3GPP TSG-RAN WG2 Meeting #116e Tdoc R2-21xxxxx

November 1st - 12th 2021

Agenda: 8.14

Source: Ericsson

Title: Summary of e-mail discussion [080] Mobility

Document for: Discussion, Decision

# 1 Introduction

In this document the following e-mail discussion is handled:

* [Post116-e][080][eQoE] Mobility (Ericsson)

 Scope: Discuss whether RAN2 intends to fulfil the SA4 requirements related to mobility, what those requirements are (e.g. based on different case). Determine whether we need further clarifications by LS, and if so LS approval. In case there is need (in order to converge on mobility in general), the non-LS part of this discussion can continue in a long email discussion (and then the report is then for next meeting).

 Intended outcome: Approved LS out, Report

 Deadline: Short 2 (not for RP)

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# 2 Discussion

## 2.1 Possible LS to SA4

In RAN2#116e RAN2 discussed the SA4 requirements related to mobility, described in TS 26.247 clause 10.1. RAN3 previously sent an LS to SA4 (cc: RAN2) in R2-2106945 asking for clarification of the requirement and SA4 replied in R2-2109384. There were different views in RAN2 of what the reply means. An LS to SA4 for clarification could be one option to be able to proceed in RAN2. The requirement:

“*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.”*

Question 1: If RAN2 would send an LS to SA4 for clarification of their requirement in TS 26.114, what do you think the question(s) should be?

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| **Company** | **Answer** |
| Ericsson | We could ask SA4 to describe the wanted network and UE behaviour related to mobility and release, e.g. when the UE moves out of the area and there is an ongoing session. Also, we could ask about the expected behaviour if the network needs to release the measurements for some other reason. |
| Samsung | In RAN2#116e, RAN2 showed different views on whether or not ongoing session is affected in case of release of QoE configuration. In our understanding, in LS (i.e., R2-2109384), SA4 clarified "*the logging and reporting criteria for ongoing session should be affected when the client receives a release of the QoE configuration."*. However, there were some companies who have different understanding (i.e., ongoing session is NOT affected in case of release of QoE configuration). Therefor we are fine to ask SA4 to clarify this issue. |
| vivo | We would ask SA4 the following:- What is the intention to continue the QoE measurement when the UE moves out of the target Area Scope? - How to utilize the QoE measurement outside the target Area Scope?- If the intention is to collect the QoE at the edge of specific cells, is it feasible that just extend the Area Scope, i.e., adding the neighbour cells into the target Area Scope?- Whether SA4 has any concern about the current Area Scope checking solution of RAN side (without session start/end indication from UE). Worth noting that RAN side solution will not introduce spec impact on the current client behaviour, that is, the target Area Scope is checked by RAN node.- If the RAN node needs to check the QoE session state when UE moves out of the target Area Scope, the QoE session state may always be exposed to RAN node, which will introduce user privacy concerns, is it acceptable from SA4 perspective? |
| ZTE | How to handle a QMC session in the following scenario and explain their understanding:1. UE moves out of the areascope with an ongoing QMC session
2. UE moves out of the areascope with a not ongoing QMC session(e.g. not activated QoE session, QoE session with paused QoE reporting flag).
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| Huawei, HiSilicon | There are two different aspects that need to be considered, related to two different questions from RAN3 posed in R2-2106945. It seems the confusion comes from the fact that these two aspects are mixed.First question from RAN3 was:

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| *Q1: Will the requirement for configuration changes of ongoing QMC sessions be applicable also for NR QMC?* |

This requirement comes from TS 26.247, clause 16.3 and it is quoted directly in the RAN3 LS, as follows:

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| RAN3 is discussing, in the context of NR QMC, the following SA4 requirement described in TS 26.114 clause 10.1, TS 26.247 clause 16.3, which was defined for QMC in UMTS and LTE. *“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.”* |

The yellow part refers to geographical filtering, i.e. checking area scope, and it says it should only be done when the session starts. Since the answer to this question from SA4 was simply: “Yes.”, it is clear that this requirement should be met and the gNB should not release an ongoing QoE measurement even if the UE moves out of the area scope.Then, the second question was about the UE behaviour when the release is received. RAN2 already agreed that the network may release QoE configuration any time and SA4 just confirms this. It does not mean that the gNB should release ongoing QoE configurations when the UE moves out of area scope as suggested by some companies.To us, the situation is clear based on the current reply:1. In normal circumstances, gNB should not release the QoE configuration for ongoing QoE session, no matter whether UE is moving out of area scope or not (see reply to Q1 from SA4).
2. If the gNB sends release for QoE configuration, the QoE configuration is released by the UE, no matter whether it is ongoing or not (see reply to Q2 from SA4).

We would prefer not to unnecessarily bother SA4 with another LS, but in case companies interpret this differently, then we are OK to ask to confirm bullet 1 above (bullet 2 seems clear). We should just focus on the SA4 preferred behaviour, no need to ask for motivations etc. |
| Intel | Agree with Ericsson’s comment and we are fine to check with SA4 for further clarification. |
| Qualcomm | We are fine to ask SA4, with the following questions1) What is the intention to continue the QoE measurement when the UE moves out of the Area Scope? 2) It is noticed that SA4 specification already defines the application layer QoE configuration, including the location filter information will be provided to UE client, and UE client will check whether to initiate QoE session based on the location filter information. RAN2 would like to ask whether such application layer mechanism already satisfies the requirement “*This also includes evaluation of any filtering criterias, such as geographical filtering, which shall only be done when the session starts.”;* if no, what ‘s the different of RAN level geographical filtering and application layer level geographical filtering? |
| Ericsson | We also think we can ask the difference/relation between the area that the gNB has and the area defined inside the container. |
| CATT | About the area scope controlled in the container or out the container, in 26.247 and 26.114, SA4 mentioned as below:  *Note that if geographical filtering is handled on the network side (i.e. QoE reporting is turned on/off by the network depending on the UE location), no LocationFilter should be specified in the QoE Configuration, as this would mean two consecutive filterings.*From the above quote, the area scope in container will be omitted if the NW handles the area scope. So we don’t need to ask question related to this issue.But one issue like as Huawei said as below: *1.In normal circumstances, gNB should not release the QoE configuration for ongoing QoE session, no matter whether UE is moving out of area scope or not (see reply to Q1 from SA4).* *2.If the gNB sends release for QoE configuration, the QoE configuration is released by the UE, no matter whether it is ongoing or not (see reply to Q2 from SA4).*These two behaviors may be conflicting when we use the NW handle the area scope solution. i.e. when UE moves out the area scope, the NW will send release to UE. If we follow the item2, the ongoing session will be released but the behavior does not obey the item1.So we may have two approach, one is RAN2 to specify the different release type. Another approach is that we state our solution about he area scope and check how to handle this issue from their specification with SA4 |
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Summary: Several questions were listed above, so it seems to be relevant to send an LS. An LS is drafted separately.

## 2.2 Phase 2

### 2.2.1 Phase 2 preparation

In RAN2#116e RAN2 discussed the SA4 requirements

There is also a second part of the e-mail discussion related to whether to fulfil the SA4 requirement and how to converge on mobility in general. Please provide feedback related to this part in question 2.

Question 2: Is there something related to the SA4 requirement that could be discussed already now? Is there some other mobility issue that needs to be discussed?

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| **Company** | **Answer** |
| Ericsson | We think we can discuss different solutions related to the SA4 requirements and the pros and cons of the different solutions. When the reply is received, we can decide what to do.We would like to discuss different options related to fullConfig from a technical point of view. |
| Intel | We suggest discussing the full solution of mobility issue, not limited to fullConfig. This includes procedure of normal handover, RRC Resume, RRC Setup including to legacy gNBs, Rel-17 gNBs not supporting the feature, e.g. what to be released/setup and how, forward compatibility, RRC ID handling at AS layer, whether is AS layer or application layer to be responsible for the release of application layer measurement report, etc. |
| CATT | Contribution driven for the mobility issue discussing. Forward compatibility should be the imported fact since the RAN-visible QoE will be discussed in RAN2 soon. |
| Ericsson | Agree to discuss various technical issues related to Mobility, that is also the part of the e-mail discussion. |
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### 2.2.2 Phase 2 discussion

In case the SA4 requirement needs to be fulfilled, the measurements may need to continue until the end of the session, even if the UE moves outside the configured area. The following solutions to achieve that behavior have been proposed:

* 1) Session start/stop indication. The UE sends an indication to the network when the session in the application layer starts and stops. The network then has information about ongoing sessions and can release the measurements at the right time.
* 2) The network sends release to the UE when the UE exits the area, but the UE doesn’t release the measurements until the session is completed. The UE needs to indicate to the network when the session is finally released, so that the network can release the measurement configuration also.
* 3) The network sends on indication to the UE when it exists the area, and presumably when it re-enters the area. Maybe needs to be combined with 2).
* 4) The LocationFilter inside the QoE configuration file is used by the application for area handling.
* 5) Network sends area scope to UE AS layer, and the UE AS layer checks whether UE moves outside of the area scope, and then indicates to application layer whenever UE moves outside or inside of the area scope.
* 6) Option 4)+Network-based release (as current RAN3 agreed). For those QoE configurations which require QoE session continuity, option 4) is applied; for those QoE configurations which don’t requires QoE session continuity, network-based release can be applied.

Question 3: Please give technical comments to the solutions above (or propose new solution), e.g. issues, benefits, unclear things.

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| **Company** | **Answer** |
| Intel | As defined in TS26.114 section 16.5.1, “If the MTSI client is informed that it is not inside the area, it shall not start any new QoE measurements even if it has received a valid QoE configuration container, but shall continue measuring for already started sessions.” However, it is not clear that whether the UE still needs to send the measurement report back to the network when it moves outside the configured area. From this aspect, we would like to wait for more information replied from SA4.If UE still needs to send the QoE measurement reports back to network even it moves outside of the area, the solution depends on where the geographical filtering is handled, e.g. network side or UE side. Case 1: When the geographical filtering is handled at network side, no LocationFilter will be specified in the QoE Configuration container, which will be sent to the UE. The QoE reporting is turned on/off by the network depending on the UE location. Hence, Solution 3) is preferred when area scope is handled by the network.Case 2: When the geographical filtering is handled at the UE side, that is, LocationFilter is included in the QoE configuration container and sent to the UE. The details of this needs confirmation from SA4. For example, can it be handled entirely within the application layer (option 4)? What is the UE expected to do with the results if it is outside of the area? When QoE measurement in application layer is finished when UE is outside of the area scope, should the UE send the session stop indication to the network and let the network decide whether and when to send QoE measurement report and when to release the corresponding QoE session? Should the result be retrieved when the UE is back in the area? However, there’s no need for the UE to send session start indication if UE moves outside of the area, considering new QoE session should not start when the UE moves outside of the configured area. |
| Apple | The solutions described above do not include the solution we proposed in R2-2110073 (submitted to R2-116e); namely, that the “the gNB provides explicit out-of-area indication to the UE while releasing QoE measurement configuration.” This can be thought of as extension of Alternative 2.We are opposed to the UE sending start/stop indications (Alternative 1) to the gNB because we are concerned about the leakage of unintentional and/or unauthorized information and the significant complexity at both UE and gNB.We are not sure why Alternative 3 needs to be considered since the same objective can be reached by releasing and activating QoE measurements based on area scope by the network.We need to wait for SA4 response before evaluating the feasibility of Alternative 4. |
| OPPO | Network based solution is preferred by us, especially considering that simultaneously multiple QoE measurement configuration and reporting are supported in 5G NR. UE based solution requires large UE memory space for storing different area scope for different QoE measurement configuration and more processing load.When UE leaves a certain area, it should be the network responsibility to check if UE enters an area outside the configured area scope and decides whether to transmit a out-of-area indication towards the UE. Upon reception of the indication, the UE should not trigger measurement for the corresponding QoE configuration. Whether or not to continue the measurement if already triggered depends on the SA4’s decision |
| Huawei, HiSilicon | It seems the companies forgot about the following RAN3 agreement:- Option 1 is agreed by RAN3 on area handling for QoE i.e. the network is responsible for keeping track of whether the UE is inside or outside the area and the network configures/releases configuration accordingly.The other two options were excluded already by RAN3 and these correspond to solution 3) (option 2) and solution 5) (option 3). Since only solution 1) is compatible with the previous agreement, we should follow it unless we identify a blocking issue or a major drawback which we currently do not see. When it comes to solutions reusing location filter, we should note that there is the following clarification in TS 26.247, Annex L.2:“Note that if geographical filtering is handled on the network side (i.e. QoE reporting is turned on/off by the network depending on the UE location), no LocationFilter should be specified in the QoE Configuration, as this would mean two consecutive filterings.”This means that it is up to the network choice/deployment whether to use location filter or rely on network based filtering (i.e. NG-RAN based filtering in this case). Solution 4) is already specified by SA4 while for RAN based filtering, solution 1) is needed. What we can clarify is that it should be possible to turn on/off session start/stop indications, e.g. in the case the network relies on location filter in application layer, they may not be needed.Solution 2) seems to have the same final result as solution 1). However, we do not think it is acceptable to allow the UE to ignore the release command from the network. |
| China Unicom | We support option 1.For UE-handling geographic filtering solutions, the disadvantages can be shown clearly as following:Firstly, for management-based QoE, UE-handling solutions will increase extra signalling interactions due to that network will send the configurations to the UEs which are not in the Area Scope.Secondly, UE-handling solutions will also increase extra signalling interactions and the complexity at handover. For example, network cannot directly release QoE sessions which are not ongoing at handover preparation phase, until UE accesses to the target gNB. And more specs impacts are required.So UE-handling geographic location solutions can be excluded.And according to the latest RAN3 agreements as below, UE won’t stop the measurement unless it received the release indication from the network. So it’s clearly enough that UE needs to send the measurement report back to the network when it moves outside the configured area. So RAN2 can decide this without RAN4’s reply.**“A UE should continue an ongoing measurement once it leaves the Area, unless the network indicates to the UE to release the QoE configuration.****The network is responsible for keeping track of whether the UE is inside or outside the area. ”**According to RAN3 agreements above, the network (which means NG-RAN) is responsible for keeping track of whether the UE is inside or outside the area, thus the NG-RAN side is responsible to handle the geographical filtering. However, LocationFilter indication cannot be handled by the NG-RAN, which will not be aligned with RAN3 agreements. Besides, it is noted in TS 26.247 that LocationFilter should not be specified if geographical filtering is handled on the network side. Thus we support option 1 to use session start/stop indication instead of LocationFilter indication.

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| L.2 XML configurationWhen QoE reporting is configured via the QMC functionality, the configuration is done according to the XML schema below. The interpretation of the different elements and attributes are the same as described in clauses 10.4, 10.5 and Annex F in the current specification.Note that if geographical filtering is handled on the network side (i.e. QoE reporting is turned on/off by the network depending on the UE location), no LocationFilter should be specified in the QoE Configuration, as this would mean two consecutive filterings. |

And I want to clarify that session start/stop indication means whether the session is ongoing or not, it doesn’t means new QoE session should start when the UE moves outside of the configured area. So UE need to send session start indication to the NG-RAN if UE moves outside of the area, which can ensure the continuity of mobility. |
| Ericsson | We agree RAN3 has agreed a network based solution and also further agreements in the direction of session start/stop indication. We are concerned about how alignment with MDT can work if the session start/stop indication is not standardized. The UE could potentially start (pre-configured) MDT measurements when a session starts, but there are also MDT measurements in the network side and the network will not know when to start these if no session start indication is received.We don’t think there can be any privacy issue with the UE indicating session start/stop, as there are time stamps for the sessions in the QoE report, so the same information is anyhow available to the network in the QoE report.We don’t think there could be any issue with high signalling load either, as the UE is anyhow starting/stopping a session, which means much more data being transferred, so an indication will not make any difference. The user data is being transferred in the user plane, but the session start/stop indication is very small and will not have much of impact to the amount of signalling.We thought option 3 above was the option proposed by Apple, that the network sends an out-of-area indication. We think this anyhow needs to be combined with option 2, or are we missing something? Just an out-of-area indication doesn’t give the UE enough information, the network needs to indicate when the measurements should be released also. And we think there needs to be two types of release in both option 2 and 3, one for immediate release and one for pending release when the UE first should finalize the ongoing measurement. Not sure what the out-of-area adds in addition, but maybe Apple or somebody else can explain.We think option 2 is network based and could work to fulfil the SA4 requirement, but the network needs to have the option to send immediate release also. However, the alignment with MDT will not work with this option as we understand it.   |
| CATT | option 2 plus option1 is the better complete solution based on RAN3 agreements.For area scope handling, RAN3 already agree use the below network based solution**on area handling for QoE i.e. the network is responsible for keeping track of whether the UE is inside or outside the area and the network configures/releases configuration accordingly. Send LS to RAN2 and SA4 informing RAN3 agreements.**Also RAN3 agreed the UE should continue the ongoing session when it leaves area.**A UE should continue an ongoing measurement once it leaves the Area, unless the network indicates to the UE to release the QoE configuration.**From these agreements, we can derive the network behaviour for the area handling.When the UE handover from source node to target node. The source node will carry the area scope of the QoE configuration.If the target node doesn’t support QoE, RAN3 agree that**In case of mobility to a target node not supporting QoE, the target node can release the QoE configuration**If the target node support QoE, the target node will check whether itself in the area or not. Then configures or releases the QoE configuration.In general, the target node will release the configuration if target node is out of area or not support QoE.When UE receive the release, the configuration cannot be released immediately if the QoE is on-going. For the on-going status handling, we may have several solutions,1. UE does not send the start indication to network.
2. UE sends the start indication to network as SA5 specification. Then the network has the information about if any QoE session is on-going.

If we select a), the network can send the release command based on the network required. The UE itself decides how to handle the on-going session. It should be informed whether it is released for area handling. If we select b), the network have two alterative, one is same as we select the a). Another is like as option1 release the session when the on-going session is ended. In SA5 specification, the start indication is sending via SRB4 report message. There is no stop indication but use the QoE report. either use stop indication or QoE report to inform network the on-going session ended, the SRB4 configuration is needed.. So the option 2 should include option 1 for the QoE report sending from UECompare the two solutions (option1 and option2), sending the release to UE in one message when it leaves area is better than sending several messages for the different sessions at different time.So we think option 2 plus option1 is the complete solution. |
| Apple\_v2 | We would like to clarify our thinking (in response to Ericsson’s question). We think the network releases the QoE configuration after it determines that the UE is out of area scope. The network indicates to the UE that the QoE configuration is being released because of area scope considerations. The UE will then release the QoE configuration immediately (if no ongoing session) or release the QoE configuration when the current session ends. We don’t think the network needs to be informed of when the QoE session is actually released. As far as the network is concerned, it should consider the QoE configuration released. Of course, we can do all kinds of optimization but it is not clear to us that they are warranted.  |
| Qualcomm | Option 1) does not work, because it cannot prevent new sessions triggered for the non-released QoE configuration when UE moves out of the area scope.Option 2) is not clear and has the following drawbacks:* The network already send release to UE and the QoE configuration should be released in the network side.
* UE should release the QoE configuration per current agreement once receiving release command from network.
* This option does not distinguish the cases of release QoE configuration due to moving outside of area scope and other reasons.
* Cannot be applied to IDLE and Inactive state.

Option 3): The QoE configuration and context has to be maintained even they are not needed again. Outside or inside of area scope indication needs to be forwarded from AS layer to application layer; Cannot be applied to IDLE and Inactive state.Option 4) is already specified in application layer, and it is agnostic AS configuration and situation, e.g. UE RRC state, different RAT type. Can achieve QoE session continuity based on UE checking. This should be baseline solution. Cell ID needs to be forwarded from AS layer to application layer. This option requires minimum standardization efforts.Option 5) can be applied to any UE state; Outside or inside of area scope indication needs to be forwarded from AS layer to application layer.Option 6) can provide operator flexibility to control whether to apply QoE session continuity when UE moves outside of the area scope for each QoE configuration. This option requires minimum standardization efforts from RAN2 point of view.We prefer to option 4) or option 6) if SA4 confirms QoE session continuity requirement when UE moves outside of area scope; and can accept option 5), opposing other solutions.For another motivation of alignment with MDT mentioned by Ericsson. We never discussed whether session start or stop indication is needed for this scenario. Actually, gNB can by implementation to determines whether and when to start MDT measurements based on e.g. receiving the first QoE reporting or something else. |
| Samsung | We also support option 1 according to previous RAN3's agreements. Besides, we don't think this option (i.e., NW-based) can be compatible with LocationFilter (i.e., UE-based). In addition, as Huawei and ChinaUnicom captured, TS 26.247 states LocationFilter should not be specified if geographical filtering is handled on the network side. It also means, if LocationFilter is specified in QoE configuration, NG-RAN is unable to release QoE configuration. We have some doubt on this with two reasons.1) LocationFilter is set by OAM or CN, and NG-RAN does not read QoE configuration, thus being unaware of whether LocationFilter is specified or not. Thus, NG-RAN cannot determine whether it can release QoE configuration or not according to LocationFilter. 2) In addition, RAN2 agreed NG-RAN should be always able to release QoE configuration. Agreement in RAN2#113bis: *From RAN2 point of view, the UE shall follow gNB commands and, NG-RAN can in principle release by RRC the application layer measurement configuration towards the UE at any time, e.g. if required due to load or other reasons (Note that other WGs are responsible to define the normal system procedures for release and which nodes are responsible etc).* Thus, we think LocationFilter seems not needed, and would like to discuss this issue with SA4. |
| Nokia | SA4 states: “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 “ We think that if the requirement mapped to radio (layer, interface, AS support) is to continue QoE Measurement in the whole PLMN (er even more) is not realistic. There will be areas where QMC are supported and other where QMC is not. Regarding the solutions  Solution 1 breaks the independence of layers and is not tailer to RRC states (RRC Connected or Idle) Solution 2: is not acceptable: UE should to release the configuration when asked by Network.  Solution 3:NW knows the Area, and can configure/de-configure the UE based on this information. There is no need to inform the UE Solution 4: Is not relevant for RAN2/3 Solution 5: As the network is in control of the configuration cell by cell in RRC connected , this is not needed for this state. This can be discussed for RRC inactive. Solution 6: is a mix of NW based Solution4We believe only NW based solution without requiring very accurate updates between App layer and RRC layer should be considered.  |
| Ericsson | We don’t think it is correct to say that Option 1 doesn’t work as commented by QC. The UE will send a session stop indication when the session is completed and then the network will release the QoE session if the UE is outside the area.Regarding alignment with MDT, it is too late to start MDT when a QoE report is received, then the QoE measurements may already be completed (or at least they have been ongoing for a while) without any alignment. Maybe a compromise could be to limit the sending of session start/stop indications to cases where it is really needed.Regarding Apple’s solution, the network cannot release the QoE measurements immediately if the UE doesn’t. The network needs to know that a QoE report can arrive and that SRB4 still needs to be configured. Also, the UE may re-enter the area again after a subsequent handover and then also new measurements may be started. There may be a mismatch between the UE and the network if the UE re-enters the area before the session is completed, as the network thinks the measurement is released (and may use the same id for another configuration), but in fact it is still ongoing in the UE. So, the QoE configurations needs to be kept on both sides until they are finally released. We still think this option with indicating out of area is very similar as sending “pending” release, as in both cases a release is sent with the meaning that the UE should release after the session is completed. |
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A question raised is what needs to be maintained in the UE RRC layer and what is just forwarded to/from the application layer. In particular a question is whether the *measConfigAppLayerId* needs to be maintained in the RRC layer.

Question 4: What QoE information needs to be maintained in the RRC layer and for what reason?

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| **Company** | **Answer** |
| Intel | Firstly, we think it is important to have a clear and common understanding on what is stored in the AS – it is essential as it forms the basis of the any solution for reconfiguration such as during HO, full configuration.As RRC segmentation is a configuration at AS layer, and “Need M” is captured in current version of RRC running CR, *rrc-SegAllowed-r17* needs to be stored as part of UE AS configuration. As for *measConfigAppLayerId*, we think it would be good to store it in the RRC layer considering it is configured by RRC, which provides more flexibility in terms of additional AS configurations in future releases that can be linked to this *measConfigAppLayerId.* Further, if *measConfigAppLayerId* is stored in AS layer, it makes the modelling and configurations during mobility (HO, full configuration, Resume, Re-establishment) easier. For example, to indicate explicitly which *measConfigAppLayerId* of certain QoE measurement need to be released during handover to a non-QoE-supporting gNB which can still comprehend ASN.1 (full configuration is not required in this case).However, during full configuration, it should be noted that all AS configurations including *measConfigAppLayerId* in AS layer) should be released.  |
| Apple | We don’t have a very strong view. But we tend to agree with Intel’s view to maintain *measConfigAppLayerId* in RRC. |
| OPPO | Agree with Intel. *measConfigAppLayerId* should be maintained in RRC. |
| Huawei, HiSilicon | The meaning of the question is a bit unclear to us, i.e. “maintained” when? During mobility, full configuration? In general, the UE needs to store its QoE configuration, perhaps except for QoE container which, once delivered to the application layer, is not needed in AS layer. |
| China Unicom | Instead of the measConfigAppLayerId, other QoE configuration for one UE except the container needs to be maintained in the UE RRC layer. |
| Ericsson | We think the measConfigAppLayerId needs to be stored in UE RRC layer. The service type and QoE configuration can be discarded after they have been forwarded to the application layer. RAN Visible parameters may need to be stored also, we can see once we know which they are. |
| CATT | The measConfigAppLayerId should be stored in AS for the report transmission and configuration release. Also the session status which we discussed in Q3 need to maintained in AS. But I don’t think the AS need maintain the RAN-visible parameter except the RRC ID. |
| Qualcomm | At lease *measConfigAppLayerId* and service type need to be maintained in RRC layer, network will use *measConfigAppLayerId* to release corresponding QoE configuration. AS layer needs to forward the release command to concerned application layer based on the service type the *measConfigAppLayerId* correlated to.Whether RAN visible configuration needs to be maintained should be further study based on the content of the configuration and whether modification will be supported for RVQOE configuration. |
| Samsung | We think all AS configuration (i.e., measConfigAppLayerId, serviceType, pauseReporting, rrcSegAllowed) need to be stored in UE for future proof.  |
| Nokia  | Agree with Intel, the id will be stored as regular AS config (and RRC configuration between the UE and the gNB). However, during full configuration, *measConfigAppLayerId* in AS layer should be released. |
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If a UE resumes or re-establishes in a gNB which e.g. does not recognize the UE context, the network may initiate an *RRCSetup* in response. The following is currently captured related to higher layers in the *RRCSetup* procedure:

5.3.3.4 Reception of the *RRCSetup* by the UE

The UE shall perform the following actions upon reception of the *RRCSetup*:

1> if the *RRCSetup* is received in response to an *RRCReestablishmentRequest*; or

1> if the *RRCSetup* is received in response to an *RRCResumeRequest* or *RRCResumeRequest1*:

2> discard any stored UE Inactive AS context and *suspendConfig*;

2> discard any current AS security context including the KRRCenc key, the KRRCint key, the KUPint key and the KUPenc key;

2> release radio resources for all established RBs except SRB0, including release of the RLC entities, of the associated PDCP entities and of SDAP;

2> release the RRC configuration except for the default L1 parameter values, default MAC Cell Group configuration and CCCH configuration;

2> indicate to upper layers fallback of the RRC connection;

When QoE measurements are released when the UE enters Idle the following is stated:

1> inform upper layers about the release of all application layer measurement configurations;

Question 5: Is there any technical reason to add/not add the same handling at the beginning of the *RRCSetup* procedure as when QoE measurements are released?

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| **Company** | **Answer** |
| Intel | We agree the same handling of RRCSetup should be followed by QoE, i.e. all AS layer configuration (including *measConfigAppLayerId*) should be released (as though the UE received an RRC Release message). As with RRC Release, AS layer should also inform application layer to release all application layer measurement configurations.For measurement reports, if UE’s AS layer has received some QoE measurement reports which haven’t been sent to the network, all measurement reports in AS layer should also be released.  |
| Apple | We do not think there is any technical reason not to have the same wording. |
| Huawei, HiSilicon | As the UE releases its entire RRC configuration during fallback to RRC Setup, we agree that the UE should also indicate release of all application layer measurement configurations to upper layers and discard all unsent QoE reports. |
| China Unicom | We also agree the same wording can be add at the beginning of the RRCSetup procedure as when QoE measurements are released. |
| Ericsson | We think it would be clearer to add the same text at RRCSetup as when the UE enters Idle. It could easily be missed in implementation otherwise. |
| CATT | Agree with above |
| Qualcomm | From simplicity point of view, prefer to have the same handling as today’s specification, i.e. 2> discard any stored UE Inactive AS context and *suspendConfig*; and then RRC layer should informs application layer release QoE configuration. |
| Samsung | We also agree to add same wording in RRCSetup. |
| Nokia | Agree to add the same wording and add instruction on “discarding all unsent QoE reports.” |
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RAN2 agreed in RAN2#115 that the network explicitly indicates the *measConfigAppLayerId’s* of the QoE configurations that should continue at Resume. Later, most companies agreed in RAN2#116 offline [042], that the network does not need to explicitly indicate the *measConfigAppLayerId’s* at Resume with delta configuration as the QoE configurations are anyhow stored in the UE context and the network then only needs to indicate possible differences to the UE context.

Question 6: Is there any technical reason for the network to explicitly indicate the *measConfigAppLayerId* of configurations that continues (i.e. which have no change in the configurations) at Resume with delta configuration?

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| **Company** | **Answer** |
| Intel | We don’t think there’s any difference between Resume procedure for QoE and other configurations. Hence, we prefer to follow existing Resume procedure, which is to explicitly **indicate the *measConfigAppLayerId* which need to be released** as delta configuration, rather than what QoE configurations should continue.The current exception we have in the specification for Scell configuration etc. had to be done that way because these configurations were released in Rel-15 and we needed to have a mechanism to continue that using explicit signalling in gNB is a Rel-16 gNB and supports the feature. For QoE, this is not the case and all Rel-17 and future gNBs should be able to comprehend the Rel-17 ASN.1 and signal the release of the QoE configuration as is done with any another RRC configuration today.  |
| Apple | No technical reason. Of course the network has to indicate the *measConfigAppLayerId* that needs to be released. |
| Huawei, HiSilicon | In our understanding the reason to explicitly indicate QoE configurations that should be resumed is to limit the impact on gNBs not supporting QoE. Such gNBs could indicate nothing and the QoE configuration would be then released. But such gNBs could also just implement release of QoE configuration, which should not be a big burden, so perhaps there is no need to diverge from normal delta configuration in this case.  |
| China Unicom | We agree with that the network to explicitly indicate the measConfigAppLayerId of configurations that continues (i.e. which have no change in the configurations) at Resume with delta configuration. So that QoE configurations not indicated by the network (including both gNBs supporting QoE or not supporting QoE) can be released.  |
| Ericsson | We don’t see any reason for the network to explicitly indicate the measConfigAppLayerId at delta configuration. If the target supports QoE, nothing needs to be sent as the UE anyhow has the QoE configurations and only possible differences need to be sent. If the target does not support QoE and doesn’t understand the QoE configuration, the network cannot send a delta configuration. Instead, a fullConfig will be triggered and the measurements will be released if no measurement is indicated. If the target does not support QoE, but somehow understands the QoE configuration, it can release them, otherwise it could trigger a fullConfig.  |
| CATT | We share with intel |
| Qualcomm | We agree with that the network to explicitly indicate the measConfigAppLayerId of configurations that continues (i.e. which have no change in the configurations) at Resume with delta configuration, and share the comments with Huawei.We need to consider the case that UE resume RRC connection in a gNB not supporting QoE (called legacy gNB). In this case, the legacy gNB may ignore the UE context it cannot comprehend, and resume other UE context using RRCResume message. Then when UE receives legacy RRCResume message, it should recognize the gNB does not support QoE or the stored QoE configurations are not valid anymore.The same handling should be also applied to the case that the target gNB does not support QoE during HO, i.e. the UE receiving legacy HO command should recognize the gNB does not support QoE or the stored QoE configurations are not valid anymore.We have different understanding with Ericsson about the case that the target gNB does not support QoE. As today’s specification, gNB fall back to RRCSetup only happens in case that the gNB cannot retrieve UE context or cannot verify UE context. So it is new requirement for gNB to fall back to RRCSetup in case that the gNB cannot comprehend part of UE context, this is not backward compatible.  |
| Samsung | There is no need for network to explicitly indicate the *measConfigAppLayerId* of configurations that continue. They are not "delta" configurations. Thus, we prefer to have similar procedure as legacy when delta configuration is used. (i.e., Network indicates only differences between the QoE configurations at resume). |
| Nokia | We agree with Intel and Huawei.  |
| Ericsson | We agree with QC that the response may not always be RRSSetup if the network doesn’t understand the UE context. The network may also send RRCResume with full configuration. Delta configuration will only be used if the network understands the UE context. If full configuration is triggered and the network doesn’t understand the UE context, our proposal in question 7, option 3 works fine. Chapter 5.3.5.11 is used both at resume and handover with fullConfig, so the proposal is applicable for both cases. 1> if no *measConfigAppLayerId* is indicated in the *measConfigAppLayerToAddModList*:2> inform upper layers about the release of all application layer measurement configurations;2> discard received application layer measurement report information from upper layers;2> consider itself not to be configured to send application layer measurement report. With this proposal a gNB which doesn’t understand the UE context doesn’t have to send anything to release the measurements, the UE will release them anyhow.If gNB uses RRCResume with delta configuration, it has to understand the UE context, otherwise it is impossible for the gNB to build a delta configuration, it cannot build a delta towards something it doesn’t understand. For this case, the UE continues uses what it had before and only possible differences need to be indicated, as normal. The agreement with had for Resume is not clear whether it is for delta of full configuration, therefore it is not possible to add it to the specification without further clarification. Different chapters in the spec are used for delta and full config and we still havn’t seen any technical reason to add it for the delta case.  |
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In existing RRC specification, at *fullConfig* the radio configurations in the UE are released, but not higher layer configurations such as application layer measurements:

5.3.5.11 Full configuration

The UE shall:

1> release/ clear all current dedicated radio configurations except for the following:

- the MCG C-RNTI;

- the AS security configurations associated with the master key;

- the SRB1/SRB2 configurations and DRB configurations as configured by *radioBearerConfig* or *radioBearerConfig2*.

Currently the application layer measurements are not released, which means that the measurements will continue in the application layer until the UE enters Idle. The reports will be discarded by the RRC layer according to RAN2 agreement, as long as the network doesn’t configure the same *measConfigAppLayerId* again.

The *fullConfig* may be triggered if the target node doesn’t recognize something in the UE context (not necessarily the QoE part of the context) or for other reason.

Some alternatives for *fullConfig*:

* 1) No change to current specification. The measurements will be hanging until the UE enters Idle or until the network configures the same *measConfigAppLayerId* again. This is the case in LTE.
* 2) The measurements are always released at *fullConfig*. This solution was rejected for LTE in RAN2#116 (see R2-2111148 and R2-2111149) ) as the QoE measurements cannot continue at any resume/handover/re-establishment with *fullConfig* in such case. The following (or similar) would need to be added to the CR:

The UE shall:

1> release/ clear all current dedicated radio configurations except for the following:

- the MCG C-RNTI;

- the AS security configurations associated with the master key;

- the SRB1/SRB2 configurations and DRB configurations as configured by *radioBearerConfig* or *radioBearerConfig2*.

[..]

1> else (full configuration after re-establishment or during RRC resume):

2> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SIB1*;

1> inform upper layers about the release of all application layer measurement configurations;

1> discard received application layer measurement report information from upper layers;

1> consider itself not to be configured to send application layer measurement report.

* 3) The measurements are released if the network doesn’t indicate any *measConfigAppLayerId*, i.e. if the target node cannot understand the QoE configurations. If the target node understands QoE configurations, the measurements can continue. The following (or similar) would need to be added to the CR:

The UE shall:

1> release/ clear all current dedicated radio configurations except for the following:

- the MCG C-RNTI;

- the AS security configurations associated with the master key;

- the SRB1/SRB2 configurations and DRB configurations as configured by *radioBearerConfig* or *radioBearerConfig2*.

[..]

1> else (full configuration after re-establishment or during RRC resume):

2> use values for timers T301, T310, T311 and constants N310, N311, as included in *ue-TimersAndConstants* received in *SIB1*;

1> if no *measConfigAppLayerId* is indicated in the *measConfigAppLayerToAddModList*:

2> inform upper layers about the release of all application layer measurement configurations;

2> discard received application layer measurement report information from upper layers;

2> consider itself not to be configured to send application layer measurement report.

Question 7: Please give technical comments to the options above (or additional options), e.g. technical issues, advantages or improvements.

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| **Company** | **Answer** |
| Intel | First of all, we would like to clarify that full configuration is normally used when the target gNB cannot comprehend ASN.1 from the source gNB. For example, a legacy target gNB from previous release. For other gNBs which can comprehend ASN.1 but not supporting QoE, full configuration should not normally be triggered and the target gNB can simply indicate the *measConfigAppLayerId* to be released if QoE is not supported.We think Solution 2) should be supported as baseline in order to support mobility to a target Rel-15 gNB. During full configuration, all *measConfigAppLayerId* as part of UE AS context are released. It is also better to release the application layer configuration – otherwise there is a risk of collision if same *measConfigAppLayerId* value is re-used afterwards for another QoE measurement, as source gNB will also release everything during full configuration. This means the mapping table between QoE reference and *measConfigAppLayerId* cannot be forwarded to the target gNB. The target gNB may use the same *measConfigAppLayerId* to represent different QoE reference. For that scenario, we will need to discuss and agree solutions to avoid such collisions (hence we don’t think solution 1 is acceptable).Then, on the use Full configuration without releasing the application layer configuration: it could potentially be useful if the network can comprehend the ASN.1 but still decides to Full configuration for other implementation specific reasons while trying to preserve the application layer QoE configuration. But such configurations should not happen frequently (for reasons given above) and we are not convinced it is essential.If a solution is to be defined for this, then Solution 3) maintains the basic concepts of Full configuration in that the entire AS configuration is released by default unless explicitly indicated). In our understanding of solution 3, if the network wants to continue with certain QoE configuration in the application layer, it has to provide the list of *measConfigAppLayerId*sthat is to be maintained and released in the message with Full Config indication. This seems to work. However, the normal principle we follow (for example with EPS bearers in LTE), is that the network only provides the list of IDs to continue (and not the list of IDs to release). Such an approach is more forward compatible, for example, if the ID list is extended in the future. Hence, if RAN2 is to define the optimisation to keep QoE configuration during Full configuration, while solution 3 is acceptable, we have a preference to follow the principle used for LTE EPS bearers where the target only provides the list of IDs to continue. |
| Huawei, HiSilicon | We agree with Intel that option 1) is prone to errors and leads to misalignment between application layer QoE configuration and AS layer QoE configuration which should be avoided. The release of all QoE configuration during full configuration should be then possible and we think option 3) addresses this in the optimal way, i.e. it also allows to keep QoE configurations (and not disturb QoE sessions unnecessarily) in case the target gNB supports QoE. We think we cannot directly reuse the way we handle EPS bearers during full config as the QoE configuration in the target gNB may differ from the one in the source gNB, e.g. the target gNB may need to release one QoE configuration while configuring another one in its place. Hence, what is proposed in solution 3) is a preferred way. |
| China Unicom | As we illustrated in Q6, QoE configurations not indicated by the network can be released, so we support option 3. |
| Ericsson | We think both option 1 and 2 have issues. We would prefer option 1 in such case, as option 2 has too large negative impact on mobility. In option 1 the measurements will be released eventually. But we think it is quite clear to take option 3 as that one doesn’t seem to have any issues connected with it. We think the option proposed by Intel also works, with the assumption that the network doesn’t reuse the same Id for a new configuration at handover (we think this is the case for EPS bearer also). But several UE vendors had concerns about storing the measConfigAppLayerId at fullConfig, as they prefer to clear the RRC configurations at fullConfig. The EPS bearers are exemptions from that and the measeConfigAppLayerId would be another exemption in such case.  |
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| CATT | We think the option3 is good approach |
| Qualcomm | Benefit of Alternative 1) is to maintain the application layer configuration while releasing AS context. When the AS context is reconfigured, the application layer does not need to be provided again. But this alternative is not aligned with current agreement, i.e. if AS configuration or context is released, AS should inform application layer to release. And this alternative may introduce UE and network behaviour ambiguity. E.g. when gNB configures *measConfigAppLayerId* again, it is likely gNB provides different *measConfigAppLayerId* for the stored QoE configuration. Can be considered in Rel-18Alternative 2) is most clear way, prefer this alternative in Rel-17. Benefit of Alternative 3) is to save QoE configuration signalling overhead in case of fullconfig, i.e. network only provides *measConfigAppLayerId* to be configured. Open to have such optimization.Considering the limited time in Rel-17, we prefer to Alt-2 in Rel-17, other enhancement can be considered in Rel-18. |
| Samsung | Given all UE AS configuration (e.g., *measConfigAppLayerId*) are released, we prefer Option 2 (i.e., All the application layer configuration/measurements are released at fullConfig) to align app layer configuration with UE AS configuration. |
| Nokia | We think Solution 2) should be the baseline to comply with generic RRC principles. E.g. during HO, if target gNB is legacy and does not support QoE the UE QoE should be released including SRB4 (as part of “all radio configurations”) |
| Ericsson | Agree that to keep the generic RRC principles and that the UE releases the *measConfigAppLayerId* and possible other QoE RRC parts. That is the case in option 3.Option 2 is not acceptable to us as no mobility will fullConfig will work in such case. It is not due to signalling optimization as commented by QC, it is a matter of having mobility support for QoE measurements. This option was rejected for LTE in RAN2#116 for this reason and to have less mobility support in NR than LTE is not acceptable. |
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The transmission of QoE reports over SRB4 is slower than transmission of other RRC messages and a handover may occur during the transmission.

Question 8: What should the UE do if a handover occurs during the transmission of a QoE report, e.g. restart the transmission in target, continue the transmission in target, discard the transmission etc?

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| **Company** | **Answer** |
| Intel | Whether the UE should continue sending/restart QoE report should depend on whether the target node.If full configuration is considered, the UE should discard the transmission.If the target gNB also supports QoE and the corresponding *measConfigAppLayerId* is not released during reconfiguration, UE can restart the transmission in the target gNB. |
| Apple | We think this may not be such an important scenario, and prefer to just drop the report. |
| OPPO | If the UE resume the transmission of the QoE measurement report collected previously at source gNB when it finishes the handover towards the target gNB, the network may use the content for optimization of radio service at the target gNB. So we suggest UE to drop the report when it starts the handover procedure until successfully finishes the handover.  |
| Huawei, HiSilicon | If the related QoE configuration still exists after the handover, the UE may resend the unacknowledged QoE report. This may lead to duplicate reports, but that is probably something that can be dealt with during post-processing in OAM system. Dropping the report means that the measurement session is incomplete and such sessions are less useful. |
| China Unicom | If a handover occurs during the transmission of a QoE report, we support UE to restart the transmission in target to guarantee the integrity of QoE reports. |
| Ericsson | We think the UE can restart the transmission in the target node, to ensure the network gets the report. Continuing (i.e. not restarting) the transmission in target would be very complex. |
| CATT | Restart the report transfer if the target node supporting |
| Qualcomm | It make sense to achieve lossless QoE data reporting, especially during HO, in which scenario the QoE usually is not good enough. Also We need to consider the case that RRC segmentation is applied, e.g. only part of segments are transmitted to the source gNB, other part of segments could be transmitted to the target gNB. |
| Samsung | For the QoE configurations to be continued in target, UE continues QoE reporting (including not sent reports during handover) to target. |
| Nokia | Agree with Apple: the report can be dropped |
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# 3 Conclusion

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