3GPP TSG-RAN WG2 Meeting #115 R2-210xxxx

Online, 09 – 27 August 2021

**Agenda item: 8.14.2.1**

**Source: Huawei, HiSilicon**

**Title: Report of offline: [AT115-e][046][QoE] Mobility (Huawei)**

**WID/SID: NR\_QoE-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This document aims at capturing views related to the following e-mail discussion:

* [AT115-e][046][QoE] Mobility (Huawei)

Scope: Treat R2-2109036 and related proposals. For each point, attempt to agree, if agreement seems not possible, outline the options or specify a FFS to be addressed later.

Intended outcome: Agreements, Report

Deadline: Tuesday W2 (CB)

Companies are asked to reply to several questions, which are based on the summary of companies’ contributions [1]-[9], as provided in the summary document in [10] (which is a revision of R2-2109036).

Section 2 contains a summary of companies contributions, which is just a copy of section 2 from [10].

The companies are requested to answer the questions in section 3.

## Companies’ contact details

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| --- | --- |
| Company | Contact details (name/e-mail) |
| CMCC | hanxingyu@chinamobile.com |
| Qualcomm | jianhua@qti.qualcomm.com |
| Huawei, HiSilicon | dawid.koziol@huawei.com |

# 2 Summary of companies contributions from [10]

## 2.1 Management based and signalling based QoE

In [1], it is proposed to clarify that the QoE configuration propagates during the handover only for signalling-based QoE activation, while it does not propagate for management-based QoE. Similarly, [5] assumes that QOE continuity is only applicable to signalling-based QoE. In [2] on the other hand, there is a view that all mobility related procedures should be applicable to both signalling-0based and management-based QoE. The rapporteur would like to note that RAN3 is already discussing this topic and made the following agreement:

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| Include signaling based QoE measurement configuration in handover preparation messages i.e. in XnAP: HANDOVER REQUEST, NGAP: HANDOVER REQUEST. FFS on NGAP HANDOVER REQUIRED |

Furthermore, it is already noted in WID (RP-210913) that for mobility handling for management based QoE activation, SA5 input is required:

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| * Specify the support for QoE measurement collection and reporting continuity in intra-system intra-RAT mobility scenario for signaling based QoE. Mobility support for management based QoE measurements is pending input from SA5. [RAN3, RAN2] |

It seems that for now RAN2 can assume that a discussion and agreements related to mobility are applicable to signalling-based QoE and whether they are applicable to management-based QoE depends on further discussions in RAN3 based on input from SA5.

**Proposal 1: RAN2 assumes that all QoE mobility related agreements made by RAN2 are applicable at least to signalling based QoE. Whether the same applies to management-based QoE is pending further input from SA5 and RAN3.**

## 2.2 Area handling for QoE during handover

RAN2 received an LS from RAN3 in R3-212976 with the following conclusion with respect to area handling for QoE during mobility:

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| RAN3 discussed further the following three options captured in TR 38.890 regarding the area handling for QoE during mobility.  - Option 1, where the network is responsible for keeping track of whether the UE is inside or outside the area and configures / releases configuration accordingly.  - Option 2, where the network is responsible for keeping track of whether the UE is inside or outside the area, and the UE responsible to manage start/stop of QoE accordingly.  - Option 3, where the UE is responsible for area checking (UE has the area configuration) and to manage start/stop of QoE accordingly.  RAN3 agreed to support Option 1. |

Based on this agreement, several contribution discuss the details of option 1 selected by RAN3, e.g. [1], [2], [4], [5], [6], [9].

In [4], [5] and [6], network side behaviour is clarified for QoE configurations handling upon handover based on the relevant area scope. It is clarified that area scope of each QoE configuration will be known at the target gNB based on the Xn signalling, at least for signalling based QoE activation. Based on this information, the target gNB can decide which QoE configurations to keep and which QoE configurations to release by taking into consideration the relevant area scope of each of QoE configuration. Similarly, [1] discusses *areaScope* parameter, which was previously described by SA5 in an LS in R2-1900096 for LTE QoE and it is also clarified that gNB itself can determine whether the UE is in the measurement area or not and can either keep or release the QoE configuration based on this. Based on the views expressed in these papers, the following can be proposed:

**Proposal 2: Area scope parameter is not introduced in RRC procedures supporting QoE.**

**Proposal 3: The target gNB decides which QoE configurations to keep and which to release during a handover, e.g. based on QoE configuration information received from the source gNB in Xn signalling and/or UE’s current RRC configuration of QoE.**

With respect to QoE handling upon mobility, in [2] and [4], the following SA4 requirement is recalled:

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| The QoE configuration shall only be checked by the client when each session starts, and thus all logging and reporting criterias for an ongoing session shall be unaffected by any QoE configuration changes received during that session. This also includes evaluation of any filtering criterias, such as geographical filtering, which shall only be done when the session starts. Thus changes to the QoE configuration will only affect sessions started after these configuration changes have been received. |

According to the contributions, this requirement means that the gNB should not release a QoE configuration for which the QoE session is ongoing, even when the UE moves outside of the QoE area. This in turn requires the gNB to be aware of when the session is ongoing. Furthermore, in [9] it is indicated that session start/end indications from the UE are required for the QoE related procedures in the network, especially for activation and deactivation procedures, e.g. for the network to know when the QoE configurations may be released from the UE once the deactivation command is received by the gNB. Based on [2], [4] and [9] the following proposals are then made:

**Proposal 4: The UE informs the gNB when the QoE measurement session starts or when the session ends, e.g. to enable QoE configuration handling upon mobility or for QoE activation/deactivation procedures.**

In [4], it is also indicated that CT1 may need to be involved to specify the relevant indication from application to AS layer:

**Proposal 5: RAN2 sends an LS to CT1 group to specify session start and session end indications from application to AS layer.**

In [2], the network side behaviour is also further clarified for the case where the UE moves out of the QoE measurement area, but the related QoE measurement session is ongoing when the handover occurs:

**Proposal 6: If SA4 confirms that the requirement for configuration changes of ongoing QMC sessions is applicable also for NR QMC: In case the UE moves out of the measurement area during a handover, the target gNB should release the QoE configuration of the UE if the related QoE measurement session is not ongoing and should keep the QoE configurations for which the QoE measurements are ongoing (regardless of whether the UE stays within the associated QoE area or not).**

Furthermore, in [1] and [4], the aspects related to SRB4 release are discussed. In [1], it is indicated that, e.g. upon moving to RRC IDLE state, the UE will release SRB4 and that it should be clarified in the specifications that releasing SRB4 is equivalent to releasing all QoE configurations. Similarly, in [4], it is noted that a UE may move into the coverage of the gNB which does not support QoE and such gNB will not support SRB4. Without being configured with SRB4, the UE will not be able to send the QoE measurement reports to the network. Hence, it is proposed to clarify that the UE should discard the reports received from application layer in case it has no associated QoE configuration / SRB4 established. Based on the discussion in these papers, the following proposals are made:

**Proposal 7: When the UE moves to RRC IDLE state, it releases SRB4, releases all QoE configurations and discards any pending or not reported QoE data.**

**Proposal 8: The UE discards the reports received from application layer in case it has no associated QoE configuration configured.**

## 2.3 QoE handling upon receiving Full configuration

In [2], it is proposed that upon receiving full configuration during a handover, a UE shall check if otherConfig includes the QoE configuration or not. If the same QoE configuration exists, the UE shall continue the QoE measurements and otherwise, the UE should release QoE configuration. In order to reduce signalling overhead, it is further proposed in [2] that QoE configuration container is included optionally in QoE configuration, so that the network does not have to repeat QoE configuration in case it wants the UE to keep the QoE configuration upon full configuration procedure. Repeating the configuration will also make the UE to release an old QoE configuration and treat the repeated as the new one, since the UE is not able to really tell whether the configuration is the same or not. Therefore, it is proposed:

**Proposal 9: Upon FullConfig, the gNB can indicate to the UE the identifiers of QoE configurations which should be kept by the UE and the UE shall continue the QoE measurements for the indicated QoE configurations.**

## 2.4 QoE handling during mobility in RRC INACTIVE

In [7], it is proposed to discuss whether the UE should always store and recover all of its QoE configurations when transitioning between RRC INACTIVE and RRC CONNECTED states, or whether there should be a possibility for the network to decide which QoE configurations are stored/recovered, e.g. via RRCRelease or RRCResume message.

In [8], it is proposed to discuss how to restore QoE configurations stored in the UE context in three scenarios:

1. UE resumes the connection in the gNB supporting QoE with no overload/congestion.
2. UE resumes the connection in the gNB supporting QoE in an overload/congestion situation.
3. UE resumes the connection in the gNB not supporting QoE feature.

Furthermore, it is proposed in [8] that:

* When the UE resumes RRC connection in a gNB not supporting QoE, UE restores QoE context and performs QoE measurements but pauses QoE reporting. UE recognizes gNB not supporting QoE by the lack of indication to restore QoE in RRCResume message.
* When UE resumes RRC connection in a gNB supporting QoE, UE restores QoE reporting only after receiving explicit indication in RRCResume message.
* The gNB supporting QoE can release or pause all or part of QoE configurations during RRC resume.

Similar topic is discussed in [4]. It is indicated that the overall principle should be the same as for UE mobility in RRC CONNECTED state, i.e. it is the target gNB (new serving gNB), which should decide which QoE configurations to keep and which to release, e.g. based on area information received from the source node (anchor gNB). According to [4], this can be achieved by gNB sending an indication to the UE in RRCResume message about which QoE configurations should be kept at the UE and when there is no indication to restore the QoE configurations, the UE should release all of its QoE configurations. This way, it is possible to release all QoE configurations from the UE (e.g. when the connection is resumed in a gNB not supporting QoE) or some of the configurations (e.g. those which are not in relevant in the area where the UE resumes the connection).

Based on the above, it seems that an explicit indication in RRCResume to restore QoE configurations is required/beneficial to support at least the case where the UE resumes the connection in a gNB not supporting QoE as well as to release the QoE configurations which are not valid in the new gNB. Since an explicit indication is proposed in both [4] and [8] while [7] seems to be neutral on this topic, RAN2 is requested to discuss and agree the following proposal:

**Proposal 10: When the UE resumes the connection in a gNB supporting QoE, the target gNB should explicitly indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure, e.g. in RRCResume message. The UE shall release all QoE measurement configurations not indicated by the gNB for restoration.**

There are different views on what should happen in case the UE resumes in the gNB not supporting QoE (e.g. in [4] and [8]), so it is further proposed to discuss the following proposal:

**Proposal 11: RAN2 is requested to discuss handling of QoE configurations when resuming the connection in a gNB not supporting QoE (recognized, e.g. by the lack of QoE indication in RRCResume):**

1. **The UE shall release all QoE measurement configurations.**
2. **The UE restores QoE context and performs QoE measurements but pausing QoE reporting.**

It is also proposed to discuss further whether it is required to allow a possibility for a target gNB to pause QoE measurement reporting during RRC Resume procedure, as proposed in [8]:

**Proposal 12: RAN2 is requested to discuss whether it should be possible for the gNB to restore and pause QoE measurement reporting for some/all QoE configurations during RRC Resume procedure.**

# 3 Offline [046] discussion

## 3.1 Potential easy agreements

The following proposals from [10] were identified by the rapporteur as potential easy agreements:

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| **Proposal 1: RAN2 assumes that all QoE mobility related agreements made by RAN2 are applicable at least to signalling based QoE. Whether the same applies to management-based QoE is pending further input from SA5 and RAN3.**  **Proposal 2: Area scope parameter is not introduced in RRC procedures supporting QoE.**  **Proposal 3: The target gNB decides which QoE configurations to keep and which to release during a handover, e.g. based on QoE configuration information received from the source gNB in Xn signalling and/or UE’s current RRC configuration of QoE.**  **Proposal 7: When the UE moves to RRC IDLE state, it releases SRB4, releases all QoE configurations and discards any pending or not reported QoE data.**  **Proposal 8: The UE discards the reports received from application layer in case it has no associated QoE configuration configured.**  **Proposal 10: When the UE resumes the connection in a gNB supporting QoE, the target gNB should explicitly indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure, e.g. in RRCResume message. The UE shall release all QoE measurement configurations not indicated by the gNB for restoration.** |

**Question 1: Companies are requested to indicate in the below table in case they object to any of the proposals above.**

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| **Company** | **Objected proposal** | **Reason for objection / alternative proposal** |
| CMCC | 8 | We may not be able to decide Proposal 8 for now, and recall that we haven’t got the reply on LS to SA4 asking where to store the report, and we haven’t got the reply on LS to SA5 asking whether the configuration release will impact the ongoing session. So it might be safer to wait for feedbacks. |
| Qualcomm |  | Not object but further clarification  For P3, it is unclear what configuration information in the “*e.g. based on QoE configuration information received from the source gNB in Xn signalling and/or UE’s current RRC configuration of QoE*” part. Actually, RAN3 is discussing this issue.  For P10, it should allow another option, i.e. 1-bit flag indicates to restore all the QoE measurement configurations, which is also proposed in R2-2107817. |
| Huawei, HiSilicon | No objections, but some clarifications | @CMCC: P8 is not related to pause/resume mechanism which we asked SA4 about. The proposal speaks of the case when there is no QoE configuration configured in RRC that corresponds to the report received from app layer. In this situation the UE will never get a possibility to report it and there is no use of storing it. The described situation may happen in case RRC releases the QoE configuration while the QoE measurement is still ongoing in application (and this is possible according to current agreement already)  @Qualcomm:   * For P3: The main purpose of the proposal is to agree that it is target gNB’s decision which QoE configurations to keep and which to release during a handover. RAN3 already agreed that signalling based QOE configuration is forwarded to target gNB and also UE AS context containing QoE RRC configuration will be forwarded, so this information can be used when making the decision (these are just examples anyway). * For P10: As during a handover without fullConfig, the gNB needs to have a possibility to indicate which configurations to keep and which not to keep (see P3). This is the same for HO with fullConfig as also in this case only a subset of QoE configuration may be relevant (e.g. because the UE moves out of area scope). Therefore, 1-but flag is not sufficient. We could have it as an optimization to handle a special case where all or none QoE configurations are relevant, but is it really worth it? |

## 3.2 Discussion on mobility in RRC CONNECTED

Based on the companies contributions, the following proposals were made in [10] with respect to QoE configuration handling during UE mobility (with no full configuration):

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| **Proposal 4: The UE informs the gNB when the QoE measurement session starts or when the session ends, e.g. to enable QoE configuration handling upon mobility or for QoE activation/deactivation procedures.**  **Proposal 5: RAN2 sends an LS to CT1 group to specify session start and session end indications from application to AS layer.**  **Proposal 6: If SA4 confirms that the requirement for configuration changes of ongoing QMC sessions is applicable also for NR QMC: In case the UE moves out of the measurement area during a handover, the target gNB should release the QoE configuration of the UE if the related QoE measurement session is not ongoing and should keep the QoE configurations for which the QoE measurements are ongoing (regardless of whether the UE stays within the associated QoE area or not).** |

The rationale for introduction of session start/stop indications from the UE to the gNB is that:

1. Session start/stop indications are used by the network during session activation and deactivation procedures.
2. Under normal circumstances (e.g. when there is no overload in the network), the gNB should not release the QoE configuration for which the session is ongoing, even when the UE moves out of the QoE measurement area during handover.

It was raised during an e-mail discussion that whether the requirement of QoE measurement continuity outside the measurement area is applicable to NR is still pending SA4 confirmation. RAN3 sent an LS to SA4 to ask this question in [11]. On the other hand, reason mentioned in bullet in 1 seems to still hold for NR. Companies are then requested to answer the following questions:

**Question 2: Do companies agree that the UE should inform the gNB when the QoE measurement session starts or when the session ends?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Reason / comments** |
| CMCC | Yes | Since QoE measurement is an end-to-end behaviour, and gNB is agnostic to whether the ongoing session is over or not otherwise. UE could have such flexibility to inform RAN to perform more flexible configuration release over uu. |
| Qualcomm | No | We have several comments on this proposal, and there are some drawbacks identified.  - For the activation or deactivation purpose, we don’t see the motivation to do that. From RAN point of view, when RAN receives the QMC configuration and then configures to the UE, then the QMC is activated. No need further start or end indication.  - From mobility perspective, RAN3 asked some questions to SA4 about the QoE measurement continuity requirement and whether “release” command will affect the ongoing sessions. SA4 answer will directly impact our discussion. So anyway, we need to wait. And in SA4, Location filter is already introduced TS26.114 and TS26.247 as following, that means UE application layer will check the location to determine whether to start a new session or not. If introducing RAN level mechanism, how to co-exist with application layer mechanism? what is the motivation to introduce RAN level mechanism on top of application layer mechanism?  *“****<LocationFilter>***  *When present, this element indicates the geographic area(s) or location(s) where quality metric collection is requested. When not present, quality metric collection is requested regardless of the device’s location. The LocationFilter element comprises one or more instances of any combination of targeted cell-IDs, polygons and circular areas.Each cell-ID entry in LocationFilter is announced in cellList, and each polygon and circular area entry is announced in the polygonList or and circularAreaList elements, respectively.”*  - We introduce pause and resume mechanism for SRB4, and SRB will be treated as lower priority. The start and end indication cannot be reported to the gNB in time, which will mislead the gNB behaviour.  - There could be multiple APPs running in the UE and multiple QoE sessions for each APP. If we consider per-slice QoE, that could be much more. If UE reports every start and end indication for all the QoE session, a large of signalling overhead will be cost.  - If finally we really need introduce something, we prefer to consider “low cost” and in-time mechanism instead of costing large of Uu signalling overhead. |
| Huawei, HiSilicon | Yes | This is useful not only in case of QoE measurement continuation outside of measurement area, which is pending SA4 reply. Based on SA5 specifications, this indication is also passed to OAM so that OAM knows whether there is sufficient number of QoE measurements ongoing already or not.  Also, we do not really agree with the disadvantages mentioned by Qualcomm. The overhead for sending a single bit indication for session start/stop is very limited and even though SRB4 has lower priority than other SRBs it does not mean that its delay will be significant.  Also, in case SA4 agrees the requirement for mobility holds, then we do not understand how location filter can be used by the gNB for this purpose. gNB has no knowledge about the location filter, so it cannot know whether it should or should not release the QoE configuration when the UE moves out of the are scope. |

**Question 3: Do companies agree that, in case SA4 confirms that the requirement for configuration changes of ongoing QMC sessions is applicable also for NR QMC, then if the UE moves out of the measurement area during a handover, the target gNB should release the QoE configuration of the UE if the related QoE measurement session is not ongoing and should keep the QoE configurations for which the QoE measurements are ongoing (regardless of whether the UE stays within the associated QoE area or not).**

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| **Company** | **Yes/No** | **Reason / comments** |
| CMCC | Yes | We generally agree to this proposal, but whether it can be turned as an agreement depends on SA4’s feedback. |
| Qualcomm | No | As commented for question 2 |
| Huawei, HiSilicon | Yes | The proposal already assumes that SA4 feedback is considered and is conditional on this feedback. |

In [10], also the following proposal was made with respect to UE mobility where full configuration is applied during handover.

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| **Proposal 9: Upon FullConfig, the gNB can indicate to the UE the identifiers of QoE configurations which should be kept by the UE and the UE shall continue the QoE measurements for the indicated QoE configurations.** |

The scenario which is targeted by this proposal is when the target gNB supports QoE, but does not support another configuration of the UE and has to apply full configuration due to that reason. It was indicated that in case QoE configurations would be provided by the gNB explicitly, then the UE would have to resend them to the application layer, which would be treated as an overwrite of the previous QoE configuration with the same identifier. Based on this, companies are requested to reply to the following question:

**Question 4: Do companies agree that, upon FullConfig, the gNB can indicate to the UE the identifiers of QoE configurations which should be kept by the UE and the UE shall continue the QoE measurements for the indicated QoE configurations?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Reason / comments** |
| CMCC | Yes |  |
| Qualcomm | Yes but | Generally ok, but need the source gNB forwards the RRC ID together with the Reference and configuration to the target gNB. |
| Huawei, HiSilicon | Yes | As for QCM’s comments, we understand that this will be done as for each handover (source gNB does not know whether target gNB performs fullConfig or not, it just passes information as usual). |

## 3.3 Mobility in RRC INACTIVE

Except for Proposal 10 from [10] which addresses QoE handling during connection resume in the gNB supporting QoE, the following proposal was made in [10] for the case where the connection is resumed in the gNB not supporting QoE.

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| **Proposal 11: RAN2 is requested to discuss handling of QoE configurations when resuming the connection in a gNB not supporting QoE (recognized, e.g. by the lack of QoE indication in RRCResume):**   1. **The UE shall release all QoE measurement configurations.** 2. **The UE restores QoE context and performs QoE measurements but pausing QoE reporting.** |

Option 1 assumes that the QoE configurations are simply released by the UE as they cannot be reported in the gNB not supporting QoE and such gNB cannot anyway belong the QoE measurement area scope.

Option 2 on the other hand proposes that even though the measurements cannot be reported to the gNB where the connection was resumed, they can be stored in the UE and reported later. However, during e-mail discussion, there were some doubts raised about the feasibility of this approach on the network side. Specifically, it was pointed out that the QoE configurations need to be forwarded between gNBs at handover, but a gNB which does not support QoE can never forward any QoE information.

Base on the above, companies are requested to answer to the following question.

**Question 5: In your opinion, in case the UE resumes the connection in a gNB not supporting QoE, the UE should:**

**Option 1: The UE should release all QoE measurement configurations.**

**Option 2: The UE should restore QoE context and perform QoE measurements but pause QoE reporting.**

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| **Company** | **Preferred approach** | **Reason / comments** |
| CMCC | Option 1 | Option 1 seems to be a simple way that will not cause mismatch between gNB and UE. |
| Qualcomm | Option 2 | Can satisfy QoE measurement continuity and to keep application measurement behaviour agnostic to RAN situation. |
| Huawei, HiSilicon | Option 1 | As indicated above, option 2 seems not to work and proponents should first clarify how to address the issues that were raised.  We also do not understand why QoE measurement continuity is mentioned here if it is challenged even for RRC Connected mode QoE? Especially considering that in RRC Inactive the UE will have no ongoing QoE measurements so what is to be continued? |

There was also a proposal in one of the contributions which is echoed in [10] in the following way:

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| **Proposal 12: RAN2 is requested to discuss whether it should be possible for the gNB to restore and pause QoE measurement reporting for some/all QoE configurations during RRC Resume procedure.** |

In the rapporteur’s understanding this proposal applies to connection resume under gNB supporting QoE and is an optimization on top of baseline behaviour proposed by Proposal 10 from [10]. The rationale is that the connection can be resumed under the gNB which is in overload condition. In this case, instead of releasing the QoE configuration (which would already be possible in case Proposal 10 is agreed), the gNB would have a possibility to pause reporting for some of the configurations. The companies are then requested to answer the following question:

**Question 6: Do companies think that it should be possible for the QoE supporting gNB to restore and pause QoE measurement reporting for some/all QoE configurations during RRC Resume procedure.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Reason / comments** |
| CMCC | Yes | gNB could have such flexibility for overload control. |
| Qualcomm | Yes | Useful for the case of resume in RAN overload, no need another reconfiguration procedure to pause QoE configuration. This is the same handling for today’s SCG bearers restoration. |
| Huawei, HiSilicon | Rather not | When the UE moves from RRC INACTIVE, it has no ongoing QoE measurements. In that situation, the gNB can just release the configurations if there is overload. This seems rather as a minor optimization. |

# 4 Summary

TBD

# References

1. R2-2107513 QoE handling in RAN Nokia, Nokia Shanghai Bell
2. R2-2108110 Mobility Support for NR QoE Management Ericsson
3. R2-2108111 [Draft] Support for Session Start and Session End Indication Ericsson
4. R2-2108207 QoE handling during UE mobility Huawei, HiSilicon
5. R2-2108228 Discussion on NR QoEcontinuity in handover ZTE Corporation, Sanechips
6. R2-2108595 Discussion on QoE continuity during mobility vivo
7. R2-2108514 More considerations on configuration and reporting CMCC
8. R2-2107817 Left issues for QoE pause and resume procedure Qualcomm Incorporated
9. R2-2107381 Activation and deactivation for QoE collection CATT
10. R2-2109040 [Pre115-e][008][QoE] Summary Support for Mobility Huawei, HiSilicon
11. R2-2106945 LS on requirement for configuration changes of ongoing QMC sessions (R3-212953; contact: Qualcomm)