**3GPP TSG RAN2 #121 R2-23xxxxx**

**Athens, Greece, 27th Feb – 3rd Mar, 2023**

**Agenda Item:**  **8.14.5 Other topics**

**Source: Huawei (email rapporteur)**

**Title:** **Report of [AT121][201][QoE] Continuity of QoE measurements during intra-5GC inter-RAT HO (Huawei)**

**Document for: Discussion and Decision**

# 1 Introduction

This is the email report of [AT121][201]:

* [AT121][201][QoE] Continuity of QoE measurements during intra-5GC inter-RAT HO (Huawei)

Scope: Discuss the possible options and identify their impacts to specifications and WGs. Should identify which options have LTE impact (and therefore are not in the current scope of the WI). If possible try to downselect which options could be feasible for this WI.

Intended outcome: Report in [R2-2302005](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-2302005.zip).

Deadline: Friday morning (before morning coffee break)

Companies providing input to this email discussion are requested to leave contact information below.

|  |  |  |
| --- | --- | --- |
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|  |  |  |

# 2 Discussion

## 2.1 List of options

Based on the relevant contributions and online discussions, at least the following options are provided. Companies can add other options if possible.

**Option 1:** (NR -> LTE/5GC -> NR) Source NR node sends RRC message to UE to pause the NR QoE. Later, when the UE goes back to NR, the NR can indicate the UE to continue the previous NR QoE reporting.

**Option 2:** (LTE/5GC -> NR -> LTE/5GC) Source LTE/5GC node sends RRC message to UE to pause the LTE QoE, which has some impacts to TS 36.331. Later, when the UE goes back to LTE/5GC, the LTE/5GC can indicate the UE to continue the previous LTE QoE reporting.

**Option 3:** (NR -> LTE/5GC) When the UE goes to LTE/5GC from NR, one previous QoE measurement can be activated in LTE/5GC (while others can be paused or released), and the QoE measurement and reporting will continue in LTE/5GC.

**Option 4:** (LTE/5GC -> NR) When the UE goes to NR from LTE/5GC, the previous QoE measurement can be continued in NR. During the inter-RAT HO, the target RAT can also configure other QoE measurements to the UE.

**Option 5:** The network can release the QoE configuration before moving UE to LTE/5GC and then reconfigure once UE moves back to NR.

[Other options…]

## 2.2 Discussion on Option 1

For option 1, the technical analysis in [2] are used here.

|  |  |  |  |
| --- | --- | --- | --- |
| **Principle** | **LTE impacts** | **Other RAN2 impacts** | **RAN3 impacts** |
| Source NR node sends RRC message to UE to pause the NR QoE. Later, when the UE goes back to NR, the NR can indicate the UE to continue the previous NR QoE reporting. | TS 36.331: no impacts | TS 38.331: impacts to inter-RAT HO command and QoE configurations storing  TS 38.300: stage-2 description | TS 38.423: check whether existing QoE config in HANDOVER REQUEST procedure can cover LTE QoE config or not |

**Q1: For option 1, do companies agree on analysis on principle and specification impacts (including LTE impacts)? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes, but | Please see our response in Q2. |
| Qualcomm |  | - There is risk that when the UE moves into LTE, and never come back into NR. Then the QoE measurement efforts will be wasted.  - For the new QoE behavior introduced in NR, e.g. per-slice based QoE, it will not be applicable when the UE moves to LTE. |
| Huawei, HiSilicon | Yes |  |
| Nokia | No | Agree with Qualcomm. The assumption in the principle is not a common case. The UE may not go back to source RAT after handover to target RAT. In our view, pause the QoE configuration in source RAT is not needed since the target RAT can reconfigure it if the UE handover back to the source RAT. Furthermore, the principle mentioned in this option actually cannot really support the QoE continuity in inter-RAT handover because the application measurement cannot be continued in target RAT. |
| Ericsson | Yes |  |
| Apple | Yes but | While we acknowledge the impacts to LTE specification can be minimized with this option, we are not sure if it fits the goal of “Continuity of legacy QoE measurement job” in the WI objective. In our understanding, we aim to allow the UE to continue with QoE measurement after HO from NR to LTE. |
| Lenovo | Yes |  |
| ZTE | Yes | but it seems this option cannot fulfil the service continuity requirement. |
| China Unicom | Yes | The principle of Option 1 can be clarified as “Source NR node sends RRC message to UE to pause the NR QoE reporting (QoE measurements are still ongoing),” so that the requirements of continuity of QoE measurement can be met. |
|  |  |  |

For the scope of this email discussion, it mentions “If possible try to downselect which options could be feasible for this WI.”, so it is suggested to collect companies’ preferences.

**Q2: Do companies support to select Option 1 for this WI? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | We would like to note the objective of WID:   * Support the continuity of legacy QoE measurement job for streaming and MTSI service during intra-5GC inter-RAT handover process [RAN2, RAN3].   In Option 1/2/5, QoE reporting is paused or released (i.e., no continuity) anyhow. It does not comply with the objective in WID. For example, with Option 1, what if UE does not come back to NR? UE continues QoE measurement in LTE cell but its reports cannot be sent. Then, QoE measurement within LTE cell is meaningless, but UE never stops measuring. There is no way LTE node releases NR QoE measurement without 36.331 impact. Therefore, we only support Option3/4. |
| Huawei, HiSilicon | Yes | Firstly, we think the meaning of “continuity” can be discussed in RAN2, and the WID does not explicitly say that the “continuity” is equal to “continuity of collection, continuity of reporting, or both”.  Secondly, Option 1 has no impacts on LTE specs, so it is preferred.  For RAN3 impacts, the above analysis may not be concrete. We observe that at least for Option 1/2/3/4, it will be helpful for RAN3 to check potential impacts once RAN2 makes some progress. |
| Nokia | No | The option add complexity to NW/UE implementation but we don’t see the benefit. |
| Ericsson | No |  |
| Apple | No for now | We think RAN2 should first try to specify mechanisms that allow the UE to continue with QoE measurements after HO to LTE, which is more aligned with WI objective. |
| Lenovo | No | We share the same understanding as Samsung that Option 1 is not compliant with the WI objective. When the WID was drafted it was our understanding that “continuity” means continuity **in measurement collection and reporting**.  Furthermore, we share Nokia’s view that Option 1 introduces additional complexity to NW/UE implementation. |
| ZTE | No |  |
| China Unicom | Yes | We don’t think the “continuity” means continuity in measurement collection and reporting. For example, when overload, the QoE reporting is still paused in AS layer, but no one can say that QoE continuity is not guaranteed. So if the reporting is paused during the inter-RAT HO, but the measurements is still ongoing, it still can be called “QoE continuity”. |
|  |  |  |
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**Summary**

For the principle and specification impacts, there are some concerns:

* There is risk that when the UE moves into LTE, and never come back into NR. Then the QoE measurement efforts will be wasted.
* For the new QoE behavior introduced in NR, e.g. per-slice based QoE, it will not be applicable when the UE moves to LTE.

6/8 companies do not prefer to select Option 1 for this WI.

## 2.3 Discussion on Option 2

For option 2, the technical analysis in [2] are used here.

|  |  |  |  |
| --- | --- | --- | --- |
| **Principle** | **LTE impacts** | **Other RAN2 impacts** | **RAN3 impacts** |
| Source LTE/5GC node sends RRC message to UE to pause the LTE QoE, which has some impacts to TS 36.331. Later, when the UE goes back to LTE/5GC, the LTE/5GC can indicate the UE to continue the previous LTE QoE reporting. | TS 36.331: impacts due to the introduction of pause/resume mechanism | TS 38.331: no impacts  TS 38.300: stage-2 description | TS 38.423: check whether existing QoE config in HANDOVER REQUEST procedure can cover LTE QoE config or not |

**Q3: For option 2, do companies agree on analysis on principle and specification impacts (including LTE impacts)? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes, but | Please see our response in Q2. |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Nokia | No | Same comment as Q1. |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| China Unicom | Yes |  |
|  |  |  |

**Q4: Do companies support to select Option 2 for this WI? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | Please see our response in Q2. |
| Qualcomm | No | Impact on LTE specification |
| Huawei, HiSilicon | No | Firstly, there may be impacts to TS 36.331.  Secondly, the direction “LTE/5GC -> NR -> LTE/5GC” is not as popular as Option 1. |
| Nokia | No | Same comment as Q2. |
| Ericsson | No |  |
| Apple | No |  |
| Lenovo | No | This Option can be ruled out due to LTE impacts. Furthermore, same as for Option 1 it is not compliant with the WI objective. |
| ZTE | No |  |
| China Unicom | No |  |
|  |  |  |

**Summary**

For the principle and specification impacts, there are some concerns:

* There is risk that when the UE moves into LTE, and never come back into NR. Then the QoE measurement efforts will be wasted.
* For the new QoE behavior introduced in NR, e.g. per-slice based QoE, it will not be applicable when the UE moves to LTE.

9/9 companies do not prefer to select Option 2 for this WI.

## 2.4 Discussion on Option 3

For option 3, the technical analysis in [2] are used here.

|  |  |  |  |
| --- | --- | --- | --- |
| **Principle** | **LTE impacts** | **Other RAN2 impacts** | **RAN3 impacts** |
| When the UE goes to LTE/5GC from NR, one previous QoE measurement can be activated in LTE/5GC (while others can be paused or released), and the QoE measurement and reporting will continue in LTE/5GC. | TS 36.331: impacts related to configuration of the QoE measurements from NR | TS 38.331: impacts to inter-RAT HO command  TS 38.300: stage-2 description | TS 38.423: NR or LTE/5GC can decide which of QoE measurements can be continued and inform NR, which has impacts to Xn. In addition, whether existing QoE config in HANDOVER REQUEST procedure can cover LTE QoE config or not can be checked. |

**Q5: For option 3, do companies agree on analysis on principle and specification impacts (including LTE impacts)? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | To avoid 36.331 impact, we can update MobilityFromNRCommand with corresponding TP update in 38.331. |
| Qualcomm |  | Besides the analysis in the table, the application layer will also be impacted. When the UE moves into LTE, the application layer will deliver service type instead of RRC ID to AS layer, not sure whether this will impact the QoE session. |
| Huawei, HiSilicon | Yes | We observe that some companies also prefer to keep one QoE session when it goes to LTE/5GC, which is simple from our point of view. |
| Nokia |  | We agree with the principle but the impacts seem not correct.  There is no direct spec impact to TS 36.331 as source RAT(NR) provides LTE QoE configuration based on TS 36.331 and up to source RAT implementation on proper QoE configuration selection for mapping. (e.g. For inter-RAT handover, as defined in TS38.300, the source RAT decides on the preparation initiation and provides the necessary information to the target RAT in the format required by the target RAT.)  Also, the RRC reconfiguration message from the target RAT is delivered to the source RAT via a transparent container, and is passed to the UE by the source RAT in the handover command. Hence it is target RAT’s implementation to build the Handover command and there is no RRC specification impact as well.  For RAN3 impact, it is not RAN2 topic and RAN3 should decide that. |
| Ericsson | No | We believe if the UE keeps and continue measurements for only one configuration for a service type supported in LTE, then there is no LTE standard impact |
| Apple | No | If we can support this option by modifying the HO command, there may be no impacts to the target RAT specifications. |
| Lenovo | No | Same as Nokia we think there are no impacts to TS 36.331 and TS 38.331. We think only RAN3 is impacted by Option 3. |
| ZTE |  | If NW implementation can handle to have only one QoE session then there has no direct impact on 36.331 since the configuration is given by source gNB and deliver to target eNB in container. However we share similar understanding the efforts is mainly on RAN3 perhaps it is up to them to decide. |
| China Unicom | Yes |  |
|  |  |  |

**Q6: Do companies support to select Option 3 for this WI? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | Please see our response in Q2. |
| Qualcomm | No | Impact on LTE, and also impact on application layer |
| Huawei, HiSilicon | Open | If only one NR QoE measurement is considered, we observe some LTE impacts as well as other impacts. But we are open and we can be ok to select it if the majority companies are fine with it. |
| Nokia | Yes, but | There should have no RRC impacts to support this option. |
| Ericsson | Yes |  |
| Apple | Yes | The specification change of this option is minimal while the requirement of “continuity of legacy QoE measurement job” can be achieved. |
| Lenovo | Yes | This option is compliant with WI objective. |
| ZTE | Yes | As long as there is no 36.331 spec impact |
| China Unicom | Open | We are open with Option 3. |
|  |  |  |

**Summary**

For the principle and specification impacts, the following understanding has lots of supports:

* The target LTE/5GC generates **one** LTE QoE configuration. Then, the configuration is delivered to the source NR via a transparent container, and is passed to the UE by the source RAT in the handover command
* It is up to source NR implementation on proper QoE configuration selection for mapping
* Companies do not observe any impacts to TS 36.331, and whether TS 38.331 will be impacted is FFS

The email rapporteur thinks that the above understanding can be considered as “continuity” in AS layer, and from APP layer point of view, the previous NR QoE session may have to be stopped and then re-start a new LTE QoE session, as the UE AS layer will pass the new LTE QoE configuration (container) to App layer. If the “continuity” is considered as “continue the previous NR QoE session before and after HO from NR to LTE/5GC”, how the above understanding can fulfill the requirement is FFS and it may be SA4 scope. Anyway, the email rapporteur thinks that RAN2 can try to progress on an option with the most support.

6/9 companies prefer to selection Option 3 for this WI if there are no impacts to TS 36.331. 2 companies are open, and 1 company says No as they think there are impacts on LTE and also on application layer.

**Proposal 1: Agree on the principle of Option 3:**

* **For HO from NR to LTE/5GC, the UE keeps and continue measurements for only one configuration for a service type supported in LTE**
* **The target LTE/5GC generates one LTE QoE configuration. Then, the configuration is delivered to the source NR via a transparent container, and is passed to the UE by the source NR in the handover command**
* **It is up to source NR implementation on proper QoE configuration selection for mapping**

**Proposal 2: Option 3 can be selected for this WI only if there are no impacts to TS 36.331.**

## 2.5 Discussion on Option 4

For option 4, the technical analysis in [2] are used here.

|  |  |  |  |
| --- | --- | --- | --- |
| **Principle** | **LTE impacts** | **Other RAN2 impacts** | **RAN3 impacts** |
| When the UE goes to NR from LTE/5GC, the previous QoE measurement can be continued in NR. During the inter-RAT HO, the target RAT can also configure other QoE measurements to the UE. | TS 36.331: impacts to inter-RAT HO command | TS 38.331: some impacts related to ensuring continuation of QoE measurement from LTE when the UE moves to NR  TS 38.300: stage-2 description | TS 38.423: check whether existing QoE config in HANDOVER REQUEST procedure can cover LTE QoE config or not |

**Q7: For option 4, do companies agree on analysis on principle and specification impacts (including LTE impacts)? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | To avoid 36.331 impact, we can update RRCReconfiguration which can be contained within MobilityFromEUTRACommand. In 38.331, RRCReconfiguation can be updated and TP when receiving RRCReconfiguration can be also updated. |
| Qualcomm |  | Besides the analysis in the table, the application layer will also be impacted. When the UE moves into NR, the application layer will deliver RRC ID instead of service type to AS layer, not sure whether this will impact the QoE session. |
| Huawei, HiSilicon | Yes | It seems straightforward to keep the LTE QoE measurement (one measurement) in the NR. |
| Nokia |  | Same comments as Q5. |
| Ericsson | No | We don’t see impact in LTE spec |
| Apple | No | If we can support this option by modifying the HO command, there may be no impacts to the target RAT specifications. |
| Lenovo | No | Same as other companies we think that there are no LTE impacts. |
| ZTE | No, but | Some coordination between gNB and eNB is needed to associated LTE QoE session with a unique *measConfigAppLayerId*, so that UE to continue the LTE QoE session in NR, otherwise according to current 38.331 UE will release the QoE session. Maybe some impact on application layer on how to associate the QoE session, which may needs to be confirmed by SA4 as well. Similar as option 3 the specs impact is in RAN3, it is up for them to decide. |
| China Unicom |  | We are also wondering is there any LTE spec impact? |
|  |  |  |

**Q8: Do companies support to select Option 4 for this WI? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | Please see our response in Q2. |
| Qualcomm | No | Impact on LTE, and also impact on application layer |
| Huawei, HiSilicon | Open | We are open and we can be ok to select it if the majority companies are fine with it. |
| Nokia | Yes, but | There should have no RRC impacts to support this option. |
| Ericsson | Open | Majority view |
| Apple | Open | We are fine to consider this option |
| Lenovo | Yes | This option is compliant with WI objective. |
| ZTE | Open | The coordination is more complicated than option 3. Also not sure if BS can decode the QoE container. We are open to discuss it as long as there is no LTE specs impact. Again, this shall be decided by RAN3. |
| China Unicom | Open |  |
|  |  |  |

**Summary**

There are similar discussions to Option 3.

3/9 companies prefer to selection Option 4 for this WI if there are no impacts to TS 36.331. 5 companies are open, and 1 company says No as they think there are impacts on LTE and also on application layer.

**Proposal 3: Agree on the principle of Option 4:**

* **For HO from LTE/5GC to NR, the UE keeps and continue measurements for only one configuration for a service type supported in NR**
* **The target NR generates one NR QoE configuration. Then, the configuration is delivered to the source LTE/5GC via a transparent container, and is passed to the UE by the source LTE/5GC in the handover command**
* **It is up to source LTE/5GC implementation on proper QoE configuration selection for mapping**

**Proposal 4: Option 4 can be selected for this WI only if there are no impacts to TS 36.331.**

## 2.6 Discussion on Option 5

For option 5, the technical analysis is shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Principle** | **LTE impacts** | **Other RAN2 impacts** | **RAN3 impacts** |
| The network can release the QoE configuration before moving UE to LTE/5GC and then reconfigure once UE moves back to NR. | TS 36.331: no impacts | TS 38.331: no impacts  TS 38.300: may be no impacts | May be no impacts |

**Q9: For option 5, do companies agree on analysis on principle and specification impacts (including LTE impacts)? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes, but | Please see our response in Q2. |
| Qualcomm |  | Clarify question: all the QoE configurations should be released, even it can be supported by LTE? Then this option is not for service continuity? |
| Huawei, HiSilicon | Yes | It is implementation related option.  For more details, maybe interested companies can provide more details, e.g. responses to Qualcomm. |
| Nokia | Yes | We think this is also one possible implementation in NW. |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Lenovo | Yes but | There should be no impacts to RAN3 as well since Option 5 should be already supported in Rel-17. |
| ZTE | Yes |  |
| China Unicom | Yes |  |
|  |  |  |

**Q10: Do companies support to select Option 5 for this WI? Please provide your comments in the comment column if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | Please see our response in Q2. |
| Qualcomm |  | Based on the clarification to the question. |
| Huawei, HiSilicon | No | Obviously, this Option 5 can not enable “Continuity of QoE measurements during intra-5GC inter-RAT HO”. |
| Nokia | Yes | It is up to NW implementation. |
| Ericsson | No |  |
| Apple | No | It cannot achieve the requirement of WI objective of “continuity of legacy QoE measurement job”. |
| Lenovo | Yes | When we brought up this Option during online discussion it was primarily meant as alternative to Option 1/Option 2. Furthermore, if we cannot meet the WI objective acc. to Option 3/Option 4, then Option 5 is the only viable solution. |
| ZTE | No | Can be done by current mechanism, but it is not service continuity |
| China Unicom | No | QoE configurations release are not preferred. |
|  |  |  |

**Summary**

For the principle and specification impacts, most of companies think Option 5 is an implementation option and thus should have no specification impacts.

6/9 companies do not prefer to select Option 5 for this WI.

# 3 Conclusion

Basded on the discussions in section 2, it is observed that Option 3 and Option 4 have the most support, and they can be agreeable if there are no impacts to TS 36.331, while other options seem not agreeable. In addition, for both Option 3 and Option 4, there may be RAN3 impacts (and FFS whether SA4 should be also consulted), so it may be good to send a LS to these WGs for finalizing their work.

So it is proposed:

**Proposal 1: RAN2 understanding is that for HO between LTE/5GC and NR, QoE continuity is done in AS layer (rather than APP layer), that means the service continuity in application layer may not be guaranteed.**

**Proposal 2: Agree on the principles of Option 3 and Option 4:**

**- Option 3: For HO from NR to LTE/5GC, the UE can keep and continue measurements for only one configuration for a service type supported in LTE**

**- Option 4: For HO from LTE/5GC to NR, the UE can keep and continue measurements for only one configuration for a service type supported in NR**

**Proposal 3: Option 3 and Option 4 can be selected for this WI only if there are no impacts to TS 36.331.**

**Proposal 4: If P2 and P3 are agreeable, it is proposed to consider sending LS to RAN3 (maybe SA4) for finalizing their work. This can be discussed either in this meeting or next meeting.**

# 4 References

[1] RAN2-121 LTE MUSIM QoE XR (Tero)\_2023-02-28-1845

[2] R2-2300356 Discussion on Rel-18 other QoE enhancement ZTE Corporation, Sanechips

[3] R2-2300603 QoE continuity between LTE-5GC and NR Huawei, HiSilicon

[4] R2-2300631 Discussion on QoE measurement during intra-5GC inter-RAT handover Lenovo

[5] R2-2300722 QoE Continuity During Intra-5GC Inter-RAT Handover Apple

[6] R2-2301339 QoE measurements at IRAT handover Ericsson

[7] R2-2301641 Discussion on QoE measurement continuity during inter-RAT handover Samsung

[8] R2-2301665 On QoE continuity during inter-RAT handover Nokia, Nokia Shanghai Bell

[9] R2-2301756 Discussion on the QoE continuity during intra-5GC inter-RAT HO China Unicom

[10] R2-2301803 Discussion on the continuity of QoE measurement CATT