**3GPP TSG-RAN2 Meeting # 117-e *R2-220xxx***

**Online, 21 Feb - 3 Mar, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **-** | **rev** | **-** | **Current version:** | **16.8.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](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:*** | 38.300 CR for Introduction of QoE measurements in NR | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | China Unicom, Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_QoE-Core | | | | |  | ***Date:*** | | | 2022-02-08 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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:*** | | CR for introduction of QoE measurements in NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The CR captures the agreements made since RAN2#113b-e meeting and RAN3#113-e meeting. The CR introduces stage-2 description of Application Layer Measurement Collection feature. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | QoE measurements will not be defined. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, X (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 Abbreviations and Definitions

## 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

5GS 5G System

5QI 5G QoS Identifier

A-CSI Aperiodic CSI

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCH Broadcast Channel

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

C-RNTI Cell RNTI

CAG Closed Access Group

CAPC Channel Access Priority Class

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFRA Contention Free Random Access

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CP Cyclic Prefix

CPC Conditional PSCell Change

DAG Directed Acyclic Graph

DAPS Dual Active Protocol Stack

DFT Discrete Fourier Transform

DCI Downlink Control Information

DCP DCI with CRC scrambled by PS-RNTI

DL-AoD Downlink Angle-of-Departure

DL-SCH Downlink Shared Channel

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell-ID (positioning method)

EHC Ethernet Header Compression

ETWS Earthquake and Tsunami Warning System

FS Feature Set

GFBR Guaranteed Flow Bit Rate

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

LDPC Low Density Parity Check

MDBV Maximum Data Burst Volume

MCE Measurement Collection Entity

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MPE Maximum Permissible Exposure

MT Mobile Termination

MTSI Multimedia Telephony Service for IMS

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

NB-IoT Narrow Band Internet of Things

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

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

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

SCS SubCarrier Spacing

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SFI-RNTI Slot Format Indication RNTI

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TCE Trace Collection Entity

TPC Transmit Power Control

TRP Transmit/Receive Point

UCI Uplink Control Information

UL-AoA Uplink Angles of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

V2X Vehicle-to-Everything

VR Virtual Reality

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

*<Next modification>*

# X Application Layer Measurement Collection

## X.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 streaming services;

- QoE Measurement Collection for MTSI services.

- QoE Measurement Collection for VR services.

Both signalling based and management based QoE measurement collection are supported.

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

## X.2 QoE Measurement Configuration

### X.2.1 QoE Measurement Collection Activation and Reporting

The feature is activated in the NG-RAN either by direct configuration from the OAM system (management-based activation), or by signalling from the OAM via the Core Network (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 Core Network, and the NG-RAN node 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 and the indication of available RAN visible QoE metrics. Each application layer measurement configuration is encapsulated in a transparent container. The NG-RAN node forwards the corresponding QoE measurement configuration(s) to the UE in a downlink RRC message containing *AppLayerMeasConfig*, as specified in TS38.331 [12].

For management-based QoE measurement activation, the OAM sends one or more the QoE measurement configurations to the NG-RAN node. The QoE measurement configuration for management-based activation also includes an application layer measurement configuration list and the corresponding information for QoE measurement collection. Each application layer measurement configuration is encapsulated in a transparent container. The NG-RAN node selects UE(s) that meet the required QoE measurement capability, Area Scope and Slice Scope.

The UE reports QoE measurement results to the NG-RAN node in an uplink RRC message, as specified in TS38.331[12]. The NG-RAN node transmits the QoE report and the corresponding QoE Reference ID to the MCE.

The QoE measurement collection is handled by application layer measurement configuration and measurement reporting, supported in RRC\_CONNECTED state only. 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 higher 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. A *measConfigAppLayerId* 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. The application layer measurement report is forwarded to OAM together with the QoE Reference. 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.

### X.2.2 QoE Measurement Collection Deactivation

QoE Measurement Collection deactivation permanently stops all or some of 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 Reference is used to deactivate the corresponding QoE measurement collection job(s).

Upon reception of QoE release command 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 configuration with another one by deactivating an existing measurement and configuring another measurement of the same configuration type.

### X.2.3 Handling of QMC during RAN Overload

QoE Measurement Collection pause/resume procedure is used to pause/resume the reporting for all QoE reports or to pause/resume QoE reporting per QoE configuration in a UE in RAN overload situation.

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

### X.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 the application layer measurement configurations.

### X.2.5 Per-slice QoE Measurement

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

The UE includes the slice ID inside the QoE report container when reporting QoE measurement.

## X.3 QoE Measurement Continuity for Mobility

The QoE Measurement Collection continuity for intra-system intra-RAT mobility 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 should continue an ongoing measurement even if it leaves the Area Scope, unless the network indicates to the UE to release the QoE configuration.

For RRC\_CONNECTED state mobility, the source NG-RAN node may transmit the QoE measurement configuration(s) and/or the information related to the configuration(s) of a specific UE to the target NG-RAN node via XnAP or NGAP. For signaling-based QoE, QoE Reference, MCE IP Address, Measurement Configuration Application layer ID, MDT Alignment Information, Area Scope, Slice Scope and Measurement Status are passed to the target node. For management-based QoE, Measurement Configuration Application Layer ID, MCE IP Address and Measurement Status are passed to the target node. For RRC\_INACTIVE state mobility, QoE measurement configuration(s) of a specific UE can be restored from the node hosting the UE context when it resumes to RRC\_CONNECTED state. Multiple sets of QoE measurement configurations should be supported during mobility.

For signalling based QoE, at handover to a target gNB which supports QoE, the target gNB decides which application layer measurement configurations to keep and which to release, e.g. based on application layer measurement configuration information received from the source gNB in Xn/NG signalling.

When the UE resumes the connection in a gNB supporting QoE, the UE keeps application layer measurement configurations indicated by the target gNB. When the UE resumes the connection in a gNB not supporting QoE, the UE releases all application layer measurement configurations.

## X.4 RAN Visible QoE Measurements

RAN visible QoE measurements are configured by the NG-RAN node, where a subset of QoE metrics is reported from the UE as an explicit IE readable by the NG-RAN node. RAN visible QoE measurements (e.g., RAN visible QoE metrics, RAN visible QoE values) could be utilized by the NG-RAN node for network optimization. RAN visible QoE measurements are supported for the DASH streaming and VR services. The NG-RAN node configures the RAN visible QoE measurement to collect all or some of the available RAN visible QoE metrics, where the indication of metric availability is received from the OAM or CN. The set of available RAN visible QoE metrics is a subset of the metrics which are already configured as part of QoE measurement configuration encapsulated in the transparent container. The PDU session ID(s) 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.

RAN visible QoE measurements can be reported with a reporting periodicity different from the one of regular QoE. If there is no reporting periodicity defined in the RAN visible QoE configuration, RAN visible QoE reports should be sent together with the legacy QoE reports.

RAN visible application layer measurement is supported only for streaming and VR services. The gNB can use RAN visible application layer measurement configurations to instruct the UE to collect application layer measurements for RRM purposes. Multiple simultaneous RAN visible application layer measurements configuration and reports can be supported for RAN visible application layer measurement, and each RAN visible application layer measurement configuration and report is identified by the same *measConfigAppLayerId* as the application layer measurement configuration and measurement report. gNB configures the required RAN visible QoE metrics in the RAN visible application measurement configuration for the UE to report. After receiving the RAN visible application layer measurement configuration, the UE RRC layer forwards the configuration to the application layer, indicating the service type, the RRC identifier and the periodicity. RAN visible application layer configuration can only be configured if there is a corresponding application layer measurement configuration for the same service type configured at the UE. The application layer sends the RAN visible application layer measurement report associated with the RRC identifier to the UE’s AS layer. UE can send both RAN visible application layer measurement reports and the application layer measurement reports to the gNB in the same *MeasurementReportAppLayer* message. gNB can release one or multiple RAN visible application layer measurement configurations from the UE in one RRC message at any time.

The UE still reports the configured RAN visible application layer measurements, even though the corresponding non RAN visible application layer measurement reporting is paused.

## X.5 Alignment of MDT and QoE Measurements

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 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 NG-RAN node 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 for QoE measurements can send to the NG-RAN node a Session Start Indication or a Session End Indication to inform the NG-RAN node about the start or the end of a session of configured QoE measurements. The NG-RAN node can activate the MDT measurements that are to be aligned with the QoE measurements performed by the UE upon/after receiving the Session Start Indication from the UE. The NG-RAN node may activate the MDT measurements upon/after receiving the MDT activation message from OAM. The NG-RAN node can deactivate the aligned MDT measurements according to OAM command which may, e.g., be triggered by the Session End Indication.

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

# Annex RAN2 agreements on NR QoE

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

## A.1 Configuration architecture general aspect

***RAN2#117-e Agreements***

1-bit indication added in the MeasurementReportAppLayer message is used to indicate session start/stop for each QoE configuration, sent with Meas ID (as other reports)

Indication of Session start/stop is configurable per QoE configuration.

***RAN2#116b-e Agreements***

Send LS to SA4 to explain that with RRC segmentation the max container size (for the report container) can be different and can change by AS reconfigurations. Ask whether the application can/would take this into account and whether this need explicit indication.

Mulitple QoE reports can be sent in one MeasurementReportAppLayer message.

There can be both multiple QoE reports with different measConfigAppLayerId and multiple QoE reports with the same measConfigAppLayerId in the MeasurementReportAppLayer message.

The maximum size of the QoE configuration container is specified as a maximum size 8000 (Bytes) of the OCTET STRING in ASN.1.

No max size of the OCTET STRING for the QoE report container is specified in ASN.1.

Send a reply LS to SA4 with the RAN2 agreements related to RRC segmentations and container size limitations.

Inform CT1 that the service type does not need to be forwarded to the application layer at release.

Inform CT1 that the QoE configurations can be configured as a list in NR and ask them to take this into account when specifying the AT-command.

Inform CT1 that all QoE configurations may need to be released without any measConfigAppLayerId being indicated from the AS-layer and ask them to take this into account when specifying the AT-command.

Send an LS to CT1 and inform them of the RAN2 agreements with impact on AT-commands.

***RAN2#116-e Agreements***

Forward the measConfigAppLayerId from the AS layer to the application layer together with the QoE configuration.

Forward the measConfigAppLayerId from the application layer to the AS layer together with the QoE report.

Support RRC segmentation for the Reporting

Reply to SA4 that the size limitation of the QoE report has chanegd. RAN2 has agreed to optionally support RRC segmentation for transmission of QoE reports, and we indicate the new limits

Size limit of QoE configuration = size of one PDCP SDU.

Inform CT1 and SA4 of these agreements and ask them to specify the measConfigAppLayerId (e.g. in AT command). Can also discuss whether we need to have an action related to size limitation (whether to inform application of the size that is supported).

FFS if to allow multiple QoE reports in the same RRC message, but leave it to UE.

***RAN2#115-e Agreements***

It is the RAN2 understanding that the QoE Reference does not need to be sent to or from the UE in RRC signaling for QoE measurements in RRC\_CONNECTED. The RRC ID, MeasConfigAppLayerId, is sufficient to identify the QoE configuration between UE and gNB.

RAN2 assumes that gNB keeps the mapping between MeasConfigAppLayerId and QoE Reference. The mapping is sent to the target gNB as part of QoE configuration and information at handover.

Send an LS to SA5 (cc R3) to confirm proposals (agreements) 1 and 2.

FFS if the RRC layer forwards the MeasConfigAppLayerId together with the QoE configuration to the application layer.

Confirm that RAN2 deprioritizes QoE measurement in RRC\_IDLE/RRC\_INACTIVE in Rel-17.

Send an LS to SA5 for confirmation of max number of QoE configurations per UE. Number 8 could be assumed, to be finally concluded offline. R2 has not concluded the max no of QoE configs per UE, numbers in the range 8 - 64 are discussed. The outgoing LS R2-2109200 is approved.

***RAN2#114-e Agreements***

gNB can release a list of QoE measurement configurations in one RRCReconfiguration message.

If a QoE measurement configuration is released, RRC layer informs the upper layer to release the QoE measurement configuration. This could be revisited based on other issues’ progress.

If the UE enters IDLE state, UE should release all of the QoE measurement configurations.

QoE configuration and report are encapsulated in a transparent container in the RRC messages. It is FFS for RAN-visible QoE configuration and report (dep on R3).

At lease service type and RRC level ID (Reference ID or shorten ID) together with corresponding QMC configuration container should be included for each QoE configuration in RRCReconfiguration message when the network setups QoE measurement to the UE.

At least RRC level ID (Reference ID or shorten ID) together with corresponding QMC report container should be included in MeasReportAppLayer message for each QoE report.

RAN2 confirms logged MDT framework for QoE data retrieval and reporting is not supported in Rel-17.

RAN2 assumes that QoE configuration modification does not need to be supported from RAN2 signalling point of view (in RRC), and send LS to SA5/SA4 to confirm the assumption.

Send LS to SA4/SA5/RAN3 ask whether multiple QoE measurement configurations can be configured for a certain service type.

RAN2 assumes to re-use the maximum container size of 1000 bytes for QoE measurements configuration and send LS to SA4 to confirm the assumption.

Send LS to SA4 to check the necessity of the maximum container size of QoE measurements report beyond than 8000 bytes.

***RAN2#113b-e Agreements***

Configure QoE measurements for NR in RRCReconfiguration.

Add configuration of QoE measurements in OtherConfig in RRCReconfiguration.

Add the configuration of QoE measurements by means of list to enable configuration of multiple simultaneous measurements.

R2 assumes that for RRC an ID is required to identify a measurement, FFS whether this is the QoE reference ID or something else.

Define SRB4 for transmission of QoE reports in NR.

Define an RRC message MeasReportAppLayer for the transmission of QoE reports in NR.

RAN2 assumes that QoE support for NR includes (as the LTE framework): activation by Trace Function, both signalling and management-based configuration and RRC procedures supporting AppLayer config and report.

From RAN2 point of view, the UE shall follow gNB commands and, NG-RAN can in principle release by RRC the application layer measurement configuration towards the UE at any time, e.g. if required due to load or other reasons (Note that other WGs are responsible to define the normal system procedures for release and which nodes are responsible etc).

The UE Inactive AS context includes the UE AS configuration for the QoE (it is not released when UE goes to Inactive).

## A.2 Start and stop

***RAN2#117-e Agreements***

Pause Resume is not applicable to RVQoE

The UE keeps stored QoE reports (while in Paused state) when going to RRC\_INACTIVE if the UE also keeps the AS QoE configuration. If or when the configuration is released, then stored QoE reports if any are discarded.

***RAN2#116b-e Agreements***

AS layer is responsible for storing QoE reports when the UE receives QoE pause indication at RAN overload (overrides earlier decisions)

There is no need for interaction between AS and Application for Pause Resume (overrides earlier decisions)

The minimal memory size of QoE paused measurements report is 64KB

At RAN overload scenarios, when the memory reserved for the QoE paused measurements becomes full, the UE is allowed to discard extra QoE paused measurements report. The action of how UE AS layer discards extra QoE paused measurements report is based on UE implementation.

When the UE receives QoE resume indication after RAN overload, AS layer should send the stored QoE paused measurements report to the RAN.

***RAN2#116-e Agreements***

We go with selective pause resume (with the understanding that we will not work further on the information the gNB may use for election).

***RAN2#115-e Agreements***

No progress and no contributions were treated.

***RAN2#114-e Agreements***

At reception of QoE release, the UE shall discard any unsent QoE reports corresponding to the released QoE configuration.

FFS whether pause resume will affect all configurations or whether pause resume can act selectively per configuration.

On whether to store reports in the AS or the application layer at Pause, Send LS to SA4/SA5/SA3 to inform them about the options and their pros/cons (if possible) and ask them for feedback. RAN2 will continue work on this topic based on the feedback received.

***RAN2#113b-e Agreements***

“QoE pause” indication from the network is used to temporarily stop QoE reports from being sent from the UE to the network. Application layer behaviour upon UE receiving “pause/resume” indications is out of RAN2 scope.

The following are options considered by RAN2 for QoE report handling during RAN overload via “QoE report pause indication”:

Option 1: Application layer is responsible for storing QoE reports when the UE receives QoE pause indication.

Option 2: AS layer is responsible for storing QoE reports when the UE receives QoE pause indication.

Option 3: The QoE container received from application layer is discarded during pause.

## A.3 Support for Mobility

***RAN2#116b-e Agreements***

Upper layers are informed of the release of the application layer measurements at RRCSetup (can be done if RRC setup is provided as a response to RRCresumerequest or RRC reestablishmentrequest).

At Resume with delta configuration the network indicates possible differences to the QoE configurations.

At mobility with fullConfig, upper layers are informed of the release of the application layer measurements if no measConfigAppLayerId is indicated by the network.

Except for restarts transmission of QoE reports after handover, The TP in the Annex of R2-2200011 is included in the running CR for QoE measurements.

***RAN2#115-e Agreements***

RAN2 assumes that all QoE mobility related agreements made by RAN2 are applicable at least to signalling based QoE. Whether the same applies to management-based QoE is pending further input from SA5 and RAN3.

Area scope parameter is not introduced in RRC procedures supporting QoE.

When the UE resumes the connection in a gNB supporting QoE, the target gNB should explicitly indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure, e.g. in RRCResume message. The UE shall release all QoE measurement configurations not indicated by the gNB for restoration. FFS how the indication looks like, e.g. granularity per QoE configuration or common for all QoE configurations.

During the handover to target gNB which supports QoE, the target gNB decides which QoE configurations to keep and which to release during a handover, e.g. based on QoE configuration information received from the source gNB in Xn/Ng signalling (exact information is up to RAN3) including the RRC container.

The UE discards the reports received from application layer in case it has no associated QoE configuration configured.

FFS whether the gNB needs to know the QoE configurations for which there are ongoing QoE sessions, e.g. to enable QoE configuration handling upon mobility (pending SA4 reply on the ongoing QoE measurement session continuity requirement).

In case the UE resumes the connection in a gNB not supporting QoE, the UE should release all QoE measurement configurations.

## A.4 RAN visible QoE

***RAN2#117-e Agreements***

SRB4 is used to transmit RAN visible QoE measurements.

***RAN2#116b-e Agreements***

On RVQoE metrics reporting, RAN2 arrived at the following possible assumptions as starting points.

- Assumption 1a: RAN2 specifies the maximum number of buffer level entries (ASN.1 value) for each buffer level metric report in one reporting message.

- Assumption 1c: It is UE implementation on which buffer level entries should be reported for each buffer level metric report when the received number of buffer level entries exceeds the maximum number.

- Assumption 2a: The parameter “t” is not reported for each buffer level entry.

- Assumption 2b: It is expected that application layer does not send parameter “t” to AS layer.

- Assumption 3: Taking the granularity 10ms for level value as baseline, i.e. integer value 1 correspnds to 10ms, value 2 corresponds to 20ms, and so on.

- Assumption 4a: Taking the maximum value of 5min as baseline for level value range.

- Assumption 4b: UE sets the value to 5min if the received level value is more than 5min.

- Assumption 5: Taking the maximum value 30 seconds as baseline for playout delay for media startup value range.

- Assumption 6: Taking the granularity 1ms as baseline for playout delay, i.e. integer value 1 correspnds to 1ms, value 2 corresponds to 2ms, and so on.

Send LS to SA4 and to RAN3 about the above assumptions, and also indicate that RAN2 doesn't consider itself as the main responsible group for definition of RV QoE metrics, so the decision whether to use these assumptions is in the hands of the receiving group(s). Can also include other agreements on RV QoE.

RVQoE configuration can share the same measConfigAppLayerId and service type RRC IEs with legacy QoE configuration.

Modification of RVQoE configuration can be supported from RRC layer point of view, it can be revisited if any problem according to further stage 3.

RAN2 confirm it is feasible that NG-RAN can release a list of RAN visible QoE configurations while not releasing the corresponding legacy QoE configuration and if the corresponding legacy QoE configuration is released, the RAN visible QoE configuration is released as well.

RVQoE measurements can be included into MeasurementReportAppLayer message.

MeasConfigAppLayerId can be used to identify both of associated legacy QoE report and RVQoE report, and it is irrespective whether RVQoE should be reported independently or together with legacy QoE.

Multiple RVQoE reports can be included in one MeasurementReportAppLayer message, and can be revisited according to legacy QoE reporting progress.

The above agreements uses somewhat incorrectly the word “legacy” to denote the non-RAN-Visible QoE (in this release). Note that the word legacy is forbidden in TSes.

***RAN2#116-e Agreements***

RAN2 assumes that RAN2 is responsible to define the procedure to support RVQOE configuration and reporting, and leave the definition of RAN QoE metrics and what should be included in RVQOE configuration and report to other WGs, e.g. RAN3, SA4.

RAN2 confirms the following is feasible from RAN2 point of view.

It is feasible to configure RVQOE using explicit RRC IEs

Multiple simultaneous QoE measurements can be supported for RVQOE. Each RVQOE measurement configuration is identified by the MeasConfigAppLayerId (or change to another generic term) corresponding to the regular QoE configuration.

UE RRC layer forwards the received RVQOE configuration to the upper (application) layer, indicating the service type.

RAN configures the required RVQOE metrics in the RVQOE configuration for UE to report.

## A.5 UE capabilities

***RAN2#117-e Agreements***

A parameter per service type indicating whether UE supports RAN visible QoE capability.

RAN2 assumes that No UE capability parameters of the alignment of QoE and MDT need to be introduced.

RRC segmentation capability can be optional with UE capability parameter (one extra bit).

R2 assumes Pause and resume capability is one of basic sub-features of QoE. (This may be revisited in Q2, if UE vendors find that this requirement is a blocker for wide deployment of QoE reporting).

RAN2 assumes that AS layer capability will be indicated to network only if the UE is capable also on higher layers

RAN2 assumes that how AS layer obtain application capability is based on UE implementation (with no AS spec impact).

RAN2 send LS to SA4 (and cc CT1), can elaborate on detailed Questions offline, if needed.

***RAN2#116b-e Agreements***

For QoE capable UE, Mandatory to support 16 QoE configs (signalling limitation), include this info in LS out to SA4.

Introduce QoE UE capability parameters for each service type i.e., streaming, MTSI and VR.

Introduce UE capability parameter(s) for RAN visible QoE.

Introduce a new sub-section in TS 38.306 to capture QoE related capabilities.

Agree that no differentiation for FDD/TDD or FR1/FR2 is needed for QoE related capabilities.

FFS on whether the Pause and resume capability is one of basic sub-features.

FFS on which of the following option to choose for RVQoE capability,

- Option 1: One parameter indicating whether UE supports RVQoE.

- Option 2: Separate parameters indicating whether UE supports RVQoE for each service type.

FFS on RRC segmentation capability for QoE report, and the following three directions are considered:

- Option 1: Conditional mandatory without UE capability parameter (no extra bit)

- Option 2: Optional without UE capability parameter (no extra bit)

- Option 3: Optional with UE capability parameter (one extra bit)