

Qualcomm

RP-211944

3GPP TSG RAN#93e

Electronic Meeting, Sep 13 - 17, 2021

Agenda Item: 9.0.3

# Views on MBS evolution for Rel-18

5G

# Email Discussion on Rel-18 MBS (RP-211659)

- **Conclusion of email discussion on Rel-18 MBS**

- For the creation of a NR MBS WI the following objectives might be considered in this priority order:
  - **(non-controversial) Rel-17 left-overs** (content to be identified and detailed at end of Rel-17)
  - **(non-controversial) SFN support for MBS reception (above gNB-DU level)**
    - **(controversial) based on which numerology**
  - **(non-controversial) Support of Multicast INACTIVE state**
  - **(controversial) Support of Multicast IDLE state**
  - **(non-controversial) Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing**
  - **(controversial) Improve Energy efficient operation/power saving mechanisms for MBS reception**
- The discussion also revealed a number of 2nd level detail objectives for these main objectives which were not discussed in detail but shall be used as starting point for the phased of WID creation.

**(Moderator) Proposed conclusion: Use these objectives in this priority order as starting point for development of the WID, consider contributed details for each objectives during the drafting of the potential WID.**

**➔ We provide our views on each bullet above in the following slides.**

# Multicast reliability – PTM RLC AM

- Email discussion conclusion:
  - (non-controversial) **Enable Higher reliability**, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing
- To be more specific, “Enabling Higher Reliability” for PTM traffic includes PTM RLC AM:
  - In Rel-17, PTM L2-based retransmissions to support reliability for multicast was discussed but not specified due to lack of time.
  - Note: Workaround by L2 PTP/PTM switching at PDCP is supported in Rel-17, however this may not work with HARQ NACK-only feedback and not radio efficient.
- **Proposal: Support L2-based retransmissions for PTM leg based on UE L2-feedback for Rel-18 Multicast.**

# Multicast reliability - UE feedback

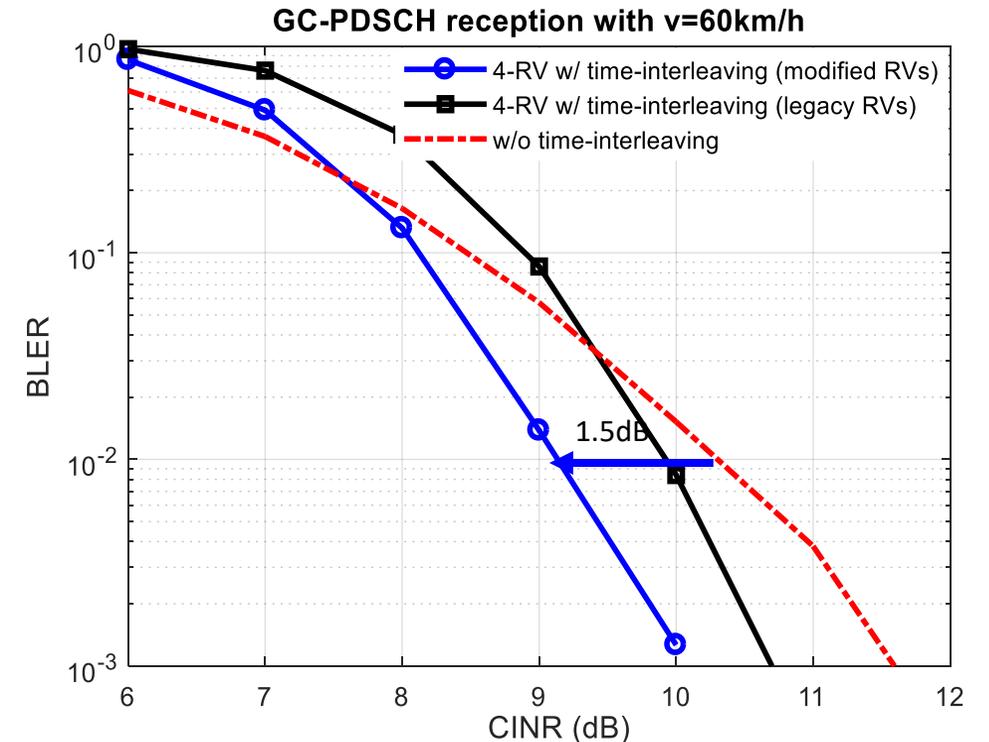
- Email discussion conclusion:
  - (non-controversial) **Enable Higher reliability**, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing
- To be more specific, “Enabling Higher Reliability” for PTM traffic also includes UE feedback enhancement
  - Optimizations for HARQ-ACK codebook with limited reception capabilities
    - A UE will typically be capable of receiving a small amount of PDSCHs in a given slot/subslot; however, it may be monitoring for multiple G-RNTIs + C-RNTI.
    - Type-1 codebook assumes 1 (or 2) bits per slot/subslot per RNTI, which unnecessarily increases the codebook size.
    - For more technical details, please refer to **R1-2101466** (section 4).
  - CSI feedback enhancement for multicast
    - Common CSI-RS can be configured for multicast, where the CSI-RS power is associated with GC-PDSCH power, instead of UE-specific PDSCH power.
    - Common aperiodic CSI-RS can be triggered by DL group-common PDCCH for the multicast UE group.
- **Proposal:**
  - Support HARQ-ACK codebook with limited reception capabilities for Rel-18 multicast
  - Support CSI feedback enhancement for Rel-18 multicast

# Larger Coverage - RV-level time-interleaving

- Email discussion conclusion:
  - (non-controversial) **Enable** Higher reliability, lower latency, **larger coverage** incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing

- To be more specific, “Enabling larger coverage” for PTM traffic includes RV-level time-interleaving

- Compared with multicast transmission, transmit diversity is relatively more important for broadcast transmission due to no CSI feedback and HARQ operation.
- For Rel-17 MBS, RV-level time-interleaving can improve SINR by ~1.5dB at BLER=1% by larger time diversity.
  - More details, please refer to [R1-2101489]



- Proposal: Support RV-level time-interleaving for Rel-18 MBS

# Multicast in RRC\_INACTIVE state

- Email discussion conclusion:
  - (non-controversial) Support of Multicast in INACTIVE state
  - (controversial) Support of Multicast in IDLE state
- Multicast is more intended for reliable services and only for UEs which have joined a multicast session.
- Multicast reception in RRC\_INACTIVE state can save UE power and alleviate RAN congestion.
- However, no clear benefits/motivation to support Multicast reception in RRC\_IDLE.
  - According to SA2 system design, RRC\_IDLE UEs are in NAS\_CM\_IDLE, which cannot support multicast (only supported in NAS CM\_CONNECTED).
  - The amount of additional work in SA2 and RAN groups to support multicast in RRC\_IDLE is too big with no clear use case/benefit.
  - ➔ No need to essentially repeat Broadcast functionality for Multicast by enabling multicast in RRC\_IDLE.
- **Proposal: Support multicast in INACTIVE state (but not in IDLE state) for Rel-18 MBS.**

# Efficient operation/Power Saving mechanisms

- Email discussion conclusion:
  - **(controversial) Improve Energy efficient operation/power saving mechanisms for MBS reception**
- To reduce the feedback overhead and UE power consumption, we propose to introduce changes that are already available for unicast traffic:
  - Pre-paging early indication (PEI) for multicast group in RRC\_IDLE/INACTIVE mode
  - PDCCH based Wake-up signal (WUS) for multicast DRX in RRC\_CONNECTED mode
  - Monitoring control of group-common PDCCH/searching space set switching may be needed, especially for multiple multicast services.
- **Proposal: Support Power saving techniques for multicast/broadcast monitoring for Rel-18 MBS**
  - E.g., PEI/WUS for MBS, PDCCH monitoring control/SS set switching for multicast, etc.

# Other aspects

- Email discussion conclusion:
  - (non-controversial) SFN support for MBS reception (above gNB-DU level)
    - (controversial) based on which numerology
  - (non-controversial) Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing
- SFN for Rel-18 MBS
  - Introducing ECP is not needed considering the negative impact on the device and specification complexity.
  - Adding a new numerology specifically for broadcast/multicast will create some of the issues that NR MBS was trying to solve (vs LTE MBSFN): MBSFN subframes, lack of commonality with unicast, etc.
  - Adding a new numerology will result in a large amount of RAN1 work, needs to be properly accounted in the overall TU number.

➔ Proposal: SFN support for MBS reception (above gNB-DU level) is based on existing numerologies

- RAN sharing for Rel-18 MBS
  - In case of RAN sharing, without supporting 5GC sharing (ex: common MB-UPF, Common MBSF, Shared MBS tunnel across PLMNs needed for 5GC sharing) or shared TMGI, it is NOT possible for RAN to identify which MBS services are shared across different PLMNs
  - Support of shared MBS services across different PLMNs and shared TMGI requires significant work in SA2 and RAN sharing alone is not sufficient to schedule different operator UEs using common radio resources.

➔ Proposal: Do not support RAN sharing since RAN cannot identify whether different PLMNs are serving shared MBS services

# Proposals

Building upon Rel-17 foundation, we support a (relatively small) Rel-18 WI to specify the following functionalities/enhancements:

- (non-controversial) Rel-17 left-overs (content to be identified and detailed at end of Rel-17)
- (non-controversial) SFN support for MBS reception (above gNB-DU level)
  - ~~(controversial) based on which numerology using existing numerologies~~
- (non-controversial) Support of Multicast INACTIVE state
- ~~(controversial) Support of Multicast IDLE state~~
- (non-controversial) Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, ~~Incl. RAN Sharing~~
  - L2-based retransmissions for PTM leg based on L2-feedback from the UE
  - RV-level time-interleaving
  - CSI feedback enhancement for multicast
  - Optimizations for HARQ-ACK codebook with limited reception capabilities
- (controversial) Improve Energy efficient operation/power saving mechanisms for MBS reception
  - Specify support of multicast in RRC\_INACTIVE
  - Power saving techniques for multicast/broadcast monitoring
    - E.g., PEI and WUS for MBS, PDCCH monitoring control/SS set switching for multicast, etc.



# Thank you

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