**Now it3GPP TSG-RAN WG3 Meeting #112-eR3-212642**

**Online, May 17th – May 27th 2021**

Agenda Item: 15.4

Source: Samsung (moderator)

Title: Summary of Offline Discussion on the alignment of Radio related measurement and QoE measurement

Document for: Approval

# Introduction

This is the SoD for the following comeback: **CB: # NRQoE5bis-RRM\_alignment**

The deadline for providing replies to Phase 1 is **Friday May21st, 23:59 UTC**

Relevant papers:

1. R3-211737 Alignment of Radio-Related Measurement and QoE Measurements (Qualcomm Incorporated)
2. R3-211841 Discussion on Alignment of MDT and QoE Measurements (CATT)
3. R3-211982 Discussion on the alignment of Radio-Related Measurement and QoE Measurement (Samsung)
4. R3-211991 The Alignment of Radio-Related Measurements and QoE Measurements (Ericsson)
5. R3-212326 On the alignment of QoE measurements and MDT measurements (Nokia, Nokia Shanghai Bell)
6. R3-212449 Alignment of MDT and QoE Measurements (ZTE Corporation, China Telecom, China Unicom)
7. R3-212452 (TP for 38.401) Alignment of MDT and QoE Measurements (ZTE Corporation, China Telecom, China Unicom)
8. R3-212453 (TP for 38.473) Alignment of MDT and QoE Measurements (ZTE Corporation, China Telecom, China Unicom)
9. R3-212455 (TP for 38.463) Alignment of MDT and QoE Measurements (ZTE Corporation, China Telecom, China Unicom)
10. R3-212496Alignment of radio related measurement and QoE measurement (CMCC)
11. R3-212517 Further analysis on spec impacts of the potential solutions to RAN assitsted measurement (Huawei)

# For the Chairman’s Notes

**TBW**

# Phase 1: Reaching the essential agreements

In NR QoE study phase, below descriptions for the radio-related measurements had been captured in TR 38.890:

## 6.8 Radio- related measurements and information for QoE

In order for the network to further evaluate and improve the QoE, the RAN could also trigger radio-related measurements towards a certain UE, based on the QoE measurement configuration received from the OAM. For triggering the measurements, an existing mechanism, e.g. MDT procedure, can be used. Collection of radio related measurements, if needed, should be done by existing methods such as MDT, if the UE supports MDT in R17.

The radio-related QoE measurements are reported for all types of supported services, and they include MDT-like measurements and, potentially, additional measurements related to the radio interface. If new radio-related measurements, with respect to what is currently specified in MDT, are required for NR QoE management, these additional radio-related QoE measurements will be specified as a part of MDT measurements. Application-related QoE measurements are only collected when the application session is ongoing. If these radio-related measurements are used for assisting application-related QoE measurements, it is beneficial and efficient if measurement collection and reporting can start at the same time. If configured together e.g. using same trace reference and time aligned, e.g. based on time stamps, correlation of the results may be done by post processing. Besides radio-related measurement results, radio-related information may also be reported. Radio-related information may be reported even when radio-related measurements are not triggered over the radio.

Both of the radio-related measurement results and radio-related information, if reported, should be aligned and correlated with the QoE report, using e.g. trace ID.

Our discussions are expected to be based on the key points high-lighted above.

## General aspects

### Mechanism for Radio-related measurements

**NOTE: The objective of phase 1 is to reach the essential agreements, based on which a TP for BLCR is to be produced in Phase 2.**

In papers [1] - [11], the discussions on Radio-related measurements are all based on the MDT mechanism. Paper [1], [2], [4], [10] and [11] discussed Radio-related measurement based on Immediate MDT. And paper [2] proposes Immediate MDT can be configured by RAN for radio-related measurements based on the QoE configuration,

Based on the above, a simple proposal can be used as a start:

**Proposal 1: Immediate MDT is used as baseline for the collection of Radio-related Measurements for assisting QoE analysis.**

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| **Company** | **Do you agree with Proposals 1?** |
| Samsung | Yes. Enhancements are needed to support the alignment |
| CMCC | Yes. Immediate MDT measurement should be the baseline for radio-related measurement. |
| Qualcomm | Yes |
| Huawei | Yes. |
| CATT | Yes |
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### Contents of Radio-related measurements

As there are many kinds of MDT measurements specified in specifications, the measurements may be performed in UE or/and gNB, Paper [3] thinks we should discuss what kind of radio-related measurements are needed for QoE, and Paper [1] proposes existing MDT measurements are sufficient to assist NR QoE management and no new radio-related measurements are to be introduced, but Paper [2] thinks new radio-related measurement may be needed based on QoE measurement special features.

Based on the above, the following proposals are derived:

**Proposal 2-1: Current measurements specified for immediate MDT can be used for radio related measurements.**

**Proposal 2-2: New radio related measurements not specified in MDT may be needed and may need further discussion.**

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| **Company** | **Do you agree with Proposals 2-1 and 2-2?** |
| Samsung | Agree with both |
| CMCC | **Agree both. And we’ve agreed during SI that if new radio related measurements are deemed useful, they will be set as a part of radio related measurements.** |
| Qualcomm | OK with proposal 2-1. Proposal 2-2 is probably not needed.  We feel existing radio related measurements from immediate MDT should suffice to be correlated with QoE measurements.  Regarding enhancements, we are okay if NG-RAN can provide additional information (e.g. radio related information), but don’t see the need to add new measurements at UE, unless not available at NG-RAN. |
| Huawei | We prefer to reuse current MDT measurement, for new radio related measurements, this could be discussed in SON/MDT WI, even there will be QoE specific measurements which will be discussed here, the final conclusion should be better to leave SON/MDT WI to handle. |
| CATT | Both, some existing measurement can be used and we may design new measurement for the QoE correlation analysis purpose |

## The alignment of Radio-related measurement and QoE measurement

The moderator notes that the solutions for the alignment from different companies are discussed from different point view. And moderator suggests we can discuss it from the procedure point view, the discussion can be divided into two phases below:

* Configuration from OAM/CN to NG-RAN
* Configuration inside NG-RAN

### Configuration from OAM/CN to NG-RAN

For the configuration from OAM/CN to NG-RAN, paper [6] discussed two cases and proposes the QoE measurement can use on going MDT measurement as radio related measurement, on the other hand, paper [4] and [10] proposes OAM can provide both QoE configuration and MDT configuration for QoE purposes to RAN simultaneously. Paper [6] proposes the OAM is responsible for providing the MDT configuration.

Based on the above, below options can be considered:

**Proposal 3: RAN3 to consider below cases for the alignment:**

* **Case 1, the configurations of radio-related measurement and QoE measurement are transmitted simultaneously from OAM/CN to the NG-RAN node.**
* **Case 2: MDT is configured before QoE configuration, and the on-going MDT measurement can be used for radio-related measurement when QoE configuration is transmitted from OAM/CN to the NG-RAN node.**

Moderator understanding is the QoE measurement and on-going MDT measurement used for radio-related measurement in case 2 belongs to different trace sessions. So in case 2, a question is whether to support more than one trace session, or keep the principle (i.e. only one TR/TRSR on-going) unchanged by doing something, e.g. deactivate the on-going MDT and then configure radio-related measurement and QoE measurement. Basically go back to case 1.

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| **Company** | **Do you agree with the case 1 or case 2 or both? in addition, if case 2, do you agree to support one than one trace session?** |
| Samsung | Case 1 should be considered.  For case 2, even MDT is configured before QoE, if new MDT configuration with QoE configuration comes, the on-going MDT is deactivated, which brings us back to case 1. |
| CMCC | **Both can be considered. OAM should ensure that the MDT measurement will last during the time for QoE measurement, no matter the MDT measurement is activated by MDT purpose or QoE purpose.** |
| Qualcomm | Same view as Samsung i.e. OAM can try to configure both together. If not, old trace session would have to be deactivated first before configuring both QoE and MDT together. |
| Huawei | Case 1 should be the typical case;  While for case 2, we think anyway both the MDT and QoE are configured by OAM/CN, if MDT is configured before, and radio related measurements is requested when QoE is configured, network could just update/reconfigure/release and reconfigure the MDT measurement configuration if needed. |
| CATT | Both cases are reasonable. Case 1 is typically for the QoE triggered MDT. Case 2 is the MDT is running and QoE triggered. |

### Start of the radio-related measurement

After the related configurations transmitted from OAM/CN to NG-RAN, it is NG-RAN to decide how to handle the start/end of the radio-related measurement or the report of the on-going MDT measurement.

**For case 1 (i.e. MDT and QoE configured together from OAM/CN)**, paper [1] prefers MDT and QoE measurements are configured together without any indications and restrictions needed, the alignment can be achieved by e.g. using same trace reference and time aligned, however, paper [4] finds this correlation-based alignment have many drawbacks, also, paper [3], [4] have the same views that correlation-based alignment is not efficient. So paper [2], [3], [4] proposes specify or support the start/stop the radio-related measurement and QoE measurements at the same time.

Furthermore, paper [2] proposes the duration of QoE associated radio-related measurement should cover all the QoE sessions if multiple QoE session configured. Paper [3] and [4] give two approaches to enable the alignment between radio-related measurement reports and QoE reports. Paper [5] also discusses Network-based and UE-based solutions to enable the alignment and shows their preference on network based solution. Paper [10] discussed 2 options and proposes RAN provides QoE configuration and MDT configuration for QoE purposes to UE simultaneously. And paper [11] proposes the time stamps for the corresponding to the start time and end time of the QoE measurement and radio-related measurement to the TCE for alignment, in which the start/end time of QoE measurement should be provided by UE.

Based on the above, for case 1, below approaches can be derived:

**In case of MDT and QoE configured together by OAM,**

* **Approach 1: Radio-related measurement is configured once QoE measurement is configured.**
  + **Approach 1-a, Radio-related measurement will not start once configured, it starts only when QoE measurement starts (e.g by receiving the indication or QoE report from UE).**
  + **Approach 1-b, Radio-related measurement starts once configured, and the measurement will last throughout the entire time for the QoE configuration. The time alignment may be achieved based on the time stamps provided by NG-RAN**
* **Approach 2: Radio-related measurement is configured only when the QoE measurement starts (e.g. by receiving the indication or QoE report from UE), and the radio-related measurement starts once configured.**

**For case 2 (i.e. MDT is configured before QoE),** paper [6] provides approaches to support the case that QoE measurement activated after MDT measurement has triggered, and proposes introduce QoE Assistant Information IE in F1AP and E1AP for alignment of QoE report and MDT report.

Based on the above, for case 2, below approach can be derived:

**In case of MDT is configured before QoE and the on-going MDT is used for radio related measurement,**

* **Approach 3: when QoE is activated, the QoE assistant information should be notified to the corresponding nodes that perform the on-going MDT measurement to start sending the MDT report to the QoE analysis server, e.g. MCE**

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| **Company** | **Which approach should be selected for the alignment?** |
| Samsung | We support Approach 1-a and Approach 2 |
| CMCC | Approach 1-b. We need to avoid the situation that MDT measurement for MDT purpose cannot be performed without QoE configuration, and it is not our intention to impact the current immediate MDT behaviour for MDT purpose.  Although radio related measurement may adopt immediate MDT measurement as a baseline, such radio related measurement is mainly used for QoE purpose. There is a chance that immediate MDT measurement for MDT purpose and for QoE purpose overlap in time, then it is enough to just collect one copy of such immediate MDT measurement during the overlapped period, but for non-overlapped period, the immediate MDT measurement should last either for MDT purpose or QoE purpose. |
| Qualcomm | **Approach 1-b** is preferred.  **Approach 1-a, Approach 2** and **Approach 3** imposes limitation that radio-related measurements can’t start till the application starts, which is not good. Radio-related measurements can still be used for MDT purposes and should not be restricted in this way.  **Approach 1-b** makes sure that radio-related measurements start before or together with the application start time and we can correlate them both at the network. |
| Huawei | Approach 1-b and Approach 2. We also think the Approach 1-b also can be used in case of MDT is configured before QoE. |
| CATT | Before we selection the approach, we should clear understanding the pre-condition. i.e what is the purpose of the MDT configured.  If the QoE is configured with the MDT at same time and aim to correlation post processing, Approach 1-a, Approach 2 are good choice  If the aim is not only for the correlation, Approach 1-a Approach 3 are good choice. So we need identify the aim of the MDT firstly |
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### End of the radio-related measurement

The same as start mechanism, there are also two cases for the end of radio-related measurement below:

* Case 1 the radio-related measurement is dependent on QoE configuration/measurement
* Case 2 the radio-related measurement is independent on QoE configuration/measurement

**For case 1,** paper [2] observes that the radio-related measurements start/stop at the same time with QoE measurement and proposes that specify the start/stop mechanism for radio-related measurement different from the existing MDT mechanism, and paper [4] also proposes RAN3 provide optional support for ending the MDT measurements and QoE measurements at the same time.

Based on the above, for case 1, below approaches can be derived:

**For the time alignment measurements of the radio-related measurement configured at the time with QoE configuration,**

* **Approach 1: Radio-related measurement stops when the corresponding QoE measurement stops.**
* **Approach 2: Radio-related measurement stops when the corresponding QoE configuration is deactivated.**

**For case 2,** paper [6] proposes introduce QoE Assistant Information IE in F1AP and E1AP for alignment of QoE report and MDT report.

**For the alignment of the radio-related measurement and QoE measurement if the radio-related measurement stops independent from QoE:**

* **Approach 3: when QoE is deactivated, the QoE assistant information should be notified to the corresponding nodes that perform the on-going MDT measurement to stop sending the MDT report to the QoE analysis server, e.g. MCE**

In addition, paper [11] proposes the NG-RAN sends the UE mobility history including the C-RNTI and the NG-RAN trace ID to the MCE when the QoE measurements is ended, it doesn’t mention it’s case 1 or case 2, so moderator assumes it can be applied for both cases. The approach is:

* **Approach 4: when the QoE measurements is ended, the NG-RAN sends the UE mobility history including the C-RNTI and the NG-RAN trace ID to the MCE**
* **Approach 5: When the QoE is deactivated or QMC is complete, NG-RAN does nothing to stop ongoing MDT measurements (MDT can continue independent of QMC stop)**

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| **Company** | **Which approach should be selected to support the alignment?** |
| Samsung | We support approach 1 |
| CMCC | Please see the answer above in 3.2.2. |
| Qualcomm | We are in favor of case 2 i.e. the radio-related measurement is independent on QoE configuration/measurement. We are not sure if we need either Approach 3 or Approach 4 if they are independent. So, we have added **Approach 5** i.e. MDT can continue independent of QMC stop. OAM can choose to deactivate MDT as well when it wants to deactivate QoE.  For case 1, similar answer as in 3.2.2. Approach 1 and 2 restrict radio-related measurements to stop when QoE is deactivated/stopped. If we have a mechanism to only deactivate QoE in Trace Deactivation message as discussed in CB NRQoE2, MDT measurements can still continue post QoE deactivation for MDT optimization purposes. |
| Huawei | Approach 4. We think the MDT configuration and QoE measurement can be configured and performed independently. Therefore we prefer the Radio-related measurement will continue until the RAN receives the legacy MDT deactivation command from the CN/OAM.  In our understanding, when the RAN sends the radio-related measurement results or QoE measurement results to the MCE, the RAN also send the UE ID and time stamps of the measurement results. The MCE can perform the alignment. But the UE will move to new cells/nodes during the QoE measurement. The MCE will receive the results from different cell/nodes. Therefore the MCE need to know the UE ID in different cells. We think the MCE can first find UE id and the measurement results received from each cell based on the mobility history, then perform the alignment. |
| CATT | As we answer in last question , we should consider the configuration purpose  If we just consider the alignments the QoE and radio related information. The approach 1 is the best solution. If consider the existing MDT, we need mix the solutions |
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### Correlation information

Paper [2], [3], [5] think QoE reference and Trace reference should be used for correlation, Paper [2], [5], [11] think time stamp can be used for correlation. Furthermore, paper [3] proposes DRB information (e.g. DRB list or QoS flow ID) related to the QoE measurement should be indicated to the gNB or QoE server for correlation. And paper [11] proposes the NG-RAN also sends the NG-RAN trace ID, C-RNTI, serving cell ID to the MCE for correlation. Moderator’s understanding is that some correlation information depends on the solution selected, maybe we can discuss this in phase2, but some should be used no matter which solution is selected.

From the above, the following proposal can be derived:

**Question 1: is there any information below should be considered no matter which solution is selected?**

* **Trace Reference**
* **QoE Reference**
* **Timestamps**
* **DRB information**
* **Serving cell ID**
* **C-RNTI**

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| **Company** | **Please provide your views.** |
| Samsung | No matter which solution is selected, trace reference and QoE reference should be considered for alignment.  Besides, DRB information corresponding to the QoE measurement should also be considered for alignment. |
| CMCC | If the information indicated here is the one transmitted from NG-RAN to Collection Entity, we need to discuss which information needs to be sent with QoE report container, and which information needs to be sent with immediate MDT measurement results.  Our understanding is that for immediate MDT measurement results, timestamps are needed to be added by NG-RAN, and at least QoE reference is also needed to help MCE/QoE server identify that such immediate MDT measurement results are performed for QoE purpose and for which QoE reference.  While for QoE report or immediate MDT measurement results, DRB information might be added for OAM observatory purpose. |
| Qualcomm | If we agree to reuse trace procedures for QoE, then there shall be only 1 trace ID active at a given UE. NG-RAN can then assume that the immediate MDT measurements and QoE reports from a given UE are for the same trace ID and can be correlated based on received time stamps.  Interpolation/extrapolation might be needed for correlation in certain cases (e.g event triggered) as alignment of MDT and QoE reports are very hard to achieve i.e. MDT is sent when a certain radio condition is met and QoE report is sent when a session ends or based on application rules. Alignment can be easier if OAM configures QoE and MDT with a same reporting periodicity. |
| Huawei | So here the proposal is to also include some radio-related information when radio-related measurement result is reported to TCE? Since C-RNTI, DRB information could be collected without MDT measurement.  Of course, trace reference is anyway needed, QoE reference is pending on discussion on CB#3. |
| CATT | Trace Reference, QoE Reference and Timestamps should be considered for the correlation |
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### Correlation entity

Paper [5] proposes RAN3 to discuss where to locate mapping between QoE Reference (if needed) and Trace Reference. Options are in the UE, in the gNB or in the post-processing system. And Paper [6] proposes QoE and related MDT report should be sent to the same collection equipment. And paper [10] proposes Legacy QoE measurement report and MDT measurement report for QoE purposes should be aligned and correlated at OAM. Paper [11] thinks it is the MCE to make correlation between radio-related measurements, radio-related info and QoE measurement results

Based on the above, the following question is derived:

**Question 2: which entity (UE, gNB, post-processing server (e.g. OAM, TCE, or MCE)) is responsible for the correlation of the Radio-related measurement and QoE measurement?**

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| **Company** | **Please provide your views.** |
| CMCC | Post-processing server needs to take responsibility. And MCE could be a proper place, for it logically collects measurement results for QoE purpose. |
| Qualcomm | OAM (i.e. TCE/MCE) can do the post processing. |
| Huawei | We would think it is OAM/TCE/MCE, since they are the final user of Radio-related measurement |
| CATT | OAM (i.e. TCE/MCE) |
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## Others

### The alignment with RAN visible QoE

Paper [10] proposes for RAN visible QoE measurement, RAN provides RAN visible QoE configuration and MDT configuration for QoE purposes to UE simultaneously, and RAN visible QoE measurement report and MDT measurement report for QoE purposes should be aligned and correlated at NG-RAN. As RAN visible QoE is under discussion in other CB, moderator is not sure whether we should consider RAN visible QoE at this stage, so below question are derived:

**Question 3, should RAN3 consider RAN visible QoE in the alignment of radio-related measurement and QoE measurement.**

**Question 3bis, if yes to question 3, for RAN visible QoE measurement, RAN is responsible for the radio-related measurement configuration and the alignment of radio-related measurement and RAN visible QoE measurement.**

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| **Company** | **Please provide your views.** |
| CMCC | Yes. RAN is responsible for such correlation. But we can wait for RAN visible QoE topic alone achieves a comparatively stable status, then to open the discussion on such crossover topics. |
| Qualcomm | This could be discussed later once we have agreements on alignment for application layer QoE and MDT. |
| Huawei | RAN visible QoE is for RAN to use, while radio-related measurement is for high layer to use, seems they are independent? Of course, they could be requested at the same time. Also we think this question depends on whether the RAN visible QoE measurement can be configured only if QoE measurements are configured for the same service type (i.e. the Q9 in CB: # NRQoE5-RAN\_visible). |
| CATT | Yes, agree with CMCC |
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### Radio-related information

Paper [11] proposes radio-related information is collected by the NG-RAN and there is no need for the UE to collect this information. Moderator is not sure whether radio-related information is in the scope of this CB, so below question are derived:

**Question 4: should RAN3 need to discuss the radio-related information in this CB?**

**Question 4bis: If yes to question 4, should radio-related information provided by gNB or UE?**

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| **Company** | **Please provide you views.** |
| CMCC | Yes, and the radio-related information, such as DRB/QoS Flow information, could be considered for correlation with RAN visible QoE report which is provided by UE. But we can wait for RAN visible QoE topic alone achieves a comparatively stable status, then to open the discussion on such crossover topics. |
| Qualcomm | Radio related information should not be provided by UE (immediate MDT should suffice). We are okay to discuss gNB provided additional information if deemed useful, may be later. |
| Huawei | Radio-related information is part of the conclusion the SI, so anyway we need to discuss if there are any spec impacts to support it.  We think radio-related information should be provided by gNB, this is also the conclusion of the SI. |
| CATT | Yes, if the MDT is configured for the QoE, the UE provided radio related information is enough. Otherwise RAN need to collect the required information. |
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### Other topics

Any other proposals.

# Phase 2: