3GPP TSG-RAN WG2 Meeting #128 DRAFT\_ R2-2410915

Orlando, USA, Nov. 18th – 22nd , 2024

Source: Session chair (Huawei)

Title: DRAFT\_Report from session on R18 MBS, R18 QoE and R19 XR

## 2.4 Instructions

CRs

* Use latest CR template version 12.3 for all CRs submitted to RAN2 meeting

Rel-18 and earlier maintenance CRs

* Only essential/critical corrections are expected
* Editorial and clarification corrections should be sent to be reviewed and approved by spec rapporteurs prior to submission.
* Editorials corrections should be collected and submitted by spec rapporteurs.
* NOTE: the tdoc limit applies to all CRs (i.e. WI spec rapporteurs are NO longer expected to submit individual contributions). They can submit a company CR where they also include miscellaneous corrections that have been sent to them.

Rel-18 UE capabilities

- EUTRA UE capabilities corrections are covered by separate CRs

- RAN1/RAN4 NR UE capabilities (new) and corrections are covered in Rel-18 common MegaCRs (38306 and 38331) covering all rel-18 WIs (end outcome).

- UE capabilities in LPP 37355 and SLPP 38355 are covered in the main CRs for the Positioning WI.

During the work on NR UE caps:

- In a Common Rel-18 Agenda Item (AI): RAN1 and RAN4 feature corrections are handled jointly under a common AI, with some explicit exceptions. Running UE cap MegaCRs are maintained for the parts handled in the common AI.

- In WI-specific Rel-18 Agenda Items: RAN2 features/corrections are handled per WI and agreed as individual CRs

Tdoc limitations

Tdoc limitations doesn’t apply to Rapporteur Input, i.e.

- Assigned summary rapporteur input of the summary.

- Email / offline discussions outcomes by discussion rapporteur,

- Limit of 1 WI/SI rapporteurs input for WI planning. The work plan is not expected to be updated/submitted every meeting, unless needed. It can include progress of other WG groups in the same Tdoc (i.e. separate Tdocs on other WG agreements are not required).

- TS rapporteur input for TS maintenance.

- Contact Company of a LSin that triggers RAN2 action may submit one tdoc to facilitate the LS reply. This only applies to one of the contact companies in case there are several (default the first).

Tdoc limitations doesn’t apply to Input created at the meeting, revisions, assigned documents etc.

Tdoc limitations doesn’t apply to shadow / mirror CRs (Cat A), or In-Principle Agreed CRs.

Tdoc limitations applies to all other submitted tdocs (e.g. discussion tdoc and CR tdoc are counted as two).

Postponed CRs still count towards tdoc limit unless 3 or more companies are co-sourcing it.

Tdoc request/submission for RAN2#128 deadlines:

* Tdoc Submission deadline: Nov. 8th, 1000 UTC

# 7 Rel-18

## 7.0 Common

Rel-18 WIs not covered under an explicit AI in 7.x. Multi-WI Rel-18 items, e.g. cross-WI-issues not handled under another WI. UE capabilities.

### 7.0.2 Rel-18 corrections

*Essential corrections only. For smaller corrections please contact CR editor / Rapporteur directly. Coordinate with rapporteurs and chair if input above limit is required*

*Tdoc limitation: 6*

#### 7.0.2.14 Enhancements of NR Multicast and Broadcast Services

(NR\_MBS\_enh-Core; leading WG: RAN2; REL-18; WID: RP-231829)

[R2-2409599](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409599.zip) Correction on Group Paging Handling CATT, CBN CR Rel-18 38.331 18.3.0 5129 - F NR\_MBS\_enh-Core Withdrawn

[R2-2409756](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409756.zip) Misc correction on NR MBS enhancement ZTE Corporation, Sanechips CR Rel-18 38.331 18.3.0 5114 - F NR\_MBS\_enh-Core

* ZTE suggests to focus on the first change.
* Ericsson does not see a strong need to clarify as this is a corner case. Current spec should be clear enough.
* Samsung agrees with the change, perhaps it would be better to say “configured to receive”.
* CATT agrees with the change, it seems a valid case.
* QCM can accept the change, but we need to understand where exactly we need to change.
* The intention of the change 1 from the coversheet in R2-2409756 is agreeable
* ZTE to bring the CR to the next meeting, covering all the places where this change needs to be applied
* The other changes are not pursued

[R2-2409939](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409939.zip) Clarification on group paging procedure Samsung CR Rel-18 38.331 18.3.0 5134 - F NR\_MBS\_enh-Core

* Ericsson does not see a strong need for this clarification. Ericsson thinks the current text is clear enough.
* Samsung clarifies that this condition is only relevant for sessions which are in group paging, not all sessions the UE is configured with.
* Huawei understands the intention, but it seems it can be derived from the context.
* ZTE, Nokia is OK with the CR, it is better to make it clear.
* Ericsson thinks in other places we do not specify this way and it is not needed for tis case either. If we do it here, then we need to change other places
* Offline, CB on Thursday

[R2-2410254](file:///D:\\3GPP\\TSGR2\\TSGR2_128\\Docs\\R2-2410254.zip" \o "D:3GPPTSGR2TSGR2_128DocsR2-2410254.zip) Multicast reception after reselection to cell with MCCH Nokia, Samsung, Ericsson, ZTE CR Rel-18 38.331 18.3.0 5153 - F NR\_MBS\_enh-Core

* Update the CR by adding “and for which the UE was indicated to stop monitoring G-RNTI;” at the end of the current change
* Clarify it refers to the new cell
* Add impacted architecture options
* [AT128][505][MBS] Update R2-2410254 (Nokia)

Scope: Update R2-2410254 and make final review

Intended outcome: Agreeable CR in R2-2411004

Deadline: CR ready for offline agreement: Friday 2024-11-22 09:00

[R2-2410630](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410630.zip) Correction on applying of PTM configuration in Paging procedure SHARP Corporation CR Rel-18 38.331 18.3.0 5176 - F NR\_MBS\_enh-Core

* Not pursued
* Ericsson indicates we did not specify when exactly the UE stores the configuration, so we do not have to specify in this case either.
* Samsung, CATT thinks the change is not needed as it is already clear.

[R2-2410876](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410876.zip) Correction on Group Paging Handling CATT, CBN, China Broadnet CR Rel-18 38.331 18.3.0 5194 - F NR\_MBS\_enh-Core

* Change the reference before the removed text from “5.3.13” to “5.3.13.1d”. Otherwise, the change number 1 from R2-2410876 is agreeable.
* With the change above, the CR is agreed in R2-2411005

For the first change:

* Samsung also indicates that in case the UE receives both group Paging and MT-SDT, the UE will also set resume cause twice. Samsung suggests that in this case we could also refer to a common section to avoid duplicity.
* Chair: Companies are encouraged to check whether for MT-SDT and MBS we also have a duplicity issue and whether it needs to be corrected.

For the second change:

* CATT clarifies that the config received for deactivated session will not be applied when received, so it needs to be applied after Paging.
* Huawei asks what happens if there is no configuration to be applied.
* Nokia agrees with the intention and thinks we need to check other parts of specs.
* Ericsson asks for clarification about the intention. Wonders about usefulness of applying the configuration which will be overwritten by the one in MCCH anyway.
* CATT thinks there are other cases, e.g. the configuration is not present in MCCH.

#### 7.0.2.15 Enhancement on NR QoE management and optimizations for diverse services

(NR\_QoE\_enh-Core; leading WG: RAN3; REL-18; WID: RP-223488)

[R2-2410654](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410654.zip) Correction on UE behaviours when reporting SRB is modified Huawei, HiSilicon CR Rel-18 38.331 18.3.0 5178 - F NR\_QoE\_enh-Core

* Ericsson thinks HO case is different because the UE disconnects from the source node. With SRB change case the UE can still report. Ericsson does not think the change is needed
* QCM agrees with the intention of the CR. QCM wonders if the already received segments can be forwarded between MN and SN?
* Huawei think MN and SN need to coordinate. Huawei asks if Ericsson assumes the UE will finalize the reporting over the old SRB? Ericsson confirms.
* Samsung thinks there is no forwarding of segments between MN and SN. Samsung thinks the reporting SRB should be changed if there is no reporting ongoing.
* Ericsson think there can be some collision cases.
* QCM does not think the UE can send something over the non-existing configuration. Supports Samsung suggestion that the command is not sent from the network in the middle of reporting.
* Nokia thinks that when SRB is changed, the old SRB can be removed. Supports suggestion from Samsung.
* Huawei is also OK with Samsung suggestion.
* QCM is OK with suggestion from Samsung and thinks it should be captured in stage-2.
* The issue described in R2-2410654 can be avoided by network implementation, i.e. the network may avoid changing the reporting SRB for QoE if there is ongoing QoE reporting. FFS whether the network may keep the previous SRB even when changing the reporting SRB to let the UE finish the ongoing reporting over the old SRB
* Capture this in stage-2.
* [AT128][503][QoE] QoE reporting SRB change issue (Huawei)

Scope: Discuss the FFS and stage-2 CR

Intended outcome: Agreeable proposal and stage-2 CR

Deadline: Report and CR ready for discussion during CB session on Thursday

[R2-2410659](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410659.zip) Miscellaneous correction on QoE measurement Samsung CR Rel-18 38.331 18.3.0 5179 - F NR\_QoE\_enh-Core

* Add impacted architecture options.
* With this the CR is agreed in R2-2411003
* QCM thinks the 1st change is not needed as there is no need to report measIDs in the case where UE goes to IDLE.
* Ericsson thinks it is useful to have the indication to upper layers anyway.
* Nokia, Huawei, Ericsson agrees with all changes.

## 8.7 XR Enhancements Ph3

(NR\_XR\_Ph3-Core; leading WG: RAN2; REL-19; WID: RP-241771)

Time budget: 2 TU

Tdoc Limitation: 5 tdocs

### 8.7.1 Organizational

LS, Rapporteur input, workplan, etc.

Incoming LS from SA2 in S2-2411253 will be discussed based on the input from the contact company.

**Rapporteur input**

[R2-2409818](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409818.zip) Rapporteur Inputs Nokia, Qualcomm (Rapporteurs) discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

**Incoming LS**

[R2-2409517](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409517.zip) Reply LS on multi-modality awareness at RAN (R3-245682; contact: Nokia) RAN3 LS in Rel-19 NR\_XR\_Ph3-Core, XRM\_Ph2 To:SA2 Cc:RAN2, SA4, RAN

* Noted

[R2-2409525](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409525.zip) Reply LS on Application-Layer FEC Awareness at RAN (S2-2410999; contact: Qualcomm) SA2 LS in Rel-19 XRM\_Ph2 To:RAN2 Cc:SA4

* Noted

[R2-2409533](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409533.zip) LS for PDU Set Information Marking Support without QoS parameters (S2-2411253; contact: vivo) SA2 LS in Rel-19 XRM\_Ph2 To:RAN2, RAN3

*Q1:SA2 would like RAN2 to provide feedback (e.g. the usefulness) on the PDU Set based handling without PDU set QoS parameters.*

* Noted

**Discussion on the reply LS on PDU Set Information**

[R2-2409767](file:///D:\3GPP\Extracts\R2-2409767_Discussion%20on%20SA2%20LSs%20on%20XRM%20and%20FEC.doc) Discussion on SA2 LSs on XRM and FEC vivo discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: RAN2 confirms that it is useful for gNB to have PDU Set Information marking without PDU Set QoS parameters, e.g. for PSI based SDU discard.

Proposal 2: RAN2 to discuss the draft reply LS in Annex A for PDU Set Information Marking Support without QoS parameters.

DISCUSSION on P1:

* OPPO thinks SA2 only asks about DL and asks if it applies for UL as well.
* Vivo thinks LS mentions DL only.
* LGE thinks both LSes from SA2 focus only on DL. LGE agrees with the proposal.
* OPPO agrees this is only for DL and then agrees with the proposal.
* Sony agrees with the proposal, it is useful.

Agreement for the reply to SA2:

* RAN2 confirms that it can be useful for gNB to have PDU Set Information marking without PDU Set QoS parameters.
* [AT128][501][XR] Reply LS on PDU set (vivo)

Scope: Reply LS

Intended outcome: Reply LS in R2-2411001

Deadline: For offline approval on Friday 2024-11-22 09:00

[R2-2410491](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410491.zip) Discussion on LS from SA2 on PDU Set information Sony discussion Rel-19 NR\_XR\_Ph3

**Draft reply LS on AL-FEC**

[R2-2409560](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409560.zip) Reply LS on Application-Layer FEC Awareness at RAN Qualcomm Incorporated LS out Rel-19 NR\_XR\_Ph3-Core To:SA2 Cc:SA4

### 8.7.2 Multi-modality support

**No contributions are expected for this AI for RAN2#128**

### 8.7.3 RRM measurement gaps/restrictions related enhancements

Objective: Specify enhancements to enable transmission/reception in gaps/restrictions that are caused by RRM measurements (from inter-frequency RRM measurement gaps, or intra-frequency measurements, or other scheduling restrictions etc).

Focus on RAN2 impacts from solutions considered by RAN1/RAN4.

**Impacts on DSR**

[R2-2409768](file:///D:\3GPP\Extracts\R2-2409768_Discussion%20on%20RRM%20measurement%20gaps%20enhancements.docx) Discussion on RRM measurement gaps enhancements vivo discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Observation 1 It is a reasonable assumption that a gNB can determine the cancellable MG skipping based on the DSR report received with a certain offset before the cancellable MG occasion.

Observation 2 Depending on the overlapping status between the PDCP discardTimer running duration and the cancellable MG during, the DSR transmission is delayed and the gNB cannot determine MG skipping in time in the following two cases:

- The DSR is triggered during the MG and can only be transmitted after the MG.

- The DSR is triggered before the MG, but the offset to the cancellable MG is too short for gNB to receive DSR or indicate the MG skipping.

Proposal 1 RAN2 to consider early DSR triggering and reporting before a cancellable MG when there is an overlapping between PDCP discardTimer running duration and MG duration.

Observation 3 Even if a triggered DSR cannot be transmitted before a cancellable MG and is transmitted to gNB after the MG, it can be still helpful somehow for delay-critical data transmission after MG.

Proposal 2 Do not support cancellation of DSR that cannot be transmitted early enough before a cancellable MG.

[R2-2409912](file:///D:\3GPP\Extracts\R2-2409912%20Discussion%20on%20MG%20enhancement%20for%20XR.docx) Discussion on MG enhancement for XR LG Electronics Inc. discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Proposal 2. No MG-specific enhancements is needed on DSR operation.

DISCUSSION:

* Ericsson agrees with LGE that DSR configuration is flexible, so no enhancements are needed. We will anyway have additional granularity in reporting.
* CMCC also supports LGE’s proposal.
* Lenovo has some sympathy for vivo’s proposal for DSR triggering enhancements.
* Xiaomi thinks there is no impact on triggering, but there is impact on remaining time calculation.
* ZTE clarifies we already have measurement gaps activation/deactivation. There is nothing new now, even with MG skipping. No DSR impact is needed.
* QCM agrees no enhancements for DSR are needed. We should define remaining time based on PDB, it should not be impacted by MG or any other scheduling events.
* Vivo indicates that in some cases DSR will not be sent on time.
* OPPO thinks that it can be considered by the network when configuring DSR.
* No MG-specific enhancements is needed on DSR operation.

**Impacts on DRX**

[R2-2410209](file:///D:\3GPP\Extracts\R2-2410209%20RRM%20Measurement%20Gaps_Restrictions%20related%20Enhancements.docx) RRM measurement gaps/restrictions related enhancements Nokia, Nokia Shanghai Bell discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 2: The UE shall consider the duration of a measurement gap or scheduling restriction period indicated to be skipped as active time without relying on configuring long enough inactivity timer.

Proposal 3: RAN2 to evaluate rules for extending the UE active time when a measurement opportunity window overlaps with (or is too close to) the DRX OnDuration, e.g. by extending the OnDuration or by waking up the UE earlier than the start of the OnDuration for potential DCI skip command monitoring.

[R2-2410154](file:///D:\3GPP\Extracts\R2-2410154%20Discussion%20on%20RRM%20enhancements%20for%20XR.docx) Discussion on RRM enhancements for XR Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core

Observation 3: When DRX is configured and the DRX periodicity is longer than the MG periodicity, the gNB may be unable to indicate the UE to skip the conflicting MGs considering the limited active time.

Proposal 4: Semi-static solutions can be considered for addressing the collision between DRX and MG.

[R2-2410082](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410082.zip) Impacts on DSR and DRX from MG skipping NEC discussion Rel-19 NR\_XR\_Ph3-Core

Observation 2 During the skipped MG period, the PDCCH monitoring activity of the UE in RRC connected mode is also governed by DRX, BA, DCP and cell DTX.

Proposal 2: Regrading impacts on DRX from MG skipping, RAN2 confirm that there are no impacts requiring specification changes/enhancements.

DISCUSSION on whether/what enhancements are needed for DRX due to MG skipping:

* IDT thinks that DCI for skipping should be indicated during active time. DRX and MG should be configured properly.
* Lenovo indicates DRX is configured according to traffic pattern.
* ZTE thinks nothing is needed to optimize. ZTE thinks the baseline is that any DCI activates inactivity timer.
* LGE also believes NW implementation can handle this as traffic pattern is known, NW can also extend active time by sending a DCI.
* QCM agrees no enhancement is needed. NW should not cancel a gap which is in inactive time. Longer on duration can also be configured. There will be data in each period anyway so inactivity timer will be triggered.
* Xiaomi also does not see issues.
* Nokia believes that UE should monitor during MG indicated as skipped by the NW.
* Huawei thinks that there is an issue with the current RAN1 solution, because we may not be able to indicate skipping of some MGs. We should note there are some issues. QCM agrees that RRC-based solution may be useful if the NW knowns in advance that there will be overlaps.
* Ericsson thinks there is no big issue, because the network is aware in advance.
* Vivo’s understanding is that MG skipping indication does not impact PDCCH monitoring. Vivo thinks we need to address the issue of UE not being able to receive DCI (because it is in inactive time).
* Ericsson sees no issue because RAN1 design allows the network to indicate each gap to be skipped.
* Lenovo’s and OPPO understanding is that UE follows current procedures, just assumes there is no MG.
* Ericsson thinks we should not discuss PDCCH monitoring in RAN2.
* RAN2 assumes that UE follows DRX pattern as currently, even when MG is indicated as skipped
* No MG-specific enhancements is needed for DRX operation.

**Stage-3 details of DCI-based solution**

[R2-2409844](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409844.zip) Discussions on measurement gap related enhancements Fujitsu discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: Enhance MAC procedure that when receiving the indication from lower layer, consider the next measurement gap occurrence starting after a minimum time offset skipped. Whether there is any restriction on the eligibility of the next measurement gap to be skipped is subject to RAN1/RAN4 decision.

Proposal 2: To support DCI-based measurement gap skipping indication, RAN2 design necessary RRC configurations, e.g., minimum time offset between the last symbol of the PDCCH carrying the DCI format and the start of the corresponding skipped measurement gap occasion, configuration on explicit indication for each DCI format, etc.

[R2-2409555](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409555.zip) Discussion on measurement gap cancelation Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

R2-2409722 Discussion on RRM measurement gaps/restrictions related enhancements Hanbat National University discussion Rel-19 Withdrawn

[R2-2409734](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409734.zip) Discussion on Measurement Gap enhancements OPPO discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409785](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409785.zip) Measurement gap skipping for XR ZTE Corporation, Sanechips discussion

[R2-2409825](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409825.zip) Discussion on RRM measurement gaps enhancements of XR traffic Xiaomi Communications discussion

[R2-2409854](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409854.zip) Consideration on Enabling TX RX for XR during RRM Measurements CATT discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409955](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409955.zip) Views on Enhancements Relating to RRM Measurement Gaps Apple discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410089](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410089.zip) RAN2 Issues on Gap Enhancements Sharp discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410095](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410095.zip) Enabling TX/RX for XR during measurement gaps/restrictions Lenovo discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410198](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410198.zip) RRM Measurement Gap/Restrictions Ericsson discussion Rel-19

R2-2410245 Discussion on RRM enhancements for XR Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core Withdrawn

[R2-2410338](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410338.zip) RRC-based MG skipping solution CMCC, Qualcomm, Google discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410387](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410387.zip) Discussion on enabling TX/RX for XR during RRM measurements Sony discussion Rel-19 NR\_XR\_Ph3

[R2-2410406](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410406.zip) RRM measurement gap related enhancements for XR InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410577](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410577.zip) RRM Measurement Gaps/Restrictions related enhancements for XR Google Ireland Limited discussion

[R2-2410718](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410718.zip) Discussion on RRM measurement gaps/restrictions enhancements for Rel-19 XR Samsung discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410740](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410740.zip) Discussion on XR RRM measurement gaps/restrictions related enhancements III discussion NR\_XR\_Ph3-Core

[R2-2410761](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410761.zip) Discussion on RRM measurement for XR enhancements Hanbat National University discussion Rel-19

[R2-2410783](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410783.zip) Discussion on RRM Measurement Gaps/Restrictions Enhancements Meta discussion

### 8.7.4 Scheduling enhancements

[R2-2410390](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410390.zip) UL scheduling enhancements for Multi-modal traffic flows Sony discussion Rel-19 NR\_XR\_Ph3

#### 8.7.4.1 LCP enhancements

Objective: Specify Enhancements for support of UL scheduling to enable high XR capacity while meeting delay requirements/avoiding too late PDUs, as follows [RAN2]:

* Specify additional Logical Channel priority handling using delay/deadline information of packets;

Further details of handling of the additional priority for LCH.

**Priority during 2nd LCP round**

[R2-2410316](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410316.zip) Consideration on fairness in delay-aware LCP for XR CMCC, Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: RAN2 agrees the negative impact of applying additional priority to non-delay-critical data on other LCHs and delay-critical data should be avoided for fairness.

Proposal 2: Delay-critical data and non-delay-critical data should be separately handled during LCP priority adjustment. The exact method for the identification and separation of delay-critical data and non-delay-critical data is up to UE implementation

[R2-2410435](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410435.zip) Discussion on Leftover Issues for Additional LCH Priority China Telecom discussion

Proposal 1: If all delay-critical data is assembled during 1st round, the LCH priority is changed to legacy one before 2nd round of resource allocation to ensure fairness.

Proposal 2: How to change the priority before the 2nd round of resource allocation can be left to UE implementation.

[R2-2409956](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409956.zip) On Priority Switching during LCP Procedure Apple discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: RAN2 confirms that the additional LCH priority is applied to both the first round and the second round of the LCP procedure. The UE does not fallback to the default LCH priority in the second round even if there is no more LCH priority-adjusted data after the first round.

Proposal 2: If Proposal 1 is not agreeable, RAN2 leaves it to UE implementation to determine if LCH priority can be changed for the second round of the LCP procedure. RAN2 should not mandate the UE behavior of changing LCH priority during an ongoing LCP procedure by specification.

DISCUSSION:

* IDT would like to address fairness, but leaving this to UE implementation makes things unpredictable to the scheduler.
* Xiaomi thinks leaving this to implementation would probably mean UEs will not do it.
* QCM thinks companies acknowledge importance of fairness. QCM does not understand the complexity issue. UE knows how much data is adjustable, so calculating the leftover is easy. Adjusting priority order is also easy among a few LCHs. Ensuring fairness is more important. Leaving up to implementation will increase unfairness issue between UE vendors.
* MTK thinks changing LCH order can be complex. MTK indicates that fairness in the second round is not critical.
* Lenovo agrees with QCM – this is not complex. Lenovo still believes that taking all the resources in the second round violates fairness. We already agreed there is no intra LCH prioritization, so this is good compromise.
* vivo acks the fairness issue, but is concerned about the complexity. Fairness issue is not big as delay critical will be scheduled in the first round.
* OPPO would not like to impact the delay of LCP procedure and fairness is not an issue in 2nd round.
* LGE agrees with MTK, vivo, OPPO. There should be one behaviour and we should choose simpler approach.
* Huawei supports QCM/Lenovo view that there is no real complexity. The UE can check the data volume only at the beginning of the procedure. Supports adjustment in the 2nd round.
* Ericsson, ZTE also sees this as a compromise, we already excluded intra-LCH, so at least adjusting priority in the second round should be supported.
* Nokia thinks we are repeating the discussions, if we cannot agree, we should move on with the baseline.
* Samsung recognizes the issue, but does not see it as practical issue, e.g. XR and URLLC is unlikely torun together. Up to UE implementation is OK.
* Sharp does not think it can be up to UE implementation. Behaviour needs to be testable.
* QCM thinks there are two dimensions of fairness – fairness between the UEs but also fairness between LCHs within the UE.
* Huawei thinks there could also be a capability and then the NW knows the UE behavoiur.
* Apple thinks that such traffic will be high priority anyway. There will be not much to optimize.
* MTK indicates Bj will anyway control where the UE takes data from.
* ZTE thinks the NW needs to know what the UE does, how it uses the grants.
* Ericsson also clarifies that the size of grant can be adjusted based on knowledge.
* As a baseline, the additional LCH priority is applied to both the first round and the second round of the LCP procedure. The UE does not fallback to the default LCH priority in the second round even if there is no more LCH priority-adjusted data after the first round.
* As an optional capability, the UE can also support to fallback to default priority in the 2nd round of LCP.

**Impact on SRB and intra-UE prioritization**

[R2-2409677](file:///D:\3GPP\Extracts\R2-2409677%20-%20Discussion%20on%20LCP%20enhancements%20for%20XR.docx) Discussion on LCP enhancements for XR OPPO discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 3 Up to network implementation to avoid SRB impact due to LCH prioritization-based LCP enhancement, i.e., configure higher priority for LCH of SRBs than LCH with LCH priority-adjusted data.

Proposal 4 The additional LCH priority also applies to intra-UE prioritization procedure. FFS whether it applies for the cases including 1) the priority of uplink grant for new transmission, 2) the priority of uplink grant for retransmission, and 3) the priority of SR.

**Impact on PBR/Bj**

[R2-2409845](file:///D:\3GPP\Extracts\R2-2409845_xr_lcp.doc) Discussions on enhancements for LCH priority-adjusted data Fujitsu discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 2: The LCH with LCH priority-adjusted data is not restricted by PBR in the first round of resource allocation procedure.

[R2-2409769](file:///D:\3GPP\Extracts\R2-2409769_Remaining%20Issues%20on%20LCP%20enhancement%20for%20XR.docx) Remaining issues on LCP enhancements for XR vivo discussion Rel-19 NR\_XR\_Ph3-Core

Observation 4 For MAC PDU construction, the LCH with delay-critical data may not be able to be allocated enough radio resource due to its buckets (Bj) exhausted.

Proposal 2 In addition to LCH priority adaptation, RAN2 should also consider temporarily allowing UE to raise the rate limit (e.g. Bj) for delay-critical LCH.

[R2-2410500](file:///D:\3GPP\Extracts\R2-2410500%20-%20LCP%20enhancements.docx) LCP enhancements Ericsson discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 2 A delay-aware LCP solution uses a new counter variable to keep track of the scheduling of the LCH priority-adjusted data.

**One or multiple additional priorities**

[R2-2410373](file:///D:\3GPP\Extracts\R2-2410373%20LCP%20enhancements_final%20clean%20version.docx) Discussion on additional priority based LCP enhancements in XR Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core

Observation 1: Depending on when the grant is provided from the network, there may be a situation where the “LCH priority-adjusted data” on an LCH with lower additional priority has lower remaining time than the data in another LCH with higher additional priority. If NW configures only one additional priority for each LCH based on the remaining time threshold, the “LCH priority-adjusted data” on the LCH with lower remaining time may be impacted, e.g. its PDB may expire.

Proposal 2: To maximize the chances that the resource allocation goes to LCH with lower remaining time, NW can configure a list of additional priorities, UE determines the additional priority for each LCH based on the smallest remaining time of data buffered on each LCH according to the configured list of additional priorities.

[R2-2409556](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409556.zip) Discussion on LCP enhancements Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409786](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409786.zip) LCP enhancements for XR ZTE Corporation, Sanechips discussion

[R2-2409790](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409790.zip) Discussion on Logical channel priority CANON Research Centre France discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409828](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409828.zip) Discussion on LCP enhancements of XR traffic Xiaomi Communications discussion

[R2-2409855](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409855.zip) Consideration on LCP Enhancement CATT discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409910](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409910.zip) Discussion on LCP enhancement for XR LG Electronics Inc. discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410038](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410038.zip) Discussion on how to apply additional priority for delay-aware LCP TCL discussion

[R2-2410090](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410090.zip) Details of LCP Enhancements Sharp discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410094](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410094.zip) Enhanced Logical channel prioritization for XR Lenovo discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410194](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410194.zip) Considerations on LCP enhancements for XR NEC Corporation discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410208](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410208.zip) Discussion on LCP enhancements for XR DENSO CORPORATION discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410210](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410210.zip) LCP Enhancements for XR Nokia, Nokia Shanghai Bell discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410407](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410407.zip) LCP enhancements for XR InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410692](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410692.zip) Remaining issue for LCP enhancement MediaTek Inc. discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410784](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410784.zip) Discussion on LCP Enhancements for XR Meta discussion

[R2-2410844](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410844.zip) Further Discussion on additional LCP handling ETRI discussion

[R2-2410850](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410850.zip) LCP enhancements for Rel-19 XR – outstanding issues Samsung R&D Institute UK discussion

#### 8.7.4.2 DSR enhancements

Objective: Specify enhanced DSR (Delay Status Report) reporting with multiple pairs of remaining time and buffer size for a LCG.

Including aspects such as need of thresholds configuration constraints (including analysis of impact on DSR triggering/cancellation etc.), inclusion of non-delay critical data, MAC CE design, interworking with legacy DSR etc.

**Thresholds configuration**

[R2-2410436](file:///D:\3GPP\Extracts\R2-2410436%20Discussion%20on%20Leftover%20Issues%20for%20DSR%20Enhancement.docx) Discussion on Leftover Issues for DSR Enhancement China Telecom discussion

Proposal 1: The triggering threshold is set to a value equivalent to a lower reporting threshold.

[R2-2409856](file:///D:\3GPP\Extracts\R2-2409856%20Consideration%20on%20DSR%20enhancement.docx) Consideration on DSR Enhancement CATT discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: The reporting remaining time thresholds need to be less than the triggering threshold in enhanced DSR to offer finer granularity about the delay status.

[R2-2409797](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409797.zip) Discussion on Delay status report CANON Research Centre France discussion Rel-19 NR\_XR\_Ph3-Core

Observation 1: In release 18, triggering threshold and reporting threshold have the same value.

Observation 2: Each setting of reporting and triggering thresholds may be advantageous to certain scenario

Proposal 1: Let the network configure the triggering and reporting thresholds without constraints.

[R2-2410684](file:///D:\3GPP\Extracts\R2-2410684%20Discussion%20on%20DSR%20enhancements.docx) Discussion on DSR enhancements HONOR discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1: The triggering threshold for the enhanced DSR should be configured by the network, which can be lower than largest reporting threshold.

Proposal 2: The existing cancelling and triggering of Rel-18 DSR is reused for the enhanced DSR.

**Non-delay critical data ahead in the queue**

[R2-2410408](file:///D:\3GPP\Extracts\R2-2410408%20(R19%20NR%20XR%20AI8742)%20DSR%20enhancements%20for%20UL%20scheduling.docx) DSR enhancements for UL scheduling InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 2: Define the non-delay critical data ahead of delay critical data in the buffer as delay critical and include it in the buffer size calculation for DSR.

[R2-2409911](file:///D:\3GPP\Extracts\R2-2409911%20Discussion%20on%20DSR%20enhancement%20for%20XR.docx) Discussion on DSR enhancement for XR LG Electronics Inc. discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 3. No further enhancements in the buffer size calculation for DSR to include non-delay critical data ahead of delay critical data

**MAC CE design**

[R2-2409770](file:///D:\3GPP\Extracts\R2-2409770_Remaining%20issues%20on%20DSR%20enhancement%20for%20XR.docx) Remaining issues on DSR enhancements for XR vivo discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 5 RAN2 to down-select one of the following options for R19 DSR format design:

- Option A: One bitmap per LCG to indicate the presence of the pairs;

- Option B: One extension bit (e.g. redefining R bit in R18 DSR) per pair to indicate the presence of the next pair of the same LCG.

**Co-existence with Rel-18 DSR**

[R2-2410728](file:///D:\3GPP\Extracts\R2-2410728-Further%20discussion%20on%20DSR%20enhancement.docx) Further discussion on DSR enhancement TCL discussion Rel-19

Proposal 2: It is suggested to use a new enhanced DSR in case there is at least one LCG configured with multiple reporting thresholds.

[R2-2409557](file:///D:\3GPP\Extracts\R2-2409557%20Discussion%20on%20DSR%20enhancements.docx) Discussion on DSR enhancements Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1. If there is at least one LCG configured with multiple reporting thresholds, the UE should always use Rel-19 DSR MAC CE, as long as it can be accommodated by the available PUSCH resource.

Proposal 2. If available PUSCH resource is not large enough to accommodate a Rel-19 DSR MAC CE, a Rel-18 DSR MAC CE is sent instead, with the delay information calculated based on the trigger threshold.

[R2-2409678](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409678.zip) Discussion on DSR enhancements for XR OPPO discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409770](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409770.zip) Remaining issues on DSR enhancements for XR vivo discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409787](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409787.zip) DSR enhancements for XR ZTE Corporation, Sanechips discussion

[R2-2409827](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409827.zip) Discussion on DSR enhancements of XR traffic Xiaomi Communications discussion

[R2-2409846](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409846.zip) Discussions on DSR enhancements Fujitsu discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409957](file:///D:\3GPP\Extracts\R2-2409957%20Views%20on%20DSR%20Enhancements.docx) Views on DSR Enhancements Apple discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410091](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410091.zip) Details of DSR Enhancements Sharp discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410189](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410189.zip) Considerations on DSR enhancements for XR NEC Corporation discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410211](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410211.zip) DSR Enhancements for XR Nokia, Nokia Shanghai Bell discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410212](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410212.zip) Discussion on DSR enhancements for XR DENSO CORPORATION discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410229](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410229.zip) Discussion on enhanced DSR for XR ITRI discussion NR\_XR\_Ph3-Core

[R2-2410286](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410286.zip) Enhanced delay status reporting for XR Lenovo discussion Rel-19

[R2-2410317](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410317.zip) Further consideratio on DSR enhancment CMCC discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410372](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410372.zip) Discussion on DSR enhancements in XR Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410408](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410408.zip) DSR enhancements for UL scheduling InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410501](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410501.zip) DSR enhancements Ericsson discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410717](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410717.zip) DSR enhancements for Rel-19 XR Samsung discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410728](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410728.zip) Further discussion on DSR enhancement TCL discussion Rel-19

[R2-2410762](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410762.zip) Discussion on XR DSR enhancements III discussion NR\_XR\_Ph3-Core

[R2-2410785](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410785.zip) Discussion on DSR Enhancements for XR Meta discussion

[R2-2410843](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410843.zip) Further Discussion on DSR enhancements ETRI discussion

### 8.7.5 RLC enhancements

Objective: RLC re-transmission related enhancements for operation of RLC Acknowledged Mode (AM) with small packet delay budget.

Including aspects such as:

* how to avoid unnecessary retransmissions, e.g. details of the combined approach
* how to ensure timely RLC retransmissions for XR, e.g.
  + what kind of enhancements are needed, e.g. autonomous retransmission, retransmission based on enhanced polling
  + details and pros and cons of different solutions (including impact on capacity and packet delay)
* discussion on the LS from SA2 in S2-2410999

**Discussion on the reply to LS on AL-FEC**

[R2-2409561](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409561.zip) Discussion on AL-FEC awareness at RAN Qualcomm Incorporated, China Telecom, Huawei, HiSilicon, Lenovo, Nokia, Nokia Shanghai Bell, Xiaomi discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Proposal 1. Reply to SA2 that it is feasible to use content ratio for discarding DL PDUs during congestion for DRBs configured with RLC AM.

Proposal 2. Reply to SA2 that it is feasible to use RLC AM for XR services, especially with the upcoming latency reduction enhancements for RLC AM (per RP-240791).

Proposal 3. Reply to SA2 that it is feasible to use content ratio for discarding DL PDUs during congestion for DRBs configured with RLC UM.

Proposal 4. Include an example of possible gNB implementation in the reply LS to illustrate the feasibility of using content ratio for discarding DL PDUs during congestion.

[R2-2409788](file:///D:\3GPP\Extracts\R2-2409788%20xrRlcEnh-v00.docx) RLC enhancements for XR ZTE Corporation, Sanechips discussion

* Noted

Proposal 1: RAN2 should reply to SA2 that content ratio information is not useful for packet discard at RAN for RLC AM as AM mode of operation generally aims at transmitting all AM packets reliably to the receiver and hence data packets that are not needed at the upper layers should never to be submitted to RAN in the first place in case of AM operation.

Proposal 2: RAN2 should reply to SA2 that content ratio information is not useful for packet discard for RLC-UM since RAN cannot determine reliably whether a given PDU has been received successfully or not for RLC UM.

[R2-2410337](file:///D:\3GPP\Extracts\R2-2410337.docx) Discussion on the RLC enhancements for XR and RAN2 impacts on the SA2 LS CMCC discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Proposal 1: It is useful for gNB to be provided the content ratio information for discarding of DL PDUs during congestion for RLC AM mode.

Proposal 2: It may not bring benefit for gNB to be provided with the content ratio information for discarding of DL PDUs during congestion for RLC UM mode.

DISCUSSION:

* Ericsson agrees with ZTE that in general we should not use AL-FEC for AM mode as it will only increase the congestion and also delays other packets.
* MTK, LGE, Meta agrees with Ericsson and ZTE. MTK also indicates that considering that we will have fake ACK, this may impact gNB judgement.
* LGE also indicates CU/DU split issues, agrees with the issue of using fake ACK to determine whether packet was truly received.
* Huawei indicates that this solution is supposed to be used during congestion, so it can tell gNB how many packets can be dropped. So it helps to mitigate the congestion. Fake ACK makes no difference.
* Meta does not believe content ratio is helpful information.
* Samsung agrees that AL-FEC should not be applied to AM mode.
* QCM reminds that AL-FEC will not increase the congestion according to SA2’s understanding. Without information about the AL-FEC, gNB discards randomly, but thanks to knowing the ratio, it can choose packets to discard.
* Vivo agrees with QCM and Huawei, this is only for congestion.
* Ericsson thinks this that it is unclear how this interacts with rate adaptation. Ericsson thinks we should have no extra packets during congestion.
* Xiaomi agrees this is useful to have. SA2 LS already clarifies that no additional packets will be generated due to intentional dropping at gNB.
* Sharp does not think this is useful for RLC AM.
* Chair: No consensus in RAN2 on whether AL-FEC ratio is useful due to concerns on e.g. impact on gNB pre-processing gain, impact of intentional dropping on app layer behaviour, lack of reliable reception ACK etc.
* There is no consensus in RAN2 that AL-FEC ratio information is useful for the gNB for both RLC AM and RLC UM.
* RAN2 understanding is that in case this information would be provided to the gNB, it is up to gNB how/whether to consider it, i.e. no impact on RAN2 specifications
* [AT128][502][XR] Reply LS on AL-FEC (QCM)

Scope: Reply LS to SA2

Intended outcome: Reply LS to SA2 in R2-2411002

Deadline: LS for offline approval: Friday 2024-11-22 09:00

**Unnecessary retransmissions avoidance – solution details**

[R2-2409636](file:///D:\3GPP\Extracts\R2-2409636.docx) RLC AM retransmission enhancements Xiaomi discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Proposal 5: The indication from Tx to Rx about the discarded RLC PDUs are not supported.

[R2-2410092](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410092.zip) Issues on RLC Enhancements Sharp discussion Rel-19 NR\_XR\_Ph3-Core

* Noted

Proposal 2 A TX-to-RX indication of obsolete SDUs can be configurable.

DISCUSSION on indication from Tx to Rx:

* LGE, Ericsson, Huawei, Nokia, QCM agrees with Xiaomi’s proposal.
* LGE thinks that the only gain is to avoid Tx window stall, but this is corner case.
* MTK, vivo does not agree this is a corner case, thinks that during congestion this can happen frequently.
* Huawei indicates that there will be delay to send indication and we agreed to have Rx local timer which addresses window stalling issue.
* Nokia thinks indication would be useful for reordering which will not be used. Window stalling is addressed by local timer.
* Vivo think with an indication we can save some time. Vivo thinks that local timer at Rx side will be long.
* OPPO agrees that we need an indication to address window stalling issue. OPPO thinks we can include it in data packet to minimize impact on specifications.
* Futurewei analyzed this in the past and window stall will almost never happen if the local timer is shorter than 1-2 seconds.
* Lenovo agrees with MTK, it can also be useful to avoid discarding of C-PDU.
* CMCC, KDDI indication is beneficial as it gives more accurate information for discarding.
* Samsung also support having an indication.
* Ericsson does not agree with the delay issue.
* QCM also does not think that some additional delay in discarding is a critical issue.
* LGE does not see clear benefit.
* OPPO thinks that local Rx timer will be set to long value to avoid losses, so then window stalling can happen.
* Ericsson thinks we are repeating the discussions we already had and we agreed a combined approach.
* There is no clear understanding on how the indication would look like or what problem it would solve that cannot be solved by the local timer
* Unless critical issue is identified, no Tx to Rx indication will be introduced

[R2-2409740](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409740.zip) Further details of RLC enhancements for XR LG Electronics Inc. discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 2. Special handling to avoid PDCP control PDU discard is not needed.

Proposal 3. A new RLC timer at the Rx is introduced to determine obsolete RLC SDUs.

Proposal 4. The abandoned RLC SDUs determined by a new RLC timer are positively acknowledged in the STATUS report.

**Timely RLC retransmissions – autonomous versus polling**

[R2-2410199](file:///D:\3GPP\Extracts\R2-2410199_More%20Discussions%20on%20RLC%20AM%20Enhancements.docx) More Discussions on RLC AM Enhancements Ericsson discussion Rel-19

Observation 2 It is important to establish the applicability of autonomous retransmissions in the context of the discard timers.

Observation 3 Autonomous retransmissions are only relevant for short discard timers.

Observation 4 For shorter discard timers, the Tx entity (under gNB control) can continue to perform blind HARQ retransmissions (rather than triggering RLC retransmissions) thereby obtaining a 3 dB gain from soft combining.

Observation 5 For short discard timers, the efficacy of HARQ retransmissions is higher than RLC retransmissions.

Observation 6 Gains with RLC retransmissions are only obtained for long discard timers.

Observation 7 Autonomous retransmissions will be redundant 90% of the time and would consume 2x UL resources per UE, per RLC SDU retransmission. For example, if segmented into 4 AMD PDUs, a UE would consume eight times the UL resources which would exacerbate UL congestion.

Observation 8 The current polling mechanism cannot consider the delay criticality of the AMD PDU in the buffer. It is a trade-off between transmission overhead and timely reception of the RLC status PDU.

Proposal 7 Do not pursue autonomous retransmissions to achieve timely retransmissions.

Proposal 8 Pursue enhancements to the polling mechanism where the delay criticality of the AMD PDU is considered.

[R2-2410135](file:///D:\3GPP\Extracts\R2-2410135.doc) Discussion on timely RLC retransmission(s) Spreadtrum, UNISOC discussion Rel-19

Observation 1: The too frequent status report triggered by enhanced polling will cause unnecessary RLC retransmission.

Observation 2: The status report triggered by enhanced polling will bring long RTT.

Observation 3: The transmission of status report is not reliable.

Proposal 1: Autonomous RLC retransmission is supported.

[R2-2409857](file:///D:\3GPP\Extracts\R2-2409857%20Consideration%20on%20XR-specific%20RLC%20Enhancement.docx) Consideration on XR-specific RLC Enhancement CATT discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 3: Both RLC autonomous retransmission and enhanced Polling could be supported and applied to different remaining delay case if configured.

**Timely RLC retransmissions – polling enhancements**

[R2-2410777](file:///D:\3GPP\Extracts\R2-2410777%20RLC%20AM%20enhancements%20with%20small%20packet%20delay%20budget.docx) RLC AM enhancements with small packet delay budget MediaTek Inc. discussion Rel-19 38.322 NR\_XR\_enh-Core

Proposal 3: RAN2 to adopt enhanced polling mechanism (with smaller values in 38.331) to achieve timely retransmission.

[R2-2409882](file:///D:\3GPP\Extracts\R2-2409882%20RLC%20Enhancements%20for%20XR.docx) RLC Enhancements for XR Samsung discussion Rel-19

Proposal 2: Dedicated polling thresholds and the associated counters are introduced for delay-critical RLC SDUs.

**Timely RLC retransmissions – autonomous retransmissions**

[R2-2410409](file:///D:\3GPP\Extracts\R2-2410409%20(R19%20NR%20XR%20A875_RLC%20enhancement).docx) Discussion on RLC enhancements InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

Observation 1: With a proper configuration of the triggering condition for autonomous retransmission, the network can minimize the capacity loss while still guarantee QoS of a service.

Proposal 1: The UE retransmits a RLC SDU if the remaining time of the SDU is smaller than a configured threshold or the number of HARQ retransmissions is greater than a configured threshold.

[R2-2409558](file:///D:\3GPP\Extracts\R2-2409558%20Discussion%20on%20RLC%20enhancements.docx) Discussion on RLC enhancements Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 1. UE autonomously triggers retransmission of a RLC PDU when one of the following conditions are met:

- after the remaining time of a PDU has dropped below a configured threshold; or

- after a PDU has failed a configured number of HARQ transmissions; or

- if a PDU is in the RLC retransmission buffer and there are spare PUSCH resources available after the LCP procedure.

[R2-2410155](file:///D:\3GPP\Extracts\R2-2410155%20Discussion%20on%20RLC%20AM%20enhancements.docx) Discussion on RLC AM enhancements Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 8: RAN2 works on the autonomous RLC retransmission, where the capacity loss can be mitigated by introducing a transmission gap or considering the channel quality.

[R2-2409733](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409733.zip) Discussion on RLC re-transmission related enhancements OPPO discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409771](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409771.zip) Discussion on RLC enhancement for XR vivo discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409798](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409798.zip) Discussion on RLC AM Enhancements CANON Research Centre France discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409819](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409819.zip) RLC enhancements Nokia discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409847](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409847.zip) Discussions on RLC enhancements Fujitsu discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409958](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409958.zip) Discussions on Fast RLC Retransmission Apple discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410036](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410036.zip) Discussion on Reply LS to SA2 on Application-Layer FEC Awareness TCL discussion

R2-2410246 Discussion on RLC AM enhancements Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core Withdrawn

[R2-2410287](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410287.zip) AM RLC enhancement Lenovo discussion Rel-19

[R2-2410383](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410383.zip) RLC AM enhancements Sony discussion Rel-19 NR\_XR\_Ph3

[R2-2410393](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410393.zip) RLC AM enhancement NEC discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410437](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410437.zip) Discussion on RLC AM Enhancements China Telecom discussion

[R2-2410685](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410685.zip) Discussion on RLC enhancements HONOR discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410786](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410786.zip) Discussion on RLC AM Enhancements for XR Meta discussion

### 8.7.6 XR rate control

Objective: Specify uplink congestion signaling [RAN2]:

* Specify in MAC layer XR rate control signaling over downlink per QoS flow/per DRB to enable faster source rate adaption to uplink congestion

Including aspects such as: per DRB or per flow indication (including analysis of the impact on QoS enforcement, interworking with L4S etc.), bit rate values indication enhancements, indication/assistance from UE to gNB etc.

**Per DRB or per QoS flow indication**

[R2-2409901](file:///D:\3GPP\Extracts\R2-2409901.docx) XR Rate Control Lenovo discussion NR\_XR\_Ph3-Core

Proposal 1 RAN2 to agree that the Recommended Bitrate indication is on a per DRB level.

Proposal 2 How the UE maps the Recommended Bitrate indication to different QoS flows of a DRB can be left to UE implementation.

[R2-2410787](file:///D:\3GPP\Extracts\R2-2410787%20Discussion%20on%20RAN%20Awareness%20and%20UL%20Rate%20Control%20for%20XR.docx) Discussion on RAN Awareness and UL Rate Control for XR Meta discussion

Observation 1: A QoS flow indication is critical for facilitating the XR application's ability to effectively adapt to network congestion on a flow level and meet QoS requirements.

Observation 2: A QoS flow level indication ensures seamless interworking with existing latency reduction and QoS enhancement techniques.

Observation 3: It is feasible for RAN to estimate the congestion information per-QoS flow.

Proposal 1: Support per QoS flow level indication of MAC layer XR rate control.

[R2-2409789](file:///D:\3GPP\Extracts\R2-2409789_XR%20rate%20control_v00.docx) Data rate control for XR applications ZTE Corporation, Sanechips discussion

Observation 1: When multiple-QoS flows are mapped to a single DRB, then per QoS-Flow rate control provides better control over the application rate than a per DRB control

Observation 2: Multi-Modal XR applications may require the network to map multiple (dependent) QoS flows to the same DRB to satisfy synchronization and other dependency related requirements

Observation 3: L4S and RAN based rate control are complimentary in nature and there is no issue with interoperability if they are both enabled regardless of whether RAN based rate control is per QoS flow or per DRB

Observation 4: Having no network control over how the bit rate recommendation is applied by the UE when multiple QoS flows are mapped to the same DRB is restrictive and may result in violation of QoS guarantees in some scenarios

Observation 5: If per QoS flow level granularity is agreed for XR rate control then further work may be needed in RAN3 to enable this in case of CU/DU split architecture.

Proposal 1: Support both (the existing) per DRB level granularity as well as per QoS-flow level granularity for XR rate control

DISCUSSION:

* Ericsson thinks the gNB looses visibility to QoS flow once the flow is mapped to DRB.
* ZTE clarifies that there is already a feature in Rel-18 which relies on per QoS flow level estimation and feasibility was confirmed. LGE agrees, no need to reconfirm.
* LGE would like to have a single solution, not both, prefer per QoS flow.
* Ericsson indicates RAN cannot decide which flow to control, it has no knowledge about the flows. Asks if the UE will follow. Meta suggests checking with L4S team. Ericsson clarifies that with 1:1 mapping they have no issue.
* Huawei, ZTE underlines that 1:1 mapping is not always possible. SA2 is working also on data rate exposure from gNB to CN which is also QoS flow level, so we should align in RAN2.
* ZTE also indicates that ECN marking is per QoS flow, so it does work, it is up to NW implementation.
* Nokia thinks technically per DRB will be OK, does not believe many flows will be mapped to a single DRB.
* Samsung thinks network should decide which flow is throttled as gNB is responsible for QoS enforcement. Proposes that UE can indicate its preference to gNB, but the final decision should be gNB based on both QoS requirements and UE preference.
* Xiaomi thinks per DRB is more aligned with MAC operation which focuses on LCH.
* CATT thinks that flow ID will introduce overhead as we need to indicate PDU session and flow ID.
* QCM recognizes there are different NW implementation and proposes a compromise that both can be signalled.
* Lenovo thinks application has the best knowledge about which flows should be throttled.
* Ericsson is still concerned that application will ignore the indication from the network.
* LGE thinks application layer will not deny, because otherwise the service will deteriorate, the application should follow. Per DRB is harder for app to follow.
* Ericsson asks how we can test the app layer. ZTE thinks the same applies to per DRB.
* QCM asks if we will force the UE to support per QoS flow indication.
* ZTE thinks we can discuss capability later and it should be separate capability of the UE.
* Samsung thinks that there is already QoS profile can already come from CN, so UE indication should be optional.
* Sony, Ericsson thinks that per QoS flow has impact on architecture.
* Apple observed more N:1 mapping than 1:1 mapping in the field, so per QoS flow makes more sense.
* Huawei indicates that QoS flow visibility at DU is already specified in RAN3. OK with the UE indication.
* Ericsson thinks we could configure QoS flows to be throttled in RRC and indicate per LCH.
* Ericsson indicates we should check architecture impacts, e.g. CU/DU split.
* RAN2 confirms it is feasible for RAN to estimate the congestion information at both per-DRB and per-QoS flow level.
* gNB can be indicated which QoS flows can be throttled. FFS whether this is indicated from UE/CN
* Rate indication from gNB to the UE on a per QoS flow level is supported. FFS the details, e.g. if: 1) flows are indicated by MAC CE or 2) by RRC while MAC CE is per DRB.

**DL rate control and UL MAC CE**

[R2-2409637](file:///D:\3GPP\Extracts\R2-2409637.docx) XR rate control Xiaomi discussion Rel-19 NR\_XR\_Ph3-Core

Proposal 6: Rate control can be applicable to UL data as well as to DL data.

Proposal 7: Query indication (similar to Recommended bit rate query) from UE to gNB is supported.

DISUCSSION on P6:

* CATT asks for the motivation. Xiaomi thinks that the other end will be affected, so DL indication is useful.
* LGE thinks the WID is clear that this is out of scope.
* QCM indicates that DL rate control is supported by legacy MAC CE already and it is useful instead of using CN signalling.
* OPPO understand the motivation but it is not in WID.
* ZTE supports downlink. ZTE clarifies that in RAN plenary they thought there is no impact to RAN2.
* RAN2 will not discuss/support rate indication for DL unless WID is updated to include it by RANP.

DISCUSSION on P7:

* Ericsson, LGE, OPPO, Nokia thinks the UL MAC CE is not needed. The gNB can know from CN.
* QCM supports P7, it is useful for the UE indicate.
* Vivo thinks that UE can provide assistance on which flow needs rate control.
* Samsung sees some value, UE can share its preference.
* ZTE would like the enhanced feature to be on par with the legacy feature, so prefers to have both DL indication and rate query
* CATT thinks we need to understand in which scenario this rate query is to be applied, e.g. before or after congestion
* RAN2 assumes that the congestion situation can be known at the gNB without any indication from the UE
* FFS whether UL MAC CE rate query/preference is supported as UE recommendation to the NW or whether legacy MAC CE can serve this already. FFS in which scenarios this is useful.

**Assistance information for the gNB**

[R2-2410039](file:///D:\3GPP\Extracts\R2-2410039%20XR%20rate%20control.docx) XR rate control Nokia, Nokia Shanghai Bell discussion NR\_XR\_Ph3-Core

- Option 1: UE based approach. For example, UE informs gNB of the QoS flow(s)/DRB(s) that are with the capability of adjusting their bit rate.

- Option 2: CN based approach. For example, gNB gets the information from CN entity (e.g. SMF) of which QoS flow(s) are with the capability of adjusting their bitrate when provided with congestion information.

Proposal 2: For XR rate control, RAN2 discuss different options how the gNB identifies which QoS flows are subject to adaptive bit rate.

[R2-2409559](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409559.zip) Discussion on XR rate control Qualcomm Incorporated discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409741](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409741.zip) Rate control signaling for XR LG Electronics Inc. discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409772](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409772.zip) Discussion on XR rate control vivo discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409858](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409858.zip) Discussion on XR Rate Control CATT discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2409959](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2409959.zip) Views on MAC Signalling for XR Rate Control Apple discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410093](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410093.zip) XR Rate Control Enhancements Sharp discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410156](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410156.zip) Discussion on XR rate control Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410191](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410191.zip) Uplink rate control for XR NEC Corporation discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410200](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410200.zip) More on XR Rate Control Ericsson discussion Rel-19

[R2-2410240](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410240.zip) Discussion on XR rate control OPPO discussion Rel-19 NR\_XR\_Ph3-Core

R2-2410247 Discussion on XR rate control Huawei, HiSilicon discussion Rel-19 NR\_XR\_Ph3-Core Withdrawn

[R2-2410318](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410318.zip) Further consideration on XR rate control CMCC discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410410](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410410.zip) Discussion on UL congestion signaling InterDigital discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410490](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410490.zip) Recommended bit rate based XR rate control Sony discussion Rel-19 NR\_XR\_Ph3

[R2-2410686](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410686.zip) Discussion on XR rate control HONOR discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410716](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410716.zip) Discussion on UL rate control for Rel-19 XR Samsung discussion Rel-19 NR\_XR\_Ph3-Core

[R2-2410739](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410739.zip) Discussion on Rate Control for XR China Telecom discussion

[R2-2410877](file:///D:\3GPP\TSGR2\TSGR2_128\Docs\R2-2410877.zip) Uplink congestion control signalling MediaTek Inc. discussion Rel-19 38.321 NR\_XR\_enh-Core