

**Email discussion summary for [RAN-R18-WS-non-eMBB-FGI] - Version 0.0.3**  
**RAN**

**3GPP TSG RAN Rel-18 workshop**

**Electronic Meeting, June 28 - July 2, 2021**

**RWS-210568**

**Agenda Item: 4.2**

**Source: FGI, Asia Pacific Telecom**

**Title: Email discussion summary for [RAN-R18-WS-non-eMBB-FGI]**

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## **1 Introduction**

This email discussion summary covers the following documents:

- (1) RWS-210191 Challenges of XR in Rel-18
- (2) RWS-210192 Views on UL Enhancements in Rel-18
- (3) RWS-210193 URLLC/IIoT Enhancements for Rel-18
- (4) RWS-210194 NTN Enhancements in Rel-18

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## **2 General Comments to The Tdocs**

### **2.1 Round 1 General Comments**

**Feedback Form 1: Round 1 General Comments**

### **2.2 Round 1 Answers**

N/A

### **2.3 Round 2 General Comments**

**Feedback Form 2: Round 2 General Comments**

## 2.4 Round 2 Answers

N/A

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## 3 Challenges of XR in Rel-18 (RWS-210191)

Proposal #1: For XR applications, solutions for power consumption reduction, system capacity improvement, and user experience degradation reduction while moving or at cell edge should be studied in Rel-18.

### 3.1 Round 1 Questions

#### Feedback Form 3: Round 1 Questions on XR

##### 1 – Spreadtrum Communications

In two cases (moving, at cell edge), the user experience degradation reduction are same or not? What different enhancements shall be applied for these two cases?

##### 2 – CATT

Thanks for sharing the idea of NR enhancement for XR. The proposed schemes of capacity enhancement, power saving technique and XR performance due to UE mobility are quite interesting. However, we believe the aspects of NR enhancements should be discussed and concluded in the working groups first during the XR study before further discussion of the scope of XR work item.

##### 3 – vivo Communication Technology

Thanks for the contribution. We agree what NR enhancement for better XR support is an important area in REL-18. Regarding mobility and coverage enhancement for XR, multiple mechanisms are proposed to minimize user experience degradation for cell edge XR devices, and we have some questions as below

- 1) Could FGI elaborate more on which L1 parameter(s) dynamic adaptation can improve mobility/coverage performance, and how it works?
- 2) Regarding alignment of UL and DL, what is the consideration from FGI on what kinds of UL transmissions e.g., HARQ-ACK/CSI/SR/configured grant PUSCH/DG PUSCH and how these UL transmissions are aligned with DL transmission?
- 3) We share the same view that jitter needs to be handled. Could FGI elaborate more on what mechanisms are used to wake the UE up on time upon arrival of DL XR traffic, and how it works?

##### 4 – Guangdong OPPO Mobile Telecom.

What does "Dynamic adaptation of L1 parameters for cell edge XR devices." mean?

##### 5 – ZTE Corporation

For the DL/UL alignment, depending on the scheduling nature for DL and UL, up to 4 combinations exist including DL/UL –SPS/CG. What's the study point other than checking whether the existing configuration of SPS/CG can fulfill the alignment?

## 6 – ITRI

Thanks for the proposals. We share the same view that the enhancements on power, capacity, mobility and coverage should be studied in Rel-18 for better supporting XR services in 5G network. Especially for the capacity enhancement, we would like to know if there are other mechanisms considered in your plan than the SPS/CG configuration enhancement to improve system capacity for XR devices.

### 3.2 Round 1 Answers

#### [Spreadtrum Communications]

[Question] In two cases (moving, at cell edge), the user experience degradation reduction are same or not? What different enhancements shall be applied for these two cases?

[Answer] Thanks to Spreadtrum Communications for the comment. To ensure the throughput is sufficient to support XR applications in case the UE is moving, further enhancements of DAPS HO can be considered, e.g., jointly considering with multi-TRP and moving among higher frequencies. Other potential improvements are open for discussion. On the other hand, due to interference and relatively large pathloss for cell edge XR devices, the reliability of the UL/DL data needs to be improved to compensate for the channel loss. Mechanisms with higher UE power class, UE aggregation, sidelink relay, UE-based PDCP duplication, UE-based L1 parameter adaptation, assistance information to the network, etc., could be adopted by the UE.

#### [CATT]

[Question] The proposed schemes of capacity enhancement, power saving technique and XR performance due to UE mobility are quite interesting. However, we believe the aspects of NR enhancements should be discussed and concluded in the working groups first during the XR study before further discussion of the scope of XR work item.

[Answer] Thanks to CATT for the comment. We also agree that the enhancements shall be based on the outcome of the XR SI.

#### [vivo Communication Technology]

[Question] Could FGI elaborate more on which L1 parameter(s) dynamic adaptation can improve mobility/coverage performance, and how it works?

[Answer] Thanks to vivo Communication Technology for the comments. 1) We think UE-based L1 parameter adaptation may be beneficial. For example, the UE could dynamically adjust the L1 parameters based on certain conditions, e.g., the UE's current channel quality. Which L1 parameter(s) can be dynamically adapted could be for FFS.

[Question] Regarding alignment of UL and DL, what is the consideration from FGI on what kinds of UL transmissions e.g., HARQ-ACK/CSI/SR/configured grant PUSCH/DG PUSCH and how these UL transmissions are aligned with DL transmission?

[Answer] Here, we tend to keep it open, i.e., not restrict to a specific type of UL transmission at this stage. The idea is to align the UL transmission with the DRX Active time and/or the time when the XR device receives DL traffics. This could be done by proper network configuration to align UL transmission with DL traffics. Some new semi-static UL configuration periodicities could also be investigated for better support of

XR traffic patterns.

[Question] We share the same view that jitter needs to be handled. Could FGI elaborate more on what mechanisms are used to wake the UE up on time upon arrival of DL XR traffic, and how it works?

[Answer] To wake the UE up promptly, the UE could rely on network indication, e.g., WUS signal.

**[Guangdong OPPO Mobile Telecom.]**

[Question] What does "Dynamic adaptation of L1 parameters for cell edge XR devices." mean?

[Answer] Thanks to Guangdong OPPO Mobile Telecom for the comment. We think UE-based L1 parameter adaptation may be beneficial. For example, the UE could dynamically adjust the L1 parameters based on certain conditions, e.g., the UE's current channel quality. Which L1 parameters can be dynamically adapted could be for FFS.

**[ZTE Corporation]**

[Question] For the DL/UL alignment, depending on the scheduling nature for DL and UL, up to 4 combinations exist including DL/UL –SPS/CG. What's the study point other than checking whether the existing configuration of SPS/CG can fulfill the alignment?

[Answer] Thanks to ZTE Corporation for the comment. The idea is to align the UL transmission with the DRX Active time and/or the time when the XR device receives DL traffics. This could be done by proper network configuration to align UL transmission with DL traffics. Some new semi-static UL configuration periodicities could also be investigated for better support of XR traffic patterns.

**[ITRI]**

[Question] We share the same view that the enhancements on power, capacity, mobility and coverage should be studied in Rel-18 for better supporting XR services in 5G network. Especially for the capacity enhancement, we would like to know if there are other mechanisms considered in your plan than the SPS/CG configuration enhancement to improve system capacity for XR devices.

[Answer] Thanks to ITRI for the comment. From FGI's perspective, some group scheduling mechanisms could also be considered for improving system capacity. This could be used in a scenario where a group of XR devices is receiving the same XR traffics.

### 3.3 Round 2 Questions

#### Feedback Form 4: Round 2 Questions on XR

##### 1 – Fujitsu Limited

Thank you for the contribution.

We also think that jitter control is important. On the proposal that the dynamic adaptation of DRX parameters to ensure the UE wakes up upon arrival of DL XR traffic, which do you have in mind, gNB-controlled-adaptation of DRX parameter (reactive) or UE-autonomous-adaptation of DRX parameter (proactive)?

## 2 – VODAFONE Group Plc

We are also interested in XR/AR/CG enhancements. These all seem to be high data rate applications involving significant video processing tasks that are likely to consume significant battery power. Ultra low end 2G phones are able to operate DRX for many weeks on a cheap battery, so receive tasks do not seem to be hugely battery consuming. Can you share some approximate numerical estimates as to why DRX improvements will dramatically change the usable duration of a device engaged in XR/AR/CG?

### 3.4 Round 2 Answers

#### [Fujitsu Limited]

[Question] We also think that jitter control is important. On the proposal that the dynamic adaptation of DRX parameters to ensure the UE wakes up upon arrival of DL XR traffic, which do you have in mind, gNB-controlled adaptation of DRX parameter (reactive) or UE-autonomous-adaptation of DRX parameter (proactive)?

[Answer] Thanks to FUJITSU for the comment. From our point of view, both gNB-controlled adaptation and UE-autonomous adaptation could be possible. Which solution to use could depend on how fast a UE needs to be waken up and the specification impact associated with the UE-autonomous adaptation of DRX parameter. More studies are required first.

#### [VODAFONE Group Plc]

[Question] We are also interested in XR/AR/CG enhancements. These all seem to be high data rate applications involving significant video processing tasks that are likely to consume significant battery power. Ultra low end 2G phones are able to operate DRX for many weeks on a cheap battery, so receive tasks do not seem to be hugely battery consuming. Can you share some approximate numerical estimates as to why DRX improvements will dramatically change the usable duration of a device engaged in XR/AR/CG?

[Answer] Based on XR SI, power saving has been identified as one of the key areas of study. Power saving is extremely important for XR devices that are expected to be used for a long period of time, e.g., AR glasses with an embedded 5G modem providing 5G connectivity. Hence, we believe that enhanced DRX mechanism is an useful mechanism for power saving purposes. At this stage, we are open to consider any solution for power saving purpose.

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## 4 Views on UL Enhancements in Rel-18 (RWS-210192)

Proposal #2: Potential solutions for supporting higher UL bandwidth and a higher UL data rate should be studied in Rel-18.

Proposal #3: Considering UE aggregation as one of the potential solutions for UL enhancements in Rel-18.

### 4.1 Round 1 Questions

## Feedback Form 5: Round 1 Questions on UL Enhancements

### 1 – ZTE Corporation

In general, we share that UL enhancements for higher UL capacity are desirable, and we have similar views on some of the proposed enhancements, including high modulation order and UE coordination, as proposed in our contribution RWS-210479 (NWM link: <https://nwm-trial.etsi.org/#/documents/4776>).

Regarding more uplink spectrum and flexible usage, we think support more UL carriers than DL carriers with flexible DL/UL association is one straightforward way to boost UL resources for higher capacity. Appreciated to hear your views on this point.

For fast activation/deactivation of SPS and CG, do you mean gNB can use SPS/CG activation/deactivation DCI to activate/de-activate a Scell and SPS/CG configurations in the Scell in the same time?

### 2 – Intel Corporation (UK) Ltd

<Intel>

Q1. Can we get any further details regarding SPS/CG enhancements?

Q2. Regarding “Enhance SR cancellation scheme for URLLC SR transmission”, would you please highlight what is the issue to resolve (e.g. considering what is already defined for intra-UE prioritization)?

Q3. Regarding “Improve conditions for LCP priority order for URLLC data”, currently priority is configured by RRC. Would you please highlight the issues with existing mechanism?

Q4. Regarding “Consider LBT failure when determining the priority of an UL resource during intra-UE prioritization”, in RAN2#113-e meeting, it was agreed that “LBT failure is not considered when determining a grant priority for intra-UE prioritization.” Is there any reason to propose this again?

Q5. Regarding “Consider the priority of an UL transmission for UE-initiated COT in FBE”, would you please highlight in which procedure to consider the priority?

### 3 – ITRI

Thanks for the contribution. We have two questions below for clarifications.

1. Please elaborate more on the meaning of UE aggregation and corresponding scenario for the usage of aggregation?

2. Does it imply the aggregated devices (i.e., UEs) shared a common RRC configuration/Radio bearer?

### 4 – Qualcomm Technologies Int

Does the proposed framework for UE aggregation envision use of unlicensed or licensed spectrum for sidelink communications?

### 5 – Huawei Tech.(UK) Co.. Ltd

We share the same view on that more uplink spectrum and flexible usage is important for UL enhancement. For the sub-bullet in Page 4, in addition to supporting triple connectivity via DC enhancement, one mechanism to support more UL carriers via CA enhancement for general transmission capability (UEs with 2 Tx only) is also important. Based on configuring more SNs for DC and more UL carriers for CA, UE can dynamically select UL band or switching Tx among configured cells for transmission based on capability and DL/UL respective demand to maximize resource utilization and capacity.

We share the view that the UE aggregation could be beneficial. Do you consider data split/duplication and transmission over multi-UE in addition to path switch as that could bring improved throughput and reliability?

## 6 – III

Regarding on the mechanism of flow control among aggregated UEs, does imply one of the UE will perform PDUs splitting? And another UE works as a slave device under controlled fully.

Did you also consider PDU retransmission procedure? If yes, which layer you prefer?

## 4.2 Round 1 Answers

### [ZTE Corporation]

[Question] For fast activation/deactivation of SPS and CG, do you mean gNB can use SPS/CG activation/deactivation DCI to activate/de-activate a SCell and SPS/CG configurations in the SCell in the same time?

[Answer] The current activation and deactivation of configured resource (i.e., SPS and CG) were sole controlled by the gNB via specific L1/L2 signaling. For supporting high data rate application with low response time requirement (i.e., burst arrival), a mechanism on shorten the latency on the activation procedure is preferred. The way of activating corresponding resource alone with SCell activation is also one acceptable way in our perspective.

### [Intel Corporation (UK) Ltd]

[Question] Can we get any further details regarding SPS/CG enhancements?

[Answer] The current activation and deactivation of configured resource (i.e., SPS and CG) were sole controlled by the gNB via specific L1/L2 signaling. For supporting high data rate application with low response time requirement (i.e., burst arrival), a mechanism on shorten the latency on the activation procedure is preferred. The way of activating corresponding resource alone with SCell activation is also one acceptable way in our perspective. Please also refer to the answers for other questions in section 5.2.

### [ITRI]

[Question] Please elaborate more on the meaning of UE aggregation and corresponding scenario for the usage of aggregation? Does it imply the aggregated devices (i.e., UEs) shared a common RRC configuration/Radio bearer?

[Answer] It can either be intra-UE aggregation or inter-UE aggregation. For intra-UE aggregation aspect, we consider that a UE can be configured with two protocol stacks in AS layer which cooperated for transmitting data flow with or without duplicated the data. At least in the first release introducing such mechanism, we prefer without duplication. Other enhancements can be further introduced in further releases. Regarding on the inter-UE, there will be at least two independent UEs sharing one common radio bearer and work together on delivering data from one signal radio bearer. That is, from gNB perspective, there are two UEs sharing one single RRC config regarding on the radio bearer, but the resource scheduled by the gNB may be coordinated by the UEs themselves. Each group of aggregated devices associated with one corresponding RB. But we do not preclude any other possibilities.

### [Qualcomm Technologies Int]

[Question] Does the proposed framework for UE aggregation envision use of unlicensed or licensed spectrum for sidelink communications?

**[Answer]** We didn't preclude using sidelink communication for UE aggregation, but think it will be easily to start with sidelink communication in licensed spectrum. This will toggle with discussion on the resource allocation for the aggregated UEs for sidelink, we prefer to apply the solutions introduced for V2X and can further study it feasibility.

**[Huawei Tech.(UK) Co.. Ltd]**

[Question] We share the view that the UE aggregation could be beneficial. Do you consider data split/duplication and transmission over multi-UE in addition to path switch as that could bring improved throughput and reliability?

**[Answer]** It is appreciated to hear your view in such area. And thanks for your question, we do think split transmission may be a feasible mechanism on top of the aggregated UEs for controlling data flow. Regarding on the duplication, we do not preclude it and also see the benefit on introducing them which improved the reliability as shared from you.

**[III]**

[Question] Regarding on the mechanism of flow control among aggregated UEs, does imply one of the UE will perform PDUs splitting? And another UE works as a slave device under controlled fully. Did you also consider PDU retransmission procedure? If yes, which layer you prefer?

**[Answer]** Thanks for the interesting questions. We are considering the aggregated UEs should cooperated with each other for sequentially deliver PDUs. A master couple with a slave UE may be a possible approach as you shared. The master device may be responsible with receiving corresponding RRC configuration with gNB as well as reconfiguration. In addition, the slave device may share a radio bearer with master which established by the gNB. We do consider the retransmission is an important part worthy to be further investigated for reliability improvements.

## 4.3 Round 2 Questions

## Feedback Form 6: Round 2 Questions on UL Enhancements

### 1 – VODAFONE Group Plc

We also see the need for uplink improvements. If there is some enhanced form of communication between the UEs that are being aggregated, what would be the definition of "one UE" and how would this impact on its/their power class/max tx power?

### 2 – vivo Communication Technology

1) Dual connectivity is introduced to decrease latency during handover, what is the motivation of triple connectivity?

2) what spec impact is expected for UL joint MTRP reception?

3) For UE aggregation case we are quite interested on this use case. It is similar to case 3.2 in our Tdoc RWS-210172(PIOT), how to connect two UEs in Asia Pacific Telecom mind?

## 4.4 Round 2 Answers

### [[VODAFONE Group Plc]]

[Question] If there is some enhanced form of communication between the UEs that are being aggregated, what would be the definition of "one UE" and how would this impact on its/their power class/max tx power?

[Answer] Thanks for the interesting question. We believe the communication between UEs is needed indeed for data transmission and flow control for example. And the definition of an aggregated UE may be UEs which applies two transmission carrier respectively for transmitting data of a common radio bearer. But such general concept can be achieved by different ways. First step to discuss on the definition of an aggregated UE is required. Then, how to consider its class power or max transmit power will be the following issues to resolve. From our point of views, the simple way may be that an aggregated UE applied two respective power classes for boosting the transmit power.

### [vivo Communication Technology]

[Question] Dual connectivity is introduced to decrease latency during handover, what is the motivation of triple connectivity?

[Answer] One benefit of dual connectivity is to let a UE to utilize the radio resources from two different nodes to increase the throughput. We believe that extending such idea to triple connectivity will bring more benefits on UL transmission. Furthermore, once triple connection is introduced, the UE may be benefited from increasing the robustness of UL connection.

[Question] what spec impact is expected for UL joint MTRP reception?

[Answer] Regarding of introducing joint UL transmission to multiple TRPs, we at least see the power control issue on simultaneous PUSCHs transmission as well as power headroom reporting. For example, maximum transmission power based on UE's capacity may also need to be considered.

[Question] For UE aggregation case we are quite interested on this use case. It is similar to case 3.2 in our Tdoc RWS-210172(PIOT), how to connect two UEs in Asia Pacific Telecom mind?

[Answer] Either defining new interface or applying PC5 interface to connect two UEs is open for us.

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## 5 URLLC/IIoT Enhancements for Rel-18 (RWS-210193)

Proposal #4: Enhancements on system capacity of URLLC/IIoT applications should be studied in Rel-18.

### 5.1 Round 1 Questions

#### **Feedback Form 7: Round 1 Questions on URLLC/IIoT Enhancements**

##### **1 – Sony Europe B.V.**

- 1) Can you clarify what it means by flexible resource assignments to improve capacity (slide 3)?
- 2) Why is Rel-17 schemes not sufficient for SR cancellation in URLLC (slide 4)?
- 3) What are the LCP priority order condition improvements you have in mind (slide 4)?

##### **2 – vivo Communication Technology**

Thanks a lot for the nice contribution.

1. Regarding to the enhancements to the system capacity for URLLC/IIoT, we observed this objective overlaps with the XR RWS-210191. Is there any difference from the technical perspective to enhance the system capacity between the XR and URLLC/IIoT? If no big difference, which WI do you prefer to cover the capacity objective?

2. For proposal 2, we are interested in the following and would like to know some details:

1) enhancing existing scheme for PUCCH transmission

Rel-17 will support carrier switching for PUCCH transmission, hence our understanding is that the reliability and latency will be improved for PUCCH transmission. We are interested in what is/are additional enhancements for PUCCH. On the other hand, for data re-transmission, currently, there is no support for HARQ retransmission cross carriers. Therefore, we think data channels should be further enhanced from reliability and latency. What are your views?

2) SR cancellation schemes

We are interested in this aspects. We would like to know is there any difference compared to Rel-16 that SR with low priority is cancelled by channels with higher priority?

3) LCP priority order

About improving conditions for LCP priority order for URLLC data, we would like to know what are the conditions and reasons do you want to added?

##### **3 – Nokia Germany**

On slide 3:

-  
SPS/ CG configurations: What specific SPS/CG enhancements are envisioned?

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More adaptive CA configuration: What specific enhancements are envisioned there?

-

Enhanced CSI measurement / reporting / MCS adaptation: What is the difference compared to the objective of the Rel-17 WI? What additional enhancements or schemes not discussed in Rel-17 are envisioned?

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Simultaneous PUSCH / PUCCH: We agreed to specify this in Rel-17 URLLC / IIoT. What additional enhancements on top of the Rel-17 discussions are envisioned?

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Simultaneous PUCCH / PUCCH: Currently there is only one cell that is carrying the PUCCH (and also the discussed Rel-17 enhancements of PUCCH carrier switching assume a single cell at a time carrying the PUCCH). Are you suggesting having multi-cluster transmission on a UL CC (e.g. two PUCCHs at the same time transmitted on the same UL CC) which is currently not supported in NR?

-

UE based PDCP duplication: Other than survival time, which is already being studied in Rel-17, what is the motivation of introducing UE-based duplication when gNB-implementation is sufficient in most cases ?

On slide 4:

-

LCP Ordering for URLLC: This can be done by implementation, where gNB assigns higher LCH priority to URLLC data. What is the area that needs further specification enhancement ?

NR-U enhancements:

-

HARQ process ID collision was discussed in Rel-16 and RAN2 concluded the issue can be handled by proper gNB configuration. Is there any additional motivation to propose such enhancement as compared to what discussed in Rel-16?

-

About considering LBT failure in intra-UE prioritization, it was already agreed not to support this in Rel-17. Do you think it should be reconsidered again for Rel-18?

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About UL priority for UE-initiated COT in FBE, isn't this still within the scope of Rel-17 objectives?

#### **4 – Guangdong OPPO Mobile Telecom.**

What does "Enhanced SR cancellation schemes" mean?

<p><b>5 – Intel Corporation (UK) Ltd</b></p> <p>&lt;Intel&gt;</p> <p>Q1. Could you provide an example how CSI can be measured more accurately?</p> <p>Q2. Could you provide an example of further enhanced CG/SPS operation?</p>
<p><b>6 – ITRI</b></p> <p>Thanks for the proposals. We share the same view that enhancements on system capacity of URLLC/IIoT applications should be studied in Rel-18. We think the enhancements may benefit multiple use cases, e.g. XR, but would like to know how to coordinate the overlapping areas to avoid redundant studies.</p>
<p><b>7 – Apple Italia S.R.L.</b></p> <p>Q1. Quite some topics seem to be overlapping with either the XR enhancements or the R17 URLLC enhancements. What is your consideration on the overlapping?</p> <p>Q2. What issue does enhanced SR cancellation scheme intend to address? What kind of scheme?</p> <p>Q3. What conditions for LCP priority order are being considered?</p>
<p><b>8 – Lenovo Mobile Com. Technology</b></p> <p>Thanks for the contribution! we have few questions in the below</p> <p>1) Could you elaborate a bit more on the detailed scenario of “Handling of HARQ process ID collision between DG and CG”?</p> <p>2) for “Simultaneous PUCCH/PUCCH” is listed below the objective “, what is carried on each PUCCH?</p>
<p><b>9 – HUAWEI TECHNOLOGIES Co. Ltd.</b></p> <p>Thanks for the contribution. Can you explain a little bit more on ”More adaptive configuration for CA” and ”Enhanced CSI report”?</p>
<p><b>10 – LG Electronics Inc.</b></p> <p>Some objectives seems to include similar items to Rel-16/17 URLLC enhancements. Is it considered as leftovers? Otherwise, what would be different from Rel-16/17 enhancements?</p>

## 5.2 Round 1 Answers

### [Sony Europe B.V.]

[Question] Can you clarify what it means by flexible resource assignments to improve capacity (slide 3)?

[Answer] For example, the capacity would be enhanced by providing lower control-to-data overhead ratio or enabling a more adaptive SPS/CG configuration.

[Question] Why is Rel-17 schemes not sufficient for SR cancellation in URLLC (slide 4)?

[Answer] Considering the case where a PUCCH for URLLC SR overlaps with a PUSCH, transmission of a BSR on the PUSCH could result in cancellation of the URLLC SR. Consequently, extra delay could be introduced. Hence, existing SR cancellation scheme may need to be enhanced for this case.

[Question] What are the LCP priority order condition improvements you have in mind (slide 4)?

[Answer] For example: Conditionally providing higher LCP order to the URLLC LCHs to maximize the allocation of an arriving UL resource to incoming URLLC data.

### **[vivo Communication Technology]**

[Question] Regarding to the enhancements to the system capacity for URLLC/IIoT, we observed this objective overlaps with the XR RWS-210191. Is there any difference from the technical perspective to enhance the system capacity between the XR and URLLC/IIoT? If no big difference, which WI do you prefer to cover the capacity objective?

[Answer] Basically, the primary motivation to improve the capacity is for XR application, so it is better to handle this objective in XR WI, however, some other enhancements such as more accurate MCS adaptation could be a general aspect for other URLLC use cases. Thus, regarding the WI preference, we could rely on the outcome of Rel-18 XR SI.

[Question] Rel-17 will support carrier switching for PUCCH transmission, hence our understanding is that the reliability and latency will be improved for PUCCH transmission. We are interested in what is/are additional enhancements for PUCCH. On the other hand, for data re-transmission, currently, there is no support for HARQ retransmission cross carriers. Therefore, we think data channels should be further enhanced from reliability and latency. What are your views?

[Answer] Enhancing existing PUCCH transmission could include leftovers from Rel-17 or allowing simultaneous PUCCH/PUCCH transmissions across different cells. From our point of views, it is not precluded to consider specifying initial transmission and re-transmission upon different cells if the benefits from reducing latency are evaluated.

[Question] We are interested in this aspects. We would like to know is there any difference compared to Rel-16 that SR with low priority is cancelled by channels with higher priority?

[Answer] Considering the case where a PUCCH for URLLC SR overlaps with a PUSCH, transmission of a BSR on the PUSCH could result in cancellation of the URLLC SR. Consequently, extra delay could be introduced. Hence, existing SR cancellation scheme may need to be enhanced for this case.

[Question] About improving conditions for LCP priority order for URLLC data, we would like to know what are the conditions and reasons do you want to added?

[Answer] For example: Conditionally providing higher LCP order to the URLLC LCHs to maximize the allocation of an arriving UL resource to incoming URLLC data.

### **[Nokia Germany]**

[Question] SPS/ CG configurations: What specific SPS/CG enhancements are envisioned?

[Answer] For example, further enhancements on the periodicities of SPS/CG configuration or providing more dynamic SPS/CG configuration can be considered.

[Question] More adaptive CA configuration: What specific enhancements are envisioned there?

[Answer] For example, more dynamic PDCCH monitoring across multiple carriers to lower control-to-data overhead ratio can be considered.

[Question] Enhanced CSI measurement / reporting / MCS adaptation: What is the difference compared to the objective of the Rel-17 WI? What additional enhancements or schemes not discussed in Rel-17 are envisioned?

[Answer] For example, A-CSI report on PUCCH has not been supported in Rel-17 WI. In addition, some CSI enhancements for control channel could be considered. Considering interference prediction from neighboring cells to prevent CSI measurement delay can be investigated, too.

[Question] Simultaneous PUSCH / PUCCH: We agreed to specify this in Rel-17 URLLC / IIoT. What additional enhancements on top of the Rel-17 discussions are envisioned?

[Answer] It could depend on the outcome of Rel-17 discussion. Rel-17 only specifies simultaneous PUCCH/PUSCH transmissions with different priorities on different cells over inter-band CA. The idea is to consider simultaneous PUCCH/PUSCH transmissions with same priority on same cell, or on different cells over intra-band CA.

[Question] Simultaneous PUCCH / PUCCH: Currently there is only one cell that is carrying the PUCCH (and also the discussed Rel-17 enhancements of PUCCH carrier switching assume a single cell at a time carrying the PUCCH). Are you suggesting having multi-cluster transmission on a UL CC (e.g. two PUCCHs at the same time transmitted on the same UL CC) which is currently not supported in NR?

[Answer] Yes, transmitting more than one overlapping PUCCHs with different priorities on one or multiple cells could be considered.

[Question] UE based PDCP duplication: Other than survival time, which is already being studied in Rel-17, what is the motivation of introducing UE-based duplication when gNB-implementation is sufficient in most cases?

[Answer] URLLC services require high reliability at a tradeoff of low resource efficiency. This issue becomes more serious if high data rate needs to be supported in Rel-18 URLLC WI. Hence, by introducing UE-based mechanisms, the reliability of the URLLC services could be boosted when really needed.

[Question] LCP Ordering for URLLC: This can be done by implementation, where gNB assigns higher LCH priority to URLLC data. What is the area that needs further specification enhancement ?

[Answer] For example, conditionally providing higher LCP order to the URLLC LCHs to maximize the allocation of an arriving UL resource to incoming URLLC data.

[Question] HARQ process ID collision was discussed in Rel-16 and RAN2 concluded the issue can be handled by proper gNB configuration. Is there any additional motivation to propose such enhancement as compared to what discussed in Rel-16?

[Answer] In Rel-18, higher data rate could be required for a URLLC service. Hence, a URLLC application with high data rate may occupy more HARQ IDs. With the current number of HARQ IDs, it is hard to avoid HARQ ID collision between CG and DG by network implementation, i.e., via separate HARQ ID pools. Hence, some enhancements could be introduced.

[Question] About considering LBT failure in intra-UE prioritization, it was already agreed not to support this in Rel-17. Do you think it should be reconsidered again for Rel-18?

[Answer] This feature brings benefit to UE's operating in unlicensed controlled environment (UCE), as it considers the channel condition when performing intra-UE prioritization. We respectively suggest RAN to reconsider it in Rel-18.

[Question] About UL priority for UE-initiated COT in FBE, isn't this still within the scope of Rel-17 objectives?

[Answer] This feature brings benefits to FBE devices, as it allows high priority UEs and/or UEs with high priority data to access the channel. We respectively suggest RAN to consider it if it is not fully addressed in Rel-17.

**[Guangdong OPPO Mobile Telecom.]**

[Question] What does "Enhanced SR cancellation schemes" mean?

[Answer] Considering the case where a PUCCH for URLLC SR overlaps with a PUSCH, transmission of a BSR on the PUSCH could result in cancellation of the URLLC SR. Consequently, extra delay could be introduced. Hence, existing SR cancellation scheme may need to be enhanced for this case.

**[Intel Corporation (UK) Ltd]**

[Question] Could you provide an example how CSI can be measured more accurately?

[Answer] For example, if the measurement delay can be reduced, the measurement results would improve accordingly.

[Question] Could you provide an example of further enhanced CG/SPS operation?

[Answer] For example: Further enhancements on the periodicities of SPS/CG configuration or providing more dynamic SPS/CG configuration can be considered, also, we are open to consider other enhancements with the same goal.

**[ITRI]**

[Question] We share the same view that enhancements on system capacity of URLLC/IIoT applications should be studied in Rel-18. We think the enhancements may benefit multiple use cases, e.g. XR, but would like to know how to coordinate the overlapping areas to avoid redundant studies.

[Answer] Some enhancements specific to XR application (e.g., SPS/CG, PDCCH monitoring adaptation for variable packet size of XR use cases) could be studied in XR, and other generic aspects (e.g., enhanced CSI measurement) could be studied in URLLC/IIoT. Also, we are open to discuss how to deal with the overlapping objectives.

**[Apple Italia S.R.L.]**

[Question] Quite some topics seem to be overlapping with either the XR enhancements or the R17 URLLC enhancements. What is your consideration on the overlapping?

[Answer] Some enhancements specific to XR application (e.g., SPS/CG, PDCCH monitoring adaptation for variable packet size of XR use cases) could be studied in XR agenda, and other generic aspects (e.g., enhanced CSI measurement) could be studied in URLLC/IIoT agenda.

[Question] What issue does enhanced SR cancellation scheme intend to address? What kind of scheme?

[Answer] Considering the case where a PUCCH for URLLC SR overlaps with a PUSCH, transmission of a BSR on the PUSCH could result in cancellation of the URLLC SR. Consequently, extra delay could be

introduced. Hence, existing SR cancellation scheme may need to be enhanced for this case.

[Question] What conditions for LCP priority order are being considered?

[Answer] For example, conditionally providing higher LCP order to the URLLC LCHs to maximize the allocation of an arriving UL resource to incoming URLLC data.

**[Lenovo Mobile Com. Technology]**

[Question] Could you elaborate a bit more on the detailed scenario of “Handling of HARQ process ID collision between DG and CG”?

[Answer] In Rel-18, higher data rate could be required for a URLLC service. Hence, a URLLC application with high data rate may occupy more HARQ IDs. With the current number of HARQ IDs, it is hard to avoid HARQ ID collision between CG and DG by network implementation, i.e., via separate HARQ ID pools. Hence, some enhancements could be introduced.

[Question] for “Simultaneous PUCCH/PUCCH” is listed below the objective “, what is carried on each PUCCH?

[Answer] UCIs with different priorities could be considered. (e.g., HARQ-ACK codebooks with different priorities)

**[HUAWEI TECHNOLOGIES Co. Ltd.]**

[Question] Can you explain a little bit more on ”More adaptive configuration for CA” and ”Enhanced CSI report”?

[Answer] For ”More adaptive configuration for CA”, more dynamic PDCCH monitoring across multiple carriers to lower control-to-data overhead ratio can be considered. For ”Enhanced CSI report”, A-CSI report on PUCCH can be supported. In addition, some CSI enhancements for control channel could be considered.

**[LG Electronics Inc.]**

[Question] Some objectives seems to include similar items to Rel-16/17 URLLC enhancements. Is it considered as leftovers? Otherwise, what would be different from Rel-16/17 enhancements?

[Answer] The main difference between R18 and leftovers is to improve system capacity by considering some enhancements, for example, reducing the control-to-data overhead ratio, and providing more efficient SPS/CG resource allocation. Moreover, some URLLC leftovers in Rel-16 and Rel-17 should be addressed in Rel-18 as well.

## 5.3 Round 2 Questions

**Feedback Form 8: Round 2 Questions on URLLC/IIoT Enhancements**

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## 1 – Nokia Germany

Thanks for the detailed answers to our round 1 questions. Some follow-up still from our side:

1. LCP ordering: Typically, URLLC data would have high LCH priority anyway (via proper gNB configuration). Do we have any use case where the URLLC LCHs originally have low LCH priority and therefore have to be boosted in some conditions?

2. NR-U enhancement: It was answered that HARQ ID collision between CG and DG is needed due to high data rate in R18, and the issue would be difficult to avoid by gNB implementation. HARQ ID collision between CG and DG was discussed in R16, i.e. targeting eMBB and high data rate applications, and RAN2 already concluded no standardized solution was needed. Could you clarify if this high data rate use case is related to IIoT/AR/VR or just an eMBB-driven improvement?

## 2 – HUAWEI TECHNOLOGIES Co. Ltd.

Thank you very much for your answer to our question in the first round. For A-CSI on PUCCH, we also think it is beneficial. It is under discussion in Rel-17 also.

## 5.4 Round 2 Answers

### [Nokia Germany]

[Question] LCP ordering: Typically, URLLC data would have high LCH priority anyway (via proper gNB configuration). Do we have any use case where the URLLC LCHs originally have low LCH priority and therefore have to be boosted in some conditions?

[Answer] For example, we could consider the prioritization between URLLC data and MAC CE.

[Question] NR-U enhancement: It was answered that HARQ ID collision between CG and DG is needed due to high data rate in R18, and the issue would be difficult to avoid by gNB implementation. HARQ ID collision between CG and DG was discussed in R16, i.e. targeting eMBB and high data rate applications, and RAN2 already concluded no standardized solution was needed. Could you clarify if this high data rate use case is related to IIoT/AR/VR or just an eMBB-driven improvement?

[Answer] From our point of view, generally, high data rate use case could relate to both cases (i.e., IIoT, XR, eMBB-driven). However, HARQ ID collision is more of an issue in the presence of URLLC traffic, especially for cases where URLLC services of a UE could potentially occupy lots of HAR.Q IDs (e.g., URLLC services requiring high data rate).

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## 6 NTN Enhancements in Rel-18 (RWS-210194)

In our observations, 25 companies support NTN enhancement in Rel-18 workshop and a brief summary is provided below.

- Rel-18 New Features: Coverage Enhancements [8/25], Power Saving [11/25], Flexible Deployment [16/25], Mobility Enhancements [9/25], Positioning Enhancement [5/25], Throughput Enhancement [15/25], Waveform Enhancement [4/25]

- Rel-17 leftovers [12/25]

We share the same view with majority companies that the outcome of Rel-17 NTN will only provide essential features. As a result, some expected use cases will NOT be supported by the Rel-17 NTN, e.g., multi connectivity, network resilience, and mobile cell hybrid connectivity shown in Table 4.2.1-1 of TR 38.811. How to enable full capacity of NTN shall be further investigated in Rel-18. Based on companies' contributions and our observations, the following is proposed:

Proposal #5: Potential solutions to support TN and NTN connectivity should be enhanced in Rel-18.

Proposal #6: Considering DAPS and RACH-less HO as the potential solutions for Rel-18 NTN enhancement.

## 6.1 Round 1 Questions

### Feedback Form 9: Round 1 Questions on NTN

<p><b>1 – Asia Pacific Telecom co. Ltd</b></p> <p>To be specific, whether DAPS and RACH-less HO shall be considered as solutions for TN and NTN connectivity?</p>
<p><b>2 – Intelsat</b></p> <p>We agree with the listed enhancements. Some however may be considered later such as DAPS.</p>
<p><b>3 – Lenovo (Beijing) Ltd</b></p> <p>Thanks for the contribution. In 194 page5. For Rel-18 NTN new feature discussion, why do we consider the scenarios that UE has GNSS capability but w/o pre-compensation of freq/time offset? Do you mean, although the UE has GNSS, the GNSS module can't be used for eMTC/NB-IoT/NR module?</p>
<p><b>4 – Intel Corporation (UK) Ltd</b></p> <p>&lt;Intel&gt;</p> <p>Q1. Enabling NR NTN without GNSS at the UE will lead to decreased system performance due to larger PRACH reception window (especially for GEO) and frequent PRACH transmission (especially for LEO). What is your view on how much portion of UEs will be corresponding to UEs without GNSS in practical operation?</p>
<p><b>5 – ITRI</b></p> <p>Thanks for the contribution. We see the necessity of supporting multi connectivity, network resilience, and mobile cell hybrid connectivity in Rel-18. We also think DAPS and RACH-less handover can be considered for Rel-18 NTN enhancement but would like to know if inter-NTN case is also considered in your proposals.</p>
<p><b>6 – Sony Corporation</b></p> <p>Thanks for the contribution. We have two questions.</p> <p>-</p> <p><i>“Enhancement on UL scheduling to reduce scheduling latency. BSR via 2-step RACH is supported in Rel-16, do you consider any further enhancement for NTN?”</i></p>

-  
*“Enhancement to SMTC/MG to address absolute propagation delay difference between satellites, e.g., UE assistant information [RAN2/4]” Rel-17 NTN will support enhancement on SMTC, do you consider any further enhancement?*

## 7 – CATT

We agree to make some enhancement for beam management, Positioning, TN/NTN coordination, etc.

Here, a few questions for clarification:

What’s the expected enhancement on hard feeder link switch? And what’s the relationship between hard feeder link switch and discontinuous coverage?

## 6.2 Round 1 Answers

### [Asia Pacific Telecom co. Ltd]

[Question] To be specific, whether DAPS and RACH-less HO shall be considered as solutions for TN and NTN connectivity?

[Answer] Support of DAPS will reduce handover latency and enhance user experience. Support of RACH-less HO has the same benefit, and it will further prevent the use of the 4-step RACH procedure that leads to a better spectrum efficiency.

### [Intelsat]

[Question] We agree with the listed enhancements. Some however may be considered later such as DAPS.

[Answer] Agree. DAPS mainly enhances user experience by having less interruption of connection. It seems not essential for all use cases we have known.

### [Lenovo (Beijing) Ltd]

[Question] For Rel-18 NTN new feature discussion, why do we consider the scenarios that UE has GNSS capability but w/o pre-compensation of freq/time offset? Do you mean, although the UE has GNSS, the GNSS module can’t be used for eMTC/NB-IoT/NR module?

[Answer] Yes. Before NTN-based positioning can be supported, UE may need to provide UE location with a radius of 2km or more based on its GNSS capability from the RAN2 perspective. (See RP-210986). However, for Rel-17 NTN, GNSS is used for synchronization, therefore UE location error must be within 50 m for UL SCS of 15/30 kHz and within 30m for UL SCS of 60/120 kHz. (See R4-2108350). This may not be an issue for commercial GNSS, but UE must maintain GNSS during RRC\_CONNECTED to prevent a resynchronization of up to 30 seconds. For Rel-18 NTN, we expect the dependency of GNSS can be removed for RAN1. For later releases (Rel-19 and beyond), we expect the dependency of GNSS can be removed completely for RAN

### [Intel Corporation (UK) Ltd]

[Question] Enabling NR NTN without GNSS at the UE will lead to decreased system performance due to larger PRACH reception window (especially for GEO) and frequent PRACH transmission (especially for LEO). What is your view on how much portion of UEs will be corresponding to UEs without GNSS in

practical operation?

**[Answer]** Not sure. It depends on a beam/cell size. The RPACH reception window shall be enlarged by 2 times of max differential delay, e.g., 6.36ms for LEO-600 with a cell size of 1000km. However, it will be only 0.654ms for a cell size of 100km. (See TR 38.821 Table 7.2.1.1.1.2-1). Smaller cell size will reduce system performance loss, e.g., STARLINK has a cell size of 20km, when non-GNSS UEs are supported.

**[ITRI]**

[Question] We see the necessity of supporting multi connectivity, network resilience, and mobile cell hybrid connectivity in Rel-18. We also think DAPS and RACH-less handover can be considered for Rel-18 NTN enhancement but would like to know if inter-NTN case is also considered in your proposals.

**[Answer]** Yes. inter-NTN mobility has been captured TR. (See TR 38.821 Figure 5.3.2-3). We believe it shall provide better coverage and deployment flexibility, e.g., GEO-based NW for continental coverage and LEO-based NW for data transmission. If there is no feasibility issue to connect both TN and NTN simultaneously, then multi-connectivity between NTNs shall be doable.

**[Sony Corporation]**

[Question] “Enhancement on UL scheduling to reduce scheduling latency. BSR via 2-step RACH is supported in Rel-16, do you consider any further enhancement for NTN?”

**[Answer]** Yes. BSR can trigger 2-step RACH. In Rel-16, when triggering BSR, the UE triggers an SR to get the UL grant to transmit the BSR if the UL-SCH resource is not available. If the SR resource is not available, the UE triggers the RA. The UE may select 2-step RA based on the RSRP threshold. If the 2-step RACH is selected, the BSR is transmitted on the MsgB. Therefore, we understand that BSR via 2-step RACH is already supported.

[Question] “Enhancement to SMTC/MG to address absolute propagation delay difference between satellites, e.g., UE assistant information [RAN2/4]” Rel-17 NTN will support enhancement on SMTC, do you consider any further enhancement?”

**[Answer]** Yes. UE assistant information including rough UE location, delay prediction on the target cell, delay difference between target and serving cell, or delay drift prediction, may help NW provide better SMTC and MG configuration.

**[CATT]**

[Question] What’s the expected enhancement on hard feeder link switch? And what’s the relationship between hard feeder link switch and discontinuous coverage?”

**[Answer]** A hard feeder link switch can result in all connected mode UEs served by the satellite attempting mobility simultaneously, leading to RACH collisions, RLF and service interruption due to cumulative delay in RRC re-establishment signaling. (See R1-2100987). Enhancement can be based on a given serving time for cells. Discontinuous coverage is like hard feeder link switch that can be predictable. The difference is that a satellite may still maintain feeder link but not provide cell service for some areas. Enhancement can be based on given serving time for cells.

## 6.3 Round 2 Questions

## Feedback Form 10: Round 2 Questions on NTN

### 1 – Omnispace

We support your list of enhancements. However we think DAPS and RACH-less HO are good but should come later since we are still we have a long list of key features for NTN.

## 6.4 Round 2 Answers

### [Omnispace]

[Question] We support your list of enhancements. However we think DAPS and RACH-less HO are good but should come later since we are still we have a long list of key features for NTN.

[Answer] Agree. DAPS mainly enhances user experience by having less interruption of connection. It seems not essential for all use cases we have known. But, support of DAPS will reduce handover latency and enhance user experience. Support of RACH-less HO has the same benefit, and it will further prevent the use of the 4-step RACH procedure that leads to a better spectrum efficiency.

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## 7 Email Discussion Summary

### RWS-210191 Challenges of XR in Rel-18

We received questions from 6 companies in the initial round and received questions from 2 companies in the second round.

The majorities agree that NR enhancement for better XR support is an important area in Rel-18, especially to handle jitter and the mobility of XR devices.

### RWS-210192 Views on UL Enhancements in Rel-18

We received questions from 6 companies in the initial round and received questions from 2 companies in the second round.

The majorities agree that UL enhancements in Rel-18 is required and show some interests on UE aggregation mechanisms.

### RWS-210193 URLLC and IIoT Enhancements for Rel-18

We received questions from 10 companies in the initial round and received questions from 2 companies in the second round.

Companies are interested in potential URLLC and IIoT Enhancements in Rel-18 and also think that some URLLC/IIoT leftovers can be addressed in Rel-18. Need to discuss on which study group (i.e., XR or URLLC/IIoT) will be in charge of the overlapping objectives (e.g., improve throughput) between URLLC and XR.

### RWS-210194 NTN Enhancements in Rel-18

We received questions from 7 companies in the initial round and received questions from 1 company in the second round.

The majorities show the support on NTN enhancements in Rel-18. Whether to consider DAPS and RACH-less HO as the potential solutions for Rel-18 NTN enhancement is to be discussed.