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). |
| 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:   |  | | --- | | *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:   |  | | --- | | 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 questions  1) 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 |
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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. |
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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. |
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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. |
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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. |
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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. |
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# 3 Conclusion

# 4 References

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1. [R2-2109662](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs//R2-2109662.zip), [QoE measurement configuration and general aspects](file:///c:\3GPP_RAN1\RAN2_116e_e\8.14.2\R2-2109662%20Intel%20QoE%20measurement%20configuration%20and%20general%20aspects.docx), Intel Corporation, RAN2#116e, e, November 2021

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