3GPP TSG-RAN WG2 Meeting #109bis-e [R2-200xxxx](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-200xxxx.zip)

Elbonia, 20 – 30 April 2020

**Agenda item: 6.19**

**Source: Nokia (discussion rapporteur)**

**Title: Discussion of MPE contributions in AI 6.19**

**Document for: Discussion and Decision**

# 1 Brief scope of the LTE legacy contributions

This document contains the summary and discussion on documents related to the RAN4 request to handle MPE as shown below:

MPE enhancements FR2

[R2-2002527](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002527.zip) LS on MPE enhancements (R4-1916183; contact: Qualcomm) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2

[R2-2002534](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002534.zip) LS on MPE enhancements (R4-2002916; contact: Nokia) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2

1 doc moved here from 6.20.3.1 :

[R2-2002820](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002820.zip) P-MPR Reporting Apple discussion Rel-16 NR\_RF\_FR2\_req\_enh

[R2-2002684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002684.zip) UE FR2 MPE enhancements and solutions Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_RF\_FR2\_req\_enh

[R2-2002685](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002685.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.331 16.0.0 1515 - B NR\_RF\_FR2\_req\_enh

[R2-2002686](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002686.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.321 16.0.0 0707 - B NR\_RF\_FR2\_req\_enh

[R2-2002687](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002687.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.306 16.0.0 0272 - B NR\_RF\_FR2\_req\_enh

[R2-2002688](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002688.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.300 16.1.0 0210 - B NR\_RF\_FR2\_req\_enh

* [AT109bis-e][041][NR16 Other] MPE enhancements FR2 (Nokia)

Scope: Treat papers above on MPE enhancements FR2

Wanted Outcome: Agreed-in-principle CRs

Deadline: April 28 0700 UTC

# 2 Summary of MPE contributions

## 2.1 LS input from RAN4

RAN 4 has sent two LSs to RAN2 on the MPE as per [1] and [2]. The content of these is summarized below.

|  |  |
| --- | --- |
| **Tdoc(s), Title, Company** | **Summary of content** |
| 1) [R2-2002527](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002527.zip) LS on MPE enhancements (R4-1916183; contact: Qualcomm) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2 | Informs RAN2 that MAC CE signalling from UE to inform network about the FR2 MPE may be needed. |
| 2) [R2-2002534](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002534.zip) LS on MPE enhancements (R4-2002916; contact: Nokia) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2 | Requests to create MAC CE signalling from UE to network according to following:* Event-triggered reporting of FR2 P-MPR level via the MAC CE
* Network-configurable prohibit timer for the MAC CE
* P-MPR reporting range to be confirmed by RAN4 later on
* The reporting mechanism should ensure sufficiently short signalling delays
 |

These seem rather straightforward requests, and although it is clear that RAN4 discussion hasn’t yet concluded on all aspects, there doesn’t seem to be anything blocking from starting the discussion in RAN2 (given that there are also contributions on the topic).

**Observation 1:** RAN4 is requesting RAN2 to define FR2 MPE P-MPR reporting via MAC CE from UE to network.

## 2.2 MPE contributions in RAN2

The contributions in [3] and [4] discuss the general topics, whereas the CRs in [5], [6], [7], [8] illustrate one version of the MPE signalling from UE to network.

1 doc moved here from 6.20.3.1 :

[R2-2002820](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002820.zip) P-MPR Reporting Apple discussion Rel-16 NR\_RF\_FR2\_req\_enh

[R2-2002684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002684.zip) UE FR2 MPE enhancements and solutions Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_RF\_FR2\_req\_enh

[R2-2002685](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002685.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.331 16.0.0 1515 - B NR\_RF\_FR2\_req\_enh

[R2-2002686](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002686.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.321 16.0.0 0707 - B NR\_RF\_FR2\_req\_enh

[R2-2002687](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002687.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.306 16.0.0 0272 - B NR\_RF\_FR2\_req\_enh

[R2-2002688](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002688.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.300 16.1.0 0210 - B NR\_RF\_FR2\_req\_enh

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| --- | --- |
| **Tdoc, Title, Company** | **Proposal(s)** |
| 3) [R2-2002820](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002820.zip) P-MPR Reporting Apple discussion Rel-16 NR\_RF\_FR2\_req\_enh | **Summary:** Proposes to utilize existing PHR MAC CE for FR2 MPE P-MPR reporting, including reusing the existing PHR prohibit timer and allowing only 4 values to be reported.**Exact proposals:****Proposal 1:** Enhance existing single and multiple entry PHR MAC CE to carry the P-MPR information.**Proposal 1a:** In PHR with P-MPR MAC CE, two R bits in the octet of Pcmax.f.c is allowing for P-MPR with 4 different values (exact values will be captured by RAN4 in TS 38.133).**Proposal 2:** Rely on legacy *phr-ProhibitTimer* to control the frequency of the PHR with P-MPR reporting. **Proposal 3:** PHR MAC CE format with P-MPR information should be enabled via RRC signalling.  |
| 4) [R2-2002684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002684.zip) UE FR2 MPE enhancements and solutions Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_RF\_FR2\_req\_enh | **Summary:** Define new MAC CE for FR2 MPE P-MPR reporting, including having a new prohibit timer, per-UE capability and event-triggered condition for sending the MAC CE.**Exact proposals:****Proposal 1:** Define a new UL MAC CE that indicates the FR2 P-MPR exceeds a given threshold due to FR2 MPE limits.**Proposal 2:** FR2 MPE P-MPR reporting events and prohibit timer are specified in MAC specification.**Proposal 3:** FR2 MPE P-MPR reporting is configured per MAC entity but is only applicable for FR2 serving cells.**Proposal 4:** Define event-based FR2 MPE P-MPR reporting in MAC that triggers when P-MPR > P-MPR\_Threshold (MPE event occurs) or when P-MPR < P-MPR\_Threshold (e.g. similar to reportOnLeave for RRM).**Proposal 5:** Define a per-UE capability for FR2 MPE P-MPR reporting, applicable only to FR2 carriers.**Proposal 6:** Endorse the CRs in CRs in [R2-2002688](http://www.3gpp.org/ftp/tsg_ran/wg2_rl2/tsgr2_109bis_e/docs/R2-2002688.zip) (38.300), [R2-2002685](http://www.3gpp.org/ftp/tsg_ran/wg2_rl2/tsgr2_109bis_e/docs/R2-2002685.zip) (38.331), [R2-2002686](http://www.3gpp.org/ftp/tsg_ran/wg2_rl2/tsgr2_109bis_e/docs/R2-2002686.zip) (38.321) and [R2-2002687](http://www.3gpp.org/ftp/tsg_ran/wg2_rl2/tsgr2_109bis_e/docs/R2-2002687.zip) (38.306) as baseline for FR2 MPE P-MPR reporting while waiting for further RAN4 feedback.**Proposal 7:** Continue MPE discussion via email discussion until RAN2#110e. |
| 5) [R2-2002685](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002685.zip), [R2-2002686](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002686.zip), [R2-2002687](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002687.zip), [R2-2002688](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002688.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR | **Proposed CRs**CR content to MAC, RRC, 38.306 and Stage-2 according to the Nokia proposals in [R2-2002684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002684.zip) |

Based on these, it seems there are at least the following questions to be considered in RAN2:

* Whether to create new MAC CE or reuse existing MAC CE?
* How are the conditions for triggering the MAC CE defined?
* How to ensure sufficiently short signalling delays for the MAC CE?
* How is the RRC configuration for the MAC CE reporting done?
* What kind of UE capabilities are needed?

Based on these, the next section contains discussion topics for each of these questions. In case other questions should be discussed, companies are requested to indicate them here.

|  |  |
| --- | --- |
| **Company** | **Are there any other questions than the 4 above that need to be discussed in RAN2?** |
| Apple | Question#1,2,4,5 should be discussed in RAN2 according to RAN4 request. But for question#3, We donot need to take it into account for the MAC CE design. RAN4 has discussed three major ways how the P-MPR related information can be conveyed - PHY, MAC, RRC - and finally concluded that MAC based approach is sufficiently fast. Thus, RAN2 does not need to re-open the same discussion.  |
| Nokia, Nokia Shanghai Bell | Question 3 was explicitly cited in the RAN4 LS so needs to be taken into account. See our replies to that.  |
|  |  |

**Table 1. Additional questions to be discussed in RAN2 about FR2 MPE P-MPR reporting?**

**Conclusions (other questions):** One company thinks question 3 (i.e. “ensuring sufficiently short signalling delays” is less relevant than others, whereas one company considers it relevant. Can be considered based on the final CRs.

# 3 Discussion on RAN2 questions for MPE

## 3.1 Create a new MAC CE or reuse an existing MAC CE?

The main difference between the input contributions [3] and [4] is the approach on MAC CE: Creating a new MAC CE is more flexible but costs an LCID, whereas reusing existing (PHR) MAC CE may require less effort but also create complications to avoid impacting legacy.

Companies are requested to provide their reasoning in the tables below using one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **Should a new MAC CE be created for FR2 MPE P-MPR reporting? Why or why not?** |
| Apple | **No. The existing legacy PHR MAC CE can, and should, be re-used because it already conveys P-MPR related information, such as Pcmax, PH and P-bit.** 1) All the aforementioned fields are set by the UE MAC entity based on the input from the corresponding RF module that makes the actual decision whether P-MPR should be applied and how much. In that sense, it is a straightforward extension for the UE side to indicate to the MAC entity by how much the transmission power was reduced. Thus, additional MPE related information can be provided in the legacy PHR MAC CE, which will reside in the same logical container and which will be received by the network at the same time.2) The existing PHR MAC CE already provides a versatile framework for configuring PHR reporting as a periodic or triggered event, whereas a new MAC CE would require RAN WG2 to re-introduce again almost the same concept.3) There is no backward compatibility issue, because the enhanced PHR MAC CE which is reusing the PHR MAC CE to carry M-PHR info is only enabled via RRC configuration.  |
| Nokia, Nokia Shanghai Bell | **Yes.** We think that would be the cleanest way and completely decouple the functionality from PHR to avoid any legacy impacts. |
| Huawei | /. We understand if the existing legacy PHR MAC CE is re-used, the MAC CE triggering conditions for P-MPR reporting should be the subset of triggering conditions for PHR reporting. Otherwise, a new MAC CE may be needed. Considering the triggering conditions for P-MPR reporting is still discussed in RAN4, we prefer to wait for RAN4 conclusion then to discuss the MAC CE design. Besides, if a new MAC CE will be introduced, it is important to clarify the relationship between PHR MAC CE and P-MPR MAC CE, and how to use them by the network if both MAC CEs are reported. |
| vivo | No strong view. Maybe more inputs from RAN4 are needed, e.g. the value range of the P-MPR and the trigger conditions of reporting the P-MPR. We see some benefits of using the reserved bits in the PHR report. The current PHR report seems already having the triggering condition for the power backoff which may also be possible to be re-used for the P-MPR report. Then reusing the current PHR MAC CE could save some specification efforts on the procedural text. However as the current PHR MAC CE only has two reserved bits left, which may not be sufficient for the report of the P-MPR. Furthermore, RAN4 is still discussing whether more fields (e.g. dynamic duty cycle) need to be reported. |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | We also prefer to wait for RAN4 conclusion on the required information. We understand MPE value could require more than 2bits, in which case a new MAC CE is definitely required.  |

**Table 2. Rationale for creating a new MAC CE for MPE**

|  |  |
| --- | --- |
| **Company** | **Should an existing MAC CE be reused for FR2 MPE P-MPR reporting? Why or why not?** |
| Apple | Yes. The reasons are referred to our answer in Table 2.  |
| Qualcomm Incorporated | Support reusing existing (PHR) MAC CE because it can provide comprehensive view on the UE situation. |
| Nokia, Nokia Shanghai Bell | **No:** Using legacy PHR MAC CEs would require more work than creating a new MAC CE. 1) Reusing PHR means that a PHR sent before MPE event occurs could prevent the MAC CE being sent (due to prohibit timer already being running). Changing that may also impact legacy, which requires extensive checking.2) Extending existing PHR report will increase the size of PHR (due to inclusion of P-MPR value). This makes the P-MPR report larger, which in turn may impact scheduling.3) PHR will have to consider both legacy PHR formats, which means more changes to MAC specification since both types of PHR have to be considered.4) A new MAC is much more easily dealt with at the network side since it can trigger disinctive actions based on the MPE event without interfering with existing actions based on PHR5) PHR may not always be configured, e.g. in small cells where the power headroom is not as critical for the cell coverage. |
| Huawei | See our comments above. |
| vivo | Same comments as given above. |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | Same comments above. |

**Table 3. Rationale for reusing an existing MAC CE for MPE**

**Conclusions (existing or new MAC CE):** Some support for both cases, with some technical issues raised with the PHR approach. Majority would like to wait for RAN4 discussions (since the P-MPR granularity may require >2 bits) to converge before deciding. Rapporteur proposed to consider this based on input contributions to next meeting illustrating concrete proposals based on latest RAN4 progress.

## 3.2 How are the conditions for triggering the MAC CE defined?

RAN4 has so far indicated that an “event-triggered” condition should be allowed for the P-MPR reporting based on a P-MPR threshold. Presumably it is MAC that triggers the condition, so the change would be captured in MAC specification (as discussed in [4]), and the MAC CR [6] illustrates one way to do this.

Companies are requested to provide their reasoning in the tables below using one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **How are the MAC CE triggering conditions defined and what are the important aspects to capture for those?** |
| Apple | RAN4 LS just indicated that at least UE’s P-MPR based event-triggered reporting, but the detail is still under RAN4 discussion. Therefore, how to specify the condition should wait for further RAN4 input.  |
| Qualcomm Incorporated | Periodic: Based on a configure periodic timer, which is separate from a prohibit timer.Event triggered:* P-MPR value exceed a configured threshold

Latest P-MPR value compare to the last value higher than or lower than a configured threshold |
| Nokia, Nokia Shanghai Bell | RAN4 has so far only requested RAN2 to provide event-triggered reporting but is also discussing periodical configuration. From Nokia viewpoint both event-triggered and periodical reporting should be supported (as also Qualcomm proposes).For the P-MPR threshold, we would note that it is an absolute threshold, not a relative one: That is, the event triggers when the applied P-MPR exceeds the threshold value, after which UE reports the (absolute) P-MPR value.  |
| Huawei | Agree with Apple that the triggering conditions for P-MPR reporting is still discussed in RAN4, we’d better wait for RAN4 conclusion. |
| vivo | The RAN4 discussion seems still on-going. However we consider that the current PHR trigger condition for power backoff could be one candidate trigger condition. |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | We also prefer to wait for RAN4 conclusion although P-MPR threshold based triggering could be re-used.  |

**Table 4. Capturing the event-triggering in specifications**

**Conclusions (capturing conditions for event-triggering):** Several companies thinks RAN2 should wait for further RAN4 inputs, while some companies would like to consider also periodic reporting in addition to event-triggered. Therefore, rapporteur proposes to wait for RAN4 progress until next meeting.

## 3.3 How to ensure sufficiently short signalling delays for the MAC CE?

The RAN4 LS [2] indicates that the signalling should have “sufficiently short signalling delays”. While the term is perhaps ambiguous, the intent is likely the fact that due to the large P-MPR incurred by FR2 MPE requirements, network should receive the information quickly to take appropriate actions (as discussed in [4]). To that end, it seems that using MAC CE (which is faster than RRC signalling) could perhaps be sufficient to ensure this.

Companies are requested to provide their reasoning in the tables below using one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **How to guarantee “sufficiently short signalling delays” as requested by RAN4?**  |
| Apple | MPE signaling based on MAC CE has ensured the sufficiently short delay compared to RRC signaling, therefore, we donot need to take it into account for the MAC CE design.RAN4 has discussed three major ways how the P-MPR related information can be conveyed - PHY, MAC, RRC - and finally concluded that MAC based approach is sufficiently fast. Thus, RAN2 does not need to re-open the same discussion.  |
| Qualcomm Incorporated | We think it is useful to allow UE to initiate new reporting even when no UL grant is immediately available to send P-MPR MAC CE. For example, UE may use the existing SR or RACH procedure to request a UL grant to send P-MPR MAC CE, so that it does not have to passively wait for it. |
| Nokia, Nokia Shanghai Bell | We think MAC CE in itself should already guarantee this. Also, having a separate MAC CE means the content can be streamlined and smaller, which also ensures faster delivery, which is another reason to have a dedicated MAC CE for MPE. |
| Huawei | As we already agreed to use MAC CE, we understand the requirement for short signalling delays can be met. Other special handling is not needed. |
| vivo | The current multiplexing priority (i.e. higher than data) of PHR is sufficient to ensure short delay.  |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | We think that the current MAC CE reporting is sufficient to meet RAN4 requirement for short signaling.  |

**Table 5. How to ensure sufficiently short signalling delays**

**Conclusions (ensuring sufficiently low signalling delay):** Most companies think this question is not so relevant or already handle by using MAC CE. One company thinks SR/RACH procedure may be involved. Rapporteur proposes to handle this in the next meeting as it’s not clear if anything is needed.

## 3.4 How is the RRC configuration for the MAC CE reporting done?

Obviously as also the RAN4 LS [2] indicates, the FR2 MPE P-MPR reporting is configured via RRC, so RAN2 needs to develop the exact signalling for that. The CR [5] illustrates an example of this and could be discussed as a starting point for the RRC modifications.

Companies are requested to provide their reasoning in the tables below using one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **What should be configured via RRC for the FR2 MPE P-MPR reporting? Is the CR [5] agreeable as a starting point for the RRC configuration?** |
| Apple | PHR MAC CE format with P-MPR information should be enabled via RRC signalling. According to the draft CR, we think it’s unnecessary to introduced new configuration for the PHR prohibit timer and threshold, since it’s possible to reuse the current PHR configuration for the PHR MAC CE with P-MPR reporting.  |
| Qualcomm Incorporated | Probably too early to agree on a CR. We should first agree on the mechanisms to be implemented. We agree to the proposal to introduce a new prohibit timer for the FR2 MPE P-MPR reporting. |
| Nokia, Nokia Shanghai Bell | Generally, we think the configuration is on all aspects requested by RAN4: Activation of being allowed to send the report and parameters needed for triggering the report. These are anyway needed regardless of how the MAC CE design is done, which is why we already provided a draft CR with the configuration.We would also note that the MPE cannot reuse prohibit timer from PHR: Since the FR2 MPE requirements are completely separated from triggers for existing PHR, having sent a PHR should not block from sending the FR2 MPE P-MPR report. |
| Huawei | Agree with Qualcomm that we should first discuss the mechanism, and this can be discussed after the issues in 3.1 and 3.2 are addressed. |
| vivo | How the ***p-MPR-Threshold*** is used is still not very clear for us. Maybe more inputs from RAN4 is needed. |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | Although it is a bit early to discuss given that RAN4 is still discussing, the CR [5] could be baseline.  |

**Table 6. RRC configuration details for MPE**

**Conclusions (RRC configuration details):** Some issues raised with the P-MPR threshold and prohibit timer. Rapporteur proposes to handle these according to company contributions to next meeting.

## 3.5 What kind of UE capabilities are needed?

Companies are requested to provide their reasoning in the tables below using one row for each new comment to better keep track of the discussion – please don’t edit the previous comments.

|  |  |
| --- | --- |
| **Company** | **What are the UE capabilities needed for the FR2 MPE P-MPR reporting?** |
| Apple | The capability to indicate whether UE support the MPE P-MPR reporting is needed.  |
| Qualcomm Incorporated | Single bit UE capability parameter seems sufficient. |
| Nokia, Nokia Shanghai Bell | Similar view as Qualcomm: Single per-UE capability bit (for FR2 only) seems sufficient. |
| Huawei | In our view it is an optional Rel-16 feature and we agree that single per-UE capability bit seems sufficient.  |
| vivo | Agree with QC and Nokia. |
| OPPO | The detail is still under RAN4 discussion, we can wait for further inputs from RAN4. |
| Intel | Single per UE capability is ok unless RAN4 requests otherwise.  |

**Table 7. UE capabilities for the MPE feature**

**Conclusions (UE capabilities):** Single bit capability seems agreeable to almost all companies. Rapporteur proposed to handle this together will all the CRs in the next meeting.

# 4 Conclusions

**The follwong conclusions are provided from this discussion:**

* **Conclusions (other questions):** One company thinks question 3 (i.e. “ensuring sufficiently short signalling delays” is less relevant than others, whereas one company considers it relevant. Therefore, no other questions are raised at the moment.
* **Conclusions (existing or new MAC CE):** Some support for both cases, with some technical issues raised with the PHR approach. Majority would like to wait for RAN4 discussions (since the P-MPR granularity may require >2 bits) to converge before deciding. Rapporteur proposed to consider this based on input contributions to next meeting illustrating concrete proposals based on latest RAN4 progress.
* **Conclusions (capturing conditions for event-triggering):** Several companies thinks RAN2 should wait for further RAN4 inputs, while some companies would like to consider also periodic reporting in addition to event-triggered. Therefore, rapporteur proposes to wait for RAN4 progress until next meeting.
* **Conclusions (ensuring sufficiently low signalling delay):** Most companies think this question is not so relevant or already handle by using MAC CE. One company thinks SR/RACH procedure may be involved. Rapporteur proposes to handle this in the next meeting as it’s not clear if anything is needed.
* **Conclusions (RRC configuration details):** Some issues raised with the P-MPR threshold and prohibit timer. Rapporteur proposes to handle these according to company contributions to next meeting.
* **Conclusions (UE capabilities):** Single bit capability seems agreeable to almost all companies. Rapporteur proposed to handle this together will all the CRs in the next meeting.

**Proposal 1:** Handle the topic based on company contributions in the next meeting. Companies should attempt to provide CRs illustrating how to achieve the RAN4-requested signalling.

# 5 List of referenced documents

[1] [R2-2002527](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002527.zip) LS on MPE enhancements (R4-1916183; contact: Qualcomm) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2

[2] [R2-2002534](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002534.zip) LS on MPE enhancements (R4-2002916; contact: Nokia) RAN4 LS in Rel-16 NR\_RF\_FR2\_req\_enh To:RAN2

[3] [R2-2002820](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002820.zip) P-MPR Reporting Apple discussion Rel-16 NR\_RF\_FR2\_req\_enh

[4] [R2-2002684](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002684.zip) UE FR2 MPE enhancements and solutions Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_RF\_FR2\_req\_enh

[5] [R2-2002685](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002685.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.331 16.0.0 1515 - B NR\_RF\_FR2\_req\_enh

[6] [R2-2002686](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002686.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.321 16.0.0 0707 - B NR\_RF\_FR2\_req\_enh

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[8] [R2-2002688](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002688.zip) Introduction of FR2 MPE P-MPR reporting Nokia, Nokia Shanghai Bell CR Rel-16 38.300 16.1.0 0210 - B NR\_RF\_FR2\_req\_enh