**3GPP TSG-RAN2 Meeting # 124 *R2-2311xxx***

**Chicago, USA, 13th – 17th Nov, 2023**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.300** | **CR** | **0768** | **rev** | **-** | **Current version:** | **17.6.0** |  |
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| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <http://www.3gpp.org/Change-Requests>.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of R18 QoE enhancement in TS 38.300 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | China Unicom, Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_QoE\_enh-Core | | | | |  | ***Date:*** | | | 2023-11-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of R18 QoE enhancement in TS 38.300. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The CR captures the agreements made since RAN2#119-e meeting. (detailed agreements are listed at the end of the CR)  Merge the stage-2 CR for Rel-18 NR QoE from RAN3 (R2-2313993\_R3-238103) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | R18 QoE measurements will not be supported in NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 21.1, 21.2.1, 21.2.3, 21.2.4, 21.3, 21.4, 21.6 (new), 21.7 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.331 CRxxxx  TS 38.306 CRxxxx | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## 3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

--- SKIP UNCHANGED PART ---

QMC QoE Measurement Collection

QoE Quality of Experience

QPSK Quadrature Phase Shift Keying

RA Random Access

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RLM Radio Link Monitoring

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

RTT Round Trip Time

RVQoE RAN visible QoE

SCS SubCarrier Spacing

--- SKIP UNCHANGED PART ---

# 21 Application Layer Measurement Collection

## 21.1 Overview

The QoE Measurement Collection function enables collection of application layer measurements from the UE. The supported service types are:

- QoE Measurement Collection for DASH streaming services;

- QoE Measurement Collection for MTSI services;

- QoE Measurement Collection for VR services.

The QoE measurement collection is supported in RRC\_CONNECTED state, RRC\_IDLE state and RRC\_INACTIVE state.

The QoE Measurement Collection function supports collection of QoE measurements for MBS communication service. The measurement collection is supported for the following two communication service types:

- MBS broadcast.

- MBS multicast.

QoE measurement collection for application sessions delivered via MBS broadcast is supported in RRC\_CONNECTED, RRC\_INACTIVE, and RRC\_IDLE states. QoE measurement collection for the application sessions delivered via MBS multicast is supported in RRC\_CONNECTED state only. Both signalling based and management based QoE measurement collection are supported in NR SA and NR-DC. Further details of NR-DC operation can be found in TS 37.340 [21] and section 21.7.

NOTE: The naming QoE Measurement is used in NG, Xn, and interfaces between the OAM and the gNB. In the Uu interface, the naming application layer measurement is used and it is equal to QoE Measurement.

## 21.2 QoE Measurement Configuration

### 21.2.1 QoE Measurement Collection Activation and Reporting

The feature is activated in the gNB either by direct configuration from the OAM system (management-based activation), or by signalling from the OAM via the 5GC (signalling-based activation), containing UE-associated QoE configuration. One or more QoE measurement collection jobs can be activated at a UE per service type, and each QoE measurement configuration is uniquely identified by a QoE reference.

For signalling-based QoE measurements, the OAM initiates the QoE measurement activation for a specific UE via the 5GC, and the gNB receives one or more QoE measurement configurations by means of UE-associated signalling. The QoE measurement configuration for signalling-based activation includes an application layer measurement configuration list and the corresponding information for QoE measurement collection, e.g., QoE reference, service type, MCE IP address, slice scope, area scope, MDT alignment information, the indication of available RAN visible QoE metrics and assistance information.

For management-based QoE measurement activation, the OAM sends one or more QoE measurement configurations directly to the gNB. The QoE measurement configuration for management-based activation also includes an application layer measurement configuration list and the corresponding information for QoE measurement collection. The gNB selects UE(s) that meet the required QoE measurement capability, area scope and slice scope.

Application layer measurement configuration received by the gNB from OAM or CN is encapsulated in a transparent container, which is forwarded to a UE as Application layer configuration in the *RRCReconfiguration* message (there can be multiple configurations in the same message). Application layer measurement reports received from UE's application layer are encapsulated in a transparent container and sent to the network in the *MeasurementReportAppLayer* message, as specified in TS 38.331 [12]. The UE can send multiple application layer measurement reports to the gNB in one *MeasurementReportAppLayer* message. In order to allow the transmission of application layer measurement reports which exceed the maximum PDCP SDU size, segmentation of the *MeasurementReportAppLayer* message may be enabled by the gNB. An RRC identifier conveyed in the RRC signalling is used to identify the application layer measurement configuration and report between the gNB and the UE. The RRC identifier is mapped to the QoE reference in the gNB, and the gNB forwards the application layer measurement report to MCE together with the QoE reference. The gNB can release one or multiple application layer measurement configurations from the UE in one *RRCReconfiguration* message at any time. The UE may additionally be configured by the gNB to report when a QoE measurement session starts or stops for a certain application layer measurement configuration.

### 21.2.2 QoE Measurement Collection Deactivation

The QoE Measurement Collection deactivation permanently stops all or some of the QoE measurement collection jobs towards a UE, resulting in the release of the corresponding QoE measurement configuration(s) in the UE. The deactivation of QoE measurement collection is supported by using UE-associated signalling. A list of QoE references is used to deactivate the corresponding QoE measurement collection job(s).

Upon reception of the QoE release message in an application layer measurement configuration, the UE discards any unsent application layer measurement reports corresponding to the released application layer configuration. The UE discards the reports received from application layer when it has no associated application layer measurement configuration configured.

The network can replace a QoE measurement configuration with another one by deactivating an existing QoE measurement configuration and activating another QoE measurement configuration of the same QoE measurement configuration type.

### 21.2.3 Handling of QMC during RAN Overload

The QoE measurement collection pause/resume procedure is used to pause/resume reporting of one or multiple QoE measurement configurations in a UE in RAN overload situation.

The gNB can use the *RRCReconfiguration* message to temporarily stop the UE from sending application layer measurement reports associated with one or multiple application layer measurement configurations. When the UE receives the QoE measurement collection pause indication, the UE temporarily stores application layer measurement reports in AS layer. When the UE receives the QoE measurement collection resume indication, the UE sends the stored application layer measurement reports to the gNB.

For a QoE measurement configuration, the assistance information provided by the OAM may be considered by the gNB for deciding whether to pause/resume the measurement reporting of certain QoE measurement configurations in case of RAN overload.

### 21.2.4 QoE Measurement Handling in RRC\_IDLE and RRC\_INACTIVE States

If the UE enters RRC\_INACTIVE, the UE AS configuration for the QoE is stored in the UE Inactive AS context.

If the UE enters RRC\_IDLE state, the UE releases all application layer measurement configurations except the application layer configurations explicitly indicated by the gNB as applicable in RRC\_IDLE and RRC\_INACTIVE states.

For application measurement configurations applicable in RRC\_IDLE and RRC\_INACTIVE states, the UE continues on-going QoE measurement collection when entering RRC\_IDLE or RRC\_INACTIVE state, and also when returning to RRC\_CONNECTED state. The UE may also start QoE collection according to the stored QoE configuration while in RRC\_IDLE or RRC\_INACTIVE state. The UE keeps the application layer measurement configurations but does not start new QoE sessions when it is outside of the area scope for QoE configurations in RRC\_IDLE and/or RRC\_INACTIVE state. The UE stores the application layer measurement reports generated while in RRC\_IDLE and/or RRC\_INACTIVE state in the AS layer.. The gNB can retrieve the application layer measurement reports/configurations and session status indication by configuring SRB4 or SRB5 after it receives application layer measurement reports/configurations availability indication. The UE can send idle/inactive application layer measurement reports to the gNB only when it has moved to RRC\_CONNECTED state due to other reasons.

Upon UE’s transition from RRC\_IDLE to RRC\_CONNECTED, the gNB serving the UE should ensure that it does not release an already configured signaling-based QoE measurement configuration for the sake of configuring a new management-based QoE measurement configuration.

### 21.2.5 Per-slice QoE Measurement

When a service is provided within a configured slice, the QoE Measurement for this service type can also be configured together with the corresponding slice scope, so that the user experience of this service can also be evaluated on a per-slice basis. Multiple QoE measurement configurations can be configured for the same service type, and each configuration can pertain to different slices, where each QoE measurement configuration is identified with a QoE reference.

The UE includes the network slice identifier inside the QoE report container when reporting QoE measurement reports.

## 21.3 QoE Measurement Continuity for Mobility

QoE measurement collection continuity for intra-system intra-RAT handover is supported, with the Area Scope parameters configured by the OAM, where the network is responsible for keeping track of whether the UE is inside or outside the area scope. A UE continues an ongoing QoE measurement even if it leaves the area scope, unless the network indicates to the UE to release the application layer measurement configuration.

For the handover, the source gNB may transmit the information related to one or more application layer measurement configurations of the UE to the target gNB via XnAP or NGAP. For signalling-based QoE, the service type indication, QoE reference, and, optionally, the MCE IP address, measurement configuration application layer ID, MDT alignment information, area scope, slice support list for QMC, available RAN visible QoE metrics and measurement status are passed to the target gNB. For management-based QoE, the service type indication, measurement configuration application layer ID, the MCE IP address and QoE measurement status are passed to the target gNB. For RRC\_INACTIVE state mobility, QoE measurement configuration(s) of a specific UE can be retrieved from the gNB hosting the UE context when it resumes to the RRC\_CONNECTED state.

For signalling-based QoE, at handover to a target gNB that supports QoE measurement collection, the target gNB decides which of the application layer measurement configurations should be kept or released, e.g., based on application layer measurement configuration information received from the source gNB in Xn/NG signalling.

For QoE sessions pertaining to data flows received via MBS broadcast, QoE measurement collection may continue during the RRC\_INACTIVE and RRC\_IDLE.

QoE measurements for ongoing sessions should be continued when switching between MBS multicast and unicast transmission modes.

When the UE resumes the connection with a gNB that does not support QoE, the UE releases all application layer measurement configurations.

QoE measurement collection continuity for intra-system inter-RAT handover is supported.

For intra-5GC handover from E-UTRA to NR, the UE releases the LTE QoE configuration if received from the source RAT and the UE applies NR QoE configuration(s) if received from the target RAT.

For intra-5GC handover from NR to E-UTRA, the UE releases all NR QoE configuration(s) if received from the source RAT, and the UE applies the LTE QoE configuration if received from the target RAT.

## 21.4 RAN Visible QoE Measurements

RAN visible QoE measurements are configured at the UE by the gNB, where a subset of configured QoE metrics is reported from the UE to the gNB as an explicit IE readable by the gNB. The RAN visible QoE measurements can be used by the gNB for network optimization. The RAN visible QoE measurements are supported for the DASH streaming and VR services. The gNB configures the RAN visible QoE measurement of all or some of the available RAN visible QoE metrics, where the indication of metric availability is received by the gNB as part of management-based or the signalling-based QoE configuration. The set of available RAN visible QoE metrics is a subset of the metrics configured as part of QoE measurement configuration encapsulated in the application layer measurement configuration container. RAN visible QoE measurements and encapsulated QoE measurements can be configured together or separately. RAN visible QoE measurements can only be configured if there is a corresponding QoE measurement configuration for the same service type configured at the UE. The gNB may modify a RAN visible QoE configuration by releasing it and configuring the UE with a new RAN visible QoE configuration pertaining to the same QoE reference. In this case, the new RAN visible QoE configuration applies immediately, i.e., even during the same application session.

Multiple simultaneous RAN visible QoE measurement configurations and reports can be supported for RAN visible QoE measurements, and each RAN visible QoE measurement configuration and report is identified by the same measurement configuration application layer ID as the corresponding QoE measurement configuration and measurement report. After receiving the RAN visible QoE measurement configuration, the UE RRC layer forwards the configuration to the application layer, indicating the service type, the measurement configuration application layer ID and, optionally, the reporting periodicity for RAN visible QoE. The application layer sends the RAN visible QoE measurement report associated with the measurement configuration application layer ID to the UE's AS layer. The PDU session ID(s) and QoS Flow IDs per PDU session ID corresponding to the service that is subject to QoE measurements can also be reported by the UE along with the RAN visible QoE measurement results.

If there is no reporting periodicity defined in the RAN visible QoE configuration, the UE sends both RAN visible QoE measurement reports and the QoE measurement reports to the gNB in the same *MeasurementReportAppLayer* message, except when QoE measurement reporting pause indication is received (e.g., in case of RAN overload). When a QoE measurement collection is paused, if there is no reporting periodicity defined in the RAN visible QoE configuration, the encapsulated QoE reports are stored at the UE's RRC layer, but the RAN visible QoE reports continue to be reported to the gNB with the reporting periodicity configured for encapsulated QoE reporting. The RAN visible QoE measurements can be reported with a reporting periodicity different from the one of the corresponding encapsulated QoE measurements, when a dedicated RAN visible QoE reporting periodicity is configured by the gNB. The UE Application layer can measure the RAN visible QoE metrics based on this reporting periodicity.

The gNB can release one or multiple RAN visible QoE measurement configurations from the UE in one *RRCReconfiguration* message at any time. If the encapsulated QoE configuration is released, the corresponding RAN visible QoE configuration shall be released as well.

The RAN visible QoE configuration can be transferred from the source gNB to the target gNB upon mobility and from the old gNB to the new gNB during context retrieval. The target gNB or the new gNB can generate a new RAN visible QoE configuration based on the available RAN visible QoE metrics received and can send the new RAN visible QoE configuration to the UE during handover or the RRC resume procedure.

## 21.5 Alignment of MDT and QoE Measurements

The radio-related measurements may be collected via immediate MDT for all types of supported services for the purpose of QoE analysis. The MCE/TCE performs the correlation of the immediate MDT measurement results and the QoE measurement results collected at the same UE.

The following is supported:

- Alignment between a signalling-based QoE measurement and a signalling-based MDT measurement. In this case, the signalling-based QoE configuration sent to the gNB includes the NG-RAN Trace ID of the signalling-based MDT measurement.

- Alignment between a management-based QoE measurement and a management-based MDT measurement.

The UE configured with QoE measurements sends an indication to inform the gNB about the start or the stop of a QoE measurement session of configured QoE measurements. The gNB can activate the MDT measurements that are to be aligned with the QoE measurements performed by the UE upon/after receiving the QoE measurement session start indication from the UE. The gNB may activate the MDT measurements upon/after receiving the MDT activation message from the OAM. The gNB can deactivate the aligned MDT measurements according to an OAM command which may, e.g., be triggered by the session stop indication.

The gNB includes time stamp information to the QoE measurement reports to enable the correlation of corresponding measurement results of MDT and QoE at the MCE/TCE. In addition, the gNB includes the MDT session identifiers (Trace Reference and Trace Recording Session Reference) in the corresponding QoE measurement report.

21.6 QoE Measurement Collection in High Mobility Scenarios

QoE measurements can be confined to high mobility state of the UE and/or to HSDN cells.

21.7 Support for RAN visible QoE measurements and reporting in NR-DC

Either the MN or the SN can generate and send a RAN visible QoE configuration to the UE. The gNB that has initially configured a UE in NR-DC with an RVQoE configuration can modify and release the RAN visible QoE configuration as long as the UE is connected to this gNB. The gNB that configures the encapsulated QoE measurements to UE is referred to as the RAN visible QoE-configuring gNB, and the peer node is referred to as the non-RAN visible QoE-configuring gNB. Upon mobility, the RAN visible QoE-configuring gNB may be changed.

The UE may send RAN visible QoE reports to the network using either SRB4 or SRB5. In addition, the gNB that received a RAN visible QoE report can forward the report to the other gNB (the SN or the MN). QoE reports and RAN visible QoE reports pertaining to the same QoE Reference can be sent over the same SRB or they can be sent over different SRBs.

The RAN visible QoE-configuring gNB can configure RAN visible QoE measurements at a UE without a priori knowledge about which gNB(s) will provide the bearer(s) for a future application session. During the lifetime of an application session, to ensure that the RAN visible QoE reports are sent to the gNB(s) that provide the bearer(s) which carry the data flow(s) associated with the RAN visible QoE measurement result in a RAN visible QoE report, the gNB receiving the RAN visible QoE reports determines the bearer(s) used to deliver the application session data flow(s) and the associated gNB (s). The determination may be based on the PDU session ID(s) and the QoS flow ID(s) indicated in a received RAN visible QoE report.

When the RAN visible QoE-configuring gNB receives a RAN visible QoE measurement report and determines that the non-RAN Visible QoE-configuring gNB provides at least one bearer for the application session, the RAN Visible QoE-configuring gNB indicates that to the non-RAN Visible QoE-configuring gNB. The non-RAN Visible QoE-configuring gNB can then, if needed, indicate to the RAN visible QoE-configuring gNB its preference with respect to the reporting path for the subsequent RAN visible QoE reports and its preferred RAN visible QoE configuration parameters.

If a gNB receives a RAN visible QoE report from a UE in NR-DC, and determines that the bearer(s) for the application session data flow(s) is (are) also provided by the other gNB, or only, provided by the other gNB, the gNB that received the RAN visible QoE measurement report may forward the received RAN visible QoE report to the other gNB. The RAN visible QoE reports can be transferred between the MN and the SN via the RRC TRANSFER message. The RAN visible QoE configuration may also be modified or released.

# Annex RAN2 agreements on NR QoE

**RAN2 agreements for information, which will be removed from final CR.**

## A.1 QoE measurements in RRC\_IDLE INACTIVE

***RAN2#124 Agreements***

When UE moves to RRC\_IDLE state, the UE will store QoE configurations it received in RRC\_CONNECTED state or it stored in RRC\_INACTIVE state in the AS layer.

When UE moves to RRC\_IDLE state, the UE will store the following information per QoE configuration (can be updated based on further RAN3 agreements):

– QoE reference.

– The ID of the Measurement Collection Entity.

– The measConfigAppLayerID.

– Service type.

– QoE measurement type (s-based or m-based measurement) for MBS broadcast service.

– AS layer based area scope info.

RAN2 agree to leave it to RAN3 to decide which entity (gNB or OAM) can be used to map MCE ID to MCE IP address.

UE doesn’t store RVQoE configurations in RRC\_IDLE state and in RRC\_INACTIVE (outside of UE INACTIVE context, if stored there).

The following agreements are based on the assumption that we use AS-layer area scope checking:

The gNB forwards the area scope to the UE AS together with the IDLE/INACTIVE applicable QoE configuration in the MeasConfigAppLayer IE.

RAN2 should send an LS to CT1 and SA4, asking CT1 to extend the +CAPLEVMCNR AT command with an “inside area”/”outside area” indication or specify a new AT command for conveying such an indication from the UE AS to the UE application. AS layer sends this indication whenever it moves in/out area scope and APP layer only considers it for non-ongoing QoE measurement session

The UE shall not autonomously release a QoE configuration when the UE leaves the area scope in RRC\_IDLE or RRC\_INACTIVE state.

The gNB can configure a priority level for each QoE configuration. When the AS buffer for QoE becomes full in IDLE/INACTIVE state, the UE first discards the QoE measurements associating to the QoE configuration with the lowest priority.

Priority level is optionally configured by the network

The QoE configuration without priority level is considered as the lowest priority.

If none of the QoE configurations is associated to a priority level, the UE may first discard the oldest QoE measurement when the AS buffer becomes full.

RAN2 will use explicit indicator in AS-layer on whether a QoE configuration is also applicable in RRC-IDLE and INACTIVE states. One indicator for both IDLE and INACTIVE states is assumed unless it causes issues during CR implementation.

RAN2 assumes this has no impact on RAN3, i.e. this indication is set based on the information already available at the gNB (e.g. broadcast indication).

QoE measurement reporting procedure is used to transmit QoE configurations info to the gNB, i.e. the NW configures SRB4 and UE send QoE configurations and/or QoE reports (if available).

Session status indication should be sent in MeasurementReportAppLayer together with QoE configuration when UE moves from IDLE/INACTIVE to CONNECTED.

Introduce a 1-bit indicator in RRCReconfiguration/RRCResume to indicate gNB supports MBS QoE configuration/report retrieval.

If the indicator is present, UE can send MBS QoE configuration and/or reports.

Otherwise (i.e., the indicator is absent), UE releases all MBS QoE configurations and reports.

Share the 1-bit indication (previously agreed in RAN2) to indicate availability of QoE configurations and/or reports stored in the UE.

When transferring to RRC\_CONNECTED, UE should check the PLMN of target gNB before UE forwards any QoE information.

If PLMN UE connects to is not included in the area scope and is different from the one which provided the QoE configuration, UE should not forward QoE configuration and report and release them.

***RAN2#123b Agreements***

The UE does NOT perform QoE area scope checking when the UE is in RRC\_CONNECTED state, i.e. it remains under the responsibility of the network, as in Rel-17.

Working assumption: For QoE configurations applicable to RRC\_IDLE/INACTIVE state, area scope checking is performed by the UE AS layer when the UE is in RRC\_IDLE/INACTIVE state.

It is feasible for gNB to store and retrieve IDLE/INACTIVE QoE configurations via UE based solution.

Session status indication can be transmitted from UE to gNB when the UE moves from RRC IDLE/INACTIVE to RRC\_CONNECTED state. Detailed RRC procedures are FFS in RAN2.

QoE configurations cannot be released via broadcast.

***RAN2#123 Agreements***

From RAN2 viewpoint, network implementation can choose which UEs to use for MBS QoE. No new specification impacts have been identified. If RAN3 decides something on this aspect, RAN2 will take it into account.

1-bit indication is used by the UE to inform the network about stored QoE reports in Msg5 (SetupComplete or ResumeComplete). RAN2 does not intend to specify additional mechanisms unless it can be identified that existing mechanisms (e.g. BSR) do not work. If RAN3 decides something on this aspect, RAN2 will take it into account.

The UE does not setup/resume RRC connection just for QoE reporting, i.e. the QoE reports are sent to the network when the UE moves to RRC\_CONNECTED state due to other reasons. RAN2 will not specify any mechanisms to cope with UEs not doing that. Can capture this in Stage-2.

RAN2 thinks that assistance information for the UE to decide which reports to discard in case the UE’s QoE buffer becomes full could be useful at least for UEs in IDLE/INACTIVE to allow network to prioritize some reports over others. Send LS to RAN3 to ask whether and what information can be provided to the UE for this.

***RAN2#122 Agreements***

Do not support delta configuration of the QoE configuration applied in RRC IDLE when the UE moves to RRC CONNECTED state unless it causes issues for QoE AL continuity in state transition.

UE is allowed to release stored reports and configuration after 48h (similar to logged MDT). No timer is configured by the network.

RAN2 assumes PLMN/TA information is needed in area scope (in one way or another). FFS how this is expressed, e.g. as list of cells.

As working assumption, RAN2 will use explicit indicator in AS-layer on whether a QoE configuration is also applicable in RRC-IDLE/INACTIVE states. Can be revisited if RAN3 decides to introduce a service type.

Do not introduce SIB1 indicator on whether UE is allowed to indicate presence of QoE measurements. UE always indicates if it has stored QoE report(s), and it’s up to network whether/when to retrieve them.

Introduce AS layer minimum memory requirement for storing Rel-18 QoE reports measured in RRC\_IDLE/RRC\_INACTIVE. Could have larger values than in Rel-17. FFS what is the minimum size requirement capability. FFS what is the value range of the capability.

***RAN2#121bis-e Agreements***

As a default behavior, when the UE’s buffer for storing QoE reports is full and a new report arrives, the UE should discard older report(s) to make room for the new one.

FFS whether it is possible to provide information (e.g. priority, service type, etc.) to UE about buffering for the UE to decide which reports to discard in case the UE’s QoE buffer becomes full.

For MBS broadcast services:

- Area scope is checked by the UE when the UE is in RRC IDLE/INACTIVE state.

- FFS whether area scope is checked by the network or by the UE when the UE is in RRC CONNECTED state for MBS broadcast services.

FFS whether area scope checking for MBS broadcast is done by UE Application layer. FFS if this is for all RRC states.

RRC Release message is not used for configuring QoE measurements for MBS broadcast.

When the UE moves to RRC-CONNECTED state and indicates that there is QoE measurement available in RRC{Setup,Resume}Complete message. Network then retrieves the report by configuring the SRB4/5 for QoE reporting and using the Rel-17 reporting mechanism.

QoE measurement configuration via broadcast signaling (e.g. System Information, MCCH/MTCH etc.) is not supported. FFS if the release of configuration can happen via broadcast.

If the UE is in RRC\_CONNECTED and receives QoE report for MBS broadcast from the application layer, the UE sends the report according to the Rel-17 QoE reporting procedure.

The QoE configuration indicates the applicable states (i.e. that the QoE measurements for CONNECTED are supposed to be gathered also in RRC\_IDLE/INACTIVE). FFS whether this is explicit or implicit.

For QoE configurations of MBS QoE in RRC IDLE, UE AS layer does not store the QoE container but stores QoE configuration ID and service type. FFS if UE AS layer stores something else.

For QoE configurations MBS QoE in RRC IDLE/INACTIVE, the UE APP layer stores all the parameters forwarded from AS layer.

For INACTIVE, FFS what else UE AS layer stores.

***RAN2#121 Agreements***

Rel-18 QoE configuration can be provided to UE as in Rel-17 (RRCreconfiguration, RRCresume).

FFS if RRCRelease can be used – proponents should provide detailed proposals on what is in RRCRelease, why it is needed, how to handle RRCReconfiguration + RRCRelease together.

RAN2 thinks existing paging can be used to bring UE to CONNECTED, where NW can release QoE configuration. This requires no specification changes.

If UE moves outside of area scope for QoE configuration, UE keeps the QoE configurations and does not start new QoE sessions.

If the AS layer buffer is full, RAN2 thinks AS layer should discard the QoE data. Can revisit this if SA5 LS reply indicates something that would create issues with this.

FFS what the minimum AS layer buffer size (at least 64 kBytes, can consider whether larger value is used in UE capability discussions).

Same as the RRC\_CONNECTED state, when the UE transfer to the IDLE state, the UE AS layer stores QoE configurations (except for QoE container) for MBS broadcast. FFS what exactly AS layer stores

Same as the RRC\_CONNECTED state, when the UE transfer to the IDLE state, the UE APP layer should store QoE configurations (at least QoE container) for MBS broadcast. FFS what exactly is sent to AL.

***RAN2#120 Agreements***

Ask SA4 if we can use application layer information for QoE measurements in IDLE/INACTIVE the Rel-18 area scope given that the needed information requires cell knowledge.

For buffering of QoE reports generated in RRC IDLE/INACTIVE state, RAN2 will make some assumptions on the minimal memory size requirement and the buffering layer. We can indicate these to SA4/SA5 to see if they think those assumptions are realistic.

Ask SA4/5 on how network would handle reports based on when they were collected, and whether it matters how “old” they are.

UE can be configured to do QoE measurements for MBS broadcast in all RRC states.

As a baseline, UE does not tigger RRC Resume – RRC Setup just for the sake of reporting QoE. FFS whether there are cases where we deviate from this baseline.

***RAN2#119b-e Agreements***

Not treated at this meeting.

***RAN2#119-e Agreements***

The gNB can send the QoE configuration for MBS broadcast service to UE by RRC message in RRC\_CONNECTED via dedicated signalling. The UE stores the configuration for QoE and performs the application layer measurement for MBS broadcast service.

FFS if configuration can be done in IDLE/INACTIVE states.

FFS how does gNB determine which UEs can be configured with MBS QoE measurements.

FFS if there is a new explicit indicator or new service type used for MBS QoE configuration in RRC\_IDLE/RRC\_INACTIVE. Wait for RAN3 progress and SA4 LS reply to RAN3.

The baseline principles for QoE measurement collection for MBS services in RRC\_INACTIVE and RRC\_IDLE states are:

1) The UE is configured with IDLE/INACTIVE QoE via RRC.

2) The UE buffers the QoE reports generated while in RRC IDLE/INACTIVE state.

3) FFS if UE can setup/resume RRC connection just for QoE reporting, or whether the QoE reports are sent to the network when the UE moves to RRC CONNECTED state due to other reasons.

When the UE moves to RRC\_CONNECTED state, the UE sends the QoE measurements availability indication to the gNB.

For buffering of QoE reports generated in RRC IDLE/INACTIVE state, RAN2 should discuss at least the minimal memory size requirement. FFS if AS layer is responsible for storing the QoE reports (as in Rel-17).

## A.2 Rel-17 leftover topics for QoE

***RAN2#123bis-e Agreements***

Not treated at this meeting.

***RAN2#123 Agreements***

Whether application layer can always provide QoS flow ID(s) for the both metrics of Bufferlevel and Playout delay follows the same approach as in Rel-17.

***RAN2#122 Agreements***

RAN2 confirms that buffer level threshold-based triggering of RVQoE reporting is triggered by application layer.

RAN2 waits for RAN3’s conclusion on the buffer level threshold-based RVQoE reporting.

RAN2 will align with RAN3’s agreement on support of radio-related event triggers for RVQoE reporting in Rel-18.

Application layer measurement configuration and reporting for shared spectrum channel access is not supported in R18.

***RAN2#121bis-e Agreements***

Not treated at this meeting.

***RAN2#121 Agreements***

Introduce the QoS flows ID information in the RVQoE reporting from the UE.

RAN2 thinks (based on view from majority of companies) buffer level threshold-based triggering of RVQoE reporting by either APP layer or AS layer is feasible, but RAN2 prefers APP layer triggering. RAN2 will send an LS to SA4 to ask whether SA4 can make required specifications changes in Rel-18.

***RAN2#120 Agreements***

Not treated at this meeting.

***RAN2#119b-e Agreements***

From RAN2’s perspective, there is no further work for per-slice-based QoE measurement.

RAN2 can wait for RAN3 progress on enhancement to per-slice RAN visible QoE measurement.

RAN2 needs to wait for the progress of RAN3 on RVQoE value.

The enhancement on UAI message to express the UE’s preference on QoE reporting configurations is not pursued.

QoE reporting via unlicensed band is out of the WID scope.

RAN2 to postpone the discussion of the QoE reporting enhancement for overload scenario to the next meeting (based on the progress of RAN3).

FFS on whether to send the priority information 1) UE and gNB or 2) only to gNB.

To wait for RAN3 decision on granularity of priority.

RAN2 can discuss event-based RVQoE, including possible options, benefits, spec impacts, and complexities based on company contributions.

FFS whether to add the QoS flow ID in the RVQoE report. If RAN3 already agreed to this, RAN2 can progress this in the next meeting where we discuss Rel-17 leftovers.

***RAN2#119-e Agreements***

Not treated at this meeting.

## A.3 Support of QoE measurements for NR-DC

***RAN2#124 Agreements***

For QoE reporting configured to be reported via SRB5, when SCG is deactivated, it is NW implementation to map SRB5 to MN, release the corresponding QoE configurations or pause the QoE reporting.

The RAN2#123 agreement “if UL traffic arrives and the UE cannot send a QoE report because the configured SRB is not available, UE continues to store the report until the SRB is available or the QoE configuration is released” is applicable only to encapsulated QoE (i.e., the QoE report storage is not applied to RVQoE).

When SN is released, all the QoE measurements configured by the SN should be released (i.e., there is no need to indicate to UE which QoE configurations should be released or kept).

When UE cannot send RVQoE report because the configured RVQoE specific SRB is not available, the UE should discard the RVQoE report.

When SN is released, the UE should discard the unsent QoE report configured to be reported via SRB5.

***RAN2#123b Agreements***

For s-based QoE configuration received by MN, MN sends the QoE configuration via SRB1, QoE reports can be sent via SRB4 or SRB5.

WA: The transparent reporting for RVQoE over RRC is not supported.

Define two different reporting leg indications for QoE and RVQoE.

For a UE in NR-DC, each legacy QoE configuration can have only one corresponding RVQoE configuration when needed.

Introduce a new indicator (ex, rrc-SegAllowed-SN-r17) for NW to inform UE of whether SN allows RRC segmentation via SRB5.

For Rel-18, clarify that the “segmentation flag” from Rel-17 refers to SRB4 only.

QoE report (e.g., either encapsulated QoE or RVQoE) associated with the non-receiving RAN node, can be send to the receiving RAN node via MeasurementReportAppLayer message if configured by NW.

QoE report over ULInformationTransferMRDC is not supported.

UE should not request to activate SCG only for the purpose of RVQoE reporting via SRB5.

When UE cannot send RVQoE report because the configured RVQoE specific SRB is not available, UE is not required to buffer the RVQoE report.

***RAN2#123 Agreements***

In Rel-18, network always configures SRB usage for each QoE reporting explicitly.

If UL traffic arrives and the UE cannot send a QoE report because the configured SRB is not available, UE continues to store the report until the SRB is available or the QoE configuration is released.

As working assumption, for encapsulated QoE report associated with the non-receiving RAN node, use option 1 (i.e.MeasurementReportAppLayer message) to send to the receiving RAN node. This can be revisited if RAN3 decisions warrant something different for RVQoE.

Send LS to ask RAN3 to ask if the above RAN2 working assumption has some problem from RAN3 perspective (e.g. since the RVQoE measurement associated with the non-receiving RAN node can be visible to the receiving RAN node). The question is included in the LS for offline 204 (Huawei).

Follow Rel-17 principles: UE indicates data availability for DRBs when requesting SCG activation. It is up to NW implementation to map SRB5 to MN or pause QoE reporting when SCG is deactivated. FFS whether this requires any specification impacts.

UE should not request to activate SCG only for the purpose of QoE reporting via SRB5. FFS for RVQoE reporting.

When SN is released, UE is indicated which QoE configurations should be released or kept. For released configurations, UE indicates the release to upper layers (as in Rel-17).

Existing SCG failure and recovery procedure are reused, i.e. SRB5 bearer and related QoE reporting are suspended During SCG failure and recovery.

Existing MCG failure and recovery procedure are reused, SRB4 bearer and related QoE reporting are suspended During MCG failure and recovery.

Do not change QoE pause/resume in Rel-18, i.e. pause/resume works based on QoE reporting IDs.

***RAN2#122 Agreements***

The network can use explicit indication per QoE config to indicate which SRB is used for the QoE reporting. Details can be discussed in Stage-3.

FFS how to handle the QoE report transmission if there is only one SRB and the QoE report is not (explicitly) configured for that SRB (to be checked if this is possible according to latest RAN3 agreements)

FFS how the above case works if SCG is deactivated or released.

RAN2 will follow RAN3 agreement on QoE config RRC IDs.

RAN2 will follow RAN3 agreements (for NR-DC when SRB5 is not configured) on forwarding the received encapsulated QoE reports to the correct recipient (i.e. MCE or SN)

***RAN2#121bis-e Agreements***

Both SRB4 and SRB5 can be configured simultaneously.

SRB5 handling (setup, modification, release) is configured via SN RRC Reconfiguration message, and SRB5 should be released when the SCG is released.

According to the RAN2/RAN3 agreements, TS 37.340 can be updated based on the introduction of SRB5.

If SRB5 is configured, the SCG is not deactivated, UE can transmit the QoE reports related to SCG in MeasurementReportAppLayer message via SRB5.

RAN2 to agree the following RRC spec impacts with SRB5 introduced:

1) SRB5 is for RRC messages which include application layer measurement report information (i.e. MeasurementReportAppLayer), all using DCCH logical channel.

2) SRB5 has a lower priority than SRB3 and can only be configured by the network after AS security activation.

3) Once AS security is activated, all RRC messages on SRB5 are integrity protected and ciphered by PDCP.

4) Split SRB is not supported for SRB5.

5) The integrity protection algorithm is common for SRB1, SRB2, SRB3 (if configured), SRB4 (if configured), SRB5 (if configured) and DRBs configured with integrity protection, with the same keyToUse value. The ciphering algorithm is common for SRB1, SRB2, SRB3 (if configured), SRB4 (if configured), SRB5 (if configured) and DRBs configured with the same keyToUse value.

6) SRB5 release is supported, e.g. via srb5-ToRelease IE

UL segmentation can be used for message over SRB5.

As a baseline, Rel-17 pause/resume procedure is reused to pause/resume reporting of one or multiple QoE measurement configurations in a UE for NR-DC. Details are FFS, e.g. whether paused QoE reports can be reported to SN (if SN is not overload).

The network can optionally explicitly indicate the SRB for the QoE reporting if both SRB4 and SRB5 are configured. FFS on the granularity, e.g. per QoE config or otherwise.

MN- or SN-associated QoE reports can use either SRB4 or SRB5 if only one of SRB4 or SRB5 is configured for the UE. FFS whether network configuration is needed.

There is no feedback from AS to AL in case reporting SRB is changed. This means that an ongoing application layer measurement session in APP layer is not affected when the reporting SRB is changed. The reporting SRB can also be changed even if the application session (from AS layer point of view) is ongoing.

For NR-DC, if SRB5 is not configured (FFS on the SCG deactivation case), UE can transmit the SN-associated QoE reports via SRB4. FFS whether there are some ambiguities how MN knows where to forward this.

The UE resumes SRB5 (if configured) during RRC connection resume based on network indication (same as for SCG bearers in general).

FFS pending RAN3 decisions: Whether RVQoE reports and encapsulated QoE reports are reported together to the same node (MN or SN) in NR-DC.

For SRB switching in NR-DC scenario, FFS on the explicit indication and implicit indication, e.g. signaling impacts, details on UE/NW behaviours.

RAN2 can wait for more RAN3 progress on the alignment of MDT and QoE before discussing any issues.

***RAN2#121 Agreements***

RRC configuration determines to which node UE sends the QoE report. It is possible to change the reporting leg via RRC signalling after it has been configured.

Split SRB for QoE reporting is not supported (unless serious problems are identified).

Define new SRB (“SRB5”) for the QoE reporting to SN. SRB4 can only be configured for MCG (as in Rel-17). The priority of “SRB5” is lower than SRB1 or SRB3.

If both MN and SN send the QoE configurations to the UE, MN and SN should not use the same set of identities.

RAN2 thinks it’s possible to have different m-based QoE configurations for UE in MN and SN if RAN3 allows it.

***RAN2#120 Agreements***

Not treated at this meeting.

***RAN2#119b-e Agreements***

Rel-18 QoE configuration may be created by MN or SN.

Either SRB1 or SRB3 can be used for providing SN configuration to UE (at least for m-based QoE). FFS if this requires additional MN-SN coordination.

In NR-DC scenario, both signalling-based and management-based QoE measurement collection shall be supported.

RAN2 assumes that there is a unique ID for QoE configurations across MN and SN. This can be accomplished by MN-SN coordination (e.g. similar as was done with measIds for NR-DC)

Use SRB4 as baseline for Rel-18 QoE. FFS how we can send QoE reports towards SN (e.g. only SRB4, define new SRB, reuse SRB3, split SRB). Discuss details in the next meeting.

***RAN2#119-e Agreements***

Not treated at this meeting.

## A.4 UE capabilities and Other topics

***RAN2#124 Agreements***

SRB5 capability should be moved to section 4.2.20 in the next revision.

SRB5 capability should be moved together with other QoE parameters in the next revision.

Do not introduce MBS multicast UE capability for all RRC states in Rel-18 QoE.

For HO from LTE/5GC to NR, UE should release all LTE QoE configurations and apply NR QoE configuration if received. How UE releases old QoE configurations can be handled in CR phase.

For HO from NR to LTE/5GC, UE should release all NR QoE configurations and apply LTE QoE configuration if received. How UE releases old QoE configurations can be handled in CR phase.

Priority-based QoE report discarding is an optional UE capability with UE capability signaling. It applies to both reports stored in IDLE/INACTIVE and in RRC CONNECTED during QoE pause.

Reuse the segmentation capability from Rel-17 QoE also for segmentation over SRB5.

***RAN2#123b Agreements***

For non-RedCap UE, minimum memory requirement for IDLE/INACTIVE reports is 64KB. This memory is in addition to 64KB used for QoE report storage during pause.

FFS For RedCap/eRedCap UE, the minimum requirement is 64 KB total for both IDLE/INACTIVE and paused reports

Introduce an optional UE capability indicates whether UE supports 128, 256, 512 and 1024KB buffer size.

Wait for RAN3 conclusion on whether there is some difference for QoE treatment for MBS and unicast.

Introduce UE capability of supporting QoE configuration in NR-DC framework with radio access capability parameter.

Introduce UE capability of supporting SRB5 for QoE reporting with radio access capability parameters.

***RAN2#122 Agreements***

Introduce an UE capability indicating whether UE can perform MBS QoE in RRC\_IDLE and RRC\_INACTIVE. FFS whether the same capability can be used for MBS QoE in RRC\_CONNECTED.

Introduce a UE capability for the supported buffer size. It is conditionally mandatory if UE supports MBS QoE. The range is from 64 kB to 1024 kB (exact values can be discussed in RRC running CR discussion). FFS whether this is shared or additional to the Rel-17 buffer size requirement.

***RAN2#122 Agreements***

Not treated at this meeting.

***RAN2#121bis-e Agreements***

Not treated at this meeting.

***RAN2#121 Agreements***

RAN2 understanding is that for HO between LTE/5GC and NR, QoE continuity is done in AS layer (rather than APP

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 the ongoing configuration for a service type supported in NR

Option 3 and Option 4 can be worked on in this WI only if there are no impacts to LTE specifications. Send LS to RAN3 and SA4 to inform them of RAN2 decisions. 1-week email discussion (Huawei) to draft the LS [215].