**3GPP T****SG-RAN WG2 Meeting #115e R2-210xxxx**

**Online, Aug 16th – 27th , 2021**

**Agenda item: 8.1.2.2**

**Source: Qualcomm**

**Title:** **Summary of MBS Scheduling and Power Saving**

**Document for: Discussion and Decision**

# 1 Introduction

This document is aimed at providing a high level summary of contributions submitted to RAN2#115e, agenda 8.1.2.2: MBS scheduling and power saving .

|  |  |  |  |
| --- | --- | --- | --- |
| S.No | **TDoc** | **Title** | **Source** |
| 1 | [**R2-2107034**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107034.zip) | Discussion on Scheduling and Power Saving of MBS | CATT |
| 2 | [**R2-2107049**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107049.zip) | DRX scheme for NR MBS | MediaTek Inc. |
| 3 | [**R2-2107205**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107205.zip) | Discussion on group-based scheduling for MBS | OPPO |
| 4 | [**R2-2107233**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107233.zip) | MBS Power Saving and Scheduling Aspects | Samsung |
| 5 | [**R2-2107337**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107337.zip) | Group scheduling and power saving for NR MBS | ZTE, Sanechips |
| 6 | [**R2-2107438**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107438.zip) | Consideration on dynamic PTM and PTP switching for NR MBS | Shanghai Jiao Tong University |
| 7 | [**R2-2107439**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107439.zip) | Deactivation and reactivation of MBS reception | Shanghai Jiao Tong University |
| 8 | [**R2-2107446**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107446.zip) | MBS group scheduling and power saving | Intel Corporation |
| 9 | [**R2-2107467**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107467.zip) | Determination of HARQ retransmission for PTM | FGI, Asia Pacific Telecom |
| 10 | [**R2-2107545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107545.zip) | NR Multicast DRX aspects | Qualcomm India Pvt Ltd |
| 11 | [**R2-2107577**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107577.zip) | DRX mechanism for MBS PTM reception | Apple |
| 12 | [**R2-2107682**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107682.zip) | DRX for PTM and PTP | TCL Communication Ltd. |
| 13 | R2-2107694 | DRX for Multicast | Nokia, Nokia Shanghai Bell |
| 14 | [**R2-2107787**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107787.zip) | Notification of the Activation/Deactivation of PTM | SHARP Corporation |
| 15 | [**R2-2107796**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107796.zip) | Further Considerations on Group Scheduling for MBS | Vivo |
| 16 | [**R2-2107920**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107920.zip) | MBS specific DRX operation and Data Inactivity Monitoring | Lenovo, Motorola Mobility |
| 17 | [**R2-2107931**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107931.zip) | MBS Group Scheduling | Samsung |
| 18 | [**R2-2108002**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108002.zip) | Open issues on group scheduling for NR MBS | Kyocera |
| 19 | [**R2-2108033**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108033.zip) | Scheduling for NR MBS | CHENGDU TD TECH LTD. |
| 20 | [**R2-2108079**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108079.zip) | Aspects on Power Saving | Ericsson |
| 21 | [**R2-2108083**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108083.zip) | Aspects on Scheduling | Ericsson |
| 22 | [**R2-2108123**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108123.zip) | Support of dynamic switch | Huawei, HiSilicon |
| 23 | [**R2-2108125**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108125.zip) | Discussion on group scheduling | Huawei, HiSilicon |
| 24 | [**R2-2108479**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108479.zip) | Power saving for MBS PTM | ETRI |
| 25 | [**R2-2108486**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108486.zip) | PTM activation and deactivation | InterDigital |
| 26 | [**R2-2108520**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108520.zip) | Discussion on group scheduling | CMCC |
| 27 | [**R2-2108551**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108551.zip) | Discussion on group scheduling and power saving | LG Electronics Inc. |
| 28 | [**R2-2108798**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108798.zip) | Discussion on the group scheduling of MBS | Xiaomi Communications |
| 29 | [**R2-2107547**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2107547.zip) | NR Multicast and Broadcast Radio Bearer Architecture aspects | Qualcomm |
|  |  |  |  |

# 2 Summary for MBS scheduling and power saving

## 2.1 scheduling related

### Mapping between G-RNTI/G-CS-RNTI and MBS session

In LTE SC-PTM, there is a one-to-one mapping between MBMS service, which is identified by the TMGI, and MBMS traffic logical channel (e.g. SC-MTCH). Further, the transmissions of an SC-MTCH are identified by a G-RNTI. Hence, there is a one-to-one mapping between TMGI and G-RNTI.

For NR MBS, considering that each MBS session can support one or multiple QoS flows according to the SA2 agreement, it is worthy to reconsider the mapping relation between G-RNTI and MBS session.

Contributions [1][3][5][8][26] proposed not to support one-to-many mapping between G-RNTI/G-CS-RNTI and MBS sessions. The intention is to avoid UE from receiving/processing MBS services in which the UE is not interested. Proponents argue that when an MBS session is activated/deactivated, the relationship between G-RNTI/G-CS-RNTI and MBS sessions need to be reconfigured, which can impact fluent transmission of other MBS session which is mapped to the same G-RNTI/G-CS-RNTI. It increases gNB complexity because different UEs are interest in different group of MBS sessions generally. If gNB configures multiple MBS sessions to one G-RNTI/G-CS-RNTI and UEs in the group are not interested in all of the MBS sessions, it will increase UE power consumption due to receiving MBS transmissions which is not interested in.

Further, contributions [15][17][21][23][27][28][29] proposed that the mapping between G-RNTI and MBS session can be extended to one-to-multiple mapping (based on network configuration). Proponents argue that if UE receives a MAC PDU containing an LCID or eLCID value which is not configured, UE will discard the corresponding subPDU.

The simplest from the network complexity perspective would be to only have one G-RNTI and MRB per cell, including one or more MBS Sessions. This comes with the result of receiving multicast data for all UEs even if that particular MBS session is not of interest for the UE, or alternatively, not having the possibility to separate some QoS Flows from other (e.g. Voice – Video - Chat). As the Use Case and situation along with UE capability an explicit need for the specification to have any restriction in either direction may be difficult, instead the best configuration can be decided by the network at MBS Session setup and configuration of UEs.

On the other hand, contribution [18] proposed that the multiple-to-1 mapping between G-RNTI and MBS session should be considered. With this mapping, separate QoS treatments (i.e. different MRBs within the same MBS session may need different handling over Uu) for a specific MBS radio bearer can be provided by gNB.

**Rapporteur’s Summary:**

Considering both options, it is upto network responsibility to identify UEs interested to receive multiple services and selected services can be grouped for mapping to a single G-RNTI/G-CS-RNTI. This also enables NW to simplify mapping and UEs interested in multiple services are not required to monitor multiple G-RNTIs (i.e helps these UEs to keep BD budget within limit). In LTE SC-PTM, only 1:1 mapping was supported for simplicity and it was intended for Broadcast services (NW does not know which UEs are interested in which services) , whereas in NR Multicast network knows which UEs are interested in which services and grouping can be made from interested UEs. Atleast from specification point of view, flexible configuration option has to be supported and network can choose what is best for given set of services for a group of UEs.

It is not clear what is benefit of supporting multiple G-RNTIs mapped to single MBS session .Even though different QoS flows of one MBS session can be mapped to multiple MRBs, all these bearers can be mapped to same G-RNTI and interested UEs can just monitor single G-RNTI to receive multiple flows mapped to different bearers associated with different LCIDs. This is already covered by RAN2 agreement “Multiplexing/de-multiplexing of different logical channels associated with the same G-RNTI is supported for NR MBS”.

Therefore, rapporteur proposes:

**Proposal 1: One-to-multiple mapping between G-RNTI/G-CS-RNTI and MBS sessions is supported in NR MBS.**

### Multicast Bearer ID and Logical channel space allocation

Regarding the ID of MBS radio bearer, contribution [3] proposed that only one ID needs to be configured for MBS radio bearer since the PDCP is common for PTP and PTM.

Contributions [1] [5] [15] [21][23][28] proposed to share common LCID space between Multicast PTM and Unicast DTCH. Contributions [3][29][17][26] proposed different LCID space between Multicast PTM and Unicast DTCH. Paper [15] indicated to use separate LCID for Broadcast PTM. Paper [18] indicated to use same LCID reseved for broadcast MTCH and MCCH.

All companies proposed to share common LCID space for PTP leg and Unicast DTCH.

**Rapporteur’s Summary:**

Proponents of shared LCID space between Multicast PTM and DTCH/DRB argue that to differentitae PTP re-transmissions of MRB from DTCH/DRB, there is need to have separate LCIDs and space need to be shared. Using reserved LCID for PTM, it was argued that it may not be possible to support HARQ soft combining in case of G-RNTI based Initial transmission and C-RNTI based re-transmission. Proponents of separate LCID space for PTM and DTCH/DRB argue that separate space enables simplified management of LCID allocation.

From Rapporteuer perspective, both are possible solutions and HARQ soft combining is still possible even if separate LCID space is reserved. Considering future compatibility, it is suggested to discuss this issue and make appropropriate decision.

Based on the above, rapporteur proposes the proposals below,

**Proposal 2: Single bearer ID is used for Multicast RB and discuss whether DRB ID space can be shared with MRB ID.**

**Proposal 3: FFS whether to share common LCID space for Multicast PTM and Unicast DTCH. FFS How many PTM LCIDs to be reserved if separate space is used.**

**Proposal 4: Multicast PTP and Unicast DTCH/DRB share common LCID space.**

**Proposal 5: Broadcast PTM uses separate LCID space than Unicast DTCH/DRB LCID.**

**Proposal 6: Broadcast MTCH and MCCH uses reserved LCID and which need to be reserved.**

### Multiplexing/de-multiplexing of logical channel associated with G-CS-RNTI

Contributions [1][8][18][19][26][28] proposed that multiplexing/de-multiplexing of different logical channels for PTM leg identified by the same G-CS-RNTI is supported in MAC. RAN1 agreed at most 8 SPS configurations including MBS and unicast can be configured for a specific UE. If the multiplexing of different LCHs is not allowed, the number of SPS configurations could be insufficient.

Based on support and above argument, rapporteur proposes

**Proposal 7: Multiplexing/de-multiplexing of different logical channels associated with the same G-CS-RNTI is supported for NR MBS.**

### HARQ operation

Contribution [3][9][17] discussed about HARQ related proposals.

Since RAN1 is actively discussing this topic and Rapporteur suggests to wait for RAN1 discussion conclusion.

**No proposal**

### Multicast PTM activation/deactivation

This topic was discussed as part of email discussion [Post114-e][072][MBS] Delivery Mode 1 PTM PTP operation and no need to repeat here.

**No proposal**

### Group common SPS

Contributions [2][3][17][24] discussed about various proposals related to group common SPS for MBS. RAN1 also discussed group common SPS details for NR Multicast UEs in RRC\_CONNECTED state and summary agreements are given below.

*RAN1#103e*

*Agreements:*

*Support SPS group-common PDSCH for MBS for RRC\_CONNECTED UEs*

* *FFS: use group-common PDCCH or UE-specific PDCCH for SPS group-common PDSCH activation/deactivation*
* *FFS: whether to support more than one SPS group-common PDSCH configuration per UE*
* *FFS: whether and how uplink feedback could be configured*
* *FFS: retransmission of SPS group-common PDSCH*

*RAN1#104e*

*Agreement:*

*For RRC\_CONNECTED UEs, more than one SPS group-common PDSCH configuration for MBS can be configured per UE subject to UE capability*

* *The total number of SPS configurations supported by a UE currently defined for unicast is not increased due to additionally supporting MBS.*
* *FFS: How to allocate the total SPS configurations between MBS and unicast.*

*Agreement:*

*For RRC\_CONNECTED UEs, support HARQ-ACK feedback for SPS group-common PDSCH for MBS*

* *FFS: The retransmission scheme(s)*
* *FFS: The HARQ-ACK details for SPS PDSCH and activation/deactivation, which can be discussed in AI 8.12.2*

*Agreement:*

*From RAN1 perspective, the CFR (common frequency resource) for multicast of RRC-CONNECTED UEs, which is confined within the frequency resource of a dedicated unicast BWP and using the same numerology (SCS and CP), includes the following configurations:*

* *Starting PRB and the number of PRBs*
* *One PDSCH-config for MBS (i.e., separate from the PDSCH-Config of the dedicated unicast BWP)*
* *One PDCCH-config for MBS (i.e., separate from the PDCCH-Config of the dedicated unicast BWP)*
* *SPS-config(s) for MBS (i.e., separate from the SPS-Config of the dedicated unicast BWP)*
* *FFS: Other configurations and details including whether signaling of starting PRB and the length of PRBs is needed when CFR is equal to the unicast BWP*
* *FFS: Whether a unified CFR design is also used for broadcast reception for RRC\_IDLE/INACTIVE and RRC\_CONNECTED*
* *FFS: Whether Coreset(s) for CFR in addition to existing Coresets in UE dedicated BWP is needed*
* *Note: The terminology of CFR is only aiming for RAN1 discussion, and the detailed signaling design is up to RAN2*
* *Note: This agreement does not negate any previous agreements made on CFR*

*Working assumption:*

*For activation/deactivation of SPS group-common PDSCH for MBS in RRC\_CONNECTED state,*

* *At least group-common PDCCH is supported*
  + *FFS: Whether and how to address the missed activation and deactivation*
* *FFS: Whether UE-specific PDCCH is supported for activation/deactivation*

*RAN1#104bis-e*

*Agreement:*

*The retransmission scheme for a given SPS group-common PDSCH can be either PTM scheme 1 or PTP.*

* *FFS: Whether PTM scheme 1 retransmission and PTP retransmission can be used simultaneously for different UEs in the same MBS group*

*Agreement:*

*Define G-CS-RNTI at least for SPS group-common PDSCH and activation/deactivation of SPS group-common PDSCH, different from CS-RNTI for unicast SPS PDSCH.*

* *G-CS-RNTI is used for PTM scheme 1 based dynamic retransmission of SPS group-common PDSCH*
* *FFS: Whether CS-RNTI can be used for PTP retransmission of SPS group-common PDSCH.*
* *FFS: Number of G-CS-RNTI.*

*Agreement:*

*For RRC\_CONNECTED UE supporting MBS, support up to 8 configured SPS configurations in a BWP of a serving cell for unicast and MBS in total.*

* *It is up to gNB implementation to configure the SPS configuration indexes for unicast and MBS, respectively.*

*Agreement:*

*Confirm the working assumption:*

*For activation/deactivation of SPS group-common PDSCH for MBS in RRC\_CONNECTED state,*

* *At least group-common PDCCH is supported*
  + *FFS: Whether and how to address the missed activation and deactivation*
* *FFS: Whether UE-specific PDCCH is supported for activation/deactivation*

*RAN1#105e*

*Agreement:*

*For PTP retransmission of SPS group-common PDSCH, CS-RNTI is used for CRC scrambling of PDCCH with the NDI bit set to 1.*

*Agreement:*

*For reliability of the group-common PDCCH activation of SPS group-common PDSCH, support at least one of the following alternatives.*

* *Alt 1: retransmit the activation command via group-common PDCCH.*
* *Alt 2: retransmit the activation command via UE-specific PDCCH.*
* *Alt 3: retransmit the activation command via MAC-CE.*
* *FFS other details.*
* *Note: Down-selection can take into account the HARQ-ACK feedback scheme for SPS activation*

*Agreement:*

*Support NACK-only based HARQ-ACK feedback at least for multicast SPS PDSCH without PDCCH scheduling.*

* *FFS for SPS activation/deactivation.*

*Agreement:*

*For support of ACK/NACK based HARQ-ACK feedback for SPS multicast,*

* *the HARQ-ACK codebook index corresponding the HARQ-ACK codebook for SPS PDSCH is included in the configuration for SPS multicast.* 
  + *UE determines a priority index from the HARQ-ACK codebook index*
* *UE can be optionally configured a separate SPS-PUCCH-AN-List for all SPS multicast configurations. Otherwise, a common SPS-PUCCH-AN-List applies to all SPS unicast and SPS multicast configurations.*

Rapporteur thinks RAN2 need to discuss about SPS configuration aspects mainly. Specific stage-3 details can be discussed as we make progress .

Proposal 8: RAN2 agrees *SPS-Config IE* provided parameters as baseline for NR Multicast SPS configuration in CFR.

Proposal 9: NR Multicast SPS can be configured per Multicast service as baseline and it is also possible to configure multiple Multicast sercices mapped to same SPS configuration as network implementation.

### Others

#### 2.1.7.1 MBS impacts on data inactivity monitoring

Contributions [4][17][16][20] proposed that both unicast and Multicast data should be considered during data inactivity monitoring and Broadcast reception is not considered for resetting data inactivity timer.

Rapporteur thinks it is not needed to consider Broadcast data reception to reset data inactivity timer since broadcast can be received in any RRC state and there are no strict QoS requirements. There is no need to have separate MBS data inactivity timer and existing timer can be configured by taking Multicast data activity into account.

Thus, it is proposed that

Proposal 10: If Data Inactivity timer is configured , data monitoring is applied both for unicast and MBS multicast (i.e. both PTM and PTP data) to decide state transition for UE.

#### 2.1.7.3 UE indication of MRB enable/disable

Contribution [7] discussed about UE indication to enable/disable Multicast PTP transmission.

Rapporteur underatanding is when UE joins Multicast session via NAS SM procedure and UE continues to receive Multicast session as long as session is activated. UE stops receiving Multicast data when it leaves multicast session through NAS SM signaling procedure and CN is expected to update RAN. Thus, there is no need to discuss this proposal.

No Proposal

## 2.2 Power saving

### Multicast Connected State DRX

In NR ,Unicast DRX is supported to enable UE to sleep when there is no data traffic to send and receive. Contributions [1][2][3][5][8][10][11][12][15][16][18][19][20][23][24][26][27][28] all proposed to support Multicast DRX, which is different from Unicast DRX. These contributaions discussed multiple proposals related to Multicast DRX configuration for PTM and PTP transmission. Overall, it can be concluded from the contributions that,

* MBS DRX pattern for MBS reception via PTM mode is configured on a per G-RNTI basis (NOTE: a common MBS DRX pattern can be used for multiple Multiast services);
* the general DRX parameters (e.g. *drx-onDurationTimer*, *drx-SlotOffset*) and timer operations of ue-specific C-DRX for unicast should be taken as baseline;
* legacy unicast DRX pattern is reused for MBS reception via PTP mode.
* DL RTT and DL Re-Transmissions timer start details
* Multicast PTM DRX has to take G-RNTI based HARQ initial transmission and re-transmission can be either G-RNTI or C-RNTI based.

**Rapporteur’s Summary:**

All contributions agree that Multicast DRX operation is supported and is independent of Unicast DRX.

Therefore, the following proposals need to be discussed,

**Proposal 11: For multicast PTM transmission, Multicast DRX is configured on a per G-RNTI basis (i.e. independent of legacy UE-specific DRX for unicast transmission).**

**Proposal 12: As network configuration, multiple Multicast services associated with one G-RNTI has one Multicast DRX.**

**Proposal 13: Legacy UE-specific DRX for unicast is reused for PTP transmission of NR MBS, which means the UE specific DRX mode are for both unicast services and the MBS PTP bearer of UE.**

**Proposal 14: UE maintains separate DRX modes for PTM DRX and Unicast DRX.**

**Proposal 15: Multicast long DRX support is baseline. FFS whether to support optional short DRX for Multicast or not.**

**Proposal 16: The Multicast Long DRX operation has to support the following parameters which are similar to the UE-specific DRX for unicast, where the last two parameters are needed if the HARQ-ACK feedback is enabled:**

* ***drx-onDurationTimerPTM***
* ***drx-InactivityTimerPTM***
* ***drx-LongCycleStartOffsetPTM***
* ***drx-SlotOffsetPTM***
* ***drx-HARQ-RTT-TimerDLPTM***
* ***drx-RetransmissionTimerDLPTM***

**Proposal 17: During PTM Multicast DRX active period, UE monitors both G-RNTI and C-RNTI (for receiving C-RNTI based unicast HARQ re-transmissions).**

**Proposal 18. For Multicast HARQ ACK/NACK feedback using UE specific PUCCH resources, RAN2 to discuss following 2 options**

**- Option 1: gNB can configure HARQ RTT and DL Re-transmission timer to take into different UEs PUCCH resource feedback time into account as gNB implementation.**

**- Option 2: gNB can indicate UEs to start HARQ RTT timer from the end of GC-PDCCH or GC-PDSCH reception and UEs still triggers HARQ RTT timer after UE specific NACK transmission while RTT timer counts from multicast GC-PDCCH/GC-PDSCH reception.**

**Proposal 19. For group common PTM Multicast HARQ PUCCH resources (NACK only feedback), the same group of UEs have aligned HRAQ RTT and DL Re-Tx timer configuration. HARQ RTT timer counting starts from end of common PUCCH resource based NACK transmission (i.e. same as Unicast DRX behaviour).**

**Proposal 20: For multicast PTM transmission, UE can monitor PDCCH for G-RNTI/G-CS-RNTI additionally with C-RNTI/CS-RNTI when drx-RetransmissionTimerDLMBS associated with the G-RNTI is running.**

### Broadast DRX

Contributions [1][2][4][5][8][19][23] discussed about Broadcast DRX configuration aspects. Based on these papers, below are summary proposals:

**Proposal 21: For NR Broadcast, the DRX is configured per G-RNTI. Multiple NR Broadcast services assocated with one G-RNTI can share common DRX mode and is up to network configuration.**

**Proposal 22: For NR Broadcast, DRX configuration includes: *drx-onDurationTimerPTM, drx-SlotOffsetPTM, drx-InactivityTimerPTM, drx-CycleStartOffsetPTM.***

### MBS WUS

Contribution [4] discussed about WUS aspects for Multicast PTP reception.

PTP is expected to re-use Unicast DRX and it is reasonable to to use PDCCH WUS for Multicast PTP reception. For PTM WUS requires additional work and can be discussed later if time permits.

Contribution [1] proposed not to support R16 power saving mechanisms.

**Proposal 23: PDCCH WUS is applicable for Multicast data reception via PTP RLC (i.e. assuming Unicast DRX is used for PTP).**

### BWP related

Contribution [4] discussed about BWP switching related proposals.

Since RAN1 is also actively discussing about same thing, we can wait for RAN1 to conclude on same topic.

No proposal is made.

# 3 Conclusion

The contribution is summarized as follows,

**Proposals for online discussion and decison:**

**Mapping between G-RNTI/G-CS-RNTI and MBS sessions:**

**Proposal 1: One-to-multiple mapping between G-RNTI/G-CS-RNTI and MBS sessions is supported in NR MBS.**

**Multicast Bearer ID and LCID space allocation:**

**Proposal 2: Single bearer ID is used for Multicast RB and discuss whether DRB ID space can be shared with MRB ID.**

**Proposal 3: FFS whether to share common LCID space for Multicast PTM and Unicast DTCH. FFS How many PTM LCIDs to be reserved if separate space is used.**

**Proposal 4: Multicast PTP and Unicast DTCH/DRB share common LCID space.**

**Proposal 5: Broadcast PTM uses separate LCID space than Unicast DTCH/DRB LCID.**

**Proposal 6: Broadcast MTCH and MCCH uses reserved LCID and which need to be reserved.**

**Mux/De-Mux of Logical Channels for G-CS-RNTI:**

**Proposal 7: Multiplexing/de-multiplexing of different logical channels associated with the same G-CS-RNTI is supported for NR MBS.**

**Group Common SPS:**

**Proposal 8: RAN2 agrees SPS-Config IE provided parameters as baseline for NR Multicast SPS configuration in CFR.**

**Proposal 9: NR Multicast SPS can be configured per Multicast service as baseline and it is also possible to configure multiple Multicast sercices associated with one G-CS-RNTI mapped to same SPS configuration as network implementation.**

**MBS impacts on Data Inactivity timer :**

**Proposal 10: If Data Inactivity timer is configured , data monitoring is applied both for unicast and MBS multicast (i.e. both PTM and PTP data) to decide state transition for UE.**

**Multicast DRX:**

**Proposal 11: For multicast PTM transmission, Multicast DRX is configured on a per G-RNTI basis (i.e. independent of legacy UE-specific DRX for unicast transmission).**

**Proposal 12: As network configuration, multiple Multicast services associated with one G-RNTI has one common Multicast DRX mode.**

**Proposal 13: Legacy UE-specific DRX for unicast is reused for PTP transmission of NR MBS, which means the UE specific DRX mode are for both unicast services and the MBS PTP bearer of UE.**

**Proposal 14: UE maintains separate DRX modes for PTM DRX and Unicast DRX.**

**Proposal 15: Multicast long DRX support is baseline. FFS whether to support optional short DRX for Multicast or not.**

**Proposal 16: The Multicast Long DRX operation has to support the following parameters which are similar to the UE-specific DRX for unicast, where the last two parameters are needed if the HARQ-ACK feedback is enabled :**

* ***drx-onDurationTimerPTM***
* ***drx-InactivityTimerPTM***
* ***drx-LongCycleStartOffsetPTM***
* ***drx-SlotOffsetPTM***
* ***drx-HARQ-RTT-TimerDLPTM***
* ***drx-RetransmissionTimerDLPTM***

**Proposal 17: During PTM Multicast DRX active period, UE monitors both G-RNTI and C-RNTI (for receiving C-RNTI based unicast HARQ re-transmissions).**

**Proposal 18. For Multicast HARQ ACK/NACK feedback using UE specific PUCCH resources, RAN2 to discuss following 2 options**

**- Option 1: gNB can configure HARQ RTT and DL Re-transmission timer to take into different UEs PUCCH resource feedback time into account as gNB implementation.**

**- Option 2: gNB can indicate UEs to start HARQ RTT timer from the end of GC-PDCCH or GC-PDSCH reception and UEs still triggers HARQ RTT timer after UE specific NACK transmission while RTT timer counts from multicast GC-PDCCH/GC-PDSCH reception.**

**Proposal 19. For group common PTM Multicast HARQ PUCCH resources (NACK only feedback), the same group of UEs have aligned HRAQ RTT and DL Re-Tx timer configuration. HARQ RTT timer counting starts from end of common PUCCH resource based NACK transmission (i.e. same as Unicast DRX behaviour).**

**Proposal 20: For multicast PTM transmission, UE can monitor PDCCH for G-RNTI/G-CS-RNTI additionally with C-RNTI/CS-RNTI when drx-RetransmissionTimerDLMBS associated with the G-RNTI is running.**

**Broadcast DRX:**

**Proposal 21: For NR Broadcast, the DRX is configured per G-RNTI. Multiple NR Broadcast services associated with one G-RNTI can share common DRX mode and is up to network configuration.**

**Proposal 22: For NR Broadcast, DRX configuration includes: *drx-onDurationTimerPTM, drx-SlotOffsetPTM, drx-InactivityTimerPTM, drx-CycleStartOffsetPTM.***

**MRB/PTP WUS:**

**Proposal 23: PDCCH WUS is applicable for Multicast data reception via PTP RLC (i.e. assuming Unicast DRX is used for PTP).**