**3GPP TSG-RAN WG2 Meeting #113-e *R2-210xxxx***

**Online, 25 January–5 February 2021**

**Agenda item: 6.1.3**

**Source: Qualcomm**

**Title: Report of [AT113-e][020][NR16] MAC PH type (Qualcomm)**

**Document for: Discussion and Agreement**

# 1 Introduction

This is to report the result of the following email discussion in RAN2#113-e Meeting [1].

* [AT113-e][020][NR16] MAC PH type (Qualcomm)

Scope: Treat R2-2100734, R2-2100314, R2-2100733, R2-2101777

Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.

Intended outcome: Report and Agreed CRs.

Deadline: Schedule A

# 2 Contact Information

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Qualcomm | Linhai He (linhaihe@qti.qualcomm.com) |
| Huawei, HiSilicon | Chong Lou (louchong@huawei.com) |
| Nokia | Chunli Wu (Chunli.wu@nokia-sbell.com) |
| Ericsson | Mats Folke (mats.folke@ericsson.com) |
| Samsung | Jaehyuk Jang (jack.jang@samsung.com) |
| ZTE | Dong fei (dong.fei@zte.com.cn) |
| vivo | Yitao Mo (yitao.mo@vivo.com) |
| Apple | Fangli XU (fangli\_xu@apple.com) |
| Xiaomi | Yumin Wu (wuyumin@xiaomi.com) |
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# 3 Discussion

## 3.1 Timeline for PH type determination

[R2-2100314](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2100314.zip) Correction to timeline for determining PH type Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, Apple, Ericsson CR Rel-16 38.321 16.3.0 1012 - F TEI16

In legacy, transmission time of PHR MAC CE and type of PH (real or virtual) are determined when the first PDCCH for UL grant is recevied after the PHR is triggered. At time of that determinition, if a serving cell has a PUSCH Tx scheduled in that slot, UE reports real PH value for that cell. Once that decision (i.e. whether to report real or virtual PH) is made, PH type for a cell does not change even if later UE is scheduled with a new UL grant or no longer performs PUSCH Tx on a serving cell (e.g. due to UL cancelation). From system’s perspective, this UE behavior is not desirable because UE reports false PH information to network. The proposed change is that UE determines PH type at the moment right before (e.g. Tproc,2 prior) the PUSCH Tx in which PHR MAC CE is sent, because after that point all new UL grants scheduled in that slot will be ignored. This enhancement would enable network to obtain more accurate PH values than legacy for its power control. On the UE side, it would align UE’s timeline for PH type determination between dynamic grant and configured grant, which can help simplify UE’s implementation of PHR procedure.

**Q1: Please provide your view on whether this enhancement should be adopted.**

|  |  |  |
| --- | --- | --- |
| Company | Agree as is; Agree with changes; Disagree | Detailed Comments |
| Qualcomm | Agree as is |  |
| HW | Disagree | We understand the intention of this CR and it was indeed heavily discussed back in Rel-15 regarding the timeline of PHR type determination. Note that it is still under discussion in RAN1 in context of UL cancellation and skipping. So we would like to avoid the back and forth corrections again and think the timeline issue should be up to RAN1 as how to calculate the PH value is in RAN1 scope.  In addtion, from RAN2 perspective, we are still not convinced by the text proposal as it cannot address the issue indeed. According to the current PHR procedural text, as long as MAC entity has UL resource for one cell, the real PH with corresponding Pcmax shall be reported as follows regardless of timeline, more details can be found in [R2-2101777](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2101777.zip)  4> if this MAC entity has UL resources allocated for transmission on this Serving Cell; or  4> if the other MAC entity, if configured, has UL resources allocated for transmission on this Serving Cell and *phr-ModeOtherCG* is set to *real* by upper layers:  5> obtain the value for the corresponding PCMAX,f,c field from the physical layer.  Therefore, we are concerned about the complexity for UE and MAC spec as the MAC entity need to check the UL skipping and cancellation when determining the PH type and it is missing from the MAC spec. Given the potential complexity but marginal benefit, we are not okay to revisit the timeline issue in RAN2, but we can further discuss the UL skipping in RAN2 as in [R2-2101777](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2101777.zip) |
| Nokia | Agree as is |  |
| Ericsson | Agree as is |  |
| Samsung | Disagree | We share the view with Huawei: the proposal can be considered as an optimization, and is not essential either. It gives additional requirement to the UE, and may also require additional capability and signalling in SIB, as stated below, which we want to avoid. |
| ZTE | Disagree | First of all, it is true that the scenario mentioned in the CR is existing, and the current spec is clearly the time point of determining the value type:  The MAC entity determines whether PH value for an activated Serving Cell is based on real transmission or a reference format by considering the configured grant(s) and downlink control information which has been received until and including the PDCCH occasion in which the first UL grant for a new transmission that can accommodate the MAC CE for PHR as a result of LCP as defined in clause 5.4.3.1 is received since a PHR has been triggered if the PHR MAC CE is reported on an uplink grant received on the PDCCH or until the first uplink symbol of PUSCH transmission minus PUSCH preparation time as defined in clause 7.7 of TS 38.213 [6] if the PHR MAC CE is reported on a configured grant.  In this paragraph, for determining the value type, there are two steps UE should go:   * STEP 1: To determine the first PUSCH for new transmission which is able to carry the PHR MAC CE as a result of the LCP * STEP 2: if STEP 1 is done, then determine the value type based on the time point of reception of related DCI, that’s why we use ‘in which’ in the highlighted sentence.   For the first possible scenario, another DCI is received after the first DCI reception as shown below:    It is not rational that we will use the PUSCH#1 for sending the PHR MAC CE, but the value type is determined based on the DCI for PUSCH#2 transmission since the PUSCH#2 do not carry the PHR MAC CE at all.  For the second possible scenario as mentioned in CR, the PUSCH transmission would be canceled by the DCI, as shown below:  In this case, by following the principle of the current spec,the PUSCH#1 cannot be sent and the triggered PHR MAC CE shall wait for the next available PUSCH, and determined the value type based on the DCI of the next available PUSCH.  So, we think the CR is not needed. |
| vivo | No strong view | In the previous RAN1#103-e meeting, the RAN1 URLLC feature lead suggested companies discussing the timeline change in RAN2 since the legacy timeline is agreed in RAN2#100 meeting. So we think it is okay to discuss this issue in RAN2.  Technically we can see some benefit in the case when the DG is skipped, resolving the PHR false issue. However, our biggest concern is about the spec impact in both RAN1 and RAN2. So we don’t have a strong view on this issue and can follow the majority view. |
| Apple | Agree as is | With this change, the PH info is more accurate and aligned with the actual transmission power distribution more than legacy behavior.  The capability and configuration can be used to resolve the inter-operability issue. |
| LG | Disagree | Same view as Huawei and Samsung |
| Xiaomi | Disagree | We share the same view with Huawei. |
| OPPO | Disagree | We think 1st issue is valid. In 2nd case, if cancelled PUSCH supposes to carry PHR MAC CE, then cancellation result in no PHR report hence it doesn’t matter how to determine real or virtual PHR. If cancelled PUSCH doesn’t carry PHR MAC CE, then UE should still report real PHR. A later DCI is possible when URLLC feature is configured and both will result in a “false” PHR value. If companies can accept the impact of cancellation we don’t understand why resolvement of 1st issue is so important. |

**Conclusion:**

**TBD**

If the change to PH type determination proposed in [R2-2100314](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2100314.zip) is adopted in Rel-16, there may be interoperability issue for networks in the following two cases:

1. Initially both PUSCH and SRS are scheduled in the same slot but later a PUSCH is canceled;
2. Initially only SRS is scheduled on a carrier but later a PUSCH is scheduled in the same slot on that carrier.

If network implements the change but UE does not, in Case #1 a legacy UE would report type-1 PH but an enhanced network would think it is type-3. In Case #2 a legacy UE would report type-3 PH but an enhanced network would think it is type-1.

If UE implements the change but network does not, in Case #1 an enhanced UE would report type-3 PH but a legacy network would think it is type-1 PH. In Case #2 an enhanced UE would report type-1 PH but a legacy network would think it is type-3.

To handle the potential interoperability issues describe above, the following two CRs propose to have UE report via UE capability signaling whether it implements the enhancement and network advertise in system information whether it supports the enhancement:

[R2-2100733](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2100733.zip) UE capability for enhanced PHR timeline Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, Apple, Ericsson CR Rel-16 38.306 16.3.0 0494 - F TEI16

[R2-2100734](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2100734.zip) Configuration and capability signaling for enhanced PHR timeline Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, Apple, Ericsson CR Rel-16 38.331 16.3.0 2350 - F TEI16

**Q2: If you agree to support the change in Q1, do you agree to introduce a UE capability and a network configuration to support the change?**

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| --- | --- | --- |
| Company | Agree as is; Agree with changes; Disagree | Detailed Comments |
| Qualcomm | Agree as is |  |
| HW | Disagree | Comments as above |
| Nokia | Agree as is |  |
| Ericsson | Agree as is |  |
| Samsung | Disagree | See the response in Q1. |
| ZTE | Disagree | See above comments |
| vivo | No strong view |  |
| Apple | Agree as is |  |
| LG | Disagree | See above comments |
| Xiaomi | Disagree | See above comments |
| OPPO | Disagree | See above comments |

**Conclusion:**

**TBD**

## 3.3 PHR reporting in case of PUSCH skipping

[R2-2101777](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_113-e\Docs\R2-2101777.zip) Discussion on PHR reporting for PUSCH skipping Huawei, HiSilicon discussion Rel-16 TEI16

The issue is whether UE should change the type of PH value it reports when a PUSCH is skipped. It was first discussed in At RAN2#103bis during Rel-15 discussion and the following agreement was made:

|  |
| --- |
| At the time of determination of PH value for a serving cell, the UE MAC assumes real transmissions for all cells with grants even if any grant is skipped |

At the last RAN2 meeting (RAN2#112-e), this issue was discussed again in email discussion [Offline-003] based on R2-2009482. As most companies did not support the change during the discussion, the following agreement was made:

|  |
| --- |
| R2-2009482 Clarification on PHR reporting for PUSCH skipping Apple CR Rel-16 38.321 16.2.1 0929 - F NR\_newRAT-Core, TEI16   * [003] Postponed * [003] The issues can be discussed only for Rel-16 |

It might be worth noting that in the last RAN1 meeting, the issue was also discussed for Rel-16 in the context of URLLC inter-UE prioritization, but without any conclusion. According to the summary of the offline discussion in [2], majority of companies think that RAN1 could follow the RAN2 previous agreements and no additional RAN1 discussion is necessary.

**Agreement**

The TP for TS 38.214 Clause 6.1.4 is endorsed in R1-2009478 (TS38.214, Rel-16, CR#0137, Cat. F)

[103-e-NR-L1enh-URLLC-06] Email discussion/approval on remaining issues on inter-UE multiplexing enhancements – Xueming (vivo)

* Issue 1: Impact to PHR calculation due to UL CI in UL CA and/or UL skipping
* Issue 2: Impact to UE power scaling due to UL CI in UL CA and/or UL skipping
* Discussion and decision by 10/29, TPs by 11/5

The email discussion was closed without any agreements or conclusions.

Based on the above information, it is proposed in R2-2101777 that:

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| --- |
| Proposal: RAN2 confirms that the Rel-15 PHR reporting for UL skipping is applicable to Rel-16 without any RAN2 spec change. |

**Q3: Do you agree that after UE shall always report real PH for a cell scheduled with PUSCH transmission, even if that PUSCH is skipped or canceled?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No/Comment | Detailed Comments |
| Qualcomm | Yes | We prefer to keep the legacy behavior.  On the other hand, we can also support the change to have UE report virtual instead of real PH when a PUSCH is skipped, if this change is supported by **all infra vendors**. |
| HW | Yes | We prefer not to reopen the discussion considering the potential impact to UE complexity and NBC issue. But we are fine with majority if it is considered as “over-restricted” from UE perspective. |
| Nokia | Yes | It’s current behaviour. No need to change. |
| Ericsson | Yes | We would like to keep existing behaviour. |
| Samsung | Yes | - |
| ZTE | Yes | Maintaining of the R15 principle in R16 is good. |
| vivo | Yes | We prefer not to revert the RAN2 agreement (i.e. UE assume the PUSCH to be present for PHR calculation even if the PUSCH is skipped) achieved in RAN2#103 meeting. |
| Apple | Up to UE implementation | Techinically, the PH is to reflect the actual power distribution.  Previous RAN2 agreement was made based on the assumption that UE may not know the UL skipping result on other CCs when performing the LCP and assembling the PHR MAC CE in one CC.  But in some case (as below) UE can know the UL skipping issue when performing the PHR MAC CE assembly. In the example as below, when UE performs LCP and assembles PHR MAC CE according to CC#1 UL grant, UE knows the UL skipping result on CC2. So there is no difficulty for UE to report the virtual PH for CC2 in this case.  **Observation 1: There is no difficulty for UE to report the virtual PH based on UL skipping result in some cases.**    In NW side, we donot see the impact when receiving the virtual PH in the skipping case. In our understanding, NodeB just performs the power scheduling based on the received PH info and will not justify whether it should be real or virtual PH: if it’s the real PH, NodeB will go to find the associated UL grant for the power scheduling, and if it’s the virtual PH, NodeB can directly use the virtual PH to perform the power scheduling. Therefore, we donot see there is any problem in NW side to receive either virtual or real PH.  **Observation 2: Virtual PH reporting in UL skipping case will not impact NodeB power scheduling implementation.**  Based on the UE and NW impact analysis, we think it’s can **up to UE implementation** to report real or virtual PH for the UL skipping case in UL CA. |
| LG | Yes | We prefer to keep the legacy behaviour. |
| Xiaomi | Yes |  |
| OPPO | Yes | We prefer to keep the legacy behaviour. |

**Conclusion:**

**TBD**

# 4 Conclusion

**TBD**

# 5 References

[1] RAN2 113-e Chairman Notes 2021-01-25 0900 UTC