

Agenda item: 6.1.3

Source: vivo

Title: Report of [AT113-e][019][NR16 IIOT] UL Skipping (vivo)

Document for: Discussion and Decision

1 Introduction

This contribution is aimed at reporting the discussion and results of the following email discussion:

- ✉ **[AT113-e][019][NR16 IIOT] UL Skipping (vivo)**
Scope: Treat R2-2100028, R2-2100138, R2-2100524, R2-2100218, R2-2101793, R2-2101794, R2-2100340, R2-2101776, R2-2101352, R2-2101377, R2-2101378, R2-2101456, R2-2100341, R2-2100855
Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.
Intended outcome: Reports and Agreed CRs if any is agreeable.
Deadline: Schedule A

The rapporteur would like to point out the specific deadline for this discussion with two phases,

- In phase 1, companies are invited to provide their views by Jan. 28th (Thursday), 2021, 12:00 UTC.
- In phase 2, the corresponding summary report, CRs, and draft reply LS will be provided. Any comments on the CRs and draft reply LS are invited to be provided by Feb. 4th (Thursday), 2021, 12:00 UTC.

Hopefully, RAN2 can output agreeable 38.306/321/331 CRs related to the Rel-16 PUSCH skipping feature in this meeting. Otherwise, the corresponding RAN1 correction CR (i.e. R1-2009687) on PUSCH scheduling will not be approved in the RAN plenary again due to a lack of packeted RAN2 CRs. What's worse, not only the dynamic PUSCH skipping feature but also the whole Rel-16 URLLC Intra-UE prioritization feature can not be implemented based on the PHY spec in the next version.

2 Participants

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3 Discussion

In the previous RAN2#112-e meeting, RAN2 had noted the RAN1 LS (i.e. R1-2007338) regarding DG PUSCH skipping (also namely dynamic UL skipping), After an offline discussion, the corresponding agreements are achieved as follows [1],

[016] Ph1 General agreements:

- ⇒ RAN2 confirms that a new UE capability is introduced for Rel-16 dynamic UL skipping.
- ⇒ RAN2 assumes the field name of the new UE capability is *skipUplinkTxDynamic-r16*.

- ⇒ RAN2 assumes that the following is introduced for the field description of the new UE capability (this version is preliminary and the wording may be further updated):
Indicates whether the UE supports skipping UL transmission for a dynamic uplink grant indicated on PDCCH only if no data is available for transmission and no UCI to be multiplexed on the corresponding PUSCH of the uplink grant as specified in TS 38.321 [8].
- ⇒ RAN2 assumes the Rel-16 dynamic UL skipping is per UE level. FFS whether it is mandatory.
- ⇒ RAN2 assumes the Rel-16 dynamic UL skipping is FDD/TDD differentiation.
- ⇒ RAN2 assumes the Rel-16 dynamic UL skipping is not FR1/FR2 differentiation.
- ⇒ The legacy capability bit (i.e. *skipUplinkTxDynamic*) is not dumified.
- ⇒ A new RRC parameter is introduced to enable Rel-16 dynamic UL skipping. FFS the field name.
- ⇒ The corresponding 38.321/331/306 CR and reply LS for Rel-16 dynamic UL skipping should be done along with the CG case.

3.1 Capability aspects of Rel-16 DG PUSCH skipping

In the previous RAN2#112-e meeting, there was an FFS left that whether the Rel-16 dynamic UL skipping feature is mandatory.

According to the following text quoted from the TR 38.822 [3], we can know that legacy DG PUSCH skipping feature has become mandatory since Rel-16.

Features	Index	Feature group	Components	Need of FDD/TDD differentiation	Need of FR1/FR2 differentiation	Mandatory/Optional
3. MAC	3-6	Skipping UL transmission	1) Skipping UL transmission for dynamic UL grant 2) Skipping UL transmission for configured UL grant	1) Yes 2) No	No	1) Optional with capability signalling. Mandatory with capability signalling from Rel-16 2) Conditional mandatory if the UE supports configured grant

Considering that the new-defined DG PUSCH skipping feature is directly inherited from the Rel-15 feature, thus, rapporteur thinks it might be natural to set the Rel-16 DG PUSCH skipping as mandatory.

Q1: Do companies agree to make Rel-16 DG PUSCH skipping feature mandatory?

Company	Yes/No	Detailed comments
vivo	Yes	We can take the legacy feature as a reference and make it mandatory, which matches the conclusion made in RAN#80.
HW	No	Note that the legacy DG UL skipping feature has been captured as Optional since the origin of Rel-16. Given that the UL skipping behaviour is dramatically different from the legacy and the late stage (from v16.4.0), we share the concerns as most UE vendors that it should be Optional.
Ericsson	Yes	As the legacy dynamic UL skipping is basically not implementable, Ericsson thinks that this updated dynamic UL skipping feature should follow what has been agreed previously. Note that the legacy DG UL skipping was not correctly captured in Rel-16, since the RAN plenary conclusion was missed in the Rel-16 CR discussion. Lastly, to be precise, this is mandatory with capability signalling.

Apple	No	The RAN#80 agreement to make UL skipping mandatory in Rel-16 is based on the Rel-15 UL skipping functionality. The Rel-15 UL skipping feature is now considered broken and we will have an extended set of sub-features in Rel-16, hence the earlier assumption no longer quite applies. At this point in time we don't think the Rel-16 UL skipping feature has reached sufficient maturity for a mandatory feature, as additional aspects need to be considered (for example TB repetitions). RAN2 should first stabilize UL skipping for Rel-16 and then review the RAN#80 decision at a later point in time.
Xiaomi	No	The Rel-16 UL skipping covers more cases than the Rel-15 UL skipping. The extra complexities for the Rel-16 UL skipping would require more implementation efforts, which should not be mandated for the UE.
OPPO	No	At least till now, we do not see any requirement to set R16 skipping feature as mandatory.

Conclusion:

TBD

3.2 Rel-16 CG PUSCH skipping

In the RAN1 LS [2] regarding CG PUSCH skipping with UCI, RAN2 is kindly requested to introduce a new capability to differentiate the new UE behavior of CG PUSCH skipping with UCI. Therefore, we need to consider whether to introduce a new UE capability for CG PUSCH skipping.

Amongst all the contributions [4]-[16] talking about the PUSCH skipping with UCI, views (e.g. proposals) on the capability of Rel-16 CG PUSCH skipping are summarized as follows,

Contribution Number	Views
R2-2100138	RAN2 confirms that a new UE capability is introduced for Rel-16 CG PUSCH skipping.
R2-2101794	Add new UE capabilities to indicate whether the UE supports skipping of UL transmission for a dynamic grant and a configured grant if no data is available for transmission.
R2-2100340	Introduce only one UE capability along with only one RRC parameter to enable Rel-16 UL skipping feature applied for both configured grant and dynamic grant.
R2-2101776	RAN2 assumes that a new UE capability is introduced for Rel-16 dynamic UL skipping for configured grant with the field name of <i>skipUplinkTxDynamic-CG-r16</i> .
R2-2101352	Introduce two new capabilities to indicate the support of the uplink skipping enhancement for CG and DG.

Based on the input contributions, the majority view is that a new capability should be introduced for Rel-16 CG PUSCH skipping. So rapporteur proposes that a new UE capability is introduced for Rel-16 CG PUSCH skipping. Please companies to provide feedback on this.

Q2: Do companies agree to introduce a new UE capability for Rel-16 CG PUSCH skipping?

Company	Yes/No	Detailed comments
vivo	Yes	Take Rel-15 NR as the baseline, we think it is natural to separately introduce capabilities for DG PUSCH skipping and CG PUSCH skipping, considering the detailed attributes/execution timeline of these two features can be different.
HW	Yes	RAN1 is still discussing the repetition case for CG, so it would be more future-proof to have a dedicated UE cap for CG UL skipping in addition to DG.
Ericsson	No	Ericsson prefers one UE capability for Rel-16 UL skipping feature, to avoid the feature fragmentation and the complexity that it brings. This feature is more related with the UL skipping itself and there is no need for differentiation between configured grant and dynamic grant. The network needs both features to work to alleviate the blind decoding complexity associated with grant skipping that has UCI-multiplexed. From the UE point of view, there does not seem to have any significant implementation challenges to support both dynamic grant and configured grant simultaneously. If one checks the legacy intention, CG/DG are meant to be mandatory. For CG, it is conditional mandatory if UE supports CG; for DG, it is mandatory with capability bit from Rel-16. There is no intention to have them separately supported. Lastly, it is typically understood that one feature group corresponds to one capability bit and in this case, it is the MAC feature group 3-6. For more complicated scenarios like repetition and others, it is okay for Ericsson to further discuss if a separate capability on the top of this common one is needed or not.
Apple	Yes	Considering that the legacy CG skipping behavior differs from what is envisioned for Rel-16 we think a new UE capability is required for CG PUSCH skipping in Rel-16. We also agree to the suggestion from RAN1 in that respect. Furthermore, we think that a common capability for both DG and CG would complicate the Rel-16 UL skipping feature due to its added implications.
Xiaomi	Yes	From our understanding, the Rel-15 CG uplink skipping would be quite different compared with the Rel-15 CG uplink skipping which requires to create a dummy MAC PDU for the UCI. Then a separate capability for the Rel-16 CG uplink skipping is anyway needed.
OPPO	Yes	The case in R16 CG skipping is much different from the one in R15, it is better to have a separate capability.

Conclusion:**TBD**

If the company's answer to Q2 is Yes, the next coming questions are to discuss attributes of the new UE capability for Rel-16 CG PUSCH skipping.

Q3: What are companies' preferences on the attribute of the new UE capability for Rel-16 CG PUSCH skipping (e.g. Per UE, M, not FDD-TFF DIFF, not FR1-FR2 DIFF)?

Company	Response				Detailed comments														
	Per	M	FDD-TDD DIFF	FR1-FR2 DIFF															
vivo	UE	Yes	No	No	We prefer to take the legacy CG PUSCH skipping feature as a reference, which is shown in the following, according to TR 38.822. <table><tr><th>Features</th><th>Index</th><th>Feature group</th><th>Components</th><th>Need of FDD/TDD differentiation</th><th>Need of FR1/FR2 differentiation</th><th>Mandatory/Optional</th></tr><tr><td>3. MAC</td><td>3-6</td><td>Skipping UL transmission</td><td>1) Skipping UL transmission for dynamic UL grant 2) Skipping UL transmission for configured UL grant</td><td>1) Yes 2) No</td><td>No</td><td>1) Optional with capability signalling. Mandatory with capability signalling from Rel-16 2) Conditional mandatory if the UE supports configured grant</td></tr></table>	Features	Index	Feature group	Components	Need of FDD/TDD differentiation	Need of FR1/FR2 differentiation	Mandatory/Optional	3. MAC	3-6	Skipping UL transmission	1) Skipping UL transmission for dynamic UL grant 2) Skipping UL transmission for configured UL grant	1) Yes 2) No	No	1) Optional with capability signalling. Mandatory with capability signalling from Rel-16 2) Conditional mandatory if the UE supports configured grant
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HW	UE	No	Y?	No	No strong view, but it would be simple to align with DG with respect to the attributes.														
Ericsson					As the answer is No in the previous question, Ericsson’s view here is that CG/DG should be aligned.														
Apple	UE	No	No	Yes	The Rel-16 UL skipping enhancement is based on L1 UCI determination. Since the UCI may contain the HARQ-ACK/CSI in another CC with different SCSs in CA mode, and the UE capability of the HARQ feedback timing is different for FR1 and FR2, the UL skipping enhancement capability should be differentiated for FR1/FR2. In addition, due to the different feedback timing, from the testing perspective, the FR specific capability is also required.														
Xiaomi	UE	N	N	N?	More inputs from RAN1 is probably needed. If some FR2 specific UCI is to be considered, maybe we should have FR1-FR2 differentiation.														
OPPO	UE	No	Yes	No	We prefer to align it with the attributes for DG, unless any issues are found.														

Conclusion:

TBD

For the Rel-16 DG PUSCH skipping feature, it was agreed in the previous RAN2#112-e meeting that a new RRC was introduced to enable Rel-16 DG UL skipping, which helps to distinguish between Rel-15 and Rel-16 UE behavior, and provide more flexibility for network control.

If a new capability for Rel-16 CG PUSCH skipping is introduced, generally, the same logic might be also applied. Amongst all the contributions [4]-[16], views (e.g. proposals) on the RRC parameter for Rel-16 CG PUSCH skipping are summarized as follows,

Contribution Number	Views
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R2-2100138	A new RRC parameter is introduced to enable Rel-16 CG PUSCH skipping.
R2-2101793	Add enable flags and new UE capabilities to indicate whether the UE supports skipping of UL transmission for a dynamic grant and a configured grant if no data is available for transmission.
R2-2100340	Introduce only one UE capability along with only one RRC parameter to enable Rel-16 UL skipping feature applied for both configured grant and dynamic grant.
R2-2101776	RAN2 assumes that a new RRC parameter is introduced to enable Rel-16 dynamic UL skipping for configured grant with the field name of <i>skipUplinkTxDynamic-CG-16</i> .
R2-2101352	Introduce two parameters to enable/disable the enhanced uplink skipping feature for CG and DG separately.

Based on the input contributions, the majority view is that a new RRC parameter should be introduced for Rel-16 CG PUSCH skipping. So rapporteur proposes that a new RRC parameter is introduced for Rel-16 CG PUSCH skipping. Please companies to provide feedback on this if their answer to Q2 is Yes.

Q4: Do companies agree to introduce a new RRC parameter to enable Rel-16 CG PUSCH skipping?

Company	Yes/No	Detailed comments
vivo	Yes	A new RRC parameter is needed to indicate whether the Rel-16 CG PUSCH skipping is implemented. Otherwise, it is hard for the UE to distinguish whether to perform the Rel-15 behavior or the Rel-16 behavior, leading to potential misalignment between UE and NW.
HW	Yes	Agree as in R2-2101776
Apple	Yes	In order to achieve configuration flexibility, UL skipping for CG and DG should be configured via a different parameters separately, as indicated in our contribution in R2-2101352.
Xiaomi	Yes	
OPPO	Yes	

Conclusion:

TBD

3.2 Rel-16 PUSCH skipping with Intra UE prioritization

In the RAN1 LS [2][17], all the UE behaviors for Rel-16 DG/CG PUSCH skipping are defined under the conditions that Rel-16 URLLC Intra-UE prioritization (including PHY layer prioritization and LCH-based prioritization) is not configured. Thus, it is worthy for RAN2 to discuss whether the defined UE behaviors are still reasonable and acceptable when LCH-based UE prioritization is configured.

In [15], it is proposed that RAN2 should firstly handle the case when LCH-based prioritization is not configured and overlapping PUSCH transmissions have two PHY priorities with UCI, as depicted in the following figure 1. And it held a view that there is no need to consider PHY priority in the MAC grant prioritization procedure considering that the Rel-16 function had been stable and an overhaul of the grant prioritization in terms of the PHY-defined procedure and MAC-defined procedure should be avoided. In other words, from the MAC perspective, DG is always prioritized over CG when *lch-basedPrioritization* is not configured. As a result, the CG PUSCH is ignored (i.e. no MAC PDU will be generated even though it is overlapping with UCI) and does not participate in subsequent physical layer procedure.

On the other hand, in [11], a concern is raised that it is not reasonable to let an empty DG PUSCH override over CG PUSCH with data. Besides, it proposes that UE should select CG when CG has available data but DG has not in CG&DG overlapped case.

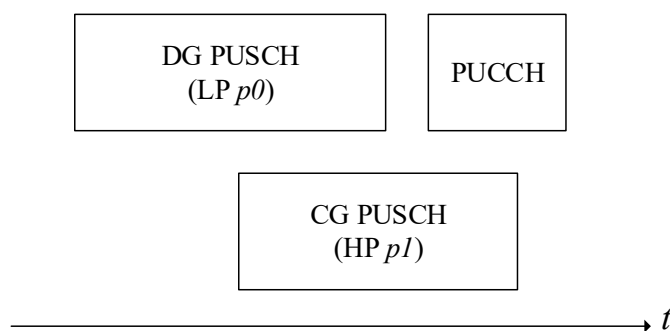


Figure 1 overlapping PUSCH transmissions have two PHY priorities with UCI

Q5: Do companies agree that DG always overrides CG when LCH-based prioritization is not configured (i.e. no MAC spec change is needed)?

Company	Yes/No	Detailed comments
vivo	Yes	No further enhancements for Rel-16.
HW	Yes	Agree with the analysis from the rapporteur. No change is needed to MAC spec and it is the consequence of the existing procedure.
Ericsson	Yes	The concern of the other alternative proposal is that it contradicts the intention in the LS R2-2100028
Apple	No	When LCH-based prioritization is not configured and CG and DG overlap, regardless of whether single or multiple PHY priority levels are used, if the CG has data available but the DG has not, based on the current specification the UE transmits padding in the MAC PDU together with the UCI over the DG and does not select the CG transmission. From transmission efficiency perspective the problematic case shown in Figure-2 of [11] should be avoided and UL grant selection should take the available data into account.

		Furthermore, when different PHY priority levels are used for the UL transmission as in the rapporteur example above, the DG might be restricted to a single PHY priority through LCP restriction allowedPHY-PriorityIndex-r16. Here a potential problem exists when a LCH is mapped to DGs of low PHY priority only and there is no data available for this LCH while another LCH mapped to an overlapping CG (and mapped to DGs of high PHY priority only) has data available. Then if the DG (of low PHY-priority) is meant to carry UCI and cannot be skipped, the data available on the overlapping CG cannot be sent due to the DG taking precedence over the CG, according to the fallback to Rel-15 behavior when LCH-basedPrioritization is not configured.
Xiaomi	Yes	The gNB knows the CG occasion. The dynamic grant overriding the CG would be most likely that the gNB wants to schedule a dynamic grant for the URLLC data. It is rare that the gNB blindly schedules a dynamic grant to override a CG without knowing whether a URLLC data arrives.
OPPO	Yes	No enhancement is needed for this case.

Conclusion:

TBD

Before going into the details of UE behaviors for Rel-16 DG/CG PUSCH skipping with LCH-based UE prioritization, it might be better to first clarify the understanding of the current MAC spec with LCH-based UE prioritization. Rapporteur understands that the main preparation steps for the generation of the MAC PDU to be transmitted on DG/CG PUSCH are given as follows,

- 1) The MAC entity receives the UL grants including both dynamic grants and configured grants;
- 2) The MAC entity delivers the UL grants and the associated HARQ information to the HARQ entity;
- 3) The MAC entity determines whether a dynamic grant/configured grant is a prioritized uplink grant;
- 4) The corresponding HARQ entity instructs the multiplexing and assembly entity for the prioritized uplink grant;
- 5) Then the multiplexing and assembly entity performs the Logical Channel Prioritization (LCP), logical channel (LCH) selection, and resource allocation procedures (including determining whether the PUSCH skipping conditions are met or not);
- 6) The corresponding HARQ entity obtains the MAC PDU to transmit from the multiplexing and assembly entity;
- 7) The corresponding HARQ entity triggers a new transmission.

It is the rapporteur's understanding that the LCH-based prioritization mechanism takes precedence over the PSUCH skipping conditions. In other words, even though the new Rel-16 PUSCH skipping conditions are introduced to MAC spec, the MAC entity will not generate a MAC PDU for a deprioritized uplink grant even though its associated PUSCH is overlapping with PUCCH.

Q6: Do companies agree with the understanding that LCH-based prioritization mechanism takes precedence over the PSUCH skipping conditions according to the existing MAC spec?

Company	Yes/No	Detailed comments
vivo	Yes	We agree with the above view.
HW	Yes	We share the view from rapporteur and don't prefer to revisit the LCH-based prioritization in Rel-16 at this late stage. But it can be

		further discussed in Rel-17 in the context of intra-UE multiplexing where high priority UCI may be multiplexed on low priority data, in order to achieve a optimal solution of intra-UE from system performance perspective.
Ericsson		Although Ericsson agrees that this is what the MAC spec has been written, it is Ericsson's view that "the MAC spec <u>can also easily support</u> that the UL-skipping condition related with UCI takes precedence over the LCH-based grant prioritization."
Apple	See comment	We agree with the above rapporteur understanding on the procedure and steps for creation of a MAC PDU in the current MAC spec. However, while LCH-based prioritization takes precedence and happens before LCP and MAC PDU creation, RAN2 should try to accommodate the requirement from RAN1 while limiting the impact to both UL interference and gNB complexity. The case where UCI is to be multiplexed in an UL transmission requires a balance between a) '<i>always generating a MAC PDU</i>' (i.e., no skipping, no matter what's the LCH priority and regardless whether or not there is data available) and b) '<i>always giving full precedence to LCH-based prioritization</i>' as per the current MAC spec.
Xiaomi	Yes	We understand that always letting the LCH-based grant prioritized precedence over the UCI may not be optimum. However we also do not see a big issue with such approach. Maybe this can be discussed in the Rel-17 IIOT if companies consider some enhancements are needed.
OPPO	Yes	We agree with rapporteur's understanding.

Conclusion:

TBD

Next, we come to discuss the UE behavior of PUSCH skipping when *lch-basedPrioritization* is configured.

[4][10] propose the MAC entity does not generate a MAC PDU for a deprioritized uplink grant (i.e. DG and CG) when its associated PUSCH is overlapping with PUCCH (i.e. no spec change on the LCH-based prioritization mechanism). The basic intention is to reduce the spec impact and keep the general principle of the current LCH-based prioritization mechanism that data of higher priority should be prioritized over data of lower priority. Taking Figure 2 as an example, the MAC entity firstly performs the LCH-based UE prioritization procedure at the T1 moment, prioritizing the DG and deprioritizing the CG. As the CG is a deprioritized UL grant, the multiplexing and assembly entity will not be called. Consequently, no MAC PDU will be generated for the CG PUSCH even though there is a PUCCH overlapping with the CG PUSCH. From the PHY layer perspective, the UE transmits the DG PUSCH and the PUCCH (if timeline permits). On the NW side, once successfully decoded the DG PUSCH, it can know that the CG PUSCH is deprioritized and will detect the UCI on the PUCCH.

On the contrary, [15][16] propose that a UCI-to-be-multiplexed grant should be prioritized even though no data is available. Otherwise, the gNB needs to blindly decode two hypotheses in each serving cell, i.e., one hypothesis is that UCI is multiplexed on CG PUSCH and another hypothesis is that the UCI is transmitted on PUCCH, which may highly increase the complexity of network detection in CA case. Taking Figure 2 as an example, the MAC entity should first prioritize the CG grant (e.g. with the highest priority) at the T1 moment,

then the DG will be deprioritized. Finally, the UE can multiplex the UCI on CG PUSCH and transmit the CG PUSCH. On the network, double-decoding is not needed for the UCI.

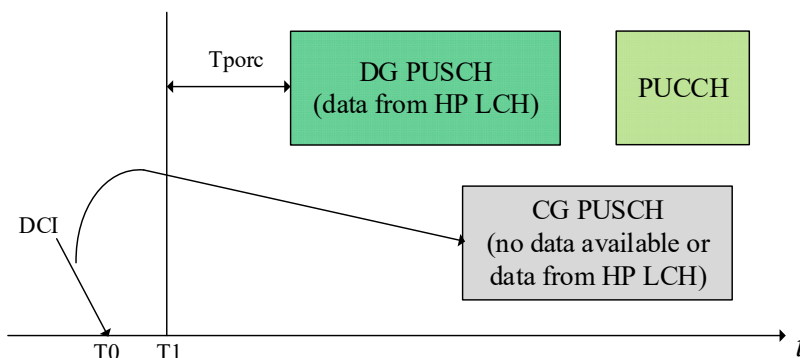


Figure 2. PUSCH overlapping with PUCCH with LCH-based prioritization

Rapporteur thinks this is hard to conclude since both options are feasible and have their advantages. Anyway, a decision is needed and other potential options are not precluded for now. So the rapporteur thinks the following options can be considered:

- **Option 1:** The MAC entity does not generate a MAC PDU for a deprioritized uplink grant even when its associated PUSCH is overlapping with PUCCH (i.e. no spec change on the LCH-based prioritization mechanism).
- **Option 2:** Prioritize the uplink grant for which there is UCI to be multiplexed (i.e. spec changes on the LCH-based prioritization mechanism is needed).
 - Option 2.1: the highest priority can be used for a UCI-to-be-multiplexed grant;
 - Option 2.2: network configurable priority adjustment (e.g. different priorities for PUSCH with data of lower priority and empty PUSCH);
 - FFS other options.
- **Option 3:** ...

Q7: What are companies' preferences?

Company	Which option(s) do you prefer?	Detailed comments
vivo	Option 1	If option2 is adopted, the MAC may prioritize an empty PUSCH (e.g. no data available) overlapping with a HARQ feedback for data of low priority over a PUSCH with data of higher priority. The general principle of Intra-UE prioritization would be broken, which definitely requires a lot of discussion on the new principle and spec polishment. We think it is too late for Rel-16. For simplicity, we prefer Option1. Other enhancements can be further discussed in Rel-17 IIoT/URLLC WI.
HW	Option1, but	Again, we prefer not to revisit the LCH-based prioritization in Rel-16 at this late stage, and any optimization can be discussed in Rel-17. But we understand RAN1 is discussing the issue in parallel, so it would be good to indicate our RAN2 assumption to RAN1 a.s.a.p to avoid back and forth discussions. The most issential work in this meeting is to approve the package of RAN2 CRs to make UL skipping feature work together with RAN1 CRs.
Ericsson	Optoin 2.1	As the raportuer concludes, both options are feasible. Option 2.1 has very little spec impacts as shown in the Ericsson's TP.

		@Vivo: The case indicated might not happen, since in that case the empty PUSCH should have the low PHY priority and the other PUSCH should have the high PHY priority. Even though the low PHY priority PUSCH grant has UCI multiplexed on it, according to the MAC spec, it cannot be transmitted due to overlapping with another high PHY priority grant and thus discarded. There are numerous other corner cases discussed in RAN1. @HW: Option 2.1 is not revisiting the LCH-based prioritization. It is more a harmonization of the features between PHY and MAC. More importantly, in the LS R2-2100026, it is written that RAN1 is further discussing the issues. It is preferable not to have parallel discussions in both groups. When the MAC entity is configured with <i>lch-basedPrioritization</i>, for the collision scenario between CG and DG with same/different PHY-priority index, and when there is collision between PUCCH and the CG with the same priority and/or there is collision between PUCCH and the DG with the same priority, RAN1 is still discussing the related PHY layer behaviour. If consensus cannot be reached, Ericsson is fine to leave this to RAN1 with the indication that both options are feasible from Ran2 point of view. Ericsson also wonders the urgency to submit the CRs to the next RAN plenary, since, in addition to this intra-UE features, there is a further discussion on the repetition. Thus, the submitted CRs would anyhow not be complete.
Apple	Conditional LCH priority adjustment	The network can configure through RRC a LCH priority adjustment applicable to UL grants with multiplexed UCI. As a result, UL grants with multiplexed UCI get a higher probability to become the prioritized grant. Since the priority adjustment happens before LCH-based prioritization, the change to the MAC spec is simple. The process of LCH-based prioritization itself is not changed. All that is required is a reference to the new RRC parameter indicating the rule used to adjust the LCH priority. Our preference is Option1a-Alt-2 described in section 3.2 of [16] where the network configures a priority adjustment for HARQ-ACK and CSI. Alternatively Option1-Alt-2 is possible as well. If these two solutions are not agreeable then Option2 or Option3, which are also listed in [16], are further possibilities (in this order). Note: If an UL grant with multiplexed UCI generally gets the highest LCH priority (like in Option 2.1), the UE ends up transmitting more 'empty' PUSCH with multiplexed UCI (but no data) while overlapping PUSCH (with data) is not transmitted. This would increase power consumption for the UE and raise UL interference for the network.

		We agree with Ericsson that the urgency to submit CRs to the RAN plenary is questionable due to the ongoing discussions in RAN1 and the need for additional aspects to be addressed in the UL skipping design (such as TB repetitions, and additional corner cases). We prefer a complete solution rather than a quick fix.
Xiaomi	Option 1	We share the same view with Huawei. The potential enhancements can be discussed in the Rel-17 IIOT.
OPPO	Option 3 (i.e. Wait for RAN1 progress) or Option 1	RAN1 is now discussing the same issue in parallel in the email discussion [104-e-NR-L1enh-URLLC-06]. Considering UCI multiplexing issue is triggered by RAN1 and it is better to avoid parallel discussion between RAN1 and RAN2, our first preference is to wait for RAN1 input firstly. If majorities want to make a decision in RAN2, we agree with Huawei and Xiaomi, i.e. not to revisit the LCH-based prioritization at this late stage in Rel-16, and any optimization can be discussed in Rel-17. So. our second preference is Option 1.

Conclusion:

TBD

3.3 Other potential impacts/enhancements

Last but not least, companies can provide their comments on the remaining issues of Rel-16 PUSCH skipping if they are not covered by this discussion.

Q8: Are there any additional comments on the remaining issues of Rel-16 PUSCH skipping?

Company	Yes/No	Detailed comments
vivo	Yes	Regarding the PUSCH repetition/aggregation impacts, we can wait for more RAN1 input and maybe discuss the potential RAN2 impacts in round 2 based on the RAN1 LS (if any).
HW	Yes	Agree with vivo.

Conclusion:

TBD

3 Conclusion

The contribution is summarized as follows,

4 References

- [1] RAN2 112-e Chairman Notes EOM Corr w ChMark 2020-11-17.
- [2] R2-2100028, LS on PUSCH skipping with UCI in Rel-16, vivo.
- [3] 3GPP TS 38.822, User Equipment (UE) feature list, V15.0.1.
- [4] R2-2100138, Remaining Issues on PUSCH Skipping with UCI in Rel-16, vivo.
- [5] R2-2100524, Draft Reply LS on PUSCH skipping with UCI in Rel-16, vivo.
- [6] R2-2100218, Correction for DG and CG UL skipping with UCI overlap, CATT.
- [7] R2-2101793, Correction on CG-DG skipping capabilities and configuration when PUCCH with UCI overlaps with PUSCH, CATT.
- [8] R2-2101794, Correction on CG and DG skipping capabilities when PUCCH with UCI overlaps with PUSCH, CATT.
- [9] R2-2100340, UL PUSCH skipping without intra-UE prioritization, Ericsson.
- [10] R2-2101776, Updates to RAN2 aspects of PUSCH with UL skipping, Huawei, HiSilicon.
- [11] R2-2101352, RAN2 Impact on UL Skipping Enhancement, Apple.
- [12] R2-2101377, MAC CR on UL skipping enhancement, Apple.
- [13] R2-2101378, RRC CR on UL skipping enhancement, Apple.
- [14] R2-2101456, UE capability on UL skipping enhancement, Apple.
- [15] R2-2100341, UL PUSCH skipping with Intra-UE prioritization, Ericsson.
- [16] R2-2100855, UL skipping and intra-UE prioritization, Apple.
- [17] R1-2007338, LS on PUSCH with UL skipping, vivo.