoE configurations can be released separate with legacy QoE. |
| **Ericsson** | OK |  |
| CATT | Yes |  |
| Nokia | Yes |  |

**Moderator’s Summary:**

All companies agree on the two proposals. Hence the following is proposed:

**Proposal 11:** NG-RAN can release a list of RAN visible QoE configurations while not releasing the corresponding legacy QoE configurations

**Proposal 12:** If the legacy QoE configuration is released, the corresponding RAN visible QoE configuration is released as well

### RVQoE configuration IE details

RVQoE configuration can include the following (the ones in red indicate no support, ones in green indicate support)

1. Metrics to be reported [3]
2. Service Type [4]
3. QoE measurement ID [4], [9]
4. Start Time [2], [3], [12]
5. Duration [2], [3], [12]
6. Reporting Interval for periodic case [2], [7], [3], [12]
7. Triggering Event [2], [7], [12], [3]
8. Indication to report QoE value [9]
9. Sample Percentage (**FFS by [2]),** [3], [12]

**Moderator Proposal 3:** RVQoE configuration can include the RVQoE metrics to be reported, service type and a measurement ID for the RVQoE. Whether existing IEs can be reused for service type and measurement ID and the signaling design is up to RAN2

Considering the limited interest and more negative votes towards Start Time, Duration and Sample Percentage, it is also proposed the following:

**Moderator Proposal 4:** There is no need to consider Start Time, Duration and Sample Percentage in the RVQoE configuration in Rel-17

**Moderator Proposal 5:** Whether to include Triggering Event (e.g., an indication when video representation changes or stalling occurs or when a QoE metric e.g., buffer level, changes beyond a threshold) in RVQoE configuration depends on the final list of RVQoE metrics and whether RVQoE values are supported and should be discussed post agreements on those topics.

**Q8: Do companies agree with Moderator proposals 3-5?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | In general yes, but | But we think we should not make things complicated, why is “the configuration of visible metrics being coupled with corresponding QoE measurement” not acceptable, this should be the straight forward way, we could discuss further enhancements in R18 if there is consensus.  **Moderator:** Your comments are not clear to me (which proposal are you referring to?). If P3, this has already been agreed “ID used to identify QoE measurements is reused for identifying the RVQoE measurements”. So RVQoE and legacy QoE are already coupled. Here we are just capturing the details of RVQoE configuration. But it is of course up to RAN2 to decide the ASN.1 structure and whether to reuse existing IEs. |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes | For P5, how to trigger the RVQoE can be done by implementation |
| CMCC | Yes |  |
| China Unicom | 3)4) OK  5) not sure | For proposal 5), it is need to clarify if the trigger event is based on RVQoE metrics. |
| **Ericsson** | Look right | **MP3: agree**  **MP4: disagree,** we do not understand the motivation from [3] and [12] not to report start/stop time and interval.  **Qualcomm: The intention is to not make RVQoE configuration more complex. Also, the benefits are not mentioned in [2].**  **MP5: disagree in this form.** We support triggering events, and we think that some interesting triggering events have nothing to do with metric values. For example, RAN may want to observe the HO performance, and it needs to be able to trigger the measurement regardless the prior measurement result.  So, in addition to defining triggers that are based on measurements/reporting, one may also consider **the events** that are not measurement-based (e.g., a handover). |
| CATT | Yes |  |
| Nokia | Yes |  |

**Moderator’s Summary:**

Consensus on Moderator Proposal 3. So, the following is proposed:

**Proposal 13:** RAN visible QoE configuration can include the RAN visible QoE metrics to be reported, service type and a measurement ID for the RAN visible QoE. Whether existing IEs can be reused for service type and measurement ID and the signaling design is up to RAN2

9/10 agree on Moderator Proposal 4. So proposed to agree the following:

**Proposal 14:** There is no need to consider Start Time, Duration and Sample Percentage in the RAN Visible QoE configuration in Rel-17

Considering 1 company brought out the topic of non-QoE metric related triggers and this was not discussed, it is proposed to leave Triggering Events as FFS.

**Proposal 15:** FFS whether to define event triggers in RAN visible QoE configuration. The

Regarding whether to support Reporting Interval, it is moderator’s understanding that this is closely related to whether RVQoE and legacy QoE can be reported separately or should be reported together (we can discuss this in section 3.4.1) and RAN2 pending reply on whether a high priority SRB can be used for RVQoE report.

Meanwhile, we could discuss the use case of RVQoE and its priority w.r.t legacy QoE to achieve some common understanding.

[3], Proposal 4: RVQOE has the same priority as legacy QoE. The main purpose of RVQOE is to expose QoE metrics to RAN and not for enabling QoE aware real-time use cases

**Q9: Does RVQoE have the same priority or higher priority than legacy QoE and why? If higher priority, is it necessary to have i) separate reporting periodicities and ii) a higher priority SRB (or can SRB4 still work)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Same or Higher priority** | **Comment** |
| Qualcomm | Same priority  Reporting Interval – Not needed  SRB4 for RVQoE report | To keep it simple, we think RVQoE can have the **same priority** as legacy QoE in Rel-17 at least till we identify RVQoE metrics which are absolutely needed with a higher frequency to enable real-time use cases.  Enabling separate reporting periodicities for RVQoE will add to the processing complexities and increase storage requirements at UE Application to handle RVQoE and legacy QoE independently. We therefore propose to not define a **Reporting Interval** for RVQoE configuration.  Also, if RVQoE has same priority as legacy QoE, **SRB4 can be reused** for RVQoE reporting and we won’t need to define a higher priority SRB (e.g., SRB1/SRB2) for RVQoE reporting. |
| Huawei | Not sure | We think visible metric report is just a by-product of QoE measurement report.  As to whether the RAN visible QoE use the same SRB with the legacy QoE, it is up to RAN2 to decide. |
| TMUS | Higher priority for RVQoE | Prefer to have the flexibility to set different priority and reporting frequency for RVQoE |
| Samsung | Higher priority for RVQoE | Agree with TMUS |
| ZTE | Same priority  Reporting Interval – Not needed  SRB4 for RVQoE report | We think RVQoE can be reported together with legacy QoE report through SRB4, which means they are of the same priority in our mind. In this way, there is no need to define a report interval for the reporting of RVQoE. |
| CMCC | Higher priority for RVQoE | And the reporting interval could be made shorter than legacy QoE. Since we’ve considered the overhead issue for the selected reporting metrics, the RVQoE report will not be large in size, so the extra overhead over Uu could be marginal. |
| China Unicom | At least RVQoE needs separate Reporting Interval  If RVQoE should have high priority need to wait RAN2 LS feedback. | Whether the RVQoE use the same SRB with the legacy QoE is up to RAN2.  Anyway, we think the separate reporting periodicities should be configured for RVQoE. |
| **Ericsson** | RVQoE has higher prio | It should be possible to report RVQoE more often because it may be used for more frequent optimization than legacy QoE. The reporting interval should be up to the RAN.  Higher priority SRB would be suitable for RVQoE, but even if SRB4 is used, the reporting intervals should be different. |
| CATT | Tend to agree Higher priority for RVQoE.  Reporting Interval is needed | If RAN 2 agrees to use SRB2 for the RVQoE report, we can set RVQOE as higher priority. Otherwise, same priority as legacy QoE  For RVQoE, RAN may want to have more just-in-time by RVQoE report, so more frequent report may be needed. The reporting interval define is needed |
| Nokia | Not sure | It seems from the described use cases that real-time interaction is not expected (e.g. analysis via statistics / AIML mechanism). RAN3 already asked RAN2 to answer this question. |

**Moderator’s Summary:**

Companies have split views on this topic as follows:

* Higher priority (4/10)
* Same priority (2/10)
* Upto RAN2 (2/10): If SRB2, higher priority, else same priority
* Not sure (2/10)

Moreover, one company proposes that even if SRB4 is used, we can have higher priority for RVQoE and a different reporting periodicity. Since there is no clarity on this, moderator proposes the following way forward.

**Proposal 16:** RAN3 should discuss whether the existing identified RAN visible QoE metrics (or values if agreed) justifies the need of a separate reporting periodicity for RAN visible QoE

**Proposal 17:** RAN3 should discuss whether having a different reporting periodicity for RAN visible QoE is independent of the RAN2 decision on which SRB to use for RAN visible QoE

## RVQoE report

### Relation with legacy QoE report

[2], Proposal 4: The RAN visible QoE reports and legacy QoE reports may be delivered in separate messages.

[3], Observation 3: If RVQoE and legacy QoE are to be reported separately, it might increase the processing complexity and storage requirements at UE Application to handle RVQoE and legacy QoE independently

[3], Proposal 10: RVQOE and legacy QoE should be reported together

[4], Proposal 2: RVQoE and legacy QOE can be reported separately or together

[9], Proposal 5: RVQoE and legacy QoE should be reported together.

[12], Proposal 3: The RAN visible QoE metrics are reported together with the QoE report container in the interface between the application layer and the AS

**Summary from contributions:**

RVQoE and legacy QoE can be reported separately [2], [4]

RVQoE and legacy QoE should be reported together [3], [9], [12]

**Q10: Whether RVQoE and legacy QoE can be reported separately or should be reported together. If can be reported separately, please provide justifications in the potential increase in processing complexity and storage requirements at UE APP as highlighted by [3]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Together or Separate** | **Comment** |
| Qualcomm | Together | Justifications provided in Q9. |
| Huawei | Together | We think this question is about the reporting between AS and APP. As to the Uu, it is up to RAN2 to decide. |
| TMUS | No Strong view | However, Separate would provide more flexibility. For example, operator can decide to disable the legacy QoE and only enable RVQoE, or give low priority to legacy QoE reporting |
| Samsung | Both are possible | We think it depends on the configuration of report interval and trigger event, if the report interval of legacy QoE report is quite long (e.g. report at the end of the session), RVQoE can be reported more frequent than legacy QoE report; if the report interval of legacy QoE report is short enough, RVQoE can be reported together with the legacy QoE report.  There’s no need to restrict whether report them together or separately, it depends on the configuration. |
| ZTE | Together | This would make it easier for the configuration and reporting of RVQoE. |
| CMCC | Both are possible |  |
| China Unicom | Separately | We think RVQoE is used for RAN optimization, it should have separate interval with legacy QoE and should be reported separately. |
| **Ericsson** | Both separately and together | Tying legacy QoE reports and RVQoE reports can significantly limit the usefulness of RVQoE.  Regarding QC’s concern about storage, we are not sure why more storage is needed, given that RVQoE reports are to be sent more often than legacy ones. The processing price is, in our opinion, not drastic and definitely worth it, given the purpose of RVQoE.  **[Qualcomm]: Suppose we have different reporting periodicities for legacy QoE and RVQoE, one possible implementation is that UE APP may store RVQoE metrics independently of QoE metrics in a different buffer because now you can’t discard your QoE measurements upon transmitting RVQoE because we still need to store it till you report legacy QoE. Alternative we could use the same buffer, but then processing becomes complex as UE have to keep track of both reporting periodicities.** |
| CATT | separately or together | We cannot restrict the report of RVQoE and legacy QoE report separately or together. These two scenario should be all supported |
| Nokia | probably together | We can't see any described use case justifying a requirement from RAN3 point of view in the direction of separate reporting. |

**Moderator’s Summary:**

Companies’ views are split on this as well

* Can be reported separately: 5/10
* Always together: 4/10
* No strong view: 1/10

**Proposal 18:** FFS whether RAN visible QoE and legacy QoE can be reported separately or should be always reported together. Note: This depends on whether a separate reporting periodicity is agreed to be defined in RAN visible QoE configuration.

### PDU session information

[2], Proposal 5: RAN3 to discuss the feasibility of including PDU session information into the RVQoE report.

[3], Observation 4: QoE support for MR-DC is not supported in Rel-17 i.e., QoE is always configured and reported over MN in Rel-17

[3], Proposal 11: There is no need to include PDU session information (e.g., DRB ID, PDU session ID, QoS Flow ID) in the RVQoE report

[6], Proposal 2: The gNB should be able to identify the DRB concerned by RVQOE reports, which will require reporting of PDU session and QoS flow information from the UE to the gNB.

[7], Proposal 4: The DRB information (or QoS flow information) should be included in the QoE report for QoS aware scheduling.

[12], Proposal 6: The PDU session information and QoS flow information are reported together with the RAN visible QoE.

**Q11: Whether PDU/DRB/QoS flow information should be included in RVQoE report? Should this be deferred to Rel-18 as QoE for MR-DC is not supported in Rel-17?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | No | Can be discussed in Rel-18 |
| Huawei | Yes to PDU/QoS | We think application layer understands the corresponding PDU/QoS info of the concerned service type, which could be convey to UE AS layer, for UE to report.  It is not the QoE for MR-DC. The motivation of RAN visible QoE is to optimize the radio resource allocation. In NR, the radio resource are configured per DRB. Therefore we think the RAN need to know the corresponding DRB of the QoE reporting. But the APP does not know the DRB information. Therefore the APP should report the PDU/QoS flow information. |
| TMUS | Yes |  |
| Samsung | Yes | The PDU/DRB/QoS flow information is needed, which ID is used can be FFS. |
| ZTE | Yes | We think PDU/QoS flow information should be included in RVQoE. |
| CMCC | Yes | PDU/DRB/QoS flow info is needed. And we can decide which granularities could be reported as a starting point in R17. |
| China Unicom | Yes to PDU | We think PDU session ID (list) can be visible for RAN. RAN can know the correlation for DRB and PDU session.  It is not for MR-DC, it is RVQoE for RAN optimization, and should be supported in R17. |
| **Ericsson** | No | We think that the feasibility i.e., whether the Application layer has access to this information, needs to be studied. For example, for the DRB/PDU session ID/QoS flow information to be included in the RVQoE report, either the Application layer needs to be aware of this information or the UE AS needs to be aware of the mapping between an application session pertaining to the QoE reference, and a DRB/PDU session.  Given the amount of work we have left, it is better to consider this in Rel18. |
| CATT |  | Can be discuss it in R18 |
| Nokia | Yes to PDU/QoS | Without mapping to a DRB (based on PDU/QoS flow), the RVQOE information can't be used in the RAN. |

**Moderator’s Summary:**

Companies’ views are split on this:

* Yes (7/10)
* No or Should be discussed in Rel-18 (3/10)

Although there is some interest, some companies proposed to discuss this in Rel-18. Also, questions have raised whether the Application layer is to be aware of DRB/PDU session ID/QoS flow ID and whether the UE AS is aware of the mapping between an application session pertaining to the QoE reference, and a DRB/PDU session.

**Proposal 19:** FFS whether to include any PDU/DRB/QoS flow information in RAN visible QoE report. It is to be clarified whether the Application layer is to be aware of DRB/PDU session ID/QoS flow ID and whether the UE AS is aware of the mapping between an application session pertaining to the QoE reference, and a DRB/PDU session.

## Mobility Support for RVQoE

[2], Proposal 6: RAN3 to agree that the RAN visible QoE configuration can be propagated via Xn from the source to target node upon mobility in RRC\_CONNECTED and during context retrieval upon resumption from RRC\_INACTIVE. The target/new RAN node may assemble a different RAN visible QoE configuration.

[3], Proposal 12: RVQoE configuration can be propagated from the source to target node upon mobility in RRC\_CONNECTED and during context retrieval upon resumption from RRC\_INACTIVE. The target/new RAN node may assemble a different RVQoE configuration

[4], Proposal 3: RVQoE configuration **will not be transferred** to target node during mobility or resumption

**Q12: Whether RVQoE configuration can be propagated from the source to target node upon mobility and during context retrieval? If not, please provide justifications.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes, but | Since visible metrics are mainly for the RAN node to check and evaluate the resource usage, we are not sure if this target RAN node is happy to do that or not, if target RAN is willing to do that, it could configure by itself, according to the received QoE measurement configuration.  In our understanding, the RAN visible QoE configuration is included in the RRCReconfiguration message. And the source RAN will transfer the RRCReconfiguration to the target RAN in the handoverPreparationInformation during the mobility and context retrieval. Therefore the target node can know the RAN visible QoE configuration from the source node. It does not have any impact on RAN3. |
| TMUS | Yes |  |
| Samsung | No | In our understanding, RVQoE is for node internal optimization, RVQoE configuration should be kept within the gNB that initiates RVQoE collection. If the UE is handed over to a new gNB, if RVQoE is needed in the new gNB, the new gNB will send the new RVQoE configuration according to its own optimization needs.  So there’s no need to transfer the RVQoE configuration 1 of gNB1 to gNB2 which may have RVQoE configuration 2 itself.  If this RVQoE configuration propagation is supported, there will be an issue that we should decide what type of RVQoE is (s-based or m-based) as the assembly of RVQoE is according to the QoE configuration from OAM (both s-based and m-based are possible), it will also make the overriding mechanism complicated.  And of course, there’s no need to kept RVQoE configuration when UE enters into RRC\_INACTIVE state. |
| ZTE | No | We think the RVQoE configuration is only used for the RAN node itself. If the UE handovers to another RAN node, we are not sure whether the RVQoE configuration counts for the target node. if the target RAN node feels necessary to perform RVQoE, it can generate the RVQoE configuration for itself, instead of taking the configuration from source node. |
| CMCC | Yes | The target could refer to config at source, and reconfigure if needed. |
| China Unicom | Yes |  |
| **Ericsson** | Yes |  |
| CATT | No | The RVQoE is RAN locally requirement and generated by the RAN node. After handover, the target node may initial the RVQoE configuration by their requirement. Follow the same principle, the RVQoE configuration also is not need to be transferred when the UE is in RRC\_inactive. |
| Nokia | No | This seems to be an enhancement that can come later if needed. |

**Moderator’s Summary:**

Companies’ views are split on this:

* Yes (6/10)
* No (4/10)

As there are still some open issues, proposed to have this as FFS and use this proposal as the way forward:

**Proposal 20:** FFS whether the RAN visible QoE configuration can be propagated from the source to target node upon mobility and during context retrieval. The following is to be clarified:

* What to do with source RVQoE configuration if target node also generates its own RAN visible QoE configuration
* How to handle override scenarios considering both signalling based and management based RAN visible QoE
* Whether there are any RAN3 impacts (RAN visible QoE configuration should be transferred to target node automatically via handoverPreparationInformation)

Further, the following proposals were made on propagation of RVQoE report:

[2], Proposal 7: The RAN visible QoE report can be signalled from the target to the source node after a successful handover.

[4], Proposal 4: RVQoE report can be signalled from the target to the source node after a successful handover

[7], Proposal 5: RAN visible QoE report should be transmitted on Xn for scheduling optimization or handover optimization.

[3], Proposal 13: RVQoE report can be signaled from the target to the source node after a successful handover

[12], Proposal 9: Sending the RAN visible QoE report from the target node to the source node can be discussed in SON/MDT WID.

Since companies have consensus, the following is proposed.

**Moderator Proposal 6:** The RAN visible QoE report can be signalled from the target to the source node after a successful handover.

**Q13: Whether Moderator Proposal 6 is agreeable?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Not sure | As suggested, we think this could be discussed in SON/MDT WI. |
| TMUS | Yes |  |
| Samsung | Yes | We should discuss how to deliver the RVQoE report to the right place, just the same as we discuss how to deliver QoE report to MCE in legacy QoE reporting.  This topic is definitely in the QoE WI scope. |
| ZTE | No | see Q12 comments. |
| CMCC | Yes |  |
| China Unicom | Yes |  |
| **Ericsson** | Yes | Yes, this is needed to monitor the impact of HO on QoE. |
| CATT | Yes |  |
| Nokia | No | This seems to be an enhancement that can come later if needed. |

**Moderator’s Summary:**

Companies’ views are split on this:

* Yes (710)
* No (2/10)
* Not sure (1/10)

No consensus. This can be discussed together with Proposal 19. We already have an FFS from last meeting. No need of a new Proposal.

## Which RVQoE metrics can NG-RAN configure?

[2], Observation 1: The OAM can configure the UE to collect a subset of the QoE metrics and not necessarily all the supported QoE metrics, meaning that the set of RVQoE metrics that are allowed to be collected is a subset of the legacy and RVQoE metrics that the UE is capable of collecting for the given service type.

[2], Proposal 1: The OAM sends a list of the available RVQoE metrics to the RAN node, outside the legacy QoE configuration container.

[12], proposal 2: For the RAN visible metrics, it should explicitly indicate to RAN the metrics which could be visible in RAN and are also configured in the container.

[3], Proposal 14: NG-RAN can conclude which RVQoE metrics are available to be collected from the UE via UE capability signaling and the service type configured for the UE (no need for OAM to configure this explicitly in the QoE configuration container)

[4], Proposal 1: RAN can conclude the metrics from the UE capability indication and the service type configured for the UE

**Q14: Which option do you prefer?**

**Option 1: NG-RAN configures RVQoE for only those metrics which are configured as part of legacy QoE configuration (needs OAM indication to NG-RAN)**

**Option 2: NG-RAN can configure any RVQoE metric without the knowledge of legacy QoE metrics configured**

An example is provided below:

* Suppose UE indicates capability to collect RVQoE metrics 1, 2 and 3 for service Type A.
* OAM configures legacy QoE metrics 1, 2 for service Type A
* Can NG-RAN configure UE to provide RVQoE metric 3 or only should be a subset of legacy QoE metrics 1 and 2?

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1 or 2** | **Comment** |
| Qualcomm | See comments | Option 1 is probably better in that it doesn’t introduce new requirements at UE to measure a QoE metric just for RVQoE (e.g., RVQoE metric 3 in the above example), but reduces flexibility at NG-RAN (i.e., it can’t configure RVQoE metric 3 in the above example).  We seek some clarifications on Option 1 as well:   1. Is there a security issue as NG-RAN is informed which legacy QoE metrics were configured by the OAM inside the QoE configuration container? (e.g., that OAM configured QoE metrics 1 and 2 in the above example) 2. This list of RVQoE metrics will need to be sent with each QoE configuration, right? So, some signalling impact is foreseen. |
| Huawei | The former | We think visible metrics should be explicitly indicated to RAN the metrics which could be visible in RAN and are also configured in the container, otherwise RAN intervenes UE application layer behaviour.  The UE capability for the collecting of each metric does not mean the OAM will configure to report this metric. Also we are still not sure how the capabilities for RAN visible QoE are designed by RAN2. |
| TMUS | Prefer option 1 |  |
| Samsung | Option 1 |  |
| ZTE | Prefer Option 1 | Prefer Option 1. By Option 2, if RAN selects a metric not configured in legacy QoE, the UE app layer would be pushed to start new measurement only for RVQoE, which is not preferred. |
| CMCC |  | Depends on what metrics we can report in RVQoE report. |
| China Unicom | Option1 | RVQoE should be a subset of legacy QoE metrics that configured by OAM. |
| **Ericsson** | Option 1 | We should liaise RAN2 to include the support for UE RVQoE capability indication.  **Moderator:** We already asked RAN2 last meeting via LS R3-214477 LS on RAN3 agreements for NR QoE |
| CATT | Option2  Option 1also can be accepted | this solution2 is simple for the implementation. We don’t think we have agreements on the RVQoE metrics should be subset of the legacy QoE. So no harmful in RVQoE have one metric which is not in the legacy QoE  For the option1, the OAM also does not know which metrics is configured because it will not decode the XML file. We should check with SA5 whether the OAM can provide this metrics information  **Moderator:** I think OAM should be able to read the XML file , only RAN can’t. So should not be a problem |
| Nokia | Option 1 |  |

**Moderator’s Summary:**

Majority agrees with Option 1. Security concern was raised, but since no comments received; a WA is proposed therefore to check security concerns raised.

**Proposal 21**: NG-RAN can configure RAN visible QoE for only a subset of those metrics which are already configured as part of legacy QoE configuration.

**Proposal 22**: WA: The OAM sends a list of the available RAN visible QoE metrics to the RAN node, outside the legacy QoE configuration container. FFS whether there is a security concern as NG-RAN is informed which legacy QoE metrics were configured by the OAM inside the QoE configuration container

## Misc topics

### RVQoE handling at RAN overload

[3], Proposal 7: If the legacy QoE configuration is paused/resumed, the corresponding RVQOE configuration is paused/resumed as well

[3], Proposal 8: A common indicator is used to pause/resume both legacy QoE and RVQoE configurations i.e., there is no support to pause/resume a list of RVQoE configurations while not pausing/resuming corresponding legacy QoE configurations

**Q15: Do companies agree on the above two proposals on RVQoE handling at RAN overload?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes | This is a simpler way. Also as we known, RAN2 are still discussing whether to support the pause at RAN overload and how to store the QoE results generated during the pause phase. Maybe we need to wait the progress of RAN2. |
| TMUS | Yes |  |
| Samsung | Depends on Q9 and Q10 | If SRB4 is used for RVQoE and RVQoE report together with legacy QoE report, the P7 and P8 can be agreed.  If RVQoE report has higher priority or report separately from legacy QoE report, we need further discuss. |
| ZTE | FFS | Maybe the above two proposals can be FFS, suggest to discuss these as enhancements in R18.  **Moderator**: I think this the handling of RVQoE at RAN overload was agreed to be considered as part of Rel-17 scope in previous meeting |
| CMCC |  | We can accept to agree on these to make progress. |
| China Unicom | Yes |  |
| **Ericsson** | No | Pausing RAN visible QoE is not needed. QoE measurement is performed during the pause and RVQoE report can be provided to RAN to monitor the user experience during overload. Given the limited size of RVQoE and its values, pausing the RVQoE may not be required. |
| CATT |  | We can make it simple in R17. But it is better to separate |
| Nokia | Yes to P7  **Moderator**: What about P8? Any concerns? | We can make it simple in R17. |

**Moderator’s Summary:**

* Yes (7/10). One company also said it depends on RAN2 progress on legacy QoE handling during RAN overload
* No (1/10)
* Depends on RAN2 decision on which SRB to use for RVQoE and whether RVQoE report has higher priority than legacy QoE (1/10)
* Discuss in Rel-18 (1/10)

Moderator’s understanding is that even if the RVQoE is agreed to have a higher priority and used for real-time optimizations (e.g., scheduler behavior), we have not discussed any use case of using RVQoE to help in RAN overload. RVQoE can be reported post the overload and can be used to check the QoE during the overload. Considering majority of companies preferred to keep it simple in Rel-18, we propose a WA.

**Proposal 23:** WA: If the legacy QoE configuration is paused/resumed, the corresponding RVQOE configuration is paused/resumed as well

### Other topics

[2], Proposal 2: The alignment between radio-related measurements and RVQoE measurements is supported.

[2], Proposal 3: RAN3 to discuss the support for per-slice RVQoE and RVQoE handling at RAN overload once the basic solution (for QoE measurements) has been defined.

[3], Proposal 17: Per-slice RVQOE and alignment of RVQOE with radio-related measurements can be discussed post progress on the corresponding topics for the legacy QoE

**Moderator Proposal 7:** Alignment between radio-related measurements and RVQoE measurements and Per-slice RVQoE can be discussed post progress on the corresponding topics for the legacy QoE.

**Q16: Do companies agree on Moderator Proposal 7?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Postpone | Can be discussed in the next meeting |
| Huawei | Yes | Let’s try to agree a baseline approach, then we could continue to discuss possible enhancements |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE | Postpone |  |
| CMCC | Yes |  |
| China Unicom | Yes | Agree with Huawei |
| **Ericsson** | Yes | We need to do this at the next meeting. |
| CATT | Yes |  |
| Nokia | Postpone |  |

**Proposal 24:** Alignment between radio-related measurements and RVQoE measurements and Per-slice RVQoE can be discussed post progress on the corresponding topics for the legacy QoE.

### Stage-3

QoE information transfer over F1 was already agreed last meeting. We can discuss the draft CR this meeting.

[7], Proposal 6: QoE information should be transmitted on F1 for scheduling purpose.

[7], Proposal 7: RAN3 agree the CR for TS 38.473 in [8] to support QoE information transfer.

**Q17: Any comments on the draft CR for TS 38.473?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes | OK in general to introduce a class-2 message QOE INFORMATION TRANSFER over F1. IE details (whether to include RVQoE values, DRB ID) can be FFS and based on agreements this meeting. |
| Huawei | Yes | This could be considered |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE |  | OK for P6, the detail of stage3 is FFS. |
| CMCC | Yes |  |
| China Unicom | Yes |  |
| **Ericsson** | OK, in general, but… | We need to refine the content, based on pending agreements. |
| CATT | Yes |  |
| Nokia |  | we need to check stage 3 in light of agreements taken |

**Proposal 25:** Agree R3-215547 rev in R3-21xxxx to introduce a new class-1 message for QoE information transfer over F1. Stage-3 IE details can be FFS.

## LSs to other groups

The following LSs to other groups have been proposed. In the 1st round, we can confirm which of the following LSs are needed and **can work on the draft LSs in the 2nd round** based on agreements achieved this meeting.

**Q18: Which of the following LSs are needed to be sent?**

1. **LS to CT1 requesting to provide the AT commands for RVQoE configuration and report between the UE Application layer and UE AS**
2. **LS to SA4 to check if any spec impact is needed to support RVQoE**
3. **LS to RAN2 on further agreements on RVQoE configuration and RVQoE metrics and RVQoE values (if agreed)**
4. **LS to SA4/CT1 to check whether the application layer can know the QoS flows of the service [13]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No on LSs i)-iv)** | **Comment** |
| Qualcomm | Except iv) | OK on LS i)-iii). Details can be decided in Phase-II.  **Not clear on LS iv)** which states the following:  *The motivation of RAN visible QoE is to optimize the radio resource allocation. In NR, the radio resource are configured per DRB. The packets belonging to different PDU sessions are mapped to different DRBs by the RAN, and the packets from different QoS flows belonging to the same PDU session can be mapped to different DRBs. According to the last reply LS from SA4, RAN3’s understanding is that the UE APP can know the PDU session information of the concerned service type, but RAN3 are not sure whether the APP can know the QoS flow information belonging to each PDU session.*  **Question to SA4**: T*herefore, RAN3 would like to check with SA4 if the APP can also know the QoS flows of the concerned service, so that RAN is able to know the correspondence between the service type with the reported visible metrics and the PDU session/QoS flows, and take potential optimizations of radio resource usage for corresponding DRB.*  Is this related to section 3.4.2 on PDU session information? If so, this can be postponed to Rel-18 as commented before. |
| Huawei | iii&iv. | We think we could a common LS to e.g. CT1/SA4, informing agreements and asking questions; another LS to RAN2 informing agreements and asking questions (if needed) |
| TMUS | i, ii and iii |  |
| Samsung | Yes to all | Agree with HW about we can have a common LS |
| ZTE | Yes on i) ii) | We submitted a draft LS to SA4 this time and we are glad to provide a draft LS for ii) in phase II if needed, based on the progress at this meeting. |
| CMCC | Yes to all |  |
| China Unicom | ii and iii |  |
| **Ericsson** | Yes to all except iv), and… | We should also liaise RAN2 to include the support for UE RVQoE capability indication.  Let us leave iv) for Rel18. |
| CATT | iii | For others, I don’t think these are needed. The i) should be in the RAN2 scope, RAN2 send the LS to CT1 with their design |
| Nokia | iv  maybe iii | iv is needed, because this information is essential for RVQOE. i: to be done by RAN2; ii: LS not needed at this meeting, but it is clear from WG ToR's that there is SA4 impact. iii: this may be needed, depending on meeting outcome |

**Moderator’s Summary:**

Only 4/10 companies agreed to send LS iv) on QoS flow information. Also, whether to support PDU session information in RVQoE report is still pending. So, moderator’s view is no need to send LS iv)

Regarding LS i), although 2 companies said LS to CT1 requesting AT commands for RVQoE should be sent by RAN2, moderator’s view is that maybe RAN3, being the leading WG for QoE WI and the limited time left in Rel-17, we can send a single LS to both SA4 and CT1 as suggested by 2 companies requesting them to provide the necessary specification support.

**Proposal 26:** Send an LS to SA4/CT1 informing about our agreements on RAN visible QoE metrics and RAN visible QoE values (if agreed) and requesting them to provide the necessary specification support.

Regarding the LS to RAN2, maybe we can have a similar rapporteur LS as last time capturing all the agreements this meeting.

**Proposal 27:** Send an LS to RAN2 capturing all the latest agreements on RAN visible QoE.

# Conclusion, Recommendations [if needed]

If needed

# References

|  |  |  |
| --- | --- | --- |
|  |  |  |
| [1] | [R3-214730](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214730.zip) | RAN Visible QoE Metrics (Ericsson) |
| [2] | [R3-214731](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214731.zip) | Configuration and Reporting of RAN Visible QoE (Ericsson) |
| [3] | [R3-214911](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214911.zip) | RAN Visible QoE (Qualcomm Incorporated) |
| [4] | [R3-215119](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215119.zip) | Discussion on RAN visible QoE configuration and reporting (CATT) |
| [5] | [R3-215120](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215120.zip) | TP for 38.423 on RAN visible QoE configuration and reporting (CATT) |
| [6] | [R3-215312](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215312.zip) | Handling of open points for RAN visible QoE (Nokia, Nokia Shanghai Bell) |
| [7] | [R3-215546](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215546.zip) | RAN visible QoE (Samsung) |
| [8] | [R3-215547](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215547.zip) | (CR for TS38.473) Support of QoE information transfer (Samsung) |
| [9] | [R3-215641](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215641.zip) | Discussion on configuration and reporting of RVQoE (ZTE, China Telecom) |
| [10] | [R3-215644](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215644.zip) | Consideration on RAN visible QoE (ZTE, China Telecom) |
| [11] | [R3-215647](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215647.zip) | [draft] LS on the support for RAN visible QoE (ZTE, China Telecom) |
| [12] | [R3-215659](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215659.zip) | Further discussions on RAN visible QoE metrics (Huawei) |
| [13] | [R3-215660](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215660.zip) | Draft LS on RAN visible QoE conclusions (Huawei) |