**3GPP TSG-RAN WG2 Meeting #118electronic R2-2206403**

**Online, May 9th – May 20th, 2022**

**Agenda Item: 6.1.3.2**

**Source: OPPO**

**Title: [AT118-e][031][MBS] MAC (OPPO)**

**Document for: Discussion and decision**

# Introduction

This paper is to trigger the following email discussion of MAC open issues in MBS.

* [AT118-e][031][MBS] MAC (OPPO)

Scope: Treat R2-2205483, R2-2205129, R2-2205122, R2-2204609, R2-2204833, R2-2205457, R2-2205218, R2-2205437, R2-2205447, R2-2205540, R2-2204667, R2-2204744, R2-2204832, R2-2204969, R2-2205156, R2-2205449, R2-2205035, R2-2205154, R2-2205480, R2-2204831, R2-2204834, R2-2204891, R2-2204904, R2-2204905, R2-2205628, R2-2205629, R2-2205673, R2-2205709, R2-2205713, R2-2205128, R2-2205481, R2-2205748

Collect one round of comments, pave the way for on-line agreement (identify agreeable points, discussion points),

Intended outcome: Report

Deadline: For online CB W1 Friday

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|  |  |

# Discussion

## 2.1 Multicast

### 2.1.1 CSI-mask on CSI reporting for multicast

Currently, csi-Mask IE is configured per MAC entity.

|  |
| --- |
| MAC-CellGroupConfig ::= SEQUENCE {  ==omit some IEs====  csi-Mask BOOLEAN ==omit some IEs====  } |

If the *drx-onDurationTimer* is not running, UE configured with the *csi-Mask* cannot report CSI on PUCCH even if the *drx-onDurationTimerPTM* is running and some companies think it will impact the MBS data secheuling. So they propose that when *allowCSI-SRS-Tx-MulticastDRX-Active* and *csi-Mask* are configured, the UE does not report CSI on PUCCH when both *drx-onDurationTimer* and *drx-onDurationTimerPTM* are not running.

However, some companies have different view based on some reasons, e.g. for the purpose of CSI masking if all MBS DRX on duration are not overlapped, or any multiplexing of individual PUCCH resources linked to MBS DRX would not be possible in time domain alone, or no need to further increase the complexity.

One company think new configuration (i.e. multicast-CSI-mask) to control the CSI report on PUCCH only during the multicast DRX on duration.

**Option 1**: When *allowCSI-SRS-Tx-MulticastDRX-Active* and *csi-Mask* are configured, the UE does not report CSI on PUCCH when both *drx-onDurationTimer* and *drx-onDurationTimerPTM* are not running.

**Option 2**: CSI masking only considers unicast DRX, i.e. excludes MBS DRX (No spec change).

**Option 3**: New configuration (i.e. multicast-CSI-mask) to control the CSI report on PUCCH only during the multicast DRX on duration.

**Q1: Which option do companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2/3? | Comments |
| Huawei, HiSilicon | Option 1 | Allowing UE to report CSI during *drx-onDurationTimerPTM* running aligns with legacy principle with unicast DRX, for which legacy CSI-mask can be reused for simplicity. |
| Nokia | 2  1 | Aligned with the original intention of the mask, simple.  Our understanding is that when allowCSI-SRS-Tx-MulticastDRX-Active is not configured, this would be similar to option 2 so would also be acceptable. |
| CATT | Option 2 | When CSI mask is configured for uncast, the network can utilize the PUCCH resources for other UEs. So when CSI mask is applied to multicast, the UE is allowed to report CSI on PUCCH even the on duration timer for unicast is not running but on duration timer for multicast is running. This is not helpful for PUCCH utilization.  On the other hand, it has been agreed that the UE can report periodic/semi-persistent SRS and CSI on PUCCH and semi-persistent CSI configured on PUSCH when the UE is in DRX Active for unicast and multicast, we think the benefits on better scheduling is not so obvious. |
| Samsung | 2 | We think both DRX cycles of multicast DRX and unicast DRX are likely to be aligned to maximize the power saving gain. Then, gain of the enhancements is not big. |
| LGE | Option 2 | We think that the purpose of CSI masking is to limit CSI reporting to on-duration to share PUCCH resource among UEs. It seems simple and sufficient to consider unicast DRX for CSI masking. If multicast DRX is taken into account, it is difficult to achieve the purpose of CSI masking considering various overlapping patterns among multiple DRX cyles (e.g. unicast DRX cycle, multicast DRX cycle per G-RNTI). |
| OPPO | Option 1 | If allowCSI-SRS-Tx-MulticastDRX-Active is not configured, it is same as option 2. So CSI-reporting can rely on configuration of allowCSI-SRS-Tx-MulticastDRX-Active. |
| MediaTek | Option 1 | CSI-mask should be aligned for both unicast and multicast DRX for simplicity. So for the case which RRC indicate CSI-masking, and the multicast DRX is considered in active time but the drx-onDurationTimerPTM is not running, the CSI shall not be reported |
| Qualcomm | Option 1 | Multicast data traffic pattern may not be same as Unicast data traffic (Multicast and Unicast DRX cycles may or may not align or overlap in all cases) and some UEs may be multicast only UEs, for these cases it is beneneficial to report CSI when Multicast DRX PTM Onduration timer is running even if Unicast DRX Ondruration timer is not running. Same PUCCH resources can be used for Unicast or Multicast based on how GNB configures to UEs. If Multicast DRX Onduration timer is not running and if UE is not allowed to report CSI, the same PUCCH resources can be used by GNB for configuring to other Unicast UEs to enable PUCCH resource multiplexing. |
| Futurewei | Option 1 | When csi-Mask is configured, normally with the same reason for both unicast and MBS. Option 2 to limit csi-mask being only applicable to unicast is not right. Option 3 is not necessary and increased complexity. |
| Spreadtrum | Option 1 | CSI-mask can be used for unicast and multicast for simplicity. PUCCH resource sharing for CSI reporting can be up to gNB implimentation. |
| Lenovo | Option 1 | The benefit of CSI-mask provides the flexibility for allowing UE more efficient power saving when CSI reporting is not unnecessary which should be applied to multicast DRX as well. |
| Ericsson | Option 1 | This would align to having the same mechanism for MBS independently to Unicast On-duaration and allows for different patterns in data activity. |
| Apple | Option 1,3 | For the configuration, we are fine with either reusing the legacy csi-mask (option 1) or introducing a new configuration (option 3). |
| TD Tech, Chengdu TD Tech | Option 1 |  |
| Xiaomi | Option 1 | This is for the simplicity of the CSI report for both unicast and multicast. |
| ZTE | Option 1 | To ensure the accuracy of PTM scheduling, CSI masking (csi-Mask) for unicast should not cover all Active Time of multicast DRX, e.g., at least not affecting the period in which on duration timer for multicast is on. |
| Sharp | Option 1 | Option 1 align with the purpose of CSI masking. |
| NEC | Option 1 | The general principal is that as long as any active time is available, MBS UE can transmit CSI/SRS. Thus we think UE can also report CSI on PUCCH during multicast DRX *drx-onDurationTimerPTM*. Also, we still have such a parameter of *allowCSI-SRS-Tx-MulticastDRX-Active* to control UE behavior, this can be acceptable. |
| Intel | Option 2 | Agree with LGE. |
| vivo | Option 1 | As *csi-mask* is configuredon basis of the per MAC entity, the same principle should be adopted for both unicast DRX and multicast DRX in terms of UE power saving. |
|  |  |  |

Summary: option 1: option 2 = 15:5. So option 1 is majority view.

**Proposal 1: (15/20)When *allowCSI-SRS-Tx-MulticastDRX-Active* and *csi-Mask* are configured, the UE does not report CSI on PUCCH when both *drx-onDurationTimer* and *drx-onDurationTimerPTM* are not running.**

### 2.1.2 DCP on CSI reporting for multicast

RAN2 assumed that DCP monitoring may be configured when multicast DRX is configured. First, RAN2 should confirm whether DCP monitoring can be configured with multicast DRX.

**Q2: Do companies agree DCP monitoring can be configured with multicast DRX?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | No significant issue has been identified with this RAN2 assumption made in last meeting. |
| Nokia | Yes | Already assumed at the last meeting. |
| CATT | Yes |  |
| Samsung | Yes | DCP monitoring for unicast DRX can be configured independently |
| LGE | Yes | Most of companies seem to support it. We can accept it for progress. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | DCP monitoring is a technique developed for unicast DRX, so it should have no impact on multicast DRX.  This two (DCP, and multicast DRX) can be configured simultaneously.  What we need to study is the impacts to multicast from DCP in the spec if DCP is enabled. |
| Sharp | Yes |  |
| NEC | Yes | It is dependent but note that the current DCP only works on unicast DRX. |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: All companies agree that DCP monitoring can be configured with multicast DRX.

**Proposal 2: (20/20) DCP monitoring can be configured with multicast DRX.**

It is common understanding that the DCP monitoring only affects whether *drx-onDurationTimer* is started*,* no impact on the starting of *drx-onDurationTimerPTM*.

Some companies think that to make multicast scheduling efficient, UE should be allowed to report CSI/SRS even the DCP conditions are satisfied if multicast DRX is in Active Time.

However, some companies have different view, e.g. how to reduce the impact of DCP on multicast DRX can be left to gNB implementation.

**Option 1**: If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE can report CSI/SRS even when the conditions for DCP and unicast DRX in TS 38321 are satisfied, if multicast DRX is in Active Time.

**Option 2**: How to reduce the impact of DCP monitoring on multicast DRX can be implemented by gNB without the spec impacts.

**Q3: Which option do companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2? | Comments |
| Huawei, HiSilicon | Option 1 | We prefer a clean procedural text in MAC specification to make the spec consistent.  Option 1 means configuration of DCP has no impact on CSI reporting for multicast, which should be the intention of decopling DCP and multicast DRX.  While Option 2 actually means configuration of DCP will restrict CSI reporting for multicast, which is not in line with the text when DCP is not configured. |
| Nokia | 1 | UE shall report |
| CATT | Option 1 | Agree with Huawei,in the sense of decopling DCP and multicast DRX,We think option 1 is reasonable. |
| Samsung | 2 |  |
| LGE | Option 2 | If CSI reporting is specified as option 1, power saving gain will be much reduced. If CSI reporting for multicast DRX is beneficial in a certain situation, CSI can be reported by gNB implementation. For example, the parameter of *ps-Wakeup* can be used to control it. |
| OPPO | Option 1 | Same reason as Q1. |
| MediaTek | Option 1 | Agree with Huawei |
| Qaulcomm | Option 1 | Same view as Huawei. |
| Futurewei | Option 1 | When allowed, as long as multicast is active time, CSI report is conducted. It shall not be impacted by unicast DRX as well as DCP. |
| Spreadtrum | Option 2 | We prefer to option2 considering the UE power saving. |
| Lenovo | Option 1 |  |
| Ericsson | Option 1 | Agree w Huawei |
| Apple | Option 1 | Agree with Huawei. |
| TD Tech, Chengdu TD Tech | Option 1 |  |
| Xiaomi | Option 1 |  |
| ZTE | Option 1 | DCP monitoring is configured for unicast DRX and should not affect behavior in multicast DRX, including reporting CSI.  Thus option 1 is preferred. |
| Sharp | Option 1 |  |
| NEC | Option 1 | The current spec is to say if DCP is configured andno any active time is available during *onDurationTimer* due to DCP, UE can not report CSI/SRS during *onDurationTimer* (unless *ps-TransmitPeriodicL1-RSRP / ps-TransmitOtherPeriodicCSI* is configured) even though multicast DRX Active Time is started.  We think the general principal is that as long as any active time is available, MBS UE can report CSI/SRS. Thus, we suggest that:  If DCP/WUS is configured, during drx-onDurationTimer, UE can transmit CSI/SRS when multicast DRX Active Time is started if allowCSI-SRS-Tx-MulticastDRX-Active is configured. |
| Intel | Option 2 | Even if *drx-onDurationTimer* is not started due to no DCP indication, there can be still additional CSI/SRS reporting for multicast DRX with existing configuration parameters. Therefore we don’t think there is need to further extend CSI/SRS reporting for multicast DRX, as in Option 1. |
| vivo | Option 2 | We think UE power saving comes first in this case. |
|  |  |  |

Summary: option 1: option 2 = 15:5. So option 1 is majority view.

**Proposal 3: (15/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE can report CSI/SRS even when the conditions for DCP and unicast DRX in TS 38321 are satisfied, if multicast DRX is in Active Time.**

Currently, IE *allowCSI-SRS-Tx-MulticastDRX-Active* is configured per MAC entity and one company think it should be configured per MBS DRX to achieve better power efficiency and scheduling flexibility.

**Q4: Do companies agree IE *allowCSI-SRS-Tx-MulticastDRX-Active* is configured per MAC (no spec change), not configured per multicast DRX?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | CSI reporting based on the indication is used for all multicast scheduling in a MAC entity. It doesn’t seem to be useful to further allow the flexibility. |
| Nokia | Yes |  |
| CATT | Yes | Per muliticast DRX is not necessary |
| Samsung | Yes | Just for flexibility but gain is not clear. |
| LGE | Yes | We support to configure the IE per MAC. The IE per multicast DRX looks an excessive control. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes | Yes for simplicity. But acknowledge that per DRX allows to handle low quality and high quality multicast sessions differently for meeting quality requirement and power saving respectively. |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | No | A UE may perform multiple multicast DRX simultaneously. A switch (allowCSI-SRS-Tx-MulticastDRX-Active) to turn on or off the CSI/SRS report reflects that in some cases CSI/SRS report is not needed.  To achieve better power efficiency and scheduling flexibility, it might be more appropriate to make parameter *allowCSI-SRS-Tx-MulticastDRX-Active* on a per multicast DRX basis, and gNB decide which Active Time of MBS DRX can be used for the transmission of CSI and SRS. |
| Sharp | Yes |  |
| NEC | Yes | Only one *allowCSI-SRS-Tx-MulticastDRX-Active* is sufficient. |
| Intel | Yes |  |
| vivo | Yes (Proponent) |  |
|  |  |  |

Summary: 18/20 companies agree that IE *allowCSI-SRS-Tx-MulticastDRX-Active* is configured per MAC (no spec change), not configured per multicast DRX.

**Proposal 4: (18/20) IE *allowCSI-SRS-Tx-MulticastDRX-Active* is configured per MAC (no spec change), not configured per multicast DRX.**

### 2.1.3 Others on CSI reporting for multicast

Currently, if UE is configured with both secondary DRX group and *allowCSI-SRS-Tx-MulticastDRX-Active*, and if one DRX group is not in Active Time, only when **all** multicast DRXs are not in Active Time, UE does not report CSI in the DRX group.

Considering dual DRXs are configured and one is for FR1 and another is for FR2, one company propose if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group if unicast DRX and all multicast DRXs of the DRX group are not in Active Time.

**Q5: Do companies agree the below proposal:**

**Proposal: If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group if unicast DRX and all multicast DRXs of the DRX group are not in Active Time.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | Similar to CSI reporting for unicast, CSI reporting for multicast should also be considered within the same DRX group. Please note that multicast can only be scheduled in a single serving cell, which means it can only be in one DRX group.  There is no point controlling CSI reporting on DRX group 1 by multicast DRX configured for DRX group 2. |
| Nokia | Yes | Note that there is a clean up from ZTE in R2-2205629 that might simplify the description. |
| CATT | Yes |  |
| Samsung | See comment | Multicast DRX is configured per CG and does not have its DRX group. The proposal may need to be rephrased:  If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group if unicast DRX of the DRX group and all multicast DRXs ~~of the DRX group~~ are not in Active Time. |
| LGE | Yes | We generally agree. One question is that multicast transmissions are expected to be configured in both DRX groups (e.g. DRX group for FR1 and DRX gropu for FR2). |
| OPPO | Yes |  |
| MediaTek | Yes | We prefer to add a word to the proposal to make it more clear.  **Proposal: If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group only if unicast DRX and all multicast DRXs of the DRX group are not in Active Time.** |
| Qualcomm | Yes | Same view as Huawei and Samsung. |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes | Same view as Huawei and Samsung that there is only group for Multicast DRX. |
| Ericsson | Yes | Agree with Samsung |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes but | yes, a clean up is needed for better readability and more future-proof. // appreciate Nokia referring to ZTE's paper in R2-2205629 |
| Sharp | Yes |  |
| NEC | Yes |  |
| Intel | Yes | Agree with Huawei and Samsung. |
| vivo | Yes | Agree with the intention. |
|  |  |  |

Summary: (20/20) All companies agree with the proposal with changes.

**Proposal 5: (20/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group if unicast DRX and all multicast DRXs of the DRX group are not in Active Time.**

If DRX is not configured for some multicasts, only when all multicast DRXs are not in Active Time, UE does not report CSI in the DRX group. This will prevent the UE from reporting CSI report for the multicast service that is not configured with multicast DRX and affects the scheduling efficiency. One company propose if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE is allowed to report CSI if some of the multicasts are not configured with multicast DRX.

**Q6: Do companies agree the below proposal:**

**Proposal: If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE is allowed to report CSI if some of the multicasts are not configured with multicast DRX.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | If some of the multicasts are not configured with DRX, it means UE should keep monitoring the related G-RNTIs although there is no “Active Time”. In this case, it is not reasonable to prevent UE from reporting CSI for multicast scheduling. |
| Nokia | Yes | Seems to make sense |
| CATT | Yes | Agree with Huawei |
| Samsung | Yes |  |
| LGE | Yes |  |
| OPPO | Yes |  |
| MediaTek | Yes | Agree with Huawei |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | same view with HW, and this is a special case that agrees with our previous understanding. |
| Sharp | Yes |  |
| NEC | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: (20/20) All companies agree the proposal that “If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE is allowed to report CSI if some of the multicasts are not configured with multicast DRX.”

**Proposal 6: (20/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE is allowed to report CSI if some of the multicasts are not configured with multicast DRX.**

### 2.1.4 Multicast DRX related changes

Due to L1 PTP retransmission for the initial transmission of PTM transmission controlled by DCI, the MAC entity is required to start the corresponding *drx-HARQ-RTT-TimerDL* and *drx-RetransmissionTimerDL* and then stop both *drx-RetransmissionTimerDL* and *drx-RetransmissionTimerDL-PTM*

HARQ process is shared by unicast and multicast and one company propose to stop both *drx-RetransmissionTimerDL* and *drx-RetransmissionTimerDL-PTM* in section 5.7.

The corresponding TP is as follows:

|  |
| --- |
| When DRX is configured, the MAC entity shall:  1> if a MAC PDU is received in a configured downlink assignment:  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;  NOTE 1a: If Serving cell is configured with *downlinkHARQ-FeedbackDisabled* and DL HARQ feedback is disabled, *drx-HARQ-RTT-TimerDL* is not started for the corresponding HARQ process.  NOTE 1b: If this Serving Cell is part of a non-terrestrial network, the latest UE-gNB RTT value shall be used to set *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL* length prior to timer start (see TS 38.331 [5] clause [X]).  2> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process;  2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.  **…**  1> if a DRX group is in Active Time:  2> monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213 [6];  2> if the PDCCH indicates a DL transmission; or  2> if the PDCCH indicates a one-shot HARQ feedback as specified in clause 9.1.4 of TS 38.213 [6]; or  2> if the PDCCH indicates a retransmission of HARQ feedback as specified in clause 9.1.5 of TS 38.213 [6]:  3> start or restart the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process(es) whose HARQ feedback is reported in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  NOTE 3: When HARQ feedback is postponed by PDSCH-to-HARQ\_feedback timing indicating an inapplicable k1 value, as specified in TS 38.213 [6], the corresponding transmission opportunity to send the DL HARQ feedback is indicated in a later PDCCH requesting the HARQ-ACK feedback.  3> stop the *drx-RetransmissionTimerDL-PTM* for the corresponding HARQ process(es) whose HARQ feedback is reported;  3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process(es) whose HARQ feedback is reported.  3> if the PDSCH-to-HARQ\_feedback timing indicate an inapplicable k1 value as specified in TS 38.213 [6]:  4> start the *drx-RetransmissionTimerDL* in the first symbol after the (end of the last) PDSCH transmission (within a bundle) for the corresponding HARQ process. |

**Q7: Do companies agree the below proposal and the above proposed changes?**

**Proposal: Stop both drx-RetransmissionTimerDL and drx-RetransmissionTimerDL-PTM in section 5.7 if multicast DRX is configured.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | When unicast/PTP transmission or SPS is received for one HARQ process, there will be no PTM retransmission for this HARQ process. So the *drx-RetransmissionTimerDL-PTM* can be stopped. |
| Nokia | Yes |  |
| CATT | Yes |  |
| Samsung | Yes | If the PDCCH indicates DL unicast transmission, the corresponding HP will not be used by PTM. Thus, it’s natural to stop the timers to avoid unnecessary Active Time. |
| LGE | Yes |  |
| OPPO | Yes | Agree with the proposal and add “if multicast DRX is configured” after the proposed changes. |
| ASUSTeK | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | same view with HW. |
| Sharp | Yes |  |
| NEC | Yes | In this case, for this HARQ process, there is no need for UE to receive retransmission data via PTM. |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: (20/20) All companies agree that stop both drx-RetransmissionTimerDL and drx-RetransmissionTimerDL-PTM in section 5.7 if multicast DRX is configured.

**Proposal 7: (20/20) When MAC PDU or PDCCH for unicast is received, stop both drx-RetransmissionTimerDL and drx-RetransmissionTimerDL-PTM in section 5.7 if multicast DRX is configured.**

In Nokia paper [R2-2205156], it clarifies in MAC spec section 5.7 that DRX Command MAC CE refers to DRX Command MAC CE with DCI scrambled with C-RNTI or CS-RNTI and configured downlink assignment does not include configured downlink multicast assignment.

**Q8: Do companies agree the changes in section 5.7 proposed in annex of [R2-2205156]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | No strong opinion | We agree with the intention but this seems quite straightforward even without change. |
| Nokia | Yes |  |
| CATT | Yes | The change is helpful as chapter 5.7 is not completely independent from multicast. |
| Samsung | Yes | Simple change |
| LGE | Partially yes | Yes for the change of configured DL assignment.  Regarding DRX Command MAC CE with DCI scrambled with C-RNTI, we share the problem pointed out. We see another issue with it. In case of PTP retransmission, DRX Command MAC CE with DCI scrambled with C-RNTI should be considered to be received for a multicast DRX cycle. The multicast DRX cycle can be iendtified by subPDU for data in the MAC PDU or the associated G-RNTI of the HARQ process. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | good to clarify. |
| Sharp | Yes |  |
| NEC | Yes | (except for modification of proposal 1) Modification of MAC CE and configured downlink assignment is acceptable. |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: Almost all companies agree the changes propsed in [R2-2205156]. The CR can be agreed and captured in MAC running CR. For the concern from LGE, in rapporteur’s understanding, the MAC CE will not be contained in the MAC PDU if the MAC PDU will be retransmitted in PTP leg and it is up to network implementation to ensure that.

Due to L1 PTP retransmission for the initial transmission of PTM transmission controlled by DCI, the MAC entity is required to start the corresponding *drx-HARQ-RTT-TimerDL* and *drx-RetransmissionTimerDL*. One company proposed that *drx-HARQ-RTT-TimerDL* is only started when the corresponding *HARQ-FeedbackOptionMulticast* is set to *ack-nack* and when DRX is configured.

**Q9: Do companies agree the changes proposed in [R2-2204834]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | See comments | Agree with “*drx-HARQ-RTT-TimerDL* is only started when the corresponding *HARQ-FeedbackOptionMulticast* is set to *ack-nack*”.  But for “and when DRX is configured”, it seems not that necessary. |
| Nokia | Yes | Makes sense if NACK-only feedback uses common resource, i.e., not possible to know which UE sent NACK.  Agree with Huawei on the need of “when DRX is configured” |
| CATT | No | Even for nack-only mode,RAN1 does not limit it to use shared PUCCH resources(RAN1 conclusion:  PUCCH resource for NACK-only can be shared by UEs transmitting the NACK-only based HARQ-ACK feedback.), the network can also receive NACK and can do retransmission based on NACK. So we think the change is not correct. |
| Samsung | No | drx-HARQ-RTT-TimerDL should be started for nack-only case. gNB may allocate the retranmission and the UE should be able to receive it by extending the Active Time. |
| LGE | Yes | It is o.k. because PUCCH resource for nack-only mode is shared by UEs of a multicast group. One question is whether PUCCH resource for nack-only is always shared by UEs of a multicast group or not. |
| OPPO | No | Current text is clear. |
| MediaTek | No | Agree with CATT |
| Qualcomm | Yes | for Nack only case, C-RNTI based Re-Tx is not possible and UE is not required to start *drx-HARQ-RTT-TimerDL.* |
| Futurewei |  | No strong opinion. Current sentence is for PTP, so It is ok without additional clarification. |
| Spreadtrum | Yes | Besides, we also think the “when DRX is configured” is not needed. |
| Lenovo | Yes | Agree with Qualcomm. |
| Ericsson | No | We agree w CATT and Samsung |
| Apple | No | Agree with CATT. |
| TD Tech, Chengdu TD Tech | Yes | Agree with huawei |
| Xiaomi | No strong view | This depends on whether the gNB can differentiate the UE via the NACK-only feedback. |
| ZTE | Yes | same view with HW and Nokia. |
| Sharp | No | Agree with CATT. |
| NEC | Partially Yes | if common PUCCH resource is used for HARQ feedback, probably the PTP retransmission is not useful as network does not know which UE decodes failed. |
| Intel | No | Agree with CATT. |
| vivo | Yes (Proponent) | Please note that drx-HARQ-RTT-TimerDL is used for L1-PTP retransmission monitoring. When NACK-only based HARQ-ACK feedback is used, only L1-PTM retransmission is feasible, which only requires drx-HARQ-RTT-TimerDLPTM running. |
|  |  |  |

Summary: only 9/20 companies agree the changes proposed in [R2-2204834]. No consensus on this.

One company think whether HARQ feedback is enabled has no impact on UE behavior of stopping the retransmission timers after receiving a DL multicast transmission and propose TP in section 5.7b.

**Q10: Do companies agree the changes proposed in [R2-2205481]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | Even if HARQ feedback is disabled, UE should stop the retransmission timers, if running, for the corresponding HARQ process if a DL multicast transmission is received. |
| Nokia | Partiially yes | Stopping drx-RetransmissionTimerDL always regardless of HARQ feedback enabling makes sense but for drx-RetransmissionTimerDL-PTM no change needed since the timer is not started if HARQ feedback is not enabled. |
| CATT | Partiially yes | Agree with Nokia |
| Samsung | Yes | Since no further DL assignment is expected, it’s natural to stop the timer. |
| LGE | Yes |  |
| OPPO | Partiially yes | Agree with Nokia |
| MediaTek | Yes | Agree with Huawei |
| Qualcomm | Yes | Same view as Nokia. |
| Futurewei | Partially yes | Agree with Nokia |
| Spreadtrum | Yes | Agree with Nokia |
| Lenovo | Yes |  |
| Ericsson | Yes | For the case of no feedback enabled |
| Apple | Partially yes | Agree with Nokia |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Partially yes | Agree with Nokia |
| Sharp | Yes |  |
| NEC | Partially Yes | We admit that whether HARQ feedback is enabled has no impact on UE behavior of stopping the retransmission timers after receiving a DL multicast transmission.  However, if HARQ feedback is disabled, there is no RTT timer started, then naturally there is also no retransmission timer running. So no strong view for the proposal change. |
| Intel | Partially yes | Agree with Nokia |
| vivo | Partially yes | Agree with Nokia |
|  |  |  |

Summary: Most companies share the same view with Nokia, i.e. Stopping *drx-RetransmissionTimerDL* always regardless of HARQ feedback enabling, but for *drx-RetransmissionTimerDL-PTM*, there is no consensus.

**Proposal 8:（20/20）Stopping *drx-RetransmissionTimerDL* always regardless of HARQ feedback enabling. FFS for *drx-RetransmissionTimerDL-PTM.***

## 2.2 Broadcast

### 2.2.1 Broadcast DRX related changes

In [R2-2205218], it proposed to add one note to highlight the timing for DRX duration calculation when SCell is configured for broadcast MBS reception.

NOTE X: If a SCell is configured for MBS broadcast reception, the SFN of this SCell is used to calculate the DRX duration, otherwise the SFN of the SpCell is used.

**Q11: Do companies agree the below proposal and the changes proposed in [R2-2205218]?**

**Proposal: If a SCell is configured for MBS broadcast reception, the SFN of this SCell is used to calculate the DRX duration, otherwise the SFN of the SpCell is used.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | See comments | Agree with the intention, but should clarify that this doesn’t require UE to read MIB of SCell. The UE can derive the SFN of SCell from SFN of SpCell. |
| Nokia | Yes |  |
| CATT | No | It may be better to align with the unicast DRX principle  //38.321, 5.7 Discontinuous Reception (DRX)  NOTE 2: In case of unaligned SFN across carriers in a cell group, the SFN of the SpCell is used to calculate the DRX duration.  [OPPO] It is for broadcast, it will be always based on SFN of the cell who broadcasts MCCH. |
| Samsung | No | In CA, inter-subframe synchronization is assumed. Agree with CATT. |
| LGE | Yes | We agree to the proposal. However, it is not sure that NOTE is required because it can be inferred from the RRC description (5.9.3.3 Broadcast MRB establishment).  1> receive DL-SCH on the cell where the *MBSBroadcastConfiguration* message was received for the MBS broadcast service for which the broadcast MRB is established and using *g-RNTI* and *mtch-SchedulingInfo* (if included) in this message for this MBS broadcast service; |
| OPPO | Yes | It is for broadcast, it will be always based on SFN of the cell who broadcasts MCCH.. |
| MediaTek | No | We assume SFN operation is transparent to the UE |
| Qualcomm | Yes |  |
| Futurewei | No | When SCell is used, the UE is in connected mode and can simply following SFN of Spcell. Agree with CATT. |
| Spreadtrum | Yes |  |
| Lenovo | Yes | It is broadcast. It is not possible for the UE to follow the SFN of Spcell since the DRX configuration is also applied to other UEs without CA configuraiton in the cell. |
| Ericsson | No |  |
| Apple | No | The UE is not required to acquire MIB on SCell, so UE is only aware of the SFN of SpCell.  In CA, we should assume the SFN is same across serving cells. |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | See comments | We should not require the UE to read the SCell MIB. If this requires the UE to read the MIB, we should then ask RAN1 on the feasibility as this will impact the UE simultaneous reception capability of PHY channels in SCell as given in 38.202. |
| ZTE | Yes | Different UE that consumes the same broadcast service might have different SpCell.  Better be aligned the DRX per service in the SCell that provides the broadcast service. |
| Sharp | Yes |  |
| NEC | No | Agree with apple |
| Intel | No | Agree with CATT. |
| vivo | Yes | Agree with the intention. |
|  |  |  |

Summary: (9/20) companies agree with proposal in [R2-2205218]. No consensus on this.

### 2.2.2 HARQ process related changes for broadcast MBS

There is no NDI and HARQ process id in DCI for broadcast scheduling, there is repetition for MTCH according to the text of beam sweeping of MTCH like OSI. At the same time, RAN1 agree to use *pdsch-AggregationFactor* also for broadcast MBS scheduling.

In [R2-2205437/ R2-2204609/ R2-2204833], companies proposed to add text for HARQ process handling for broadcast MBS reception, but the wordings are different.

Which text do you preferred?

|  |  |
| --- | --- |
| Option 1  R2-2204609 | For each received TB and associated HARQ information, the HARQ process shall:  1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or  1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or  1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI or a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MCCH or MTCH schedule indicated by RRC; or |
| Option 2  R2-2205437 | For each received TB and associated HARQ information, the HARQ process shall:  1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or  1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or   1. if the HARQ process is associated with a transmission indicated with a MCCH-RNTI or a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or |
| Option 3  R2-2204833 | For each received TB and associated HARQ information, the HARQ process shall:  1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or  1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or  1> if the HARQ process is allocated for the received TB for MCCH or broadcast MTCH, and this is the first received transmission for the TB according to the scheduling information indicated by RRC; or |

**Q12: Do companies agree the changes and which text do companies prefer in [R2-2205437/ R2-2204609/ R2-2204833]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Maybe no | We think another condition can cover the case of MBS broadcast:  1> if this is the very first received transmission for this TB (i.e. there is no previous NDI for this TB): |
| Nokia | Yes | Option 1 rather than option 3. Option 2 seems to assume scheduling via DCI ? |
| CATT | Yes  None | We think there is no retransmission for MCCH or broadcast MTCH. So the the modification can be:  For each received TB and associated HARQ information, the HARQ process shall:  1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or  1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or  1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI or a G-RNTI for MBS broadcast; or |
| Samsung | Yes | MAC spec should consider this case. We prefer Option 2, which is consistent with 38.214 v17.10 section 5.1.2.1  “When receiving PDSCH scheduled by DCI format 4\_0 in PDCCH with CRC scrambled by G-RNTI for MTCH, if the UE is configured with *pdsch-AggregationFactor* in the *pdsch-Config-MTCH*, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots.”  For Option 1 and Option 3, “MTCH schedule” and “scheduling information indicated by RRC” are ambiguous description. |
| LGE | Yes – Option 1 |  |
| OPPO | Yes | Option 1 |
| MediaTek | Yes | Option 1 |
| Qualcomm | Yes  Option 2 | Same view as Samsung. |
| Futurewei | Yes | Option 1 |
| Spreadtrum | Yes | Option 1 |
| Lenovo | Yes | Option 1 |
| Ericsson | Yes | Option 1, agree that the use of “schedule, …” is not clear still |
| Apple | Yes | Option 1 |
| TD Tech, Chengdu TD Tech | Yes | Option 1 |
| Xiaomi | Yes | Option 1 or Option 2 |
| ZTE | no. | similar view with Huawei. |
| Sharp | Yes | Option 1 |
| NEC | Yes | Prefer option 2, fine to option 1 |
| Intel | Yes | Option 1 |
| vivo | Yes | Either solution is fine to us. |
|  |  |  |

Summary: (18/20) companies agree to capture something in 38.321 for HARQ process handling for MCCH/MTCH. It is common understanding, the MCCH and MTCH is deliveried via beam sweeping and there is similar repetion like OSI. It is also true that *pdsch-AggregationFactor* is also used for MTCH, not MCCH. So the concern from Samsung is valid and the changes is proposed as:

1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MCCH schedule indicated by RRC; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MTCH schedule indicated by RRC or according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or

**Proposal 10: (18/20) The text about new tranmision or retransmission handling for HARQ process of MCCH/MTCH reception is captured in 38.321. The following text can be as baseline for phase 2 discussion:**

1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MCCH schedule indicated by RRC; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MTCH schedule indicated by RRC or according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or

In [R2-2205437], company proposed MCCH should be readily identified with the MCCH-RNTI and be delivered to upper layers due to no multiplexing for MCCH and proposed the following text:

|  |
| --- |
| 1> if the data for this TB was successfully decoded before:  2> if the HARQ process is equal to the broadcast process; or  2> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI:  3> deliver the decoded MAC PDU to upper layers.  2> else if this is the first successful decoding of the data for this TB:  3> deliver the decoded MAC PDU to the disassembly and demultiplexing entity. |

**Q13: Do companies agree the changes above proposed in [R2-2205437]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | No | MAC PDU for MCCH should be first delivered to the disassembly and demultiplexing entity for MAC header disassemble before delivery, as there is a MAC header for this MAC PDU. |
| Nokia | No | Agree with Huawei BUT why do we actually need an LCID, couldn’t we use a transparent MAC for MCCH since it is scheduled with MCCH-RNTI ? |
| CATT | No | Agree with Huawei |
| Samsung | Yes |  |
| LGE | Yes | This change is also aligned with change of Figure 4.2.2-1 and Figure 4.2.2-2 handled in Q20. |
| OPPO | No | MCCH is different from BCCH. For BCCH, there is TM RLC and no MAC subheader. For MCCH, there is UM RLC and also MAC subheader. Anyway, MAC will remove the subheader even if there is no multiplexing. |
| MediaTek | No | Agree with Huawei |
| Qualcomm | No | Same view as Huawei |
| Futurewei | No | Agree with Huawei/OPPO |
| Spreadtrum | No | Agree with Huawei |
| Lenovo | No | Agree with Huawei |
| Ericsson | No | Agree w Huawei |
| Apple | No | Agree with Huawei |
| TD Tech, Chengdu TD Tech | No |  |
| Xiaomi | No | Agree with Huawei |
| ZTE | no | it can be a special case in which de-multiplexing happens to be not needed. |
| Sharp | No | Agree with Huawei. |
| NEC | See comment | There is indeed a MAC header (LCID = 0) for this MAC PDU. But I have a question that is this misalignment with TS 38.300 Figure 16.10.3.2 as for MCCH there is no disassembly and demultiplexing entity. |
| Intel | Yes | Agree with Huawei. |
| vivo | Yes | It is similar to the handling for the SI message. |
|  |  |  |

Summary: (17/20) disagree with the following change proposed in [R2-2205437]. The changes below are not agreed.

1> if the data for this TB was successfully decoded before:

2> if the HARQ process is equal to the broadcast process; or

2> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI:

In [R2-2205457], company proposed to add text to clarify how to select HARQ process for MCCH/MTCH reception.

|  |
| --- |
| The number of parallel DL HARQ processes per HARQ entity is specified in TS 38.214 [7]. The dedicated broadcast HARQ process is used for BCCH. For MCCH or broadcast MTCH, the UE implementation selects an HARQ process other than the dedicated broadcast HARQ process. |

**Q14: Do companies agree the changes above proposed in [R2-2205457]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Postpone | Should wait for reply LS from RAN1 first. |
| Nokia |  | It would be good to define a dedicated HARQ process for MCCH similar to BCCH. For broadcast MTCH the addition makes sense. |
| CATT | No | not needed, there is already a NOTE in the spec  //38.321  NOTE: It is up to UE impletentation to allocate the received TB for MCCH or broadcast MTCH to one HARQ process. |
| Samsung | No | NOTE is already there in spec. It is also already clear that dedicated broadcast HARQ process is only for BCCH.  *NOTE: It is up to UE impletentation to allocate the received TB for MCCH or broadcast MTCH to one HARQ process.* |
| LGE | No | We think the following NOTE already covers the intention.  NOTE: It is up to UE impletentation to allocate the received TB for MCCH or broadcast MTCH to one HARQ process. |
| OPPO | No | Agree with LGE. |
| MediaTek | Yes | It is good to clarify the UE’s behavior. Also ok to wait for RAN1 |
| Qualcomm | No | Same view as CATT and Samsung. |
| Futurewei | No | Agree with above companies points. |
| Spreadtrum | No | Agree with CATT. |
| Lenovo | No |  |
| Ericsson | No | Not needed |
| Apple | No |  |
| TD Tech, Chengdu TD Tech | No |  |
| Xiaomi | Yes | Proponent, but fine wit wait for the reply LS from RAN1. |
| ZTE | no | Agree with CATT/Samsung/LGE. |
| Sharp | No |  |
| NEC | No | See above |
| Intel | No | Agree with CATT. |
| vivo | No | The current spec has captured this. |
|  |  |  |

Summary: (18/20)companies disagree with the changes proposed in [R2-2205457]. Following majority view, the changes are not agreed.

### 2.2.3 Other proposed changes

In [R2-2204606], company proposed to capture text for MTCH reception via beam sweeping in 38.321, not in 38.331.

**Q15: Do companies agree the below proposal and agree the corresponding changes proposed in [R2-2204606]?**

**Proposal: Capture text for MTCH reception via beam sweeping in 38.321, not in 38.331.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | No strong view | Either way is fine for us. |
| Nokia | ~ | No strong view. |
| CATT | No strong view |  |
| Samsung | No | The current 331 text is enough. MAC spec does not similar texts for other cast type. Also, in 38.321 CR, ordering of text description for “PDCCH reception” and “mapping for PDCCH monitoring occasion for MTCH” is ambiguous |
| LGE | No | We think RRC is proper for the description. If it is required to capture it in a lower layer, physical layer spec. seems more proper than mac spec. because it is related to beam sweeping opreration. |
| OPPO | Yes | MTCH is data, it is better to capture the text for data reception in 38.321.  For MCCH,OSI reception, they are signalling and it is OK to capture text for data reception in 38.331. |
| MediaTek | No strong view |  |
| Qualcomm |  | May be RRC is better place than MAC. |
| Futurewei | No | Do not see a strong reason to make the change. |
| Spreadtrum | No strong view |  |
| Lenovo | No strong view |  |
| Ericsson | No | MAC does not describe these currently, also the text is not clear. |
| Apple | No strong view |  |
| TD Tech, Chengdu TD Tech | No |  |
| Xiaomi | No strong view |  |
| ZTE | yes | reasonable to do so. |
| NEC | No strong view | Although RRC description is sufficient. |
| Intel | No | Typically beam sweeping operations are not captured in MAC. |
| vivo | No strong view | Just a modeling issue. |
|  |  |  |

Summary: Most companies have no strong view about moving text for MTCH reception via beam sweeping from 38.331 to 38.321. There is same question in #29, so it is up to the discussion in #29.

In [R2-2205218], company proposed one note in 5.9 to clarify that the SCell cannot be deactivated by MAC CE if the SCell is configured for broadcast reception.

|  |
| --- |
| NOTE X: The SCell configured for MBS broadcast reception cannot be deactivated via the SCell Activation/Deactivation MAC CE and Enhanced SCell Activation/Deactivation MAC CE. |

**Q16: Do companies agree the below proposal and the changes proposed in [R2-2205218]?**

**Proposals: The SCell configured for MBS broadcast reception cannot be deactivated via the SCell Activation/Deactivation MAC CE and Enhanced SCell Activation/Deactivation MAC CE.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | No | It is up to NW implementation. If the UE supports MBS broadcast reception on non-serving cell, it has no problem to deactivate this SCell. |
| Nokia | No | Wouldn’t that unecessarily increase power consumption and require the deactivation timer to be set to infinity always? |
| CATT | No | It is up to NW implementation. |
| Samsung | No | Broadcast reception via SCell it up to UE implementation? |
| LGE | No | Considering that UE can receive MBS broadcast in RRC\_IDLE/INACTIVE and in non-serving cell depending on UE capability, the NOTE does not need to be captured. It may be left to UE implementation. |
| OPPO | Yes |  |
| MediaTek | No |  |
| Qualcomm |  | Intention is OK. UE can only receive Broadcast in CFR only if BWP is Active (i.e SCell has to be activated). But if same broadcast service is not available in other frequnecies, there is no choice for NW other than keeping SCell activated. We are fine to leave it upto NW implementation. |
| Futurewei | No |  |
| Spreadtrum | No | It is up to NW implementation. |
| Lenovo | No | How to receive the broadcast in Scell is up to UE implementation. |
| Ericsson | No | Both UE and NW means to use SCell is up to implementation. |
| Apple | No |  |
| TD Tech, Chengdu TD Tech | No |  |
| Xiaomi |  | The UE should not be required to receive broadcast MBS via deactivated SCell. |
| ZTE | No | network is in charge. |
| Sharp | No |  |
| NEC | No | Leave this to NW implementation. |
| Intel | No | It is up to network implementation. |
| vivo | No | Leave it to NW implementation. |
|  |  |  |

Summary: (19/20) companies disagree with proposal above proposed in [R2-2205218]. The below proposal is not agreed, i.e, The SCell configured for MBS broadcast reception cannot be deactivated via the SCell Activation/Deactivation MAC CE and Enhanced SCell Activation/Deactivation MAC CE.

The following changes proposed in [R2-2204833].

|  |
| --- |
| When the MAC entity needs to read BCCH, the MAC entity may, based on the scheduling information from RRC:  1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the SI-RNTI;  2> indicate a downlink assignment and redundancy version for the dedicated broadcast HARQ process to the HARQ entity.  When the MAC entity needs to read MCCH, the MAC entity may, based on the scheduling information from RRC:  1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the MCCH-RNTI;  2> indicate a downlink assignment and redundancy version for the dedicated broadcast HARQ process to the HARQ entity. |

**Q17: Do companies agree the changes proposed in [R2-2204833]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | No | This seems not necessary as it may not be possible for soft combining due to possible segmentation of RLC PDUs of MCCH, e.g. RLC SNs will be different for different TBs. |
| Nokia | Yes |  |
| CATT | No | “the dedicated broadcast HARQ process” is for BCCH,can not be used for MCCH |
| Samsung | No | There’s no broadcast HARQ process. |
| LGE | See comments | We agree to the intention that presence of DL assignment and the associated HARQ information need to be indicated to the HARQ entity. However, we need to discuss TP improvement. At least, ‘the dedicated broadcast HARQ process’ needs to be changed because it is UE implementation to select a HARQ process. |
| OPPO | No | Cannot see the necessary. |
| MediaTek | No | Agree with CATT |
| Qualcomm | Yes |  |
| Futurewei | No |  |
| Spreadtrum | Yes | Agree with LGE |
| Lenovo | No |  |
| Ericsson | No strong opinion | Not necessarily needed but if added the HARQ process is up to UE to select and should be changed. |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | No |  |
| Xiaomi |  | Fine with the intention. However there is no dedicated broadcast HARQ process. |
| ZTE | Yes with comments | Agree with LGE |
| Sharp | No |  |
| NEC | - | Agree with LGE |
| Intel | Yes | Text related to HARQ process can be further improved. |
| vivo | Yes (proponent) | Agree with LG. |

Summary: (9/20) companies agree with the changes proposed in [R2-2204833]. No consensus on this.

In [R2-2205447], company proposed the text in MAC reset section to excluding broadcast related timer and HARQ process handling. Do you agree the changes?

**Q18: Do companies agree the changes proposed in [R2-2205447]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes |  |
| Nokia | No | Not needed at this stage. |
| CATT | Yes |  |
| Samsung | Yes | Broadcast timers should not be stopped. |
| LGE | Yes |  |
| OPPO | No strong view | Following majority view. |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes |  |
| Sharp | Yes |  |
| NEC | Yes | broadcast reception should not be affected by MAC reset scenarios. |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: (18/20) companies agree the changes about MAC reset proposed in [R2-2205447]. The changes are agreed and captured in MAC running CR.

## 2.3 others

In [R2-2205122/ R2-2205129], companies proposed text to clarify discarding unexpected sub PDU for broadcast MBS reception. In previour MAC running CR discussion, most companies agreed to add text in secion 5.3.3, not 5.13. it is better not to open this discussion again, i.e. the yellow highlight text in 5.3.3 below will be kept.

|  |
| --- |
| 5.3.3 Disassembly and demultiplexing The MAC entity shall disassemble and demultiplex a MAC PDU as defined in clauses 6.1.2 and 6.1.5a.  When a MAC entity receives a MAC PDU for MAC entity's G-RNTI or G-CS-RNTI, or by the configured downlink assignment for MBS multicast containing an LCID or eLCID which is not configured, the MAC entity shall at least:  1> discard the received subPDU. |

Due to L1 PTP retransmission for the initial transmission of PTM transmission, the UE may receive a MAC PDU scambmed with C-RNTI or CS-RNTI for retrsnamission of MBS multicast scampbed with G-RNTI or SPS. It is not clear how to handle this case and it is already captured in 5.13 for a error case.

|  |
| --- |
| 5.13 Handling of unknown, unforeseen and erroneous protocol data When a MAC entity receives a MAC PDU for the MAC entity's C-RNTI or CS-RNTI, or by the configured downlink assignment, containing a Reserved LCID or eLCID value, or an LCID or eLCID value the MAC Entity does not support, the MAC entity shall at least:  1> discard the received subPDU and any remaining subPDUs in the MAC PDU.  When a MAC entity receives a MAC PDU for the MAC entity's C-RNTI or CS-RNTI, or by the configured downlink assignment, containing an LCID or eLCID value which is not configured, the MAC entity shall at least:  1> discard the received subPDU. |

**Option 1**: Due to L1 PTP retransmission for the initial transmission of PTM transmission, when UE receive a MAC PDU scambmed with C-RNTI or CS-RNTI for retrsnamission of MBS multicast scampbed with G-RNTI or SPS, UE discard the unexpected subPDU according to 5.13, i.e. no spec change.

**Option 2**: Due to L1 PTP retransmission for the initial transmission of PTM transmission, when UE receive a MAC PDU scambmed with C-RNTI or CS-RNTI for retrsnamission of MBS multicast scampbed with G-RNTI or SPS, UE discard the unexpected subPDU according to 5.3.3, i.e. add corresponding text for CS-RNTI and C-RNTI case in multicast reception in 5.3.3.

**Q19: Which option do companies prefer and do companies agree the changes proposed in [R2-2205122] if option 2 is chosen?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Option 1 | No need for duplicated handling as already covered by section 5.13. |
| Nokia | Yes | Option 2. |
| CATT | Option 1 |  |
| Samsung | 1 |  |
| LGE | Yes – Option 2 | For the first change in R2-2205122, we think that handling of PTP retransmission case is considered as a normal operation for the received MBS subPDUs containing (e)LCID which is not configured. Therefore, it would be better to specify all handling of MBS MAC PDU in one place. With option 1, it may be confusing whether handling for MBS MAC PDU received by C-RNTI/CS-RNTI is intentionally missing in 5.3.3 or not.  For the second change in R2-2205122, we think that it is not clear that the UE discards only the received subPDU containing an (e)LCID which is not configured with the current text, and the second change makes it clear. |
| OPPO | Option 1 |  |
| MediaTek | Yes | Option 2 |
| Qualcomm | Option 2 |  |
| Futurewei | Option 1 |  |
| Spreadtrum | Yes | Option 2 |
| Lenovo | Option 1 |  |
| Ericsson | Option 1 | (text needs some work..) |
| Apple | Option 1 |  |
| TD Tech, Chengdu TD Tech | Option 1 |  |
| Xiaomi | Option 1 |  |
| ZTE | Option 1 | same view with HW. |
| Sharp | Option 1 |  |
| NEC | Option 1 |  |
| Intel | Option 1 |  |
| vivo | Option 1 |  |
|  |  |  |

Summary: (15/20) companies prefer option 1, i.e. there is no spec change.

In [R2-2205483], company proposed to change the HARQ model for MCCH and broadcast MTCH in Figure 4.2.2-1 and Figure 4.2.2-2.

**Q20: Do companies agree the changes proposed in [R2-2205483]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| Huawei, HiSilicon | Yes | Otherwise it is not aligned with the agreed HARQ modelling. |
| Nokia | Yes | It would be good to define a dedicated HARQ process for MCCH since currently MBS broadcast always uses at least 2 HARQ processes. |
| CATT | Yes |  |
| Samsung | Yes | HP is shared by unicast, multicast and broadcast. |
| LGE | Yes |  |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Futurewei | Yes |  |
| Spreadtrum | Yes |  |
| Lenovo | Yes |  |
| Ericsson | Yes | To align the HARQ model. |
| Apple | Yes |  |
| TD Tech, Chengdu TD Tech | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes. |  |
| Sharp | Yes |  |
| NEC | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
|  |  |  |

Summary: (20/20) All companies agree the changes proposed in [R2-2205483]. The changes are agreed.

## 2.4 Any other issues?

**Q21: Any other open issues?**

|  |  |  |
| --- | --- | --- |
| Company | Issues | Comments |
| Huawei, HiSilicon | For unicast DRX, retransmission timer and RTT timer are maintained per HARQ process. Similarly, for multicast DRX, retransmission timer and RTT timer are also maintained per HARQ process. Besides, according to the current specs, multicast DRX is configured and operated per G-RNTI/G-CS-RNTI. In other words, network may configure different values for retransmission timer or RTT timer corresponding to different G-RNTIs/G-CS-RNTIs. Considering that HARQ processes are shared by unicast and multicast, there may be multiple sets of retransmission timers and RTT timers associated with the same HARQ process, for unicast DRX and multiple multicast DRXs.  **Proposal: RAN2 to confirm that retransmission timer and RTT timer of multicast DRX are maintained per G-RNTI/G-CS-RNTI per HARQ process and further study the impact on multicast DRX operation.** |  |
| Nokia | What about the restructuring proposed by ZTE in 5629? | See annex, it will be discussed in phase 2. |
| ASUSTeK | In addition to Q7 in 2.1.4 (Multicast DRX), the second proposal as below in R2-2205128 seems missing. Probabaly we can add one more question Q7-1.  In R2#117, we just agree to start the unicast RTT Timer, and DRX Retx timer for unicast would be naturally started (if needed) after its unicast RTT timer expires. Hence, the action of stopping DRX Retx timer for unicast should be removed (since it was not fully discussed). Actually, if DRX Retx timer for unicast is already running but stopped here, UE may miss potential unicast transmission from NW.  **Proposal 2: If UE receives a PDCCH indicating a multicast transmission, not stop the corresponding *drx-RetransmissionTimerDL* for unicast.** | It can be discussed in phase 2. |
| ZTE | Current spec which combines the efforts of spec rapporteur and all other contributing companies, is a precise reflection of RAN2 agreements. We appreciate it.  It could be further refined though, for better readability and more future-proof if any new feature is to be added on unicast or multicast DRX.  based on the comments received so far, the controversy in front of us lies in the fact that it might not be a good idea to couple:  - unicast DRX (which is per DRX group in a cell group) // in 5.7  - and multicast DRX (which is configured per G-RNTI per cell group, but actually per cell as it will only be scheduled in no more than one cell) // in 5.7b  into the same DRX procedure in 5.7.  Samsung's comments to Q5 also told that multicast group DRX was not able to be categorized into some DRX group.  They are with different granularity and different supported features, e.g., *allowCSI-SRS-Tx-MulticastDRX-Active*, *csi-Mask* and whether DCP enabled or not can be apply to multicast, unicast DRX or both.  to be honest, we struggled to understand the logic behind the protocols with various layers of conditional expressions, exceptions and their combinations.  One simple way out can be to decouple the description of unicast DRX and multicast DRX into separate sections (multicast DRX is already there in 5.7b). And the per UE behaviour is a synthesize of both. This is exactly how the spec is written: "When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification" in 38.321. In one specific slot, MAC determines what to report and what to monitor based on all sections 5.7/5.7b, and other possible clauses.  we suggest a re-structuring as in R2-2205629 (the corresponding feature to be supported is pending on discussion result in section 2.1). | See annex, it will be discussed in phase 2. |
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# Conclusions

Based on the discussion above, we propose:

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| --- |
| ***Multicast*** |

**Proposal 1: (15/20)When *allowCSI-SRS-Tx-MulticastDRX-Active* and *csi-Mask* are configured, the UE does not report CSI on PUCCH when both *drx-onDurationTimer* and *drx-onDurationTimerPTM* are not running.**

**Proposal 2: (20/20) DCP monitoring can be configured with multicast DRX.**

**Proposal 3: (15/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE can report CSI/SRS even when the conditions for DCP and unicast DRX in TS 38321 are satisfied, if multicast DRX is in Active Time.**

**Proposal 4: (18/20) IE *allowCSI-SRS-Tx-MulticastDRX-Active* is configured per MAC (no spec change), not configured per multicast DRX.**

**Proposal 5: (20/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE does not report CSI in a DRX group if unicast DRX and all multicast DRXs of the DRX group are not in Active Time.**

**Proposal 6: (20/20) If *allowCSI-SRS-Tx-MulticastDRX-Active* is configured, UE is allowed to report CSI if some of the multicasts are not configured with multicast DRX.**

**Proposal 7: (20/20) When MAC PDU or PDCCH for unicast is received, stop both drx-RetransmissionTimerDL and drx-RetransmissionTimerDL-PTM in section 5.7 if multicast DRX is configured.**

**Proposal 8: (20/20) Stopping *drx-RetransmissionTimerDL* always regardless of HARQ feedback enabling. FFS for *drx-RetransmissionTimerDL-PTM.***

**Proposal 9: (19/20)the changes propsed in [R2-2205156] can be agreed and captured in MAC running CR.**

|  |
| --- |
| ***Broadcast*** |

**Proposal 10: (18/20) The text about new tranmision or retransmission handling for HARQ process of MCCH/MTCH reception is captured in 38.321. The following text can be as baseline for phase 2 discussion:**

1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MCCH schedule indicated by RRC; or

1> if the HARQ process is associated with a transmission indicated with a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MTCH schedule indicated by RRC or according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or

**Proposal 11: the changes about MAC reset proposed in [R2-2205447] are agreed and captured in MAC running CR.**

|  |
| --- |
| ***Others*** |

**Proposal 12: the changes proposed in [R2-2205483] are agreed and captured in MAC running CR.**

# Phase 2

* When allowCSI-SRS-Tx-MulticastDRX-Active and csi-Mask are configured, the UE does not report CSI on PUCCH when both drx-onDurationTimer and drx-onDurationTimerPTM are not running.
* DCP monitoring can be configured together with multicast DRX.
* If allowCSI-SRS-Tx-MulticastDRX-Active is configured, UE shall report CSI/SRS even when the conditions for DCP and unicast DRX in TS 38321 are satisfied, if multicast DRX is in Active Time.

Based on agreements P1/3 and text already captured in 38.321 about issue “not reporting CSI….”, some companies have concerns about where to capture the corresponding text. There are 3 options (the changes text are showed in annex):

**Option 1**: Capture the text related multicast MBS on CSI/SRS reporting in 5.7.

**Option 2**: Capture the text related multicast MBS on CSI/SRS reporting in 5.7b. One note is added to say “If any DRX operation (i.e. multicat DRX or unicast DRX) results in CSI reporting or SRS tranmision, then CSI reporting or SRS transmission will report or transmission.”

**Option 3**: Create a new clause to describe CSI/SRS reporting considering both unicast DRX operation and multicast DRX operation.

**Q1: which option do companies prefer, see the detailed changes in annex?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2/3? | Comments |
| LGE | Option 1 |  |
| OPPO | Option 3 or 1 | It is better to creat a new section only for CSI/SRS reporting/transmission due to DRX operation, including multicast DRX and unicast DRX. it is easy for future change due to introduction of new feature.  Option 1 is also fine, but not clean. |
| ZTE | option 2 | do appreciate Rapporteur effort on the CR work. solute to OPPO, as sorting out the options is of tons of work there.  our view on the CR structure options:  - option 1 might work, however, more clarification/edit might be needed, e.g., the definition of DRX group and relation to multicast DRX. In our understanding to the existing definition and RAN1/2 agreement of multicast scheduling, they have a influence to CSI report in a different granularity. we find it hard to modify current spec to make it right and less confusing.  - option 2 provides more cleaner structure, and it is more future proof, e.g., if new features are to be considered, life is easier to future CR, moreover, we wont have the definition of DRX group and multicast group issue in option 1, i.e., the concept DRX group stays as it was.  // in our view we think the CR in 5629 by ZTE can be the baseline for option 2, it might be not needed to mention DCP in section 5.7b though, based on our agreements this week (DCP does not impact the CSI report for multicast DRX).  - option 3 should have been the solution we took since Rel-15, it is neat and bold, to decouple CSI report from the DRX in separate section. Our only concern to option 3 is this might bring impacts to other WI, and this is a cross WI level CR.  to conclude, we prefer option 2, although option 3 itself is beautiful. |
| CATT | Option 1 | It is clear to capture the corresponding part in DRX procedure. |
| vivo | Option 1 | Additional clarification can be added to the existing test for unicast DRX. |
| Nokia | Option 2 | The cleanest without (a risk of) affecting legacy behaviour |
| MediaTek | Option 1 or 3 | Since similar text of multicast DRX has been added to section 5.7, it’s better to capture the text together.  However, option 3 is more concise and future friendly. If option3 is used, the text of multicast DRX already in section 5.7 should be also moved to the new clause. |
| Intel | Option 1 | There are already multicast DRX related CSI/SRS text captured in section 5.7, it is preferable to capture other text in section 5.7 as well. |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 | For Option 2, note that current specs specifies the conditions for UE **not to** report CSI. If the conditions are splited into different sections, UE will not report CSI when any of the conditions are satisfied, which is not the intention.  For Option 3, it will cause massive changes to specs. What’s worse, it will change the location of legacy text (since Rel-15), which may lead to confusion during implementation. |
| NEC | Option 1 | The description of DCP and csi-mask have already captured in 5.7.  It is simple solution to consider multicast active time under these cases. |
|  |  |  |

In [R2-2204833], it indicates that when a downlink assignment for a PDCCH occasion has been received on the PDCCH for the MCCH-RNTI, the MAC entity shall indicate the presence of a downlink assignment and redundancy version to the HARQ entity. During phase 1 email discussion, many companies agree the intention but conern the wording.

From rapporteur point of view, the intention is correct and the wording is improved as below. At the same time, the similar change is also neeed for broadcast MTCH reception.

**Q2: Do companies agree the below changes for MCCH reception and broadcast MTCH reception?**

|  |  |  |
| --- | --- | --- |
| Company | MCCH reception:  Yes/No? | MTCH reception:  Yes/No? |
| LGE | Yes with the following change because HPID is not included in the DCI and I think the HARQ entity selects one HP.  ~~for the selected HARQ process for MCCH reception~~ to the HARQ entity | Yes with the following change (same reason with MCCH reception)  ~~for the selected HARQ process for broadcast MTCH reception~~ to the HARQ entity |
| OPPO | Yes | Yes |
| ZTE | Yes (the "selected" process is a good reflection of the agreement) | Yes |
| CATT | Yes | Yes |
| vivo | Yes. | **No,** the following highlighted test can be reused for MTCH reception (which is addressed to G--RNTI). We fail to see the motivation.  1> if a downlink assignment for this PDCCH occasion and this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI, or Temporary C‑RNTI, or G-RNTI:  2> if this is the first downlink assignment for this Temporary C-RNTI:  3> consider the NDI to have been toggled.  2> if the downlink assignment is for the MAC entity's C-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or G-CS-RNTI, or a configured downlink assignment for unicast or MBS multicast; or  2> if the downlink assignment is for the MAC entity's G-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or G-CS-RNTI, or other G-RNTI, or C-RNTI, or a configured downlink assignment for unicast or MBS multicast:  3> consider the NDI to have been toggled regardless of the value of the NDI.  2> if this is the first downlink assignment after initial transmission for CG-SDT with CCCH message as in clause 5.4.1:  3> stop the *cg-SDT-RetransmissionTimer* for the corresponding HARQ process for initial transmission with CCCH message.  2> indicate the presence of a downlink assignment and deliver the associated HARQ information to the HARQ entity. |
| Nokia | Yes but why “may” | Yes but why “may” |
| MediaTek | Yes | Yes |
| Intel | Yes | Yes |
| Ericsson | Yes | Yes |
| Huawei, HiSilicon | Yes | Yes |
| NEC | Yes | Yes |
|  |  |  |

|  |
| --- |
| 5.3.1 DL Assignment reception Downlink assignments received on the PDCCH both indicate that there is a transmission on a DL-SCH for a particular MAC entity and provide the relevant HARQ information.  When the MAC entity has a C-RNTI, Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion during which it monitors PDCCH and for each Serving Cell:  1> if a downlink assignment for this PDCCH occasion and this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI, or Temporary C‑RNTI, or G-RNTI:  2> if this is the first downlink assignment for this Temporary C-RNTI:  3> consider the NDI to have been toggled.  2> if the downlink assignment is for the MAC entity's C-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or G-CS-RNTI, or a configured downlink assignment for unicast or MBS multicast; or  2> if the downlink assignment is for the MAC entity's G-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or G-CS-RNTI, or other G-RNTI, or C-RNTI, or a configured downlink assignment for unicast or MBS multicast:  3> consider the NDI to have been toggled regardless of the value of the NDI.  2> if this is the first downlink assignment after initial transmission for CG-SDT with CCCH message as in clause 5.4.1:  3> stop the *cg-SDT-RetransmissionTimer* for the corresponding HARQ process for initial transmission with CCCH message.  2> indicate the presence of a downlink assignment and deliver the associated HARQ information to the HARQ entity.  1> else if a downlink assignment for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI or G-CS-RNTI:  2> if the NDI in the received HARQ information is 1:  3> consider the NDI for the corresponding HARQ process not to have been toggled;  3> indicate the presence of a downlink assignment for this Serving Cell and deliver the associated HARQ information to the HARQ entity.  2> if the NDI in the received HARQ information is 0:  3> if PDCCH contents indicate SPS deactivation:  4> clear the configured downlink assignment for this Serving Cell (if any);  4> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is running:  5> indicate a positive acknowledgement for the SPS deactivation to the physical layer.  3> else if PDCCH content indicates SPS activation:  4> store the downlink assignment for this Serving Cell and the associated HARQ information as configured downlink assignment;  4> initialise or re-initialise the configured downlink assignment for this Serving Cell to start in the associated PDSCH duration and to recur according to rules in clause 5.8.1;  For each Serving Cell and each configured downlink assignment, if configured and activated, the MAC entity shall:  1> if the PDSCH duration of the configured downlink assignment does not overlap with the PDSCH duration of a downlink assignment received on the PDCCH for this Serving Cell:  2> instruct the physical layer to receive, in this PDSCH duration, transport block on the DL-SCH according to the configured downlink assignment and to deliver it to the HARQ entity;  2> set the HARQ Process ID to the HARQ Process ID associated with this PDSCH duration;  2> consider the NDI bit for the corresponding HARQ process to have been toggled;  2> indicate the presence of a configured downlink assignment and deliver the stored HARQ information to the HARQ entity.  For configured downlink assignments without *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:  HARQ Process ID = [floor (CURRENT\_slot × 10 / (*numberOfSlotsPerFrame* × *periodicity*))] modulo *nrofHARQ-Processes*  where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].  For configured downlink assignments with *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:  HARQ Process ID = [floor (CURRENT\_slot × 10 / (*numberOfSlotsPerFrame* × *periodicity*))] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset*  where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].  NOTE 1: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the HARQ Process ID used for configured downlink assignments.  NOTE 2: CURRENT\_slot refers to the slot index of the first transmission occasion of a bundle of configured downlink assignment.  When the MAC entity needs to read BCCH, the MAC entity may, based on the scheduling information from RRC:  1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the SI-RNTI;  2> indicate a downlink assignment and redundancy version for the dedicated broadcast HARQ process to the HARQ entity.  When the MAC entity needs to read MCCH, the MAC entity may, based on the scheduling information from RRC:  1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the MCCH-RNTI;  2> indicate a downlink assignment and redundancy version for the selected HARQ process for MCCH reception to the HARQ entity.  When the MAC entity needs to read broadcast MTCH, the MAC entity may, based on the scheduling information from RRC and DCI:  1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the G-RNTI configured for broadcast MTCH;  2> indicate a downlink assignment and redundancy version for the selected HARQ process for broadcast MTCH reception to the HARQ entity. |

Based on [R2-2205481], RAN2 agreed stopping drx-RetransmissionTimerDL always regardless of HARQ feedback enabling. FFS for drx-RetransmissionTimerDL-PTM.

* Stopping drx-RetransmissionTimerDL always regardless of HARQ feedback enabling. FFS for drx-RetransmissionTimerDL-PTM.

The change example as:

|  |
| --- |
| 1> if a MAC PDU is received in a configured downlink multicast assignment:  2> if HARQ feedback is enabled:  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* 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;  2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process. |

In rapporteur’s understanding, the HARQ can be enable and diabble dynamically via DCI. If the previous multicast data is HARQ enable and the current multicast is HARQ disable or enable, then the *drx-RetransmissionTimerDL-PTM* should stop no matter the current multicast is HARQ disble or disable. So the changes proposed in [R2-2205481] can be agreed and the FFS can be removed.

**Q3: Do companies agree “Stopping *drx-RetransmissionTimerDL-PTM* always regardless of HARQ feedback enabling” and remove the FFS?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| LGE | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| vivo | Yes | It seems the simplest modeling for all the potential use cases. |
| Nokia | Yes | We assume the dynamic control via DCI is per UE. |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes |  |
| Huawei, HiSilicon | Yes |  |
| NEC | Yes | The intension is for the case that the previous multicast data is HARQ enable and the current multicast is HARQ disable or enable. Thus we are fine for the changes proposal in R2-2205481. |
|  |  |  |

RAN1 agreed that the group common PDCCH/PDSCH with CRC srambemd with G-RNTI on SCell is supported [R1-2202928]. So the multicast data reception can be configured on one SCell or PCell. It also aligns with RRC spec.



However, it is not clear for MBS SPS configuration and whether MBS SPS can be configured on one SCell. In MAC spec, it highlights that the MBS SPS can only be configured on PCell, no SCell case.

|  |
| --- |
| 5.8.1a Downlink for Multicast MBS Semi-Persistent Scheduling (SPS) is configured by RRC on PCell per BWP. Multiple assignments can be active simultaneously in the same BWP.  ====omit some text==== |

Q4: **Do companies agree that MBS SPS can also be configured on one SCell or PCell? and whether a LS to RAN1 is needed to confirm MBS SPS configuratiaon issue?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| LGE | Yes | LS to RAN1 is not needed. But, if majority companies support, I’m fine to send an LS to RAN1. |
| OPPO | Yes | LS is better because RAN1 did not concluded the MBS SPS on SCell. |
| ZTE | Yes | it might be safer to ask RAN1? |
| CATT | Yes | We tend to agree to check with RAN1. |
| vivo | Yes |  |
| Nokia | Yes and No | Seems like a pure signalling/L2 issue, no need to ask RAN1. |
| MediaTek | Yes | OK to check with RAN1 |
| Intel | Yes | OK to check with RAN1. |
| Ericsson | Yes | No need for LS |
| Huawei, HiSilicon | Yes and No | Seems straightforward as RAN1 agreed with multicast on SCell and there is no restriction on MBS SPS configuration in RRC specs. LS is not necessary. |
| NEC | Yes |  |
|  |  |  |

For the DRX command MAC CE, it is not clear the DRX MAC CE is for multicast or unicast in case of L1 PTP retransmission for the initial PTM transmission. In rapporteur’s understanding, there are two options to solve the issue.

* The changes propsed in [R2-2205156] can be agreed and captured in MAC running CR (as baseline), can discuss further changes, e.g. for PTP retransmission case (for DRX cmd MAC CE).

**Option 1**: Define one new LCID to address the DRX command MAC CE for multicast DRX. And G-RNTI is used to indicate the DRX command MAC CE is for which multicast DRX further.

**Option 2:** One R bit in MAC subheader is used to indicate the DRX command MAC CE for multicast DRX or unicast DRX. And G-RNTI is used to indicate the DRX command MAC CE is for which multicast DRX further.

Q5: **Which option do companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No? | Comments |
| LGE | See comments | The change of R2-2205156 is baseline. The change can be enhanced to handle PTP retransmission case without option 1 or option 2 as suggested in email reflector.  Only with the change of R2-2205156, gNB should avoid all PTP retransmissions for DRX Command MAC CE. I think it’s too much restriction. It is sufficient that gNB avoids PTP retransmission only when UE failed to decode PDCCH for G-RNTI (PTM initial transmission). Pleaes note that PDCCH decoding failure (or PDCCH missing) is a rare case. gNB can detect PDCCH decoding failure. When there is no harq feedback from a UE, gNB can know PDCCH decoding failure.  Therefore, only for PDCCH decoding failure case, gNB can avoid PTP retransmission for DRX Command MAC CE.  For other cases (when UE decoded PDCCH for G-RNTI successfully), gNB can peform PTP retransmission and UE can identify unicast DRX Command MAC CE or multicast DRX Command MAC CE, respectively, based on the TP below.  In 5.7  if a DRX Command MAC CE with DCI scrambled with C-RNTI for unicast transmission:  In 5.7b  if a DRX Command MAC CE with DCI scrambled with a G-RNTI is received; or  if a DRX Command MAC CE with DCI scrambled with C-RNTI for multicast retransmission is received and the previously received transmission is received from PDCCH addressed to a G-RNTI:  [LGE2] Regarding option 1 (using one new LCID) and option 2 (using one R bit), I understand that the new LCID or one R bit is not used to obtain the G-RNTI.  And, even with option 1 or option 2, G-RNTI is needed to indicate the multicast DRX cycle (per G-RNTI).  It means that G-RNTI should be obtained in case of PTP retransmission, and the G-RNTI can be obtained from the PTM initial transmission by using the HPID and NDI value.  Then, based on the G-RNTI, UE can know whether the received DRX Command MAC CE is for a multicast DRX cycle or not without option 1 or option 2. |
| OPPO | Option 2 |  |
| ZTE | Option 1 | if we have to choose from the above two options. |
| CATT | Option 1 | There is only one R bit in the MAC subheader. We think it can be used for common MAC PDU usage. And the UE can only decode the R after decoding LCID which located after the R bit for DRX command MAC CE. We are wondering whether it impacts the decoding efficiency. |
| vivo | No strong view | Either way leads to Rome. It is just a modeling issue about the selection between option 1 and 2. |
| Nokia | None | We agree with LGE.  If UE has missed the PDCCH of the first transmission, then the UE does not know G-RNTI used for the MAC CE. Then Option 1 or 2 do not help when MAC CE is received (for the first time) with C-RNTI  Furthermore, as argued earlier, not agreeing short DRX means that something more flexible than pure long DRX is likely not needed and thus, the restrictions w.r.t. to the handling of retransmissions of a TB carrying a DRX MAC CE are acceptable. |
| MediaTek | Option 1 | Define one new LCID to avoid the ambiguity of L1 PTP transmission. |
| Intel | None | Agree with LGE and Nokia that neither option 1 or 2 is helpful for the UE to know G-RNTI when MAC CE is scrambled with C-RNTI. |
| Ericsson | None | Agree w Nokia |
| Huawei, HiSilicon | Option 1 | It is a clean solution without complex changes in specs to sovle the concern left from online session:“for PTP retransmission case (for DRX cmd MAC CE)”.  Even if the initial PTM transmission is missed, this can at least prevent multicast DRX command MAC CE from affecting unicast DRX and it is up to UE implementation to ignore the multicast DRX command MAC CE.  Besides, the new LCID is better to be an eLCID. |
| SJTU | None,  if have to,we choose Option1 | Agree with LGE.  1. Both Option1 and Option2 can’t solve the problem.  If the initial PDCCH scambled by G-RNTI is missed by the UE and the retransmission by C-RNTI is received, neither the new LCID nor the R bit can help the UE to find the G-RNTI to which the DRX command MAC CE is associated.  2. If UE decoded PDCCH scambled by G-RNTI successfully, gNB can peform PTP retransmission and UE can identify the G-RNTI to which the DRX command MAC CE is associated,  So we think this issue can be solved by UE and gNB implementation. |
| NERCDTV | None,  if have to, choose Option1 | Both the new LCID and the R bit can not help the UE to identify the G-RNTI to which the DRX command MAC CE is associated, if the PDCCH scambled by G-RNTI is missed and the PTP retransmission is received by the UE.  For such case, gNB can retransmit the DRX command MAC CE by G-RNTI to avoid the problem.  If the initial PDCCH scambled by G-RNTI was decoded successfully, gNB can peform PTP retransmission and UE can itself identify the G-RNTI to which the DRX command MAC CE is associated.  So, we think no enhancement is needed. And anyway the R bit shouldn’t be used for such purpose. |
| NEC | None |  |
|  |  |  |

# Annexs

Based on agreements P1/3 and text already captured in 38.321 about issue “not reporting CSI….”, some companies have some concerns about where to put the corresponding text. There are 3 options (the changes text are showed in annex):

**Option 1**: Capture the text related multicast MBS on CSI/SRS reporting in 5.7.

**Option 2**: Capture the text related multicast MBS on CSI/SRS reporting in 5.7b. One note is added to say “If any DRX operation (i.e. multicat DRX or unicast DRX) results in CSI reporting or SRS tranmision, then CSI reporting or SRS transmission will report or transmission.”

**Option 3**: Create a new clause to describe CSI/SRS reporting considering both unicast DRX operation and multicast DRX operation.

**Proposal: RAN2 is kindly asked to disucss which option is preferred in phase 2.**

## Option 1 [R2-2205480]:

5.7 Discontinuous Reception (DRX)

\*\*\*\*\*Text omitted\*\*\*\*\*

1> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3; and

1> if the current symbol n occurs within *drx-onDurationTimer* duration; and

1> if *drx-onDurationTimer* associated with the current DRX cycle is not started as specified in this clause:

2> if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b and all multicasts are configured with multicast DRX:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];

3> not report semi-persistent CSI configured on PUSCH;

3> if *ps-TransmitPeriodicL1-RSRP* is not configured with value *true*:

4> not report periodic CSI that is L1-RSRP on PUCCH.

3> if *ps-TransmitOtherPeriodicCSI* is not configured with value *true*:

4> not report periodic CSI that is not L1-RSRP on PUCCH.

1> else:

2> in current symbol n, if a DRX group would not be in Active Time considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, in current symbol n, if all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7] in this DRX group;

3> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH in this DRX group.

2> if CSI masking (*csi-Mask*) is setup by upper layers:

3> in current symbol n, if *drx-onDurationTimer* of a DRX group would not be running considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and

3> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured, or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and in current symbol n, if *drx-onDurationTimerPTM(s)* of all multicast DRXs corresponding to the DRX group would not be running considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b and all multicasts corresponding to the DRX group are configured with multicast DRX:

4> not report CSI on PUCCH in this DRX group.

NOTE 4: If a UE multiplexes a CSI configured on PUCCH with other overlapping UCI(s) according to the procedure specified in TS 38.213 [6] clause 9.2.5 and this CSI multiplexed with other UCI(s) would be reported on a PUCCH resource either outside DRX Active Time of the DRX group in which this PUCCH is configured or outside the on-duration period of the DRX group in which this PUCCH is configured if CSI masking is setup by upper layers, it is up to UE implementation whether to report this CSI multiplexed with other UCI(s).

Regardless of whether the MAC entity is monitoring PDCCH or not on the Serving Cells in a DRX group, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] on the Serving Cells in the DRX group when such is expected.

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).

## Option 2 [based on R2-2205629]:

## 5.7 Discontinuous Reception (DRX)

1> else:

2> in current symbol n, if a DRX group would not be in Active Time considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and

2> ~~if~~ *~~allowCSI-SRS-Tx-MulticastDRX-Active~~* ~~is not configured or,~~~~in current symbol n, if all multicast DRX would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b:~~

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7] in this DRX group;

3> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH in this DRX group.

2> if CSI masking (*csi-Mask*) is setup by upper layers:

3> in current symbol n, if *drx-onDurationTimer* of a DRX group would not be running considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause; and

4> not report CSI on PUCCH in this DRX group.

## 5.7b Discontinuous Reception (DRX) for MBS Multicast

NOTE X: A PDCCH indicating activation of multicast SPS is considered to indicate a new transmission.

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).

When multicast DRX is configured for a G-RNTI or G-CS-RNTI, the MAC entity shall:

1> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3; and

1> if the current symbol n occurs within *drx-onDurationTimer* duration; and

1> if *drx-onDurationTimer* associated with the current DRX cycle is not started as specified in this clause:

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this Clause and all multicasts are configured with multicast DRX:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];

3> not report semi-persistent CSI configured on PUSCH;

3> if *ps-TransmitPeriodicL1-RSRP* is not configured with value *true*:

4> not report periodic CSI that is L1-RSRP on PUCCH.

3> if *ps-TransmitOtherPeriodicCSI* is not configured with value *true*:

4> not report periodic CSI that is not L1-RSRP on PUCCH.

1> else:

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, in current symbol n, if all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7] in this DRX group;

3> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH in this DRX group.

2> if CSI masking (*csi-Mask*) is setup by upper layers:

3> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured, or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and in current symbol n, if *drx-onDurationTimerPTM(s)* of all multicast DRXs corresponding to the DRX group would not be running considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b and all multicasts corresponding to the DRX group are configured with multicast DRX:

4> not report CSI on PUCCH in this DRX group.

NOTE X: If any DRX operation (i.e. multicat DRX or unicast DRX) results in CSI reporting or SRS tranmision, then CSI reporting or SRS transmission will report or transmission.

## Option 3:

## 5.7 Discontinuous Reception (DRX)

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CI-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, TPC-SRS-RNTI, AI-RNTI, SL-RNTI, SLCS-RNTI and SL Semi-Persistent Scheduling V-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification. When in RRC\_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this clause; otherwise the MAC entity shall monitor the PDCCH as specified in TS 38.213 [6].

NOTE 1: Void

RRC controls DRX operation by configuring the following parameters:

- *drx-onDurationTimer*: the duration at the beginning of a DRX cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity;

- *drx-RetransmissionTimerSL* (per SL HARQ process): the maximum duration until a grant for SL retransmission is received;

- *drx-HARQ-RTT-TimerSL* (per SL HARQ process): the minimum duration before an SL retransmission grant is expected by the MAC entity;

- *ps-Wakeup* (optional): the configuration to start associated *drx-onDurationTimer* in case DCP is monitored but not detected;

- *ps-TransmitOtherPeriodicCSI* (optional): the configuration to report periodic CSI that is not L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started;

- *ps-TransmitPeriodicL1-RSRP* (optional): the configuration to transmit periodic CSI that is L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started;

- *uplinkHARQ-Mode* (optional): the configuration to set the HARQ mode per UL HARQ process.

Serving Cells of a MAC entity may be configured by RRC in two DRX groups with separate DRX parameters. When RRC does not configure a secondary DRX group, there is only one DRX group and all Serving Cells belong to that one DRX group. When two DRX groups are configured, each Serving Cell is uniquely assigned to either of the two groups. The DRX parameters that are separately configured for each DRX group are: *drx-onDurationTimer*, *drx-InactivityTimer*. The DRX parameters that are common to the DRX groups are: *drx-SlotOffset*, *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL*, *drx-LongCycleStartOffset*, *drx-ShortCycle* (optional), *drx-ShortCycleTimer* (optional), *drx-HARQ-RTT-TimerDL*, *drx-HARQ-RTT-TimerUL*, and *uplinkHARQ-Mode* (optional).

When DRX is configured, the Active Time for Serving Cells in a DRX group includes the time while:

- *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running; or

- *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerSL* is running on any Serving Cell in the DRX group; or

- *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4 or 5.22.15). If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the first Scheduling Request transmission plus the UE-gNB RTT; or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clauses 5.1.4 and 5.1.4a).

When DRX is configured, the MAC entity shall:

1> if a MAC PDU is received in a configured downlink assignment:

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;

NOTE 1a: If Serving cell is configured with *downlinkHARQ-FeedbackDisabled* and DL HARQ feedback is disabled, *drx-HARQ-RTT-TimerDL* is not started for the corresponding HARQ process.

NOTE 1b: If this Serving Cell is part of a non-terrestrial network, the latest UE-gNB RTT value shall be used to set *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL* length prior to timer start (see TS 38.331 [5] clause [X]).

2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if a MAC PDU is transmitted in a configured uplink grant and LBT failure indication is not received from lower layers:

2> if this Serving Cell is not configured with *uplinkHARQ-Mode*; or

2> if this Serving Cell is configured with *uplinkHARQ-Mode* and the corresponding HARQ process is configured as HARQ Mode A:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first transmission (within a bundle) of the corresponding PUSCH transmission;

2> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process at the first transmission (within a bundle) of the corresponding PUSCH transmission.

1> if a *drx-HARQ-RTT-TimerDL* expires:

2> if the data of the corresponding HARQ process was not successfully decoded:

3> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL*.

1> if a *drx-HARQ-RTT-TimerUL* expires:

2> start the *drx-RetransmissionTimerUL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerUL*.

1> if a *drx-HARQ-RTT-TimerSL* expires:

2> if a HARQ NACK feedback for the corresponding HARQ process is transmitted on PUCCH; or

2> if a HARQ NACK feedback for the corresponding HARQ process is not transmitted on PUCCH due to UL/SL prioritization:

3> start the *drx-RetransmissionTimerSL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerSL*.

2> else if the PUCCH resource is not configured and PSFCH is configured for the SL grant:

3> start the *drx-RetransmissionTimerSL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerSL*.

NOTE 1c: The UE handles the *drx-RetransmissionTimerSL* operation when *sl-PUCCH-Config* is configured by RRC but PUCCH resource is not scheduled same as when *sl-PUCCH-Config* is not configured.

1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:

2> stop *drx-onDurationTimer* for each DRX group;

2> stop *drx-InactivityTimer* for each DRX group.

1> if *drx-InactivityTimer* for a DRX group expires:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer* for this DRX group in the first symbol after the expiry of *drx-InactivityTimer*;

3> use the Short DRX cycle for this DRX group.

2> else:

3> use the Long DRX cycle for this DRX group.

1> if a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer* for each DRX group in the first symbol after the end of DRX Command MAC CE reception;

3> use the Short DRX cycle for each DRX group.

2> else:

3> use the Long DRX cycle for each DRX group.

1> if *drx-ShortCycleTimer* for a DRX group expires:

2> use the Long DRX cycle for this DRX group.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer* for each DRX group;

2> use the Long DRX cycle for each DRX group.

1> if the Short DRX cycle is used for a DRX group, and [(SFN × 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*):

2> start *drx-onDurationTimer* for this DRX group after *drx-SlotOffset* from the beginning of the subframe.

1> if the Long DRX cycle is used for a DRX group, and [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3:

3> if DCP indication associated with the current DRX cycle received from lower layer indicated to start *drx-onDurationTimer*, as specified in TS 38.213 [6]; or

3> if all DCP occasion(s) in time domain, as specified in TS 38.213 [6], associated with the current DRX cycle occurred in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to start of the last DCP occasion, or during a measurement gap, or when the MAC entity monitors for a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* of the SpCell identified by the C-RNTI while the *ra-ResponseWindow* is running (as specified in clause 5.1.4); or

3> if *ps-Wakeup* is configured with value *true* and DCP indication associated with the current DRX cycle has not been received from lower layers:

4> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

2> else:

3> start *drx-onDurationTimer* for this DRX group after *drx-SlotOffset* from the beginning of the subframe.

NOTE 2: 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 a DRX group is in Active Time:

2> monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213 [6];

2> if the PDCCH indicates a DL transmission; or

2> if the PDCCH indicates a one-shot HARQ feedback as specified in clause 9.1.4 of TS 38.213 [6]; or

2> if the PDCCH indicates a retransmission of HARQ feedback as specified in clause 9.1.5 of TS 38.213 [6]:

3> start or restart the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process(es) whose HARQ feedback is reported in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

NOTE 3: When HARQ feedback is postponed by PDSCH-to-HARQ\_feedback timing indicating an inapplicable k1 value, as specified in TS 38.213 [6], the corresponding transmission opportunity to send the DL HARQ feedback is indicated in a later PDCCH requesting the HARQ-ACK feedback.

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process(es) whose HARQ feedback is reported.

3> if the PDSCH-to-HARQ\_feedback timing indicate an inapplicable k1 value as specified in TS 38.213 [6]:

4> start the *drx-RetransmissionTimerDL* in the first symbol after the (end of the last) PDSCH transmission (within a bundle) for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission:

3> if this Serving Cell is not configured with *uplinkHARQ-Mode*; or

3> if this Serving Cell is configured with *uplinkHARQ-Mode* and the corresponding HARQ process is configured as HARQ Mode A:

4> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first transmission (within a bundle) of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates an SL transmission:

3> if the PUCCH resource is configured:

4> start the *drx-HARQ-RTT-TimerSL* for the corresponding HARQ process in the first symbol after the end of the corresponding PUCCH transmission carrying the SL HARQ feedback; or

4> start the *drx-HARQ-RTT-TimerSL* for the corresponding HARQ process in the first symbol after the end of the corresponding PUCCH resource for the SL HARQ feedback when the PUCCH is not transmitted due to UL/SL prioritization;

4> stop the *drx-RetransmissionTimerSL* for the corresponding HARQ process.

3> else:

4> start the *drx-HARQ-RTT-TimerSL* for the corresponding HARQ process at the first symbol after end of PDCCH occasion;

4> stop the *drx-RetransmissionTimerSL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL, UL or SL) on a Serving Cell in this DRX group:

3> start or restart *drx-InactivityTimer* for this DRX group in the first symbol after the end of the PDCCH reception.

NOTE 3a: A PDCCH indicating activation of SPS, configured grant type 2, or configured sidelink grant of configured grant Type 2 is considered to indicate a new transmission.

NOTE 3b: If the PDCCH reception includes two PDCCH candidates from corresponding search spaces, as described in clause 10.1 in 38.213, start or restart *drx-InactivityTimer* for this DRX group in the first symbol after the end of the PDCCH candidate that ends later in time.

2> if a HARQ process receives downlink feedback information and acknowledgement is indicated:

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

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).

## 5.x CSI reporting and SRS transmission in DRX operation

When multicast DRX and/or unicat DRX is configured, the MAC entity shall:

1> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3; and

1> if the current symbol n occurs within *drx-onDurationTimer* duration; and

1> if *drx-onDurationTimer* associated with the current DRX cycle is not started as specified in this clause:

2> if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in clause 5.7; and

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b and all multicasts are configured with multicast DRX:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];

3> not report semi-persistent CSI configured on PUSCH;

3> if *ps-TransmitPeriodicL1-RSRP* is not configured with value *true*:

4> not report periodic CSI that is L1-RSRP on PUCCH.

3> if *ps-TransmitOtherPeriodicCSI* is not configured with value *true*:

4> not report periodic CSI that is not L1-RSRP on PUCCH.

1> else:

2> in current symbol n, if a DRX group would not be in Active Time considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in clause 5.7; and

2> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured or, in current symbol n, if all multicast DRXs would not be in Active Time considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7] in this DRX group;

3> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH in this DRX group.

2> if CSI masking (*csi-Mask*) is setup by upper layers:

3> in current symbol n, if *drx-onDurationTimer* of a DRX group would not be running considering grants/assignments scheduled on Serving Cell(s) in this DRX group and DRX Command MAC CE/Long DRX Command MAC CE received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in clause 5.7; and

3> if *allowCSI-SRS-Tx-MulticastDRX-Active* is not configured, or, if *allowCSI-SRS-Tx-MulticastDRX-Active* is configured and in current symbol n, if *drx-onDurationTimerPTM(s)* of all multicast DRXs corresponding to the DRX group would not be running considering multicast assignments and DRX Command MAC CE for MBS multicast received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in Clause 5.7b and all multicasts corresponding to the DRX group are configured with multicast DRX:

4> not report CSI on PUCCH in this DRX group.

NOTE 4: If a UE multiplexes a CSI configured on PUCCH with other overlapping UCI(s) according to the procedure specified in TS 38.213 [6] clause 9.2.5 and this CSI multiplexed with other UCI(s) would be reported on a PUCCH resource either outside DRX Active Time of the DRX group in which this PUCCH is configured or outside the on-duration period of the DRX group in which this PUCCH is configured if CSI masking is setup by upper layers, it is up to UE implementation whether to report this CSI multiplexed with other UCI(s).

Regardless of whether the MAC entity is monitoring PDCCH or not on the Serving Cells in a DRX group, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] on the Serving Cells in the DRX group when such is expected.

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