3GPP TSG RAN WG2 Meeting #117-e R2-22xxxxx

e-Meeting, 21st February – 3rd March, 2022

**Agenda item: 8.1.3.1**

**Source: Samsung**

**Title: Report of [Pre117-e][002][MBS] UP open Issues Input**

**Document for: Discussion**

# 1 Introduction

This document is a report of the following open issue discussion:

* [Pre117-e][002][MBS] UP open Issues Input (Samsung)

This discussion covered UP open issues captured by the open issue document [1], for which company tdocs are not invited, as follows:

- RRC CR-related issue

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| FFS whether RRC can enable/disable C-RNTI based PTM retransmission |  | Company input into Pre117-e-offline (i.e. no company tdocs). |
| FFS whether the UE for multicast can be configured with multiple MTCHs with the same LCID (to be scheduled using different G-RNTIs like broadcast) |  | Company input into Pre117-e-offline (i.e. no company tdocs). |

- MAC CR-related issues

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| FFS how to start the RTT timer when no feedback is transmitted in NACK only case. | 5.7b | Company input into Pre117-e-offline (i.e. no company tdocs). The question would be rephrased. |
| FFS to support DRX Command MAC CE for MBS DRX. | 5.7b | Company input into Pre117-e-offline (i.e. no company tdocs). The question would be rephrased. |
| FFS to support short DRX for MBS. | 5.7b | Company input into Pre117-e-offline (i.e. no company tdocs). |
| FFS to HARQ disable or HARQ is not configured case for MBS. | 5.7b | Company input into Pre117-e-offline (i.e. no company tdocs). The question would be rephrased. |
| Editor’s note: FFS how to associate the G-CS-RNTI and MBS SPS. | 5.8.1a | Company input into Pre117-e-offline (i.e. no company tdocs). The question will be rephrased. It seems not releveant in MAC. May discuss in RRC. |
| Whether there are MBS specific impacts on MAC reset procedure |  | Company input into Pre117-e-offline (i.e. no company tdocs). The question would be rephrased. |

- PDCP CR-related issue

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| FFS whether it is up to UE implementation to prevent COUNT wrap-around for broadcast, given that HFN is selected by the UE itself. |  | Company input into Pre117-e-offline (i.e. no company tdocs) |

- Other open issue

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| FFS whether dedicated broadcast HARQ processes are used for MCCH and MTCH? |  | Company input into Pre117-e-offline (i.e. no company tdocs) |

# 2 Contact Information

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# 3 Discussion

## 3.1 DRX Command MAC CE and Short DRX

During RAN2 offline discussion [AT116bis-e][028][MBS] MAC Open Issues [2], necessity and signalling including format were discussed but the companies’ view were not converged.

There were two split views:

1. Support DRX Command MAC CE for Multicast MBS:
   * It can achieve more power saving.
   * Considering service specific traffic pattern, MBS DRX is needed.
2. Not support DRX Command MAC CE for Multicast MBS:
   * Benefits may be marginal considering there are multiple DRX configurations for MBS.
   * It’s less efficient, since some UEs may miss the MAC CE and not sleep.
   * It just increases the complexity of MBS DRX.

For WI completion, RAN2 has to decide whether to have the MAC CE.

**Q1) Do companies support DRX Command MAC CE for Multicast MBS?**

1. **Yes, DRX Command MAC CE for Multicast MBS is needed.**
2. **No, DRX Command MAC CE for Multicast MBS is not needed**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes | This is very much needed to improve UE power saving. MAC-CE is more dynamic than RRC signalling based configuration change. |
| Samsung | No | The gain is not quantified and we think it’s very marginal saving gain in total modem power consumption. |
| MediaTek | Yes |  |
| OPPO | Yes | It is benefit for UE power saving. |
| Nokia | Maybe | In our opinion, Q1 and Q3 should both be answered together as they both aim at minimising power consumption. In other words, it would be odd to insist on having MAC CE supported but argue that short DRX does not matter. |
| CATT | No | Agree with Samsung. The power saving gain will be marginal. |
| Huawei， HiSilicon | No, but | Fine to go with the majority for the sake of progress. |
| Apple | Yes | It’s beneficial for UE power saving. |
| Xiaomi | Yes |  |
| Kyocera | Yes | We think it’s quite beneficial for UE power saving, as same with DRX Command MAC CE for unicast. |
| ZTE | No | 1.A MAC CE in PTM manner might not be reliable. If we ask for further reliability measures, it is against the intention of power saving.  2.MBS traffic characteristic can be well known by network, it can be rare for network to manually put UE to sleep.  Therefore in our view, the gain of DRX Command is not well justified. |
| SJTU | Yes | It is necessary to support DRX Command MAC CE for Multicast MBS to improve UE power saving. |
| NERCDTV | Yes | We think it is needed for power saving. |
| Ericsson | Maybe | Agree with Nokia. |
| LGE | No |  |
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Depending on conclusion of Q1 (in case that the MAC CE is introduced), further discussion on the format and signalling would be useful. One thing is clear that, DRX Command for a G-RNTI (irrespective of detailed format and delivered RNTI), *drx-onDurationTimerPTM* and *drx-InactivityTimerPTM* timer for that G-RNTI shall be stopped. Based on the assumption, we may discuss a next-level for progress.

The first issue could be how to identify the MBS DRX Command MAC CE. We may have the following options:

1) A new LCID value is used for MBS DRX Command MAC CE. This MAC CE should be separated from unicast MAC CE.

2) MBS DRX Command MAC CE can be separated by G-RNTI. If the MAC CE is received by G-RNTI, it will be MBS MAC CE. The same LCID value(s) (60: DRX command and/or 59: Long DRX Command) can be reused.

3) MBS DRX Command MAC CE can be separate by R bit in MAC subheader as in the following format.



**Q2) If RAN2 agreed to introduce DRX Command MAC CE, which option do companies support for separation of MBS DRX Command MAC CE?**

1. **New LCID value**
2. **Used RNTI (G-RNTI 🡪 MBS DRX, C-RNTI 🡪 Unicast DRX)**
3. **R-bit in MAC subheader**

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| **Company** | **Option** | **Comment** |
| Qualcomm | Option 2 |  |
| Samsung | 1 | Option 2 may not work well. Since C-RNTI is used for both unicast and PTP retransmission of PTM initial transmission. If PTP retransmission resource includes the DRX Command MAC CE, it should be interpreted as MBS DRX MAC CE but UE may misinterpret in case that initial G-RNTI DCI is missed.  We do not support Option 3, since we have to be very careful to use R bit. |
| MediaTek | Option 1 | Option1 can work and reserve LCID/extend LCID space for MBS Command MAC CE.  For Op2, the same issue may occur when the PTP is used for PTM retransmission |
| OPPO | Option 1 | If the MBS data reception is switched from PTM to PTP due to bad channel condition, this UE may not receive the DRX command. So it is better to send the DRX command MAC CE for this UE also via PTP leg.  Both option 3 and option 2 are supported for different case, i.e. PTM reception and PTP reception. |
| Nokia | Option 2 |  |
| CATT | Option 2 |  |
| Huawei， HiSilicon | Option 2 | Less specs effort.  Regarding the PTP retransmission issue mentioned above, we think the gNB implementation can make sure PTP retransmission is not used for PTM transmission of DRX Command MAC CE. Actually, we see no need to re-transmit such MAC-CE considering the UE would anyway enter DRX mode after the inactivity timer expires if this MAC-CE is missed. |
| Apple | Option 1 | In Option 1, NW can send the PTM DRX command via both PTM and PTP link, but in Option 2, the command is only possible to delivered via PTM link,and cannot work in case of the PTM retransmission via PTP link. |
| Xiaomi | Option 1 or 2 |  |
| Kyocera | Option 2 |  |
| ZTE | 2 | if we need to define such MAC CE |
| SJTU | Option 2 | Option 2 has less impact on the specification and can achieve introducing the MBS DRX Command MAC CE on a per G-RNTI basis. |
| NERCDTV | Option 2 or Option1 | We think Option 2 and Option1 are both OK. |
| Ericsson | Option 2 |  |
| LGE | Option 1, but | Regarding option 2 and option 3, we have the same view with Samsung.  We think that MBS DRX Command MAC CE needs to be separated by G-RNTI. Otherwise, the use of MBS DRX Command MAC CE is very limited when multiple G-RNTIs are configured. It can be sent only when all MBS sessions in the cell are silent.  Since option 2 does not work, MBS DRX Command MAC CE needs to contain a G-RNTI value at which it targets. |
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In the offline discussion [2], companies view on short DRX was almost evenly split (9 support vs 11: not).

1. Support Short DRX
   * It can used for voice with talk burst/silence period and public safety
   * It could be NW flexibility to optionally configure.
2. Not support Short DRX
   * There is a potential cycle mismatch problem (Some UEs may not receive the MAC CE, thus it may not work well)
   * MBS will not have URLLC or delay-sensitive data. Emergency feedback can be delivered via unicast/PTP.
   * It just increases the complexity of MBS DRX.

Both camps have reasons and the discussion has been done many times. Thus, the rapporteur would like to check companies view once again to find a way forward.

**Q3) Do companies support Short DRX for MBS?**

1. **Yes**
2. **No**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes | We strongly prefer to support short DRX for MCPTT kind of applications. As short DRX is already supported for unicast and we don’t think it adds any complexity. Note that MBS is designed to serve diverse applications and based on application characteristic network can configure short DRX. It is NOT correct to say “MBS will not have URLLC or delay-sensitive data.” |
| Samsung | No | The side-effect on cycle mismatch may not be controlled. It may not work properly. |
| MediaTek | Yes | It should be optional and up to NW to configure the DRX pattern depending on multiple UEs |
| OPPO | No | MBS service is not delay sensitive service as URLLC. So no need to use short DRX especially in R17.  In PTM reception, reception performance may decrease for some UEs, and these UEs may not receive the PTM data and enter long DRX in advance and result in mismatch problem among multiple UEs. |
| Nokia | Yes | Agree with Qualcomm, this is essential for public safety, the most likely use case for MBS. |
| CATT | No | Agree with the side-effect mentioned by companies above and the gain is marginal. |
| Huawei， HiSilicon | No | Prefer not to support this in Rel-17 with potential mismatch issue which we don’t have much time to further discuss. |
| Apple | No | The short DRX cycle is designed for the transmission of the potential quick feedback which is triggered by the transmission in the long DRX cycle. Since the multicast PTM transmission is the DL only transmission, it seems no need to introduce the short DRX cycle configuration for PTM. Even for the MCPTT service, if there is any emergency feedback, it can be delivered via the PTP/unicast link. |
| Xiaomi |  | No strong view. We can accept the short DRX cycle configuration when no extra enhancements (e.g. HARQ) except for the short DRX are used. |
| Kyocera | (No) | We don’t see much benefit, but we can follow the majority’s view for progress.  Just for clarification in case of 1), we wonder if Short DRX is supported only for multicast sessions. |
| ZTE | No | Potential cycle mismatch issue. |
| SJTU | Yes | It’s useful for some use cases. Since Short DRX is optional, it is up to NW to configure it or not. |
| NERCDTV | Yes | Short DRX can be configured up to NW implementation. |
| Ericsson | Yes | As stated before, we think there are very valid use cases for public safety and other that will benefit from this. |
| LGE | No | Short DRX will increase occurrences of cycle mismatch, and some UEs suffer from degradation of reception performance. |
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## 3.2 DRX Timer Handling

In the offline discussion [2], the start condition of *drx-HARQ-RTT-TimerDL-PTM* and *drx-RetransmissionTimerDL-PTM*, for NACK-only feedback was not concluded due to the lack of time. But there were proposals with clear majority support as follows:

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| **Proposal 10: (14/19) If there is no real HARQ feedback transmission due to ACK in NACK only case, the UE will not start DRX RTT timer.**  **Proposal 11: (15/19) After DRX RTT timer expires, UE will not start DRX retransmission timer if the corresponding MAC PDU is decoded successfully.** |

In the rapporteur’s understanding, P10 and P11 are aligned to the current MAC running CR [3], i.e. no further change is required.

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| When multicast DRX is configured for a G-RNTI or G-CS-RNTI, the MAC entity shall for this G-RNTI or G-CS-RNTI:  1> if a MAC PDU is received in a configured downlink multicast assignment:  2> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  2> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process.  1> if a *drx-HARQ-RTT-TimerDL-PTM* expires:  2> if the data of the corresponding HARQ process was not successfully decoded:  3> start the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL-PTM*.  1> if [(SFN × 10) + subframe number] modulo (*drx-LongCycle-PTM*) = *drx-StartOffset-PTM*:  2> start *drx-onDurationTimerPTM* after *drx-SlotOffsetPTM* from the beginning of the subframe.  NOTE 1: In case of unaligned SFN across carriers in a cell group, the SFN of the SpCell is used to calculate the DRX duration.  1> if the MAC entity is in Active Time for this G-RNTI or G-CS-RNTI:  2> monitor the PDCCH for this G-RNTI or G-CS-RNTI as specified in TS 38.213 [6];  2> if the PDCCH indicates a DL multicast transmission:  3> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  3> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process.  2> if the PDCCH indicates a new multicast transmission for this G-RNTI or G-CS-RNTI:  3> start or restart *drx-InactivityTimerPTM* in the first symbol after the end of the PDCCH reception.  NOTE 2: A PDCCH indicating activation of multicast SPS is considered to indicate a new transmission. |

ACK 🡪 feedback is not generated nor transmitted 🡪 *drx-HARQ-RTT-TimerDL-PTM* is not started. & *drx-RetransmissionTimerDL-PTM* is stopped.

NACK 🡪 feedback is generated and transmitted on a PUCCH resource 🡪 *drx-HARQ-RTT-TimerDL-PTM* is started in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback & *drx-RetransmissionTimerDL-PTM* is stopped. 🡪 Since it was NACK (not successfully decoded), the *drx-RetransmissionTimerDL-PTM* is started in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL-PTM*.

Although there were other options, the rapporteur think we can go with option supported by clear majority and without further text change.

**Q4) Do companies accept the following proposals made in [AT116bis-e][028][MBS]?**

* **If there is no real HARQ feedback transmission due to ACK in NACK only case, the UE will not start DRX RTT timer.**
* **After DRX RTT timer expires, UE will not start DRX retransmission timer if the corresponding MAC PDU is decoded successfully.**

**1) Yes (current MAC running CR)**

**2) No (please provide the alternative TP)**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Samsung | Yes |  |
| MediaTek | Yes |  |
| OPPO | No | In unicast DRX, no matter the HARQ feedback is ACK or NACJK, the UE will start the DRX RTT timer for power saving purpose in DRX RTT timer running period. If the MAC PDU is not decoded successfully, the DRX retransmission timer will be started after DRX RTT timer expiries, otherwise, the DRX retransmission timer will be not started.  In MBS reception, if NACK only based HARQ feedback is configured, the ACK UE does not know if there is other UE feedback NACK and the ACK UE also does not know whether the next transmission in this HARQ process is new transmission or retransmission. No matter the next transmission is new transmission or retransmission, the UE does not need to monitor the PDCCH in the RTT timer period for UE power saving purpose. After DRX RTT timer expiries, the UE can start DRX retransmission timer to receive the new transmission or retransmission. Some companies may think no need to start DRX retransmission timer because there is no need to receive retransmission due to ACK. However, if the UE does not start RTT timer, the UE may keep active and results in power consumption during RTT running period.  The next question is the time point to start the DRX RTT timer?  If there is no real HARQ feedback transmission due to NACK only, the UE start the DRX RTT timer in the first symbol after the end of the corresponding PUCCH resource for NACK only feedback.  =======TP==== 5.7b Discontinuous Reception (DRX) for Multicast MBS For multicast MBS, the MAC entity may be configured by RRC with a DRX functionality per G-RNTI or per G-CS-RNTI that controls the UE's PDCCH monitoring activity for the MAC entity's G-RNTI(s) and G-CS-RNTI(s) as specified in TS 38.331 [5]. When in RRC\_CONNECTED, if multicast DRX is configured, the MAC entity is allowed to monitor the PDCCH for this G-RNTI or G-CS-RNTI discontinuously using the multicast DRX operation specified in this subclause; otherwise the MAC entity monitors the PDCCH for this G-RNTI or G-CS-RNTI as specified in TS 38.213 [6]. The multicast DRX operation specified in this subclause is performed independently for each G-RNTI or G-CS-RNTI and independently from the DRX operation specified in subcaluse 5.7 and 5.7a.  Editor’s note: FFS how to handle the PTP for PTM retransmission case.  RRC controls multicast DRX operation per G-RNTI or per G-CS-RNTI by configuring the following parameters:  - *drx-onDurationTimerPTM*: the duration at the beginning of a DRX cycle;  - *drx-SlotOffsetPTM*: the delay before starting the *drx-onDurationTimerPTM*;  - *drx-InactivityTimerPTM*: the duration after the PDCCH occasion in which a PDCCH indicates a new DL multicast transmission for the MAC entity;  - *drx-LongCycleStartOffsetPTM*: the long DRX cycle *drx-LongCycle-PTM* and *drx-StartOffset-PTM* which defines the subframe where the long DRX cycle starts;  - *drx-RetransmissionTimerDL-PTM* (per DL HARQ process for multicast MBS): the maximum duration until a DL multicast retransmission is received;  - *drx-HARQ-RTT-TimerDL-PTM* (per DL HARQ process for multicast MBS): the minimum duration before a DL multicast assignment for HARQ retransmission is expected by the MAC entity;  When multicast DRX is configured for a G-RNTI, the Active Time includes the time while:  - *drx-onDurationTimerPTM* or *drx-InactivityTimerPTM* or *drx-RetransmissionTimerDL-PTM* for this G-RNTI or G-CS-RNTI is running;  Editor’s note: FFS other condition to define the Active Time.  When multicast DRX is configured for a G-RNTI or G-CS-RNTI, the MAC entity shall for this G-RNTI or G-CS-RNTI:  1> if a MAC PDU is received in a configured downlink multicast assignment:  2> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  Editor’s note: FFS how to start the RTT timer when no feedback is transmitted in NACK only case.  2> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding PUCCH resource used for carrying the DL HARQ feedback if there is no real HARQ feedback transmission;  2> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process.  1> if a *drx-HARQ-RTT-TimerDL-PTM* expires:  2> if the data of the corresponding HARQ process was not successfully decoded and NACK only is not configured:  3> start the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL-PTM*.  Editor’s note: FFS to support DRX Command MAC CE for MBS DRX.  Editor’s note: FFS to support short DRX for MBS.  1> if [(SFN × 10) + subframe number] modulo (*drx-LongCycle-PTM*) = *drx-StartOffset-PTM*:  2> start *drx-onDurationTimerPTM* after *drx-SlotOffsetPTM* from the beginning of the subframe.  NOTE 1: In case of unaligned SFN across carriers in a cell group, the SFN of the SpCell is used to calculate the DRX duration.  1> if the MAC entity is in Active Time for this G-RNTI or G-CS-RNTI:  2> monitor the PDCCH for this G-RNTI or G-CS-RNTI as specified in TS 38.213 [6];  2> if the PDCCH indicates a DL multicast transmission:  3> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  3> start the *drx-HARQ-RTT-TimerDL-PTM* for the corresponding HARQ process in the first symbol after the end of the corresponding PUCCH resource used for carrying the DL HARQ feedback if there is no real HARQ feedback transmission;  3> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process.  2> if the PDCCH indicates a new multicast transmission for this G-RNTI or G-CS-RNTI:  3> start or restart *drx-InactivityTimerPTM* in the first symbol after the end of the PDCCH reception.  NOTE 2: A PDCCH indicating activation of multicast SPS is considered to indicate a new transmission.  Editor’s note: FFS to CSI and SRS reporting due to MBS DRX.  Editor’s note: FFS to HARQ disable or HARQ is not configured case for MBS.  Editor’s note: FFS to PTP for PTM retransmission case.  The MAC entity needs not to monitor the PDCCH if it is not a complete PDCCH occasion (e.g. the Active Time starts or ends in the middle of a PDCCH occasion). |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei， HiSilicon | Yes |  |
| Apple | Yes |  |
| Xiaomi | Yes |  |
| Kyocera | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| LGE | Yes |  |
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HARQ feedback enable/disable is supported by DCI or RRC according to RAN1 agreement, and was implemented in the RRC running CR [4].

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| ***harq-FeedbackEnablerMulticast***  Indicates whether the UE shall provide HARQ-ACK feedback for MBS multicast. Value *dci-enabler* means that whether the UE shall feedback HARQ-ACK for MBS multicast is indicated by DCI. Value *enabled* means the UE shall always feedback the HARQ-ACK for MBS multicast. When the field is absent, the UE shall not feedback the HARQ-ACK for multicast. |

In the offline discussion [2], multiple companies agreed that even if HARQ feedback is disabled for a UE, gNB can retransmit the data for other UEs or perform blind retransmission, especially for cell-edge or poor coverage UE. An issue here is if Multicast DRX’s Active Time should be extended by DRX retransmission timer in case that HARQ-ACK feedback is disabled or not configured. A simple way could be similar to the case of non-numerical k1 value, i.e. start the *drx-RetransmissionTimerDLPTM* in the first symbol after the PDSCH transmission

**Q5) Do companies support to extend Multicast DRX’s Active Time for receiving retransmission in case that HARQ-ACK feedback is disabled or not configured?**

1. **Yes**
2. **No**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | No | If HARQ feedback is disabled or not configured, then any blind re-transmission or for other UEs may or may not happen. It is unnecessary for UE to start RTT timer when there is no feedback configured. |
| Samsung | Yes | Disabling HARQ-ACK was introduced due to the assumption that a number of UEs are receiving multicast services and PUCCH resource for HARQ feedback is not sufficient. Thus, blocking reception of retransmission will degrade the reliability performance of multicast. |
| MediaTek | Yes | UE can still receive retransmission for other UE/blind retx data even if the HARQ feedback is not sent. |
| OPPO | No | If the HARQ is disable for PTM leg via RRC signalling, it means there is no HARQ feedback and no PTM retransmission in PTM leg. So the *drx-HARQ-RTT-TimerDLPTM* and *drx-RetransmissionTimerDLPTM* are not useful any more for MBS DRX. The multicast DRX operation in PTM leg is similar as broadcast DRX.  When HARQ feedback is disabled, UE does not start RTT timer in NTN case.  In at meeting email discussion for MAC open issue in last RAN2 meeting, some companies think gNB can retransmit the data for other UEs or perform blind retransmission. However, it is hard to rely on *drx-HARQ-RTT-TimerDLPTM* and *drx-RetransmissionTimerDLPTM* to keep UE in active time to receive blind retransmission because it is hard for UE to start *drx-HARQ-RTT-TimerDLPTM* timer, e.g. which time point and there is no HARQ feedback and even no PUCCH configuration.  If network intends to enable the blind HARQ retransmission, network can configure the larger value of the PTM DRX inactivity timer to ensure the DRX active time cover the potential HARQ retransmission period. |
| Nokia | No | Even if HARQ feedback is disabled, the RTT timer starts when receiving a TB, and upon expiry of the RTT timer, the UE starts the retransmission timer if decoding was unsuccessful. Not sure we understand the problem with not having HARQ feedback. |
| CATT | Yes | Based on RAN1’s discussion, when HARQ-ACK feedback is disabled or not configured for a specific UE, retransmission is not disabled. It is beneficial for that UE to receive the possible retransmission. |
| Huawei， HiSilicon | No | The gNB implementation can make sure cell-edge or poor coverage UE’s feedback is not disabled because multicast transmission should consider the worst UE’s reception status. |
| Apple | No | If HARQ feedback is disable for PTM, from the DRX mechanism perspective, UE doesnot need to start the *drx-HARQ-RTT-TimerDLPTM* and *drx-RetransmissionTimerDLPTM* for the potential HARQ retransmission. And the PTM DRX scheme here is like broadcast DRX.  If NW would like to perform the blind retransmission, NW can configure the longer PTM inactivity timer to keep UE in the DRX active time. |
| Xiaomi | No | The blind retransmission should not be considered. |
| Kyocera | No | We share Qualcomm’s view. We assume it can be up to UE implementation whether to receive the retransmissions for other UEs and the blind retransmission. |
| ZTE | Yes | We echo the need for blind re-transmission in some cases. In current spec, RTT timer wont start before the feedback is sent out:  2> start the drx-HARQ-RTT-TimerDL for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback  Therefore to support such blind re-transmission, it is necessary to define a mechanism to keep UE in Active for the potential re-transmission. Either start the re-transmission timer or RTT timer upon the first symbol after the PDSCH transmission is fine.  To avoid unnecessary staying in Active Time (power waste), a pre-configuration or indication might be needed for such blind re-transmission. |
| Ericsson | Yes | The various mechanisms of feedback in place were designed for PUCCH resource limitations and that included blind retransmissions and DRX impact as an assumption in our understanding. |
| LGE | No | There is no need to extend multicast DRX’s active time for receiving retransmission. DRX operation specifies when UE should monitor. It does not prohibit monitoring outside the active time.  It would be better to let UE decide whether to try to receive retransmission by UE implementation. |
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## 3.3 Indication to enable/disable C-RNTI based PTM retransmission

RAN2 needs to discuss whether RRC can enable/disable C-RNTI based PTM retransmission. This may be related to the following agreement on DRX:

* In PTP for PTM retransmission, the UE monitors UE specific PDCCH/C-RNTI only during unicast DRX’s active time. Unicast DRX’s RTT timer can be started when PTP retransmission is expected.

More specifically, how the UE expects PTP retransmission, i.e. RRC enable/disable C-RNTI based retransmission or UE always starts the unicast DRX’s RTT timer when HARQ ACK feedback is transmitted (as least for ACK/NACK FB and NACK-only FB).

**Q6) Do companies support the RRC indication to enable/disable C-RNTI based PTM retransmission?**

1. **Yes**
2. **No**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | No but no strong view | We think it is dynamic for GNB to use C-RNTI based Re-Tx or not. From UE perspective, there should not be any issue. |
| Samsung | Yes | It’s useful for power saving to avoid unnecessary unicast Active Time. |
| MediaTek | No | We think it is up to gNB scheduling to aligned the Unicast DRX’s timer for PTP based PTM retransmission and there is no specification work. |
| OPPO | Not sure | It is up to RAN1. The response LS from RAN1 is expected in first week during meeting. |
| Nokia | No | Seems simpler to always start the timer. |
| CATT | No | We understand C-RNTI based PTM retransmission should be a dynamic decision by RAN1 TB by TB.it is not reasonable to enable/disable it via RRC signalling |
| Huawei， HiSilicon | Yes | With specific RRC indication, the UE avoid extra power consumption in case the gNB doesn’t intend to perform C-RNTI based retransmission for PTM (may be for reducing the complexity of HARQ process management introduced by C-RNTI based retransmission of PTM), or the gNB doesn’t support C-RNTI based retransmission for PTM at all.  Besides, we think this is an issue that we can discuss in RAN2 because it is very much related to DRX operation which is beyond RAN1’s expertise. |
| Apple | No | We think it’s up to NW scheduling. |
| Xiaomi |  | No strong view. It seems that the network scheduling can handle the C-RNTI retransmission properly. |
| Kyocera | Maybe yes | We assume it’s not efficient that the UE waits retransmission via C-RNTI while the gNB actually does it via G-RNTI. So, we assume the enable/disable mechanism is expected to minimize such a mismatch. |
| ZTE | Yes | better to tell which manner of re-transmission is adopted, to avoid any unnecessary PDCCH monitoring.  also the agreements is telling us that UE only monitor the PTP transmission "when PTP re-transmission is expected", which implies that we follow a condition or configuration. |
| Ericsson | No | We do not see any issue to resolve as the UE anyway needs to receive C-RNTI. The MAC PDU content just needs to be routed based on LCID. Always starting the timer is simplest. This should be handled in RAN2. |
| LGE | Yes | The RRC indication is preferred. When PTP retransmission is indicated, UE starts unicast DRX RTT timer when retransmission is expected. When only PTM retransmission is indicated, UE does not start unicast DRX RTT timer. When gNB can use PTM retx and PTP retx dynamically, UE starts both unicast DRX RTT timer and multicast RTT timer when retransmission is expected. |
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## 3.4 Dedicated HARQ Process for Broadcast (MCCH/MTCH)

A common understanding on HARQ process is that Multicast (PTM/PTP) and Unicast shares the HARQ process and HARQ process ID space. The issue is whether Broadcast MCCH/MTCH requires a dedicated HARQ process(es) or can share the same HARQ process. In the rapporteur’s understanding, gNB does not 100% correctly know which UEs are receiving which Broadcast data, so dedicated HARQ process for Broadcast could avoid further confusion on HARQ process handling. But, someone could argue that gNB should control it.

**Q7) Do companies support dedicated HARQ processes for MCCH and Broadcast MTCH?**

1. **Yes**
2. **No**

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| --- | --- | --- | --- |
| **Company** | **Yes/No**  **for MCCH** | **Yes/No**  **for**  **MTCH** | **Comment** |
| Qualcomm | No | No | RAN1#107bis-e discussed same topic and concluded not to have any dedicated HARQ Process ID for MCCH and MTCH. |
| Samsung | Yes | Yes | We think it should be avoided at any rate to have any interruptions and conflicts for HARQ process(es) usage among MCCH, broadcast MTCHs and multicast MTCHs for the UE. MCCH has quite fixing timings and behaviour resembles to the SI reception. However, broadcast HARQ process defined for SI is not usable for MCCH given their independent timings. Therefore, MCCH should be provided a dedicated broadcast HARQ process.  While the HARQ processes for broadcast MTCHs and multicast MTCHs can possibly be scheduled with some flexibility by network but it comes at an increased complexity and coordination requirements between commonly accessed broadcast services and UE/UE-group specific multicast services on the network part, and may not be 100% accurate always.  We understand RAN1 conclusion is just not to increase HW capability for HARQ process management, but RAN2 can further consider on the HARQ process separation aspects. |
| MediaTek | No | No | Agree with Qualcomm |
| OPPO | No | No |  |
| Nokia | Yes | Yes | Simpler to manage for the network. |
| CATT | No | No | It can be up to UE implementation. As mentioned by companies above, it may have impact on RAN1 but RAN1 did not conclude to use dedicated HARQ process |
| Huawei， HiSilicon | YES, but | YES, but | First, we think t**his question is to discuss dedicated(or reserved) HARQ process ID rather than HARQ process entity(extra HARQ process)** since RAN1 has agreed that no extra HARQ process(extra entity) is introduced for broadcast, i.e. the HARQ process resources are shared between broadcast, unicast and multicast.  Regarding with the reserved HARQ process ID (may be specified in spec), we think it is beneficial in reducing UE complexity of managing the shared HARQ process entity.  In addition, in MAC, we need to further discuss the number of HARQ processes used for broadcast, and we think only one HARQ process is needed for MCCH and MTCH, as RAN1 has agreed FDM between MCCH and MTCH is not supported and there is no HARQ retransmission for MBS broadcast. |
| Apple | No | No | Agree with Qualcomm. RAN1 has made the conclusion. |
| Xiaomi | No | No |  |
| ZTE | no | no | does a dedicated HARQ process require extra UE capability (e.g., extra HARQ process supported by UE other than existing HARQ process?)  if so, we'd like to share HARQ process with any other transmission. We assume network is always aware of UE interests for RRC\_CONNECTED UE. And the left is UE implementation (to allocate available HARQ process to handle the MCCH/MTCH reception) regardless of the HARQ Process ID. |
| Ericsson | No | No | We agree RAN1 agreed to not extend the available HARQ processes, not explicitly on process reservation itself. However, it was assumed that the gNB would be able to manage (shared) HARQ process usage so that there are available processes to be used for BC. |
| LGE | No | No |  |
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## 3.5 Initial HFN Selection for Broadcast

In RAN2#116bis-e, RAN2 agreed that the initial HFN value is selected by the UE [5]. A captured FFS point is whether it is up to UE implementation to prevent COUNT wrap-around for broadcast, given that HFN is selected by the UE itself. Note that NR PDCP Receive Operation does not support COUNT wrap-around, so RAN2 may need to decide how to prevent the COUNT wrap around, i.e. reaching the maximum COUNT value. The current status is fully up to UE implementation and no standardized solution is defined due to reasons including:

* PDCP Status Report is not needed for Broadcast. gNB does not check HFN value.
* Indication of HFN may be difficult for Broadcast.

However, a concern would be even if a (bad) UE implementation selects very large HFN value due to the lack of any guideline, nobody can say that it is not a 3GPP MBS compliant UE. Regarding solution, there may be a couple of options.

**Q8) Please provide your preference how to prevents COUNT wrap-around for broadcast MRB.**

**- Option 1) Fully up to UE implementation to prevent COUNT wrap-around, (successful delivery may not be guaranteed due to reaching the max COUNT value. No standardization.)**

**- Option 2) UE refreshes the HFN value to smaller value.**

**- Option 3) The initial HFN value is indicated by gNB via RRC (Revert the RAN2#116bis-e agreement)**

**- Option X) Other (please add)**

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| --- | --- | --- |
| **Company** | **Preferred Option** | **Comment** |
| Qualcomm | Option 1 |  |
| Samsung | 1 | RAN2 already agreed that UE selects the initial value, although there is a risk to select larger initial HFN value. However, we are ok to keep it as it is (fully up to UE) |
| MediaTek | Option 1 | For broadcast, there will not be out-of-order delivery so there is no need to prevents COUNT wrap-around issue.  Option2 can be used by UE implementation to avoid COUNT to reach the max value. |
| OPPO | Option 1 |  |
| Nokia | Option 1 |  |
| CATT | Option 1 | Agree with MediaTek, Initial HFN for Broadcast is not a issue. |
| Huawei， HiSilicon | Option 1 | How to avoid COUNT wrap-around can be left to UE implementation. Option 2 can be one of the implementation methods and no need to specify. |
| Apple | Option 1 |  |
| Xiaomi | Option 1 |  |
| Kyocera | Option 1 or 2 | In general, we think there is no critical issue with Option 1, while we think Option 2 is one of straightforward implementations. Considering the rapporteur’s concern, we’re also fine to capture Option 2 as Note. |
| ZTE | 1 |  |
| Ericsson | Option 1 |  |
| LGE | Option 1 |  |
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## 3.6 MBS Impact to MAC Reset

TS 38.321 has two MAC reset procedures, i.e. 1) reset of the MAC entity and 2) Sidelink specific reset of the MAC entity, as follows:

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| 5.12 MAC Reset  If a reset of the MAC entity is requested by upper layers, the MAC entity shall:  1> initialize *Bj* for each logical channel to zero;  1> initialize *SBj* for each logical channel to zero if Sidelink resource allocation mode 1 is configured by RRC;  1> stop (if running) all timers;  1> consider all *timeAlignmentTimer*s as expired and perform the corresponding actions in clause 5.2;  1> set the NDIs for all uplink HARQ processes to the value 0;  1> sets the NDIs for all HARQ process IDs to the value 0 for monitoring PDCCH in Sidelink resource allocation mode 1;  1> stop, if any, ongoing Random Access procedure;  1> discard explicitly signalled contention-free Random Access Resources for 4-step RA type and 2-step RA type, if any;  1> flush Msg3 buffer;  1> flush MSGA buffer;  1> cancel, if any, triggered Scheduling Request procedure;  1> cancel, if any, triggered Buffer Status Reporting procedure;  1> cancel, if any, triggered Power Headroom Reporting procedure;  1> cancel, if any, triggered consistent LBT failure;  1> cancel, if any, triggered BFR;  1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure;  1> cancel, if any, triggered Pre-emptive Buffer Status Reporting procedure;  1> cancel, if any, triggered Recommended bit rate query procedure;  1> cancel, if any, triggered Configured uplink grant confirmation;  1> cancel, if any, triggered configured sidelink grant confirmation;  1> cancel, if any, triggered Desired Guard Symbol query;  1> flush the soft buffers for all DL HARQ processes;  1> for each DL HARQ process, consider the next received transmission for a TB as the very first transmission;  1> release, if any, Temporary C-RNTI;  1> reset all *BFI\_COUNTER*s;  1> reset all *LBT\_COUNTERs*.  If a Sidelink specific reset of the MAC entity is requested for a PC5-RRC connection by upper layers, the MAC entity shall:  1> flush the soft buffers for all Sidelink processes for all TB(s) associated to the PC5-RRC connection;  1> consider all Sidelink processes for all TB(s) associated to the PC5-RRC connection as unoccupied;  1> cancel, if any, triggered Scheduling Request procedure only associated to the PC5-RRC connection;  1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure only associated to the PC5-RRC connection;  1> cancel, if any, triggered Sidelink CSI Reporting procedure associated to the PC5-RRC connection;  1> stop (if running) all timers associated to the PC5-RRC connection;  1> reset the *numConsecutiveDTX* associated to the PC5-RRC connection;  1> initialize *SBj* for each logical channel associated to the PC5-RRC connection to zero. |

An issue to consider would be whether there are MBS specific impacts on MAC reset procedure. It may be useful when 1) only MBS-related MAC functions can be reset (unicast functions do not need to reset), e.g. MRB type change, or 2) only unicast MAC functions can be reset (Multicast MAC functions do not need to reset), e.g. reconfiguration with unicast security key change. A potential TP would be as follows:

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| If a MBS specific reset of the MAC entity is requested for MBS by upper layers, the MAC entity shall:  1> stop (if running) all timers associated to Multicast;  1> flush the soft buffers for all Multicast DL HARQ processes;   1. for each Multicast DL HARQ process, consider the next received transmission for a TB as the very first transmission;   1> initialize *Bj* for each logical channel associated to MRB to zero. |

**Q9) Do companies support to define MBS specific reset of the MAC entity?**

1. **Yes**
2. **No**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Samsung | Yes |  |
| MediaTek | Yes |  |
| OPPO | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei， HiSilicon | Yes, but | We think it is better to identify which aspects are multicast specific first, e.g. multicast timers, multicast HARQ buffers and so on. At least, Bj is not related to MBS as it is for uplink. |
| Apple | Yes | For Bj, it’s related to the potential UL feedback from the RLC-AM entity associated to the MRB.  For the multicast DL HARQ process description, we may need to clarify it as the DL HARQ process for the multicast transmission, since we donot introduce the multicast specific HARQ process concept. |
| Xiaomi | Yes |  |
| Kyocera | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| LGE | No | It is unclear at which scenario/event a MBS specific reset of a MAC entity is needed. Regarding timers, at which scenario/event does a UE stop all timers associated to multicast without stopping all other timers associated to unicast?  After identifying scenarios/events which requires stopping all timers associated to multicast, flushing HARQ buffers associated to multicast, and etc., it can be determined whether a MBS specific reset of a MAC entity is needed or not and what actions are needed for a MBS specific reset. |
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## 3.7 Multiple Multicast MTCHs with the same LCID

An FFS point is whether the UE for multicast can be configured with multiple MTCHs with the same LCID (to be scheduled using different G-RNTIs like broadcast). In other words, RAN2 needs to decide if two different multicast RLC bearer (different RLC entities and corresponding logical channels) can share the same LCID value.

**Q10) Do companies support that the UE for multicast can be configured with multiple MTCHs with the same LCID?**

1. **Yes**
2. **No**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Samsung | No | Considering we have 32 LCID values for DTCHs and multicast MTCHs, we do not need this. Unique LCID value for each LCH is sufficient. |
| MediaTek | No | LCID space can be extended if is not enough for multicast. |
| OPPO | No | What is the intension? |
| Nokia | No | RLC bearer release is based on LCID and for PTM/PTP split bearer, initial transmissions on PTP leg use C-RNTI and LCID should tell which MRB is transmitted. |
| CATT | No | In the case of PTP HARQ retransmission, it may cause ambiguity on which TB is for which MTCH |
| Huawei， HiSilicon | Yes | There are only 32 available LCID s for SBR+DRB+MRB, which means about 20 LCHs can be used for MRB. If split MRBs are used, only about 10 MRBs can be configured for a UE. Considering that fact that we need keep consistent LCID for PTM leg for a MRB service for all UEs in one cell, the might result only 10+ MBR is supported in one cell. Which is too restrictive from the network point of view. One may argue that PTM LCID can be reused for UEs in separate groups. **However, it would be too complex for network to manage the LCIDs in this way if there are many MBS services.** For example, if the network configures the same LCID for two G-RNTIs associated to separate multicast groups, and once the UE in one group joins the other group latter, network may need to reconfigure the LCID of all UEs in one of the groups to avoid LCID collision.  We think LCID for PTM leg can be reused for different G-RNTIs in case C-RNTI based retransmission of PTM is disabled by the network. It would be up to network to decide whether such reusing is possible or not.  The UE can use LCID + G-RTNI instead of LCID only to identify a RLC entity. To make this work, simply adding “associated-G-RNTI-index” in RLC bearer management procedure should be enough. |
| Apple | No | It cannot work well according to current L2 model, RLC cannot identify the MRB based on the LCID when receiving the data. |
| Xiaomi | No |  |
| Kyocera | Yes | Although we think it’s clearer to use different LCIDs for different RLC entities, we think it works to share the same LCID (e.g., by using G-RNTI to identify the right RLC entity for given packet). |
| ZTE | Yes | can leave it to network configuration, it is possible to have the same LCID in case C-RNTI for PTM re-transmission is not configured or scheduled by network, as in Huawei's suggestion.  As for the LCID space, we might anyway need to expand it for its scarcity shared among UE and multiple MBS services. |
| Ericsson | No | This will increase complexity ( e.g. to have routing by RNTI linking), and in our mind is not necessary considering LCIDs. It has impact on RLC bearers and Split MRB. |
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| LGE | Yes | Common LCID space is shared by DTCHs and MTCHs. Multiplexing of different logical channels associated with the same G-RNTI is supported. A UE may be configured with multiple G-RNTIs. Then, this may be helpful to reduce the required number of LCID values for multicast and to reserve a number of LCID values for unicast. |
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## 3.8 CS-RNTI Monitoring in Unicast Active Time

The last FFS point covered by this discussion is FFS how to associate the G-CS-RNTI and MBS SPS. The main issues will be concluded in RAN1 based on RAN2 LS, but its RAN2 impact is probably DRX operation. In RAN2#116bis-e, RAN2 agreed “In PTP for PTM retransmission, the UE monitors UE specific PDCCH/C-RNTI only during unicast DRX’s active time. Unicast DRX’s RTT timer can be started when PTP retransmission is expected.” This agreement focused only on dynamic scheduling by C-RNTI but MBS SPS retransmission by CS-RNTI should be considered. Considering the case of dynamic grant was already agreed, the case of MBS SPS associated with CS-RNTI can be confirmed in the rapporteur’s understanding.

**Q11) Do companies confirm that the previous agreement is applicable for MBS SPS, as follows?**

**: In PTP for PTM retransmission, the UE monitors UE specific PDCCH/CS-RNTI only during unicast DRX’s active time. Unicast DRX’s RTT timer can be started when PTP retransmission is expected.**

1. **Yes**
2. **No**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Samsung | Yes | It’s natural that CS-RNTI should be monitored. |
| MediaTek | Yes |  |
| OPPO | No | It’s natural that CS-RNTI should be monitored. Yes, it is true.  But it does not mean the unicast RTT will be started. It is same as C-RNTI monitor for PTM retransmission and it is also handled in rapporteur’s “Resolution proposals to Rapporteur Handled Open Issues”.  **I can explain why I say No:**  If the PTP for PTM retransmission is enabled by gNB per TB or per (re-)transmission, and if the PTM data is NACK, the UE will always start the unicast retransmission timer and PTM retransmission timer at the same time because the UE does not know the retransmission is from PTM or PTP. The next question is which RTT timer is used to trigger unicast retransmission timer?  Option 1: Start PTM RTT timer only and start both PTM retransmission timer and unicast DRX retransmission timer if PTM RTT timer expires.  Option 2: Start PTM RTT timer and unicast RTT timer and start PTM retransmission timer and unicast DRX retransmission timer if corresponding RTT timer expires.  The RTT timer is only used to control the DRX retransmission timer start, no need to start both. The key point is to keep the unicast DRX active. So option 1 is better. |
| Nokia | Yes | Just to make sure: “can” here does not mean it will be an optional behaviour. |
| CATT | Yes | RAN1 agreed PTP retransmission of SPS group-common PDSCH is scheduled by CS-RNTI. |
| Huawei， HiSilicon | Yes |  |
| Apple | Yes |  |
| Xiaomi | Yes |  |
| Kyocera | Yes |  |
| ZTE | Yes | we share the same concern from OPPO that which timer to use. This further depends on which kind of re-transmission is expected by UE, and  - if both PTP and PTM are expected, does UE need to have two independent RTT timer running? seems unnecessary. RTT timer is only a reflection of allowed minimum gap between HARQ feedback and possible re-tx, from this perspective, we dont think we shall start both timer.  - If there will be an indication anyway from network which re-transmission scheme (PTP or PTM, as in Q6), we start the corresponding timer  - Another possibility is not to define PTM RTT at all, but simply to follow PTP RTT timer if needed. |
| LGE | Yes |  |
| Ericsson | Yes |  |
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# 4 Conclusion

To be updated.

# 5 References

[1] R2-2202025, Updated Open issue list for NR MBS, Huawei, Hisilicon

[2] R2-2201943, [AT116bis-e][028][MBS] MAC Open Issues (OPPO), OPPO

[3] R2-2201813, 38.321 running CR for NR MBS, OPPO

[4] R2-2201829, 38.331 running CR for NR MBS, Huawei, Hisilicon

[5] R2-2201874, Report of [AT116bis-e][027][MBS] PDCP and RLC initial variables (xiaomi), Xiaomi Communications

[6] R2-2201366, User Plane Aspects for MBS, Samsung