3GPP TSG-RAN WG2 #119-bis-e R2-221xxxx

Electronic meeting, 10th – 19th October 2022

Agenda Item: 8.11.2

Source: CATT

Title: Report of [AT119bis-e][605][eMBS] PTM configuration for INACTIVE (CATT)

Document for: Discussion, Decision

# 1 Introduction

This document is the report of the following email discussion,

* [AT119bis-e][605][eMBS] PTM configuration for INACTIVE (CATT)

      Scope: Treat the remaining proposals from R2-2210068:

-       Gather comments on the current proposals and refine them accordingly

-       Identify a (hopefully big) set of easy proposals for offline agreement, capture controversial parts as FFS, if needed

-       Identify a (very small) set of proposals for online discussion

      Outcome: Report

      Deadline: Report available: Tuesday 2022-10-18 1200 UTC

Two phases are planned for the discussions, i.e.,

* Ph1: companies’ comments collected before Friday Oct. 14th 23:00 UTC
* Ph2: proposals/summary checked before Tuesday Oct. 18th 10:00 UTC

# 2 Contact information

Participants are encouraged to leave their contact information in the following table.

|  |  |
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|  |  |

# 3 Ph1 discussions

## 3.1 Whether and how to notify the session state change to UEs in INACTIVE

### 3.1.1 Session activation

Whether UE is informed about session activation

In [1], almost all the companies agree that Rel-18 UE in INACTIVE should be informed when the session is activated (Details FFS). So the Proposal 6 in [1] is renamed as proposal 1 and copied below.

**Proposal 1 Rel-18 UE in INACTIVE can be informed when the session is activated (Details FFS).**

**Question 1 Do you have any concern on Proposal 1?**

|  |  |
| --- | --- |
| Company | Please only comment if you have concern on P1. |
| TD Tech, Chengdu TD Tech | NO. |
| Nokia | No concerns |
| Kyocera | No concern. |
| NEC |  |
| OPPO | No concern after the changes.  **Proposal 1 Rel-18 UE in RRC\_INACTIVE can be be informed when the session is activated if the session is configured to receive for UEs in RRC\_INACTIVE(Details FFS).** |
| Huawei, HiSilicon | No |
| MediaTek | No |
| ITRI | No concern. |
| CMCC | No concern. |
| ZTE | No concern. |
| Xiaomi | No concern. |
| Samsung | No |
| vivo | Agree with the current proposal. |
| Intel | No |
| LGE | No concern but it is just a legacy behavior. Do we really need to have this as a new agreement? Maybe, R18-specific issue is whether UE receiving the multicast in RRC\_INACTIVE can be informed whether the session is de-activated. |
| Spreadtrum | No concern. |

How to inform UE about session activation

Firstly, note that we already agreed that “For both option 1 and option 2, as a baseline, group paging can be used to switch UEs receiving multicast from RRC\_INACTIVE to RRC\_CONNECTED, and UEs continue the multicast reception in CONNECTED.

Then, although not explicitly proposed in [1], Rapporteur understands that based on Proposal 1, it is possible to form a baseline regarding how to inform UE about the session activation. Therefore the following proposal and question are added.

**Proposal 2 As a baseline, group paging can be used to inform UE(s) about the session activation. (Details FFS).**

**Question 2 Do you agree with Proposal 2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Nokia | Yes | However, additional mechanisms are needed in addition to group paging (such as an indication in the SIB/MCCH that the multicast service is delivered to UEs in RRC\_CONNECTED or an indication whether the multicast service is active) to get RRC\_INACTIVE UEs that reselects to a new cell for moving UE to RRC\_CONNECTED in the new cell. Such UEs reselecting to the new cell may miss the group paging previously performed in the new cell. Note here that which RRC state to keep the UE is a per cell decision, therefore, the UE may be receiving the multicast service in RRC\_INACTIVE state in the previous cell. |
| Kyocera | Yes | We agree with the rapporteur that Proposal 2 is the natural interpretation of the latest agreement. |
| Qualcomm | Yes | FFS details is ok for now, which could include further enhancements needed e.g. to differentiate session activation and continue in INACTIVE vs session activation along with command to the UE to go to CONNECTED, vs end of temporary data inactivity of already activated session etc. |
| NEC | Yes | It is straightforward to reuse group paging to realise session activation also is agreement.  For UE who supports Mcast reception in RRC\_INACTIVE and has a valid PTM configuration, when it receives group paging, it can directly start to receive Mcast session without entering RRC\_CONNECTED. And more details see Q3.  For UE who has not a valid PTM configuration, it enters RRC\_CONNECTED to acquire the PTM configuration, and whether receive Mcast in RRC\_CONNECTED or not can be based on NW indication (e.g., RRCRelease). |
| OPPO | yes | It is same as legacy behavior, i.e R17 group paging, no matter the MBS session is allowed to receive for UEs in RRC\_INACTIVE or not. |
| Lenovo | Yes | FFS details is OK. We can further discuss whether some enhancements on group paging is needed later. |
| Huawei, HiSilicon | Yes |  |
| MediaTek | Yes |  |
| ITRI | Yes | Using group paging for session activation notification is legacy behavior. |
| CMCC | Yes |  |
| ZTE | Yes | as legacy. no intention to have two solution for same issue in different releases. |
| Xiaomi | Yes |  |
| CATT | Yes | Support to have this as baseline, given the progresses that we already made. |
| Samsung | Yes | FFS details is fine. |
| BT | Yes |  |
| vivo | Yes | For the case where group paging for session activation is used to transit the Rel-18 INACTIVE UE to CONNECTED, we agree with this proposal. |
| Intel | Yes |  |
| LGE | Yes | This is a legacy behavior, but agree no need to define a separate solultion for R18 UE. |
| Spreadtrum | Yes | It is a straightforward way to used group paging for the session activation as in R17. FFS details is fine. |

Upon session activation, how does UE determine whether it can receive the multicast session in RRC\_INACTIVE or not?

Upon session activation, UEs should know whether it can receive the multicast session in INACTIVE. In [1], this issue was discussed extensively in Question 9, i.e., “Q9: Do you agree Rel-18 UE in INACTIVE should be informed whether the multicast session can be received in INACTIVE when the session is activated (Details FFS)?”. Some alternatives have been mentioned therein.

**Proposal 7 Further discuss the following alternatives regarding how UE is indicated whether it can receive the multicast session in RRC\_INACTIVE or not when the multicast session is activated:**

**Alt. 1 When the multicast session is activated, UE can receive the multicast session in RRC\_INACTIVE if the PTM configuration used in RRC\_INACTIVE for the session is available to the UE (e.g., configuration provided to UE via dedicated RRC signaling or via MCCH), otherwise it goes back to RRC\_CONNECTED to receive the multicast session.**

**Alt. 2 When the multicast session is activated, UE is indicated by group paging whether it can receive the multicast session in RRC\_INACTIVE or not (detail signaling FFS).**

**Other possible alternative(s) if any.**

Basically, Alt. 1 does not require changes to the group paging, i.e., UE determines whether it can receive the session in INACTIVE based on whether the related PTM configurations are available to the UE, while Alt. 2 requires changes to the group paging as it needs explicit indication in the group paging.

For the sake of progress the Proposal 7 in [1] is reformulated to the following question.

**Question 3 If Proposal 1 and Proposal 2 are agreed, which alternative do you prefer regarding how UE determines whether it can receive the multicast session in RRC\_INACTIVE or not when the session is activated?**

**Alt. 1 When the multicast session is activated, UE can receive the multicast session in RRC\_INACTIVE if the PTM configuration used in RRC\_INACTIVE for the session is available to the UE (e.g., configuration provided to UE via dedicated RRC signaling or via MCCH), otherwise it goes back to RRC\_CONNECTED to receive the multicast session.**

**Alt. 2 When the multicast session is activated, UE is indicated by group paging whether it can receive the multicast session in RRC\_INACTIVE or not (detail signaling FFS).**

**Other possible alternative(s) if any.**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | | Alt. 1, 2 or others | Comment if any, e.g., please specify them if you prefer other alternatives. |
| TD Tech, Chengdu TD Tech | | See our comments | We should consider the following three scenarios when a multicast session is activated.  Scenario 1: gNB decide to make all UEs receive the multicast session in RRC\_INACTIVE state with the PTM configuration sent before  Scenario 2: gNB decide to make some UEs receive the multicast session in RRC\_INACTIVE state with the PTM configuration sent before and the other UEs receive the multicast session in RRC\_CONNECTED state  Scenario 3: gNB decide to make all UEs receive the multicast session in RRC\_INACTIVE state with the new PTM configuration which has not sent to all UEs  We think both scenariio 1 and scenario 2 shall be supported. Therefore, alt 2 is reasonable:  Along with TMGI, the group paing shall carry the other information to indicate which UEs are allowed to receive in RRC\_INACTIVE state. For example, a UE ID list is used to indicated which UEs can receive the multicast session in RRC\_INACTIVE state. If group pagin has no UE ID list, all UEs need to receive in RRC\_CONNECTED state.  Whether or not supporting scenario 3 shall be decided. If scenario 3 shall be supported, group paging shall carry the new PTM configuration. |
| Nokia | | Alt2 with additions | Additional mechanisms are needed in addition to group paging (such as an indication in the SIB/MCCH that the multicast service is delivered to UEs in RRC\_CONNECTED or an indication whether the multicast service is active) to get RRC\_INACTIVE UEs that reselects to a new cell for moving UE to RRC\_CONNECTED in the new cell. Such UEs reselecting to the new cell may miss the group paging previously performed in the new cell. Note here that which RRC state to keep the UE is a per cell decision, therefore, the UE may be receiving the multicast service in RRC\_INACTIVE state in the previous cell.  Regarding alt1: The delivery mode depends on different things, e.g., size of the audience, current conditions at the gNB, … . For the dedicated signalling approach, it should not be automatic for the RRC\_INACTIVE UE to not reconnect, as the gNB may change its decision and would like to provide the service in RRC\_CONNECTED. |
| Kyocera | | Alt. 1 & 2 | We think Alt.1 is anyway needed, since the UEs staying INACTIVE needs the valid PTM configuration and the other UEs not having PTM configuration need to transition to Connected.  On top of that, when the multicast session is activated, we think it’s up to the network whether to make all UEs or only some of UEs transition to Connected for multicast reception, e.g., due to up-to-date network congestion status. So, we think Alt.2 would be needed for flexibility of network control.  Additionally, we wonder if the network may need means to page UEs selectively. It’s FFS whether it can be achieved by the legacy paging or needs some enhancement on the group paging. |
| Qualcomm | | Both 1 & 2 are needed.  They are not alternatives.  Also see comment. | In Alt1, following red text should be added  “When the multicast session is activated, UE can receive the multicast session in RRC\_INACTIVE if the UE has already joined the multicast session and PTM configuration used in RRC\_INACTIVE for the session is available to the UE (e.g., configuration provided to UE via dedicated RRC signaling or via MCCH), otherwise it goes back to RRC\_CONNECTED to receive the multicast session.” |
| NEC | | Open | Alt 1 can based on the availability of PTM configuration to implicitly indicate whether it can receive Mcast session in RRC\_INACTIVE.  For Alt 2, since the current group paging (carrying TMGI) is only used to indicate session activation, so if we want to indicate more information such as “ whether it can receive Mcast session in RRC\_INACTIVE”, we need to enhance it to realise such a differentiation. |
| OPPO | | Others | There is no agreement to use dedicated signaling and “SIB+MCCH”, right?  Whther the UE enter RRC\_CONNECTED or not, it depends on whther there it preconfigured indicaton to indicated for the MBS session and the MBS session allows to receive for UEs in RRC\_INACTIVE. Otherwise, the UE will enter RRC\_CONNECTED as legacy. |
| Lenovo | | Both | Both alternatives are needed. If UE has no available configuration, the UE has to go to RRC\_CONNECTED anyway. |
| Huawei, HiSilicon | | Alt 2 | The network should be able to move the UE to RRC-CONNECTED mode or keep UE still in RRC\_INACTIVE for multicast reception when the service is activated based on load/strategy in the serving cell, which can’t be pre-configured by dedicaited signaling at RRC release  We also share the same understanding with Nokia that the session activaiton/deactivation state should be visible from MCCH or BCCH so that UE can sync with network in some unexpected error scenario such as missing group paging during cell reslection or temporary weak channel condition. |
| MediaTek | | Alt1 with enhancement,  Also see comments | In our understanding,   * For Alt1, the reception in INACTIVE is notified implicitly by the presence of PTM configuration for INACTIVE when session activate. * For Alt2, the information of whether reception in INACTIVE is notified by group paging when session activate.(This needs further enhancement in group paging)   Alt1 seems better since it is more compatibility friendly. If one multicast session is both provided to UE supporting Rel-17 and Rel-18 multicast, the enhancenent in group paging (i.e. Alt 2) may not work well.  For Alt1, we wonder if the information can also provided to UE earlier? E.g.,when UE joins in the multicast session, UE is notified whether it can receive in INACTIVE, then UE can receive in INACTIVE in Alt1 way (implicitly) when session activate.  Even the PTM configuration may be provided to UE earlier to avoid the PRACH collision in high density scenario when session activate. (if option1 is finally selected) |
| ITRI | | Alt 1 | We should consider the use cases for alt 2 when the session is activated:  Case 1: Once the cell congestion situation is **not reduced**:  The cell could use the indicator in group paging to indicate the UE should receive the multicast session in RRC\_INACTIVE.  If the PTM configuration used in RRC\_INACTIVE for the session is available to the UE, the UE can receive the multicast session in RRC\_INACTIVE. Otherwise it goes back to RRC\_CONNECTED to receive the multicast session.  Case 2: Once the cell congestion situation **is reduced**:  The cell could use the indicator in group paging to indicate the UE should receive the multicast session in RRC\_CONNECTED to provide better MBS reception quality.  In case 2, from the UE power saving perspective, it isn’t necessary to wake UE up to receive the activated session, if the UE has the available PTM configuration used to receive the session in RRC\_INACTIVE.  Therefore, no metter in case 1 or case 2, when the session is activated whether the RRC\_INACTIVE UE should enter RRC\_CONNECTED to receive the activated session depends on whether the RRC\_INACTIVE UE has the available PTM configuration used to receive the activated session. |
| CMCC | | Alt2 | As discussed in Q2, when session actived, group paging is used to inform UEs, and Alt 2 is a straightforward way to indicate whether RRC\_INACTIVE UE(s) need to switch its RRC states. But for a UE in RRC\_INACTIVE can still receive multicast without state switching, UE should have the PTM configuration in advance, Alt 1 seems like the precondition, while Alt 2 provides the indication for UE’s decision. |
| ZTE | | others, or alt3 | alt 3: UE could be well informed about "whether it can receive the multicast session in RRC\_INACTIVE" by dedicated signaling before UE is released.  - if session is in deactivated, UE in RRC\_INACITVE monitor group paging for session activation, if enabled, UE stays in RRC\_INACTIVE to receive the multicast data; if not, UE triggers RRC resume as legacy.  therefore, no impacts to legacy group paging mechanism. and it works well. |
| Xiaomi | They are not alternatives.  Prefer alt.1.  Whether alt2 is needed or not is FFS | | We want to confirm the scenario of multicast reception in RRC\_INACTIVE first.  In our understanding, currently, we only consider the multicast reception for INACTIVE UE who has the pre-configured multicast configuration, as the following agreements:   * In Rel-18, multicast reception for UEs in INACTIVE supports at least the following scenarios, **with the assumption that the UE already has a valid PTM configuration**   For this case, we think the alt1 is the straightforward way without extra indication in network signaling.  For whether to support alt2, we think it depends on whether the multicast reception for UE without pre-configured multicast configuration is considered or not. If it is supported, gNB can indicate which UE can be allowed to receive the multicast session in INACTIVE state. |
| CATT | | See comments | We tend to agree with some comments above that technically speaking both of these alternatives work and they are not necessialry mutually exclusive. Also we agree that alt. 2 requires some enhancement to group paging.  Perhaps we can allow more time to discuss before making a conclusion on this matter. |
| Samsung | | Alt 2 (is superset of Alt 1) | We understand Alt 1 is just the premise, while Alt 2 is real approach.  We think network is well aware and in control that UE has joined multicast session, UE has valid PTM configuration (as it was provided by network irrespective of signaling mechanism) and UE is in RRC\_INACTIVE (network only transitions UE state), then with Alt 2 (group paging) networks knows and indicates which RRC state UE should receive multicast session. Also to note that Network has additional inputs on cell load/congestion etc., while making this decision. |
| BT | | - | For an operational point of view, it is important that a subset of UEs receiving a multicast session can be moved to INACTIVE mode.  For an operator, it is impossible to ensure that all UEs receiving the same multicast session will be Rel-18. Hence, the solution of group paging should consider the same multicast session will be received by Rel-17 and Rel-18 UEs.  For security reasons, we need to make sure that only UEs that have the right to “listen” the multicast session in INACTIVE can dedoce the information. We are fine with the text added by QC “*When the multicast session is activated, UE can receive the multicast session in RRC\_INACTIVE if the UE has already joined the multicast session and PTM configuration used in RRC\_INACTIVE for the session is available to the UE (e.g., configuration provided to UE via dedicated RRC signaling or via MCCH), otherwise it goes back to RRC\_CONNECTED to receive the multicast session”*. |
| vivo | | Alt 1 | Once valid PTM configuration is acquired and restored, in our understanding, the NW at this time would like to make the UE receive the multicast service in the INACTIVE state. We think applying the PTM configuration is independent of group paging. |
| Intel | | Alt. 1 | Alt. 1 has the benefit of less paging signalling overhead, while in Alt. 2, gNB can have finer control of which UEs to receive in RRC\_INACTIVE and which UEs to receive in RRC\_CONNECTED for the same multicast service. However given that UEs are in RRC\_INACTIVE state when the multicast session is activated, if a service can be received in RRC\_INACTIVE, it is not clear why gNB would blindly move some UEs to RRC\_CONNECTED. Therefore, the benefit of Alt. 2 is not clear. |
| LGE | | - | UE should be notified of whether the multicast reception in RRC\_INACTIVE is allowed or not via dedicated signalling before/when entering RRC\_INACTIVE. During RRC\_INACTIVE, if an UE is allowed to receive the multicast session in RRC\_INACTIVE, the UE should keep RRC\_INACTIVE regardless of the activation/de-activation state of the multicast. If it is not allowed, the UE should resume the RRC connection upon receiving the group notification for multicasat activation. |
| Spreadtrum | | Alt2 | When session is deactived, the gNB need not to change the RRC state of UEs to receive the Multcast session. Therefore, even if the PTM configuration used in RRC\_INACTIVE for the session is available in UE, it doesn’t mean UE will receive this multicast session in the RRC inactive state when the session is activated.  Then the gNB needs to indicate whether UE can receive the multicast session in RRC\_INACTIVE or not in the group paging message. |

Note: A Proposal 3 may be added based on output in ph1.

### 3.1.2 Session deactivation

The following were concluded from [1].

**Observation 1 Majority of the companies see a need to inform UEs in RRC\_INACTIVE when a multicast session is deactivated.**

**Proposal 8 Further discuss whether UEs in INACTIVE should be informed when the multicast session is deactivated, and if yes what is the solution.**

Rapporteur understands that most of the companies think that UE may be aware when a multicast session is deactivated, but there may be different views regarding how this is achieved, e.g., some thinks group paging can be used, some think MCCH can be used, etc.

Therefore to progress, the Proposal 8 in [1] is updated to the following and companies can further comment on it.

**Proposal 4 UE may be aware when a multicast session is deactivated. FFS how this is achieved (e.g., informed via group paging, MCCH, or other ways).**

**Question 4 Do you agree with Proposal 4?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment if any |
| TD Tech, Chengdu TD Tech | Yes | We think MCCH can be used to send the multicast session deactivation notification with PTM mode, where MCCH can be a cell specific MCCH or a session specific MCCH.   1. For a multicast session activation notification, only group paging can be used. But for multicast session deactivation, there are several options. 2. If multicast session deactivation is also sent with group paging and many mutlcast sessions are supported simultaneously, more POs may be configured to UE, which means more power consumption in UE. |
| Nokia | Yes | Not sure completely about question as the proposal indicates “UE MAY be aware”. What does that mean? UE is aware or is not?  Anyway we think UE should be aware whether session is provided in RRC\_INACTIVE or not. |
| Kyocera | Yes, but… | We think it’s a possible option to use MAC CE scrambled with G-RNTI, which is similar to SC-PTM Stop Indication in LTE, so we would suggest to add it as an example on Proposal 4. |
| Qualcomm | Yes but | Similar to Nokia’s comment: the proposal wording is unclear. It should be changed to  “UE **is notified** ~~may be aware~~ when a multicast session is deactivated. FFS how ~~this is achieved~~ (e.g., informed via group paging, MCCH, or other ways).” |
| NEC | Yes | We support to inform UEs of session deactivation for power saving reason. Basically fine with this proposal 4 but we prefer Mcast-like method to realise this, i.e., group paging instead of Bcast-like method.  BTW, same view with companies above, **may** is not clear here. |
| OPPO | Yes with changes | **Proposal 4 UE is notified when a multicast session is deactivated if the MBS session is preconfigured to allow to receive for UEs in RRC\_INACTIVE. FFS how this is achieved (e.g., informed via group paging, MCCH, or other ways).** |
| Lenovo | Yes, but | We agree with QC’s comments. |
| Huawei, HiSilicon | Yes | It’s beneficial for UE’s power saving to stop monitoring the G-RNTI when the MBS session is deactivated. |
| MediaTek | No | We think the benefit for notifying UE the session deactivation is marginal. If UE detects the interruption, it can be up to UE implementation to save the power.  We have the same concern that such enhancement it too complicated and may lead to compatibility issue to legacy multicast. |
| ITRI | Yes, but | We agree the QC’s comments. |
| CMCC | Yes | With this, UE can stop unnecessary G-RNTI monitoring for power saving. |
| ZTE | yes but | "may" to "should"  Same concern with Nokia, although we said no.  We think it is necessary for one UE to be aware when a multicast session is deactivated for power saving.  it "should" be notified to UE about the even of session deactivation.  For us the introduction of session deactivation is to let gNB release the radio resources. gNB should do it (during cell congestion, gNB does not have to do it immediately, but still should do it), and UE should be informed. |
| Xiaomi | Yes | We support to inform UE of the multicast session deactivation for the purpose of power saving for UE.  And we agree with above comments on the wording and the following change can be considered.  “UE **is notified** ~~may be aware~~ when a multicast session **which is allowed to be received in RRC\_INACTIVE state** is deactivated. FFS how this is achieved (e.g., informed via group paging, MCCH, or other ways).” |
| CATT | Yes | We also think it is beneficial to inform UE about session deactivation. |
| Samsung | Yes but | Agree with QC’s comments |
| BT | Yes | We agree with Nokia’s comment “*UE should be aware whether session is provided in RRC\_INACTIVE or not*”  Based on QC’s suggestion and for completeness:  “UE **is notified** ~~may be aware~~ when a multicast session is deactivated. FFS how ~~this is achieved~~ UE is notified (e.g., informed via group paging, MCCH, or other ways).” |
| vivo | Yes with comments | We think a MAC CE based indication for deactivation can be feasible, if needed. Furthermore, legacy UEs can not be impacted since the sub-PDU with new/unknown LCID should be discarded. |
| Intel | Yes with comments | This can be implicitly done without explicit indication in AS layer about the deactivation of multicast session, e.g. gNB implementation can stop providing the relevant configuration in MCCH when option 2 is used. |
| LGE | Yes, but | Support the change from QC. |
| Spreadtrum | Yes | We think the short message can also be considered for indication of deactivation. |

### 3.1.3 Session release

The following were concluded from [1].

**Proposal 9 Rel-17 mechanism (NAS-based indication) is applicable for multicast session release, if Rel-18 UEs move from RRC\_INACTIVE to RRC\_CONNECTED. FFS if any enhancement is needed.**

Basically this confirms that Rel-17 mechanis applies and it is open whether any enhancements are needed.

The Proposal 9 in [1] is renamed as Proposal 5 and comments if any can be provided in the following.

**Proposal 5 Rel-17 mechanism (NAS-based indication) is applicable for multicast session release, if Rel-18 UEs move from RRC\_INACTIVE to RRC\_CONNECTED. FFS if any enhancement is needed.**

**Question 5 Do you agree with Proposal 5?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Yes or no | Comment if any | |
| TD Tech, Chengdu TD Tech | No | We think the solution needing studying is how to release a multicast session for a Rel-18 UE. This solution should solve the following questions:  Q1: How to inform UE of multicast session release?  Q2: What shall UE do upon the reception of notification?  For Q1, MCCH and MAC CE may be used to inform UE of release. For Q2, if MCCH or MAC CE is used to inform UE of release, UE may move to RRC-CONNECTED to release multicast session through NAS mechanism or just release the related AS/NAS configuration by itself without moving to RRC\_CONNECTED.  But accoding to proposal 5, the release notification is sent with paging and UE moves to RRC\_CONNECTED to release multicast session through NAS mechanism.  We haven’t discuss how to send release notification fully.  We think proposal 5 can be modified as below.  **Proposal 5 Select among the following solutions for multicast session release:**  **Opton 1: Rel-17 mechanism (NAS-based indication) is applicable for multicast session release for Rel-18 UE. FFS if any enhancement is needed.**  **Option 2: MCCH/MAC CE is used to send multicast session release notification, UE can release AS/NAS configuration without moving to RRC\_CONNECTED**  **Option 3: MCCH/MAC CE is used to send multicast session release notification, UE can move to RRC\_CONNECTED to release multicast session through NAS mechanism.** | |
| Nokia | Yes |  | |
| Kyocera | Yes |  | |
| Qualcomm | See comment | The current proposal is not clear. Does this mean same as “Option 1” explained by TD Tech, or does it mean something else? Option 1 makes sense.  We would also be open to Option 3 from TD Tech.  But for Option 2, there is risk of state mismatch between the UE and the network. | |
| NEC | See comments | If this proposal means we will use legacy RAN paging to explicitly release session during RRC\_CONNECTED, then the answer is YES. | |
| OPPO | No | It is too early to reach the proposal 5. More discussion are needed and everything is not clear. | |
| Lenovo | Yes |  | |
| Huawei, HiSilicon | Yes | Multicast session release should be done between UE and CN in NAS layer.  Of course, UE in INACTIVE should enter CONNECTED to perform NAS layer operation, but this is transparent to RAN and should be discussed in SA2, same as Rel-17. | |
| MediaTek | See comment | We agree to the descirption of Option1 mentioned by TD Tech. | |
| ITRI | Yes |  | |
| CMCC | Yes |  | |
| ZTE |  | The “Option 1” proposed by TD Tech reads better.. | |
| Xiaomi | See comments | Anyway, the Rel-18 UEs needs to move from RRC\_INACTIVE to RRC\_CONNECTED when the multicast session is released, in order to avoid the mismatch between the UE and the network. As for how to notify UE when the multicast session is released can be FFS. |
| CATT | yes | Based on discussions in R2-2210068, the intention of P5 is to say R17 mechanism applies and whether any enh is needed for R18 is ffs.  We are OK to update the wording as outlined by TD Tech, i.e.,  =>  Proposal 5 Rel-17 mechanism (NAS-based indication) is applicable for multicast session release~~, if Rel-18 UEs move from RRC\_INACTIVE to RRC\_CONNECTED~~. FFS if any enhancement is needed. | |
| Samsung | Not clear | 1. The proposal is not clear.   As Huawei explained, UE in RRC\_INACTIVE should move to RRC\_CONNECTED to perform NAS layer operation, which is beyond RAN2 scope. Whether it conforms to Rel-17 mechanism, it is up to SA2 to decide.  (b) The main question here should be discussed is how Multicast session release for the UEs receiving multicast in RRC\_INACTIVE is notified? It seems group paging can be readily extended for this purpose to cater to large population of RRC\_INACTIVE UEs together. | |
| BT | Yes | For us, alignment between UE and core is required so option 2 proposed by TD Tech adds an extra unnecessary complexity | |
| vivo | Yes | We think R17 NAS-based indication is enough. Other enhancement is redundant. | |
| Intel | Yes |  | |
| LGE |  | We agree with option 1 from TD Tech and open to option 2. | |
| Spreadtrum | Yes | We are ok that NAS-based indication is applicable for the session release. How to inform UE to switch to RRC connected state can be discussed further. | |

## 3.2 Further analysis of Option 1

The following were concluded from [1].

**Proposal 10 If option 1 is supported for PTM configuration, group paging may be used to inform the UE when network changes the PTM configurations, and UE upon reception triggers RRC connection resume procedure to obtain the updated configurations (details of group paging can be FFS).**

**Observation 2 For Option 1, majority of the companies think there is issue in signalling/system load when a large number of UEs in the cell need PTM configuration update. Several companies observed that the likelihood of such problem is rare and suggested existing solutions may be applicable.**

**Proposal 11 If Option 1 is supported, further discuss how to solve the issue in signalling/system load when a large number of UEs in the cell need PTM configuration update.**

Proposal 10 and 11 in [1] are renamed and merged below and comments if any can be provided to them.

**Proposal 6 If option 1 is supported for PTM configuration**

* **group paging may be used to inform the UE when network changes the PTM configurations, and UE upon reception triggers RRC connection resume procedure to obtain the updated configurations (details of group paging can be FFS).**
* **FFS how to solve the issue in signalling/system load when a large number of UEs in the cell need PTM configuration update.**

**Question 6 Do you agree with Proposal 6?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comment if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Nokia | Partially yes | In case Option 1 is used without any “mixed” mode operation, i.e., no SIB/MCCH indications to be provided, group paging would be required in the RNAs of all the UEs that joined a session and configurations updates shall be given. This needs to be done for different multicast services at different times. Significant amount of signalling load would be created.  A mixed mode operation can also be used, where some changes (e.g., session deactivation, session not provided to UEs in RRC\_INACTIVE ) can be provided in SIB (or MCCH), whereas other configuration updates can be provided by group paging and providing the UE with new configuration using dedicated signalling. |
| Kyocera | Yes |  |
| Qualcomm | Yes, with comment | The configuration for PTM should be looked more carefully. In our view, the configuration does not change frequently. MAC and above configuration are not really expected to change frequently. (MAC config change such as DRX config is not expected to dynamically change, RLC is UM mode, PDCP has no security configuration, RoHC is unidirectional. So, in practice, these configurations wouldn’t change during a multicast session.) PTP configuration is not applicable for INACTIVE anyway.  In theory, the PHY configuration such as CFR could be updated, but how likely and frequent it is in real deployments? For multicast in INACTIVE, CFR has to overlap with initial BWP. For a given multicast session, these would typically be semistatic. NW can schedule anywhere within the CFR so there is scheduling flexibility already without updating the CFR.  RAN2 has already captured FFS on the mechanism that the PTM configurations, once acquired by a UE, may apply to a certain area (i.e., a set of cells instead of a single cell). With such mechanism, where it would be upto the network to configure the area, the need to update configurations within the area due to UE mobility in INACTIVE will be further reduced.  So, the issue of signalling overhead, while possible, is rare. Therefore, the second bullet should be updated to the following, and the companies which worry about signalling overhead can explain further in the next meeting.  “- FFS whether anything new is needed to address ~~how to solve~~ the issue in signalling/system load when a large number of UEs in the cell need PTM configuration update.” |
| NEC | Yes with comment | Generally fine to the proposal.  But FFS part for the issue of large numbers of UEs, in our understanding, there is no need to solve this problem, maybe it exists sometime, but based on paging determination formula, you can see that UEs are already divided into different PO which means different time zone, so UEs can receive paging message including session change indication at different time. Note that in one paing DRX cycle (e.g., 320ms, 640ms, …), there could be multiple SSB periods to be choosed for random access. Therefore, guess this can alleviate the problem. |
| OPPO | Yes with comments | We share the similar view with QC. We also think the change of PTM configuration is not frequently. We are also agee with the change from QC to the FFS part. |
| Lenovo | Yes with comments | We share the similar view with QC. We do not think there is any signalling/system load issue. |
| Huawei, HiSilicon | Yes with comments | In this case, the change of PTM configuration will cause significant overhead/load (e.g RACH, individual RRC signaling to each UE) to the network, which would defeat the purpose to introduce multicast reception in RRC\_INACTIVE, i.e. for congestion alleviation.  The PTM configuration is needed at least in the following scenarios:   * The need of PTM parameters update, e.g. MBS session update(add or removal of Qos flows) or radio resouces update in cell (for example the CSI-RS resources used for unicast update will impact the ratematching configuration for multicast) * PTM transmission for INACTIVE switches on/off in the pre-configured cells, e.g. due to congestion allevation or UE mobility   And the overhead issue is difficult to avoid for Option 1. |
| MediaTek | Partially | It is redundant to notify UE when PTM configuration update, since UE need to resume anyway. When UE detects the interruption, UE should trigger RRC connection resume procedure(or at least by UE implementation) to obtain the PTM configuration (no matter whether it is updated).  We agree to further discuss the issue in high density scenario when large amount of UEs request PTM configuration update simultaneously. |
| ITRI | Yes |  |
| CMCC | Yes |  |
| ZTE | Yes | Still not sure what we can do to avoid RACH and signaling overhead for an already congested cell. |
| Xiaomi | Yes, with comments | The first bullet is fine to us.  For the second bullet, as QC and other companies pointed out, whether there is serious issue in signallling/system load or not should be confirmed firstly. |
| CATT | Yes | We are not sure if the PTM configuration update is so rare. Also, we think the specification should allow configuration update in the cases where number of UEs is large.  So we prefer to keep the current wording of P6. |
| Samsung | Yes, but | As also detailed in Qualcomm comments, the configuration change is likely to be quite rare and hence signaling /system load may not be the issue.  We also support to amend second bullet of proposal as suggested by Qualcomm |
| vivo | Yes | We think signaling/system load is not a real issue since R17 multicast configuration update has been always transmitted via dedicated signaling and there is no obvious overhead increasing between R17 and R18 configuration update procedure when state transition signaling can be omitted/reduced, e.g. updated configurations carrying directly in RRC Release message as response to RRC Resume Request. |
| Intel | Yes with comments | Our understanding is that the congestion issue is a critical drawback of option 1. Before discussing any enhancements, we need to consider solution direction (e.g. option 2) which do not have such issue. |
| LGE | Yes | For FFS, we agree with the change from QC. |
| Spreadtrum | Yes, with comment | We think the frequent PTM configuration change should be avoid as possible considering the signallling overhead. If the certain applicable ara for PTM configuration is introduced, more signalings for applicable area change are needed. |

## 3.3 Further analysis of Option 2

The following were concluded from [1].

**Proposal 12 FFS if there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2 without/before joining the multicast session, and if yes, what is the security issue on the condition that security is enabled by service layer.**

Proposal 12 in [1] is renamed below and comments if any can be provided to them.

**Proposal 7 FFS if there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2 without/before joining the multicast session, and if yes, what is the security issue on the condition that security is enabled by service layer.**

**Question 7 Do you agree with Proposal 7?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Yes or no | Comment if any | |
| TD Tech, Chengdu TD Tech | NO | The following agreement was made Tuesday.   1. The following general description is taken as baseline for PTM configuration delivery Option 2:  (2-a) PTM configurations (i.e., configurations used for multicast reception in RRC\_INACTIVE) are provided via an MCCH-like channel (same or different as used for MBS broadcast), and information regarding MCCH scheduling is provided via SIB, FFS dedicated signalling  (2-b) UE can receive such configurations when it is in RRC\_INACTIVE, FFS whether it is allowed/needed to also receive when UE is in RRC\_CONNECTED  (2-c) If there is a need to update some or all the received configurations, UE does not need to resume RRC connection but is notified of such changes (e.g. via MCCH DCI) and obtains the updated configurations via MCCH.   **Based the agreement above,  optoin 2 can be divided into the following two suboptions.**  **Option 2-1: SIB+MCCH**  **Option 2-2: dediciated signaling+MCCH**  **Futhermore, MCCH in opton 2-2 can be a cell specific MCCH or a session specific MCCH. Therefore, option 2 can be covered by the following three options.**  **Option 2.1: SIB+cell specific MCCH**  **Optoin 2.2: dedicated signaling +cell specific MCCH**  **Optoin 2.3: dedicated signaling +session specific MCCH**  **Considering the three options above, Proposal 7 in the email discussion is not accurate. For option 2.2 and opton 2.3, UE can't obtain all the PTM configurations without/before joining a multicast session. For option 2.3, UE can only obtain the PTM configuration of the multicast session which UE has joined.**  **We suggest Propsal 7 is rewritten as below:**  **Propoal 7: Acccording to the agreement on optoin 2, option 2 can be covered by the following three options. FFS if there is an issue for opton 2.1 that a UE can obtain all the PTM configurations without/before joining the multicast session, and if yes, what is the security issue on the condition that security is enabled by service layer.**  **Option 2.1: SIB+cell specific MCCH**  **Optoin 2.2: dedicated signaling +cell specific MCCH**  **Optoin 2.3: dedicated signaling +session specific MCCH** | |
| Nokia | Fine to have this as  FFS although there does  not seem to be any real  problem shown | In our view, security would be needed from UP encryption at application layer or at core level (MBSTF), appropriately, as defined for Rel-17, to avoid multicast to be received by any UE in a geographical area and limit the service only to the UEs that joined the session.  However, this is doable by Rel-17 specifications, and this is not unnatural. Indeed, for that reason, no major security concerns were raised for MCCH-based approach of broadcast, which shall be similar to what we define for Rel-18 multicast for RRC\_INACTIVE UEs.  We do not believe that fake-gNB is a real issue that is specific for MCCH-based solution, rather a more general issue addressed by SA3 already.  Thus, security is not a major problem with SIB/MCCH-based Option 2. | |
| Kyocera | Yes |  | |
| Qualcomm | Yes, see comments | We think the UE should not be allowed to receive ‘all’ the configurations needed to receive multicast while being in INACTIVE before joining the multicast session. That is because it is against the principal of multicast where only network-authorized UEs (e.g. only those who have paid for it, or the authorized members of the mission in a public safety usecase) should receive the configuration and the service. Further, without such requirement, even the UEs in IDLE can receive such configuration without the network knowing about it. This means the service essentially becomes a broadcast.  **If the differentiation is only at the core level but not in RAN, there would be no need to do anything further in RAN in this release – broadcast is already supported in INACTIVE state in Rel-17.**  Additionally, even at the Core Network level, our understanding is MBSTF is optional and was introduced for the purpoe of ineterworking with eMBMS. See 23.247:  NOTE 1: The MBSF is optional and may be collocated with the NEF or AF/AS, and the MBSTF is an optional network function.  Service layer security is also not mandatory, so RAN solution cannot assume it will always be there.  So, we are fine to keep the FFS for now and open to discuss different options as suggested by TD Tech and others to guarantee that UEs cannot get ‘all’ the configurations without/before joining the multicast session. We would suggest to reword the proposal to make it concise:  “FFS if there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2 without/before joining the multicast session~~, and if yes, what is the security issue~~ on the condition that security is enabled by service layer.” | |
| NEC | Comment | Generally fine with this proposal, but Why don’t we firstly downselect the option 1 and option 2 to avoid duplicated work? | |
| OPPO | No | RAN2 cannot assume the security solution for MBS, it should be confirmed by SA3. | |
| Lenovo | Yes | The FFS seems fine. But do we need to check with SA3 as early as possible so that we can down select one solution in RAN2. | |
| Huawei, HiSilicon | See comments | We don’t see genuine security issue with option 2:   * The security for multicast is enabled in service layer and even though the eavesdropper happens to be in a cell where multicast service is being provided to inactive UEs and can receive packets in AS layer by the configuration in MCCH, it has no way to understand the content. Then what will be the consequence if unauthorized UE obtains the configuration (we are not even sure any UE will do this)?   Note that even in dedicate signaling solution (option 1), the UE can still keep the configuration already acquired after leaving the group, which will also lead to risk of exposing the PTM configuration to a UE not in the group anymore.  If the concern is that a fake gNB can generate a MCCH message and cheat the UE to receive multicast in the cell (not sure for which purpose), the UE can easily detect such situation by integrity protect failure or consecutive packet errors in service layer. This is common to all services and not sure whether we should consider it only for multicast, as fake gNB can anyway generate a fake SIB. Also this issue is under discussion in SA3 and may also be applied to this case if there is a solution. | |
| MediaTek | Yes | We agree with Qualcomm’s comments.  Also for TD tech’s suggestion, we think it is a valid try for option 2 to solve the security issue. Maybe we should not limit option2 discussion on SIB+ MCCH way. | |
| ITRI | Yes | For us, the FFS seems fine. However, we should also check with SA3.  We also think the option 2-2 in TD tech’s suggestion is a reasonable method to solve the security issues. | |
| CMCC | Fine to have this as FFS |  | |
| ZTE | we might not need the FFS. | if this is an issue, I'd say the issue exists for SIB or even unicast. as per UE transmission is always open for all.  this is the nature of wireless communication.  also this is a general fake gNB issue that is being addressed by 3GPP.  LTE eMBMS and Rel-17 broadcast work well with broadcast signaling and security mechanism in service layer.  For the privacy concern, a possible solution for the privacy concern is that, using a TMGI index that is anonymous to other UE, in MCCH to replace the real TMGI (which reduces the payload too). In this way, only a group of UEs which has joined the multicast session know the real multicast TMGI of PTM configuration in MCCH. | |
| Xiaomi | See comments | For the multicast MCCH, we agree that the issue of unauthorized access needs to be considered.  **In addtion to this,** for option 2, the security issue caused by fake gNB which results in multicast configuration failure should also be considered **for all UE who can receive the multicast configuration via the MCCH.**  For multicast, as the multicast configuration can also be provided via the dedicated signaling in CONNECTED state, there exists a case where UE combines the CONNECTED multicast configuration with the configuration provided via the fake gNB MCCH when UE switches between CONNECTED and INACTIVE state. It will lead to the multicast configuration failure and even cause UE entering IDLE state.  It should be noted that the issue is different from broadcast. Because for broadcast, UE always apply the configuration provided via the broadcast MCCH and no combination with the dedicated configuration.    So, we can find the security issue is not only for the UE without joining the multicast session, it also exists for all UE who can receive the multicast configuration via the MCCH.  We are fine to keep it as FFS but we’d like to adopt the following rewording to include the fake gNB issue.  **Alt1: FFS if there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2 without/before/after joining the multicast session ~~, and if yes, what is the security issue~~ on the condition that security is enabled by service layer.**  **Alt2: FFS if there is security issue for multicast configuration delivery via Option2 on the condition that security is enable by service layer.**    For the LS to SA3, some companies think there is no need as MCCH security issue is under SA3 discussion. However, as the broadcast MCCH is different from the multicast MCCH and the issue for multicast is more serious, we think if RAN2 can not conclude the security issue next meeting, anyway the LS is needed to inform SA3 of the security issue for multicast MCCH. | |
| CATT | Yes, with comments | | 1) Agree with Nokia and Huawei that given the service layer protection there is no real security issue with Option 2.  2) Ok with rewording from QC.  3) Regarding the suggestion from TD Tech, we understand the consideration and we are open to study the mixed option such as mentioned by TD Tech.  Therefore in our view maybe we can consider update P7 to  Proposal 7 FFS if there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2 without/before joining the multicast session~~, and if yes, what is the security issue~~ on the condition that security is enabled by service layer. And if yes FFS how to solve the issue (e.g., dedicated configuration + MCCH) |
| Samsung | Yes | | Joining the multicast session is an essential condtion as it involves CN interaction. It is upto gNB to command UE to receive a multicast session in RRC\_INACTIVE. Receiving multicast configuration through MCCH exposes dedicated signalling configuration parameters to the attackers and makes it vulnerable. MCCH configuration is not secured by application or by RAN. (Further, in general, as also mentioned by Qualcomm, application level security is optional feature in 5MBS)  We understand RAN2 is not the competant WG to make a final decision on security aspect and strongly recommend the issue should be checked by SA3.  Note that RAN2 was earlier advised by SA3 to not even include TMGI in MII before security activation. |
| vivo | Yes | | We think security issue is the key drawback of option 2. Specifically, the MCCH message itself can not be transmitted with security protection (p.s. the MCCH can be regarded as a part of multicast data which requires UE authorization). |
| Intel | See comments | | In Rel-17, multicast service data can be protected by security in service layer. Therefore for UEs which are not authorized to receive multicast, even if those UEs can receive PTM configuration and receive PDSCH, they cannot obtain the multicast service data. Regarding the concerns on the fake gNB, SA3 is already working on security enhancements against fake gNB and it is expected that solutions developed by SA3 would be applicable for all use cases including MBS.  In summary we don’t see security issues for Option 2. |
| LGE | OK to have it as FFS, but | | we cannot find any real issue in option2. Thoug the PTM configuration is acquired, unqualified UE cannot interpret the multicast. We also fine to ask SA3 about the security issue. It would be benefical for RAN2 to down select one option. |
| Spreadtrum | Yes | | Fine with FFS. |

# 4 Ph2 discussions

Review the summary/proposals based on ph1, TBD

# 5 Conclusions

TBD

# 7 Reference

[1] R2-2210068 Report of [Post119-e][610][eMBS] PTM configuration for INACTIVE (CATT)

# Appendix - Previous agreements on Multicast reception in RRC\_INACTIVE

## RAN2 #119-e

**Multicast reception in RRC\_INACTIVE**

In Rel-18, multicast reception for UEs in INACTIVE supports at least the following scenarios, with the assumption that the UE already has a valid PTM configuration:

- Scenario 1: a UE has been receiving multicast in CONNECTED, and it enters INACTIVE and continues the multicast reception.

- Scenario 2: a UE has joined a multicast session and has been directed to INACTIVE, the UE starts to receive the multicast session

FFS for state changes, e.g. due to service being not provided in INACTIVE anymore etc.

It is up to gNB to decide whether a multicast session may be received by UE(s) in INACTIVE. FFS what information gNB may be provided to form such decision (related to SA2 discussion).

It is supported that gNB transmit one multicast session to both UEs in CONNECTED and INACTIVE in the same cell. FFS how the gNB configures this.

It is assumed the network can choose which UEs receive in RRC INACTIVE and which in RRC Connected and can move UEs between the states for Multicast service reception.

The following is taken as baseline: we assume the same PDCCH/PDSCH resources (e.g. resources used for MTCH) can be used for all UEs (including UEs in CONNECTED and/or INACTIVE states) for receiving the same multicast session. Different configuration/resources are not precluded as well. FFS what exactly can be common and what not (e.g. HARQ, SPS etc.) and what is needed in addition (to legacy PTM config).

For PTM configuration delivery, RAN2 further investigates the following solutions:

Option 1: Dedicated signalling

Option 2: Solution based on SIB+MCCH

We do not preclude some “mix” of the options

HARQ feedback and PTP are not supported for multicast reception in RRC\_INACTIVE.

Multicast service continuity after cell reselection in RRC\_INACTIVE state (i.e. without resuming RRC connection) will be supported (if the configuration of the new cell is available for the UE). FFS whether there are cases where the UE needs to resume the connection. FFS RAN3 impacts due to inter-gNB mobility.

Upon cell reselection to neighbour cells during active multicast session, if the configuration of the session is not available for the new cell for UEs in INACTIVE, then the UE is required to resume RRC connection to get the Multicast MRB configuration.

## RAN#119-bis-e

* The following general description is taken as baseline for PTM configuration delivery Option 1:

(1-a) PTM configuration(s) (i.e., configurations used for multicast reception in RRC\_INACTIVE) of one or more multicast sessions for at least one cell are provided via dedicated RRC signaling to a UE.

(1-b) The RRC message for this includes RRCReconfiguration and/or RRCRelease and/or RRCResume (details FFS)

(1-c) UE stores the received configurations while it is in RRC\_INACTIVE, and if there is a need to update some or all the configurations, the UE is notified of such changes and may trigger RRC connection resume to obtain the updated configurations. In case of mobility in RRC\_INACTIVE, the UE triggers RRC connection resume if the configuration of the session is not available for the new cell.

* The following general description is taken as baseline for PTM configuration delivery Option 2:

(2-a) PTM configurations (i.e., configurations used for multicast reception in RRC\_INACTIVE) are provided via an MCCH-like channel (same or different as used for MBS broadcast), and information regarding MCCH scheduling is provided via SIB, FFS dedicated signalling

(2-b) UE can receive such configurations when it is in RRC\_INACTIVE, FFS whether it is allowed/needed to also receive when UE is in RRC\_CONNECTED

(2-c) If there is a need to update some or all the received configurations, UE does not need to resume RRC connection but is notified of such changes (e.g. via MCCH DCI) and obtains the updated configurations via MCCH.

* Dedicated RRC signalling (i.e. RRC release message with suspendConfig) is used for switching a multicast receiving UE from RRC\_CONNECTED to RRC\_INACTIVE and continue multicast reception (details FFS).
* For both option 1 and option 2, as a baseline, group paging can be used to switch UEs receiving multicast from RRC\_INACTIVE to RRC\_CONNECTED, and UEs continue the multicast reception in CONNECTED. FFS if there is any potential issue if Rel-17 group paging is reused. FFS if there are other cases when UE triggers resume. FFS if MCCH can also be used in case of option 2.
* FFS whether to introduce PTM configuration applicable area, i.e., the mechanism that the PTM configurations, once acquired by a UE, may apply to a certain area (i.e., a set of cells instead of a single cell).