3GPP TSG-RAN WG2 #113bis-e Tdoc R2-210xxxx

Electronic meeting, 2021-04-12 – 2021-04-20

Agenda Item: 8.1.x.y

Source: Ericsson

Title: Email discussion report for [Post113-e][054][MBS17] PTP/PTM dynamic switch and MRB type change

Document for: Discussion, Decision

# 1 Introduction

The following email discussion was defined to make progress about NR multicast PTM to PTP operation.

* **[AT113bis-e][036][MBS17] PTM PTP operation switching (Ericsson)**

Scope: Based on R2-2103518 and related on-line discussion, offline on P6/P7, focus on the main aspects, determine the options on the table (with significant support) with brief justifications (the issue(s) that an option is expected to address) and converge if possible. If R1 aspects e.g. DCI impacts need to be captured we can capture FFS for now, no LS now.

Intended outcome: Report.

Deadline: In time for CB Tuesday April 20

# 2 Background (reiterated)

The endorsed 38.300 running CR contains the following definitions for PTM and PTP and also a text on the RLC entities:

For multicast service, gNB may deliver MBS data packets using the following methods:

- PTP Transmission: gNB individually delivers separate copies of MBS data packets to each UEs independently, i.e. gNB uses UE-specific PDCCH with CRC scrambled by UE-specific RNTI (e.g., C-RNTI) to schedule UE-specific PDSCH which is scrambled with the same UE-specific RNTI.

- PTM Transmission: gNB delivers a single copy of MBS data packets to a set of UEs, e.g., gNB uses group-common PDCCH with CRC scrambled by group-common RNTI to schedule group-common PDSCH which is scrambled with the same group-common RNTI.

A gNB node dynamically decides whether to deliver multicast data by PTM or PTP for a given UE based on the protocol stack defined in section16.x.3.

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For multicast session, the UE may be configured with two RLC-UM entities for an RB: one RLC entity is used to receive data using PTP transmission, and the other RLC entity is used to receive data using PTM transmission, as described in section 16.x.5.4. And the UE may be configured with one RLC-UM or RLC-AM entity for an RB for multicast session, which can be used to receive data using PTP transmission. Alternatively, the UE may be configured with one RLC-UM entity for an RB for multicast session, which can be used to receive data using PTM.

## 2.1 Agreements from main session 113e-bis:

Agreements

Chair: NOTE that the below agreements are only based on architecture decisions so far. The reliability discussion not concluded yet i.e. other cases than RLC UM + RLC UM. PTM PTP switch for such other cases is FFS

* Dynamic PTM/PTP switch is supported for a split MRB bearer (type) with a common (single) PDCP entity.
* As a baseline, no new UE based signalling is introduced to support gNB switch decision (e.g. PDCP SR for high reliability is still TBD)

# 3 PTM and PTP operation for switching

From several contributions (e.g. R2-2100643, R2-2100677, R2-2100942, R2-2101143, R2-2101317, R2-2101605) a minimum main-stream procedure to setup and use the MRB with both PTP and PTM was discussed (as presented in R2-2103518):



Figure 2.3-1: Baseline procedure

*In step 0 the UE is in RRC Connected, normal unicast is setup, MBS groups are setup and now the gNB wants to establish an MRB.*

*In step 1 the gNB configures the UE to setup the MRB bearer with PTM and PTP. This configuration should roughly contain RLC modes, G-RNTI, etc. The exact details can be decided later.*

*In step 2 the UE monitors both G-RNTI and C-RNTI for MRB traffic for both PTM and PTP. The UE receives PDUs on G-RNTI and/or C-RNTI which does not result in any activation/deactivation of any leg/RNTI. Selection between PTM and PTP is a scheduling decision in the gNB.*

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Additionally some contributions (R2-2100173, R2-2100506, R2-2100677, R2-2100988, R2-2101012, R2-2101217, R2-2101317, R2-2101627) mention the need to rapidly activate/deactivate G-RNTI (and correspondingly the PTM leg). As the UE always should monitor for C-RNTI while in RRC connected (legacy), the discussion should determine if the UE may suspend/resume monitoring for G-RNTI based on e.g. some indication. Some contributions (e.g. R2-2100084, R2-2100321, R2-2100942) mention a two-step process where the network could activate the UE to enable PTM after the configuration step.

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From the online session, it is clear that most companies think that PTM PTP switching is a scheduling decision by gNB (or directly related to scheduling), and this may be transparent to the UE. However, it was not clear to what extent activation/deactivation, power saving and additional bearer configurations that was to be supported for a switch between operation in PTM and PTP.

Currently companies' opinion can be summarised to:

* That there may be power saving gain in suspending/resuming monitoring of G-RNTI.
* There are a number of uncertainties in the significance to those gains: complexity, SPS (as supported for MBS in RAN1), assuming MBS specific DRX (discussed under group scheduling) and the related support for additional signalling.
* Other operational scenarios for where the PTM and PTP leg is not “active” simultaneously for a split MRB bearer type.
  + The Rapporteur suggests postponing this issue for now.

As a result, there are these two initial points for discussion:

1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTP leg of the split-MRB is determined by UE scheduling by gNB following R16 for unicast DRBs and no activation or deactivation is required after the necessary split-MRB configuration. (Majority view from the email discussion into the meeting)
2. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to per-UE activation or deactivation.

Proposal from the Rapporteur:

1. Agree to 1, FFS on 2.

Q1: Please summarize and motivate your view on the Rapporteur proposal.

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| **Company** | **Comments** |
| Huawei, HiSilicon | Point 1 may be difficult to understand. Suggested revision:   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTP legt cannot be deactivated (i.e. the UE needs to always monitor C-RNTI) after the necessary split-MRB configuration. (Majority view from the email discussion into the meeting) |
| Qualcomm | Point1 is confusing.  Huawei suggested edit is much better .  However, split-MRB including both PTM and PTP RLC legs should be considered as “one possible configuration choice” and “as default configuration choice”. If both PTM and PTP legs are configured, agree that UE monitors both G-RNTI and C-RNTI. PTM leg can be activated/deactivated.  We should allow MRB configuration with PTM RLC only, PTP RLC only, PTM + PTP legs. |
| Nokia | Agree with the proposal from the rapporteur. If an activation is introduced, we cannot mandate network to send it (and it is very likely that UE vendors will not agree to have it introduced as mandatory feature). Thus, the first point is the baseline.  The 2nd point needs to be motivated by tangible gains when considering available mechanisms (and not in isolation). Those include DRX, SPS and CA activation/deactivation (when PTM and PTP transmissions do not reside on the same carrier). From a power consumption viewpoint, the gains would depend on PDCCH configuration (CORESET/SS) where DCI scrambled with G-RNTI scheduling PDSCH, so RAN1 should be involved. Furthermore, ignoring PTM transmissions that are anyway taking place, and having to deal with possible delays when switching occurs would inevitably introduces losses. This also needs to be taken into account before agreeing such a mechanism. |
| CATT | Agree with point 1,UE always needs to monitor C-RNTI.  For point 2, it is not mentioned whether there is notification to UE on the activation/deactivation of PTM leg. Suggested revision as below,  2.Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to per-UE activation or deactivation, and UE may be informed for the power saving purpose. |
| ZTE | **Point 1 is fine to us, would be better with the following revision** (we might not need to declare something we won't do in the spec, and following network scheduling is clear enough. One can't really deactivate C-RNTI monitoring as long as UE is in RRC\_CONNECTED state. The rest is about the DRX operation which we will discuss in another thread):  - Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTP leg of the split-MRB is determined by UE scheduling by gNB after the necessary split-MRB configuration. (Majority view from the email discussion into the meeting)  **As for point 2, we support the per-UE activation or deactivation for cases of split MBR (i.e., both legs configured).**  There might be DRX for the monitoring of G-RNTI transmission, it is always beneficial from power efficiency perspective if no PDCCH monitoring in Layer 1 is needed at all. As for the possible data loss, there are a few options to reduce or even eliminate it: simultaneous reception, PDCP SR, etc.  **Configuration options (both, or single leg, and default?)**  We agree with QC that split-MRB with both PTP/PTM legs configured is just one choice of the possible configurations, there are other choices like single leg options. However, whether split-MRB should be the "default" choice, our answer is why dont we just leave it to network decision.  - For example, for Rel-15 UEs, is it possible for the network always to configure PTP transmission for them? It is always beneficial to have more UEs being able to receive the Multicast services.  - And for cases when UE is the first one consuming the Multicast service, PTP only apparently is the only choice (whom is the PTM for anyway?) |
| Kyocera | For Point 2, we support the activation/deactivation of PTM-leg of split-MRB, but we can accept to leave it to FFS for now, for progress. We think the UE has to wake up additional occasions to monitor G-RNTI, i.e., due to a group DRX which is independent from unicast DRX. So, the deactivation of PTM-leg, while the gNB schedules MBS data transmissions via PTP-leg, is quite efficient in terms of UE power saving. We assume it’s gNB implementation when to activate/deactivate PTM-leg, according to the scheduling of MBS data via PTP-leg. Note that we assume in general, the gNB may always transmit MBS data via PTM-leg for other UEs. |
| Sharp | Agree with point 1, PTP is a unicast, so UE should follow unicast UE behaviour. For point 2, we support that the usage of the PTM leg of the split-MRB is subject to per-UE activation or deactivation, switching off PTM is more power efficient way than using DRX/SPS which are design for power saving for PTM in activated state. |
| vivo | Generally, we think the concept “dynamic switching between PTP and PTM” means switching between PTP and PTM&PTP via L1/L2 signaling when both PTM leg and PTP leg are configured, similar to SUL switch, BWP switch, and search space set group switching. In this sense,   * For 1st bullet, if the UE needs to always monitor PTM leg (associated with G-RNTI) and PTP leg (associated with P-RNTI) when both PTM leg and PTP leg are configured, we think there will be no need to discuss dynamic switching in this case since the switching has no impacts on UE and which leg(s) is used for data scheduling is totally up to NW. This is similar to the existing NR case where the UE just simply monitors these two SSs when a UE is configured with both CSS and USS (i.e. no SS switching concept is introduced). Anyway, we can agree that activation/deactivation or initial state indication might be not always needed (i.e. the UE monitors PTP&PTM if the field for (de)activation-enable and/or initial state on PTM leg is not configured in the split-MRB configuration). * For 2nd bullet, we think the initial state of PTP in the RRC configuration should be also considered.   Based on the above, we propose the following revision:   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, support the split-MRB configuration that activation or deactivation of PTM leg is not required. The usage of the PTP leg of the split-MRB is determined by UE scheduling by gNB following R16 for unicast DRBs. (Majority view from the email discussion into the meeting) 2. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to per-UE activation or deactivation (e.g. initial state on PTM leg). |
| Samsung | Agree with rapporteur’s original wording.  We did not agree dynamic activation of monitoring G-RNTI. We agree UE always monitors C-RNTI, as in legacy UE and we are fine to keep FFS on activation of monitoring for G-RNTI.  Regarding the power saving gain, we agree with Nokia. We have a number of RNTIs UE has to monitor and dynamic activation may have some packet loss. We do not see there is big difference between deactivation and release of PTM leg. Thus we prefer to avoid this additional option and we think release of PTM leg is sufficient. |
| NERCDTV | Agree with point 1，i.e. UE in connected state anyway needs to always monitor C-RNTI.  **For point 2, we support the per-UE activation or deactivation for monitoring G-RNTI**，and UE activates/deactivates monitoring G-RNTI **based on some indication from the network**. Suggested revision:   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to per-UE activation or deactivation based on indication from the network to UE. |
| Shanghai Jiao Tong University | Agree with point 1，UE in connected state should always monitor C-RNTI.  **For point 2, we support the per-UE activation or deactivation of PTM leg**，and **there should be notification to UE** on the activation/deactivation of PTM leg. Suggested revision:   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to per-UE activation or deactivation based on indication from the network to UE. |
| Xiaomi | We agree with the intention of the two points.  For Bullet 1, we slightly prefer the revision from Huawei.  For Bullet 2, “per-UE” should be removed, as the group scheduling is for a group of UEs. Maybe whether the activation/deactivation is per-UE or per-UE-group can be marked as FFS. |
| Futurewei | Dynamic switch between PTM PTP needs UE to monitor both G-RNTI and C-RNTI. UE is already monitoring multiple RNTIs, and the amount of power saving gain from deactivation of G-RNTI is not clear. Per-UE activation/deactivation of G-RNTI also have impacts on operations of PTM DRX and SPS. It should be discussed in RAN1 as well.  At this stage, we are fine with rapporteur’s proposal – agree proposal 1, FFS proposal 2. |
| LGE | We agree to point 1. It would be better with the revision suggested by ZTE.  We agree to point 2. Furthermore, regarding usage of the PTM leg of a split-MRB, we support the idea that UE deactivates PTM by UE implementation when switched to PTP, on the other hands, UE activates PTM by NW indication of switching from PTP to PTM or starting with PTM.  In addition , even though the switching between non-split MRBs is supported, it should be considered as semi-static switching, not dynamic switching, and all decisions made in this agenda should apply to the dynamic switching only. Focusing on the PTM/PTM dynamic switch, MRB needs to be configured with both PTM and PTM. If an MRB was previously configured with either PTM or PTM only, it needs to be reconfiguired with both PTM and PTP for PTM/PTP dynamic switch. We think that step 1 of the baseline procedure can imply this reconfiguration as well. |
| Lenovo and Motorola Mobility | Agree with 1 if it means the usage of PTP leg, if configured, is upon scheduling, thus no explicit activation/deactivation signaling for PTP leg is needed.  Agree with 2, since explicit deactivation of PTM leg would be helpful for UE to stop monitoring G-RNTI and the relevant DRX operation. We are fine to put 2 as FFS is it’s not easily agreeable. |
| TCL | We share the same view with Shanghai Jiao Tong University.  We agree with point 1 that UE should always monitor C-RNTI in connected mode.  As for point 2, we support the per-UE activation or deactivation of PTM leg，and there should be notification to UE on the activation/deactivation of PTM leg. And wordings like “based on indication from the network to UE” is suggested to be added. |
| APT | Regarding the configuration of MRB, we think in addition to “MRB configured with a PTM leg and a PTP leg”, the network should also have the flexibility to provide the following configuration options:  MRB configured with PTP leg only.  MRB configured with PTM leg only.  Moreover, we could at least consider having “MRB configured with a PTM leg and a PTP leg” as the default configuration.  Regarding scheduling of MBS data, we believe it could be up to a gNB to decide whether to schedule on the PTP leg and/or the PTM leg. Moreover, it is beneifital to suspend/resume monitoring of G-RNTI in the case where a MRB is configured with a PTM leg and a PTP leg. Otherwise, the UE will waste extra power and PDCCH decoding effort to continuously monitor for G-RNTI even when there is no scheduling on the PTM leg. We should also be aware that a UE could be configured with more than one G-RNTI. Hence, the wasted power and PDCCH decoding effort could be significant.  Finally, we think other power saving mechanisms ,e.g., DRX for MBS, should also not be precluded. |
| BT | P1: we agree with the proposal due to an UE needs to monitor the C-RNTI but we also agree with other companies that current wording is a bit confusing.  P2: at the moment we don’t have any prove of the benefit that this feature can bring (i.e. UE power reduction) vs complexity to support it (i.e. specific DRX, SPS, CA, mobility), therefore we prefer to leave this FFS and allow companies to bring the results. From an operational point of view and in case the PTM leg of the split-MRB can be activated or deactivated per-UE, it has to be up to network configuration if the UE can deactivate the PTM leg. |
| OPPO | For 1, we are fine with huawei’s wording.  For 2, we see the benefit to have PTM leg deactivation if network decide to use PTP leg for ue power saving purpose. If the UE is in RRC\_CONNECTED state and MBS service is deactivated, we also see the benefit to deactive the PTM leg for UE power saving. In the latter case, the deactivation may be a per MBS deactivation. So we can remove “per UE”.   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTM leg of the split-MRB may be subject to activation or deactivation. |
| NEC | Point 1 seems only addresses the case the swith from PTM to PTP, then here comes the following problems:  1:How and when the UE swith from PTP to PTM?  2:if a split MRB switches from PTM to PTM, it there any benefit to deactivate the PTM leg other than power saving aspect for the UE?  3: we have not discussed the scenario that the PTP leg works as an complementary leg(for retransmission only) or a individual leg. If this PTP leg needs no activation/deactivation, we’d clarify what this PTP leg can do. |
| Spreadtrum | For point1, we are fine with the Huawei’s revision.  For point2, we support the per-UE activation or deactivation of PTM leg of split-MRB for UE power saving. E.g. for the dynamic PTM to PTP switching or MBS session deactivation cases. |
| Intel | Agree with the rapporteur proposal in general.  Point 1 might be simplified as below:   1. Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTP leg of the split-MRB is determined by gNB scheduler following unicast DRBs and no activation or deactivation is required after the necessary split-MRB configuration. (Majority view from the email discussion into the meeting)   As for point 2, we agree with Nokia that whether to introduce the option should be carefully evaluated. We anyway have RRC (re)configuration regarding PTM and PTP legs, and the gain of dynamic deactivating PTM leg should be compared with the reference case of RRC reconfiguration. |
| ITRI | We agree to the point 1 that the UE needs to monitor C-RNTI in conneted mode.  For point 2, we share the same views as Samsung, Futurewei and BT that the power saving gain may not be so evident when compared with the complexity to support it. Therefore, we should leave this FFS for now. |
| Convida | Point 1: Agree in principle - but as others have suggested, it may be useful to reword a little  Point 2: We do not think this can be FFS.  We think that the usage of the PTM leg of the split-MRB should be subject to a per-UE activation or deactivation. We can leave the determination of the activation and deactivation as FFS (e.g. an indication sent by network or determined autonomously by UE).  If the network decides to schedule a UE1 only on the PTP leg, UE1 should stop monitoring the PTM leg. The PTM leg is shared by UE1 and a number of other UEs. Even after the scheduling on the PTP leg for UE1, the network continues to send transmissions on the PTM leg. However, UE1 needs to stop processing the transmissions on the PTM leg. Otherwise it would continue to look for G-RNTI, to decode the PTM transmission on the PDSCH, to potentially soft combine the received transport block, etc. |

**Summary:**

1. tbd

# 8 Summary

Based on above email discussion summary, the following proposals are presented for discussion and agreement:

TBD