3GPP TSG-RAN WG2 #119-bis-e R2-22xxxxx

Electronic meeting, 10th – 19th October 2022

Agenda Item: x.x.x

Source: CATT

Title: Report of [Post119-e][610][eMBS] PTM configuration for INACTIVE (CATT)

Document for: Discussion, Decision

# 1 Introduction

This document is the report of the following email discussion,

* [Post119-e][610][eMBS] PTM configuration for INACTIVE (CATT)

Scope: Discuss the details of the identified PTM configuration solutions:

* + - Attempt to reach aligned understanding/descriptions (to the possible level of details) of the solutions including the aspect of UE state transitions, session state changes and related notifications
    - Identify main issues and pros and cons specific for each approach
    - Attempt to identify issues/solutions common for all approaches

Outcome: Report with proposals

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

* Ph1: companies’ comments collected before Friday September 24th 10:00 UTC
* Ph2: proposals/summary checked before Thursday September 29th 12:00 UTC

The remainder of this document is organized as the following. Section 3 is to align on the general descriptions of the solutions. Section 4 is the common aspects for both option 1 and 2. Issues specific for option 1 and 2 are discussed in section 5. Section 6 include the conclusions.

# 2 Contact information

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

|  |  |
| --- | --- |
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| TD Tech, Chengdu TD Tech | Limei Wei (limei.wei@td-tech.com) |
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# 3 General descriptions of the solutions

For PTM configuration delivery, previously we agreed to further investigate the following solutions:

Option 1: Dedicated signalling

Option 2: Solution based on SIB+MCCH

We do not preclude some “mix” of the options

The reminder of this section is to align companies understandings of these solutions to possible extend, in order to facilitate future discussions.

Please note that the discussions do not cover the exact contents of the configurations (i.e., what is included in the configurations), which can be FFS.

## 3.1 General description for Option 1: Dedicated signalling

The solution is characterized by the following

(1-a) PTM configurations for at least one cell are provided via dedicated RRC signaling to a UE.

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

(1-c) UE stores the received configurations when it is in RRC\_INACTIVE, and if there is a need to update some or all the configurations (e.g., including update of PTM configuration parameters or disabling INACTIVE PTM configuration for any of the configured cell(s)), the UE is notified of such changes and is required to resume RRC connection to obtain the updated configurations. In case of mobility in RRC\_INACTIVE, the UE triggers resume if the configuration of the session is not available for the new cell.

**Q1: Do you have any comments on the above descriptions of Option 1?**

|  |  |
| --- | --- |
| Company | Comments if any |
| TD Tech, Chengdu TD Tech | 1. From our point of view, what we discuss is the PTM configuration for RRC\_INACTIVE per G-RNTI ( one-to-multiple mapping between G-RNTI and multicast session is supported in R17). The description “PTM configurations for at least one cell” is not clear. We suggest to modify (1-a) as below:   (1-a) The PTM configuration for RRC\_INACTIVE per G-RNTI can be provided to UE via dedicated RRC signaling.   1. For (1-c), the description “ UE stores the received configurations when it is in RRC\_INACTIVE” is not clear. How can UE receive the configuration information via RRC dedicated signalling in RRC\_INACTIVE? We suggest to delete this sentence. The description “the UE triggers resume if the configuration of the session is not available for the new cell” is not clear either. UE triggers RRC resume in the source cell or target cell? We suggest (1-c) is updated as below.   (1-c) If the PTM configuration for RRC\_INACTIVE per G-RNTI needs to be updated (e.g., the PTM configuration for RRC\_INACTIVE per G-RNTI is modified or disabled), the UE is notified of such update and is required to resume RRC connection to obtain the updated configuration. In case of mobility in RRC\_INACTIVE, UE triggers RRC resume in the source cell if UE finds the PTM configuration for RRC\_INACTTIVE is not available for the target cell. |
| Kyocera | We’re fine with the rapporteur’s description of Option 1 in general. Though, for (1-c), we think it’s still FFS whether the PTM configuration is valid only in a cell or within multiple cells. Also, we think the RRC connection is not needed to be resumed completely, if RRC Release provides the new PTM configuration in response to RRC Resume Request, i.e., the UE can stay in INACTIVE like the existing RNAU. |
| ZTE | Whether PTM configuration can be carried in RRCRelease needs to be further discussed. It is not a typical way to convey resource config in a release message. In current spec RRC release in only used for release or suspend RB configuration, and redirected Carrier or cell Reselection. We tend to think it is good to keep a minimized RRC release design. |
| Samsung | Agree in general.  For (1-a), we understand NW can provide PTM configuration for specific multicast session(s) to be received in RRC\_INACTIVE. This may be more clearly specified as  *PTM configurations for one or more multicast sessions for at least one cell are provided via dedicated RRC signaling to a UE.*  For (1-b), RRCRelease with SuspendConfig seems sufficient and efficient to handle  specific multicast sessions among both activated and deactivated ones at the time of RRC state transition  (1-c) seems fine as UE needs to store PTM configuration for use in RRC\_INACTIVE e.g. for multicast session which is presently in deactivated state and based on activation, starts receiving session utilizing stored configuration |
| Qualcomm | In general, ok with the description. Suggest minor edits as below to avoid confusion.  (1-a) PTM configurations for at least one cell are provided via dedicated RRC signaling to a UE in RRC\_CONNECTED.   * This should address the confusion raised by TD tech for (1-c). * Further, ok to add ‘for one or more multicast sessions’ as suggested by Samsung.   (1-c) UE stores the received configurations while ~~when~~ it is in RRC\_INACTIVE, and if there is a need to update some or all the configurations (e.g., including update of PTM configuration parameters or disabling INACTIVE PTM configuration for any of the configured cell(s)), the UE is notified of such changes and ~~is~~ the UE may be required to resume RRC connection to obtain the updated configurations. In case of mobility in RRC\_INACTIVE, the UE triggers resume if the configuration of the session is not available for the new cell.   * This first change should address the confusion raised by TD tech. * The reason for second change is that in some cases UE may not even need to resume, e.g. upon the service deactivation notification, the UE may release the configurations without transitioning to CONNECTED. * We disagree with further suggestions on (1-c) by TD tech. E.g., resume in ‘source’ cell ‘after’ mobility in INACTIVE does not make sense.   For (1-b), RRCRelease messages are indeed typically used to convey the configuration to be used in IDLE or INACTIVE in case the configuration is not already present in the UE. However, if the UE already has the required configurations, there is no need to again signal it in RRCRelease. I.e., configuration by RRCReconfiguration is also a valid use case. So, we agree with rapporteur’s current wording and do not see a need to restrict one way or other as ZTE and Samsung seem to suggest. |
| Xiaomi | We share the same view with Kyocera that it is possible to provide the PTM configuration via the response to RRC Resume Request, so  For (1-a), we prefer the original wording with the detail is FFS and we disagree with QC’s modification that it is only provided to UE in CONNECTED as it can also stay in INACTIVE and get the new configuration via the RRC Resume Request Response.  For (1-b), it should be “RRCRelease with suspendConfig” and the response to the RRC Resume Request should also be considered.  For(1-c), we prefer the following wording:  UE stores the received configurations when it is in RRC\_INACTIVE, and if there is a need to update some or all the configurations (e.g., including update of PTM configuration parameters or disabling INACTIVE PTM configuration for any of the configured cell(s)), the UE is notified of such changes and is required to trigger RRC connection resume to obtain the updated configurations. In case of mobility in RRC\_INACTIVE, the UE triggers resume if the configuration of the session is not available for the new cell. |
| Ericsson | * Suggest to say “PTM configuration(s)”, i.e. it can be one or more PTM configurations * Clarify that RRCReconfiguration is used when the session has already started, and RRCRelease is used when the session has not started yet but the UE is released to Inactive * Perhaps good to add that when the UE is released to Inactive the UE does not release the multicast MRB (details FFS), similar as when the UE is receiving broadcast in connected and is released the UE does not release the broadcast MRB. * What does it mean when the PTM configuration is “disabled”, i.e. this means “deactivated”? * “*the UE is notified of such changes*”: RAN2 did not discuss/agree on this yet. Perhaps the PTM configuration does not change during the short period there is congestion, i.e. no need to indicate PTM configuration change via MCCH/SIB. Furthermore notification of session (de-)activation status during congestion is an optimization which is not strictly needed to enable service continuity. The congestion period could be short, and perhaps the session can be assumed activated during an emergency anyways, i.e. notifications via SIB/MCCH should be optional. * “*and is required to resume RRC connection to obtain the updated configurations*”: we think this is not an option for the main use case to support multicast reception in Inactive, i.e. during congestion the UEs receiving multicast in Inactive should not return to connected mode for a PTM configuration change. |
| MediaTek | Just the clarification for 1-c, regarding the "UE is notified of such changes and is required to resume RRC connection to obtain the updated configurations." Since *RRCRelease* message can be delivered to UE in both CONNECTED and INACTIVE state, UE may only to request multicast configuration by *RRCResumeRequest*, then receives the updated configuration by *RRCRelease* message. Therefore, the UE may stay in RRC INACTIVE without really go to CONNECTED state.  Therefore, we think it is more general to say “ the UE is notified of such changes and sends *RRCResumeRequest* to obtain the updated configurations” to cover this case. |
| Lenovo | For PTM configuration update, we also think that the UE is not necessary to return RRC\_CONNECTED state for obtaining the updated configuration.  1-b): RRCRelease with suspendConfig should be supported for PTM configuration update without returning RRC\_CONNECTED state.  1-c): the wording ‘resume RRC connection to obtain the updated configurations’ needs to be refined. |
| CATT | We are OK with the general description.  In the light of the above comments maybe we can consider some rewording  (1-a) PTM configuration(s) 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 (details FFS)  (1-c) UE stores the received configurations ~~when~~ while it is in RRC\_INACTIVE, and if there is a need to update some or all the configurations (e.g., including update of PTM configuration parameters or disabling INACTIVE PTM configuration for any of the configured cell(s)), the UE is notified of such changes and ~~is required to resume~~ may trigger RRC connection resume to obtain the updated configurations. In case of mobility in RRC\_INACTIVE, the UE triggers resume if the configuration of the session is not available for the new cell.    Then, for the rest of the potential aspects/issues we prefer to leave more detailed discussions to later questions. |
| Intel | Agree with rapporteur’s description of Option 1. |

## 3.2 General description for Option 2: Solution based on SIB+MCCH

The solution is characterized by the following

2-a) PTM configurations are provided via an MCCH-like channel (same or different as used for MBS broadcast), and information regarding MCCH scheduling is provided via SIB

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.

**Q2: Do you have any comments on the above descriptions of Option 2?**

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| --- | --- |
| Company | Comments if any |
| TD Tech, Chengdu TD Tech | We think “ PTM configurations” can be modified as “ PTM configuration for RRC\_INACTIVE per G-RNTI”. The corresponding description for option 2 is updated as below.  2-a) The PTM configuration for RRC\_INACTIVE per G-RNTI is provided via a multicast MCCH (same or different as the MCCH used for broadcast sessions), and the semi-static scheduling information for the multicast MCCH is provided via a SIB (same or different as SIB20)  2-b) UE can receive the corresponding PTM configuration when it is in RRC\_INACTIVE, FFS whether UE needs to receive the corresponding PTM configuration in RRC\_CONNECTED  2-c) If the PTM configuration for RRC\_INACTIVE is updated for a G-RNTI, UE in RRC\_INACTIVE does not need to resume RRC connection but is notified of such change (e.g. via MCCH change notification sent on the DCI scheduling the multicast MCCH) and obtains the updated configuration via the multicast MCCH. |
| Kyocera | We’re fine with the rapporteur’s description of Option 2, except for the “MCCH-like channel” since we’re not sure what benefit is expected by defining such a new channel. |
| ZTE | 1/ shall we keep it "MCCH-like" in all cases to be consistent before we made a decision to reuse the MCCH or not?  2/ since for an Rel-18 UE option 1 will anyway be supported as in Rel-17 for UE in RRC\_CONNECTED, for option 2 an indication might be needed to inform UE to start work in option 2. |
| Samsung | For 2-a), it is not clear if UE in RRC\_INACTIVE can receive PTM configuration for a new multicast session. UE needs to “join” and also be informed by network to receive multicast in RRC\_INACTIVE. |
| Qualcomm | For 2-a/2-b), if the UE can receive such configurations when it is in RRC\_INACTIVE, how does the network make sure that the UE has ‘joined’ the multicast session, and how is it guaranteed that only the UEs which have joined can receive it? The basic principle of multicast system design is that only the UEs that have specifically joined the session can receive the configuration and the service, otherwise the service should be provided as broadcast.  Also, similar to 1-c), following should be added for option 2:  2-d) In case of mobility in RRC\_INACTIVE, the UE triggers resume if the configuration of the session is not available for the new cell. |
| Xiaomi | We’re fine with the rapporteur’s description. |
| Ericsson | * “same or different as used for MBS broadcast with different MCCH-RNTI” * We have similar concerns as SS/QC, i.e. how to ensure that only UEs that have joined can use the PTM config indicated in MCCH. |
| MediaTek | Regarding 2-a), we think it is too early to decide that the MCCH-like channel is provided via SIB.  According to the agreement from the last meeting, the mix of the options is not precluded. The initial reception of MCCH-like channel may also be provided by dedicated signaling.  (This will be further analyzed in 5.2)  Also, MCCH provided by SIB is too similar to Rel-17 broadcast and it may be difficult for network to make sure that the UE receiving the multicast service are authorized. |
| Lenovo | We share the same concerns as SS/QC, how is it guaranteed that only the UEs which have joined can receive the multicast session. UE needs to “join” and also be informed by network to receive multicast in RRC\_INACTIVE before or in step 2a. |
| CATT | We are OK with the general description. For the rest of the potential aspects/issues we prefer to leave more detailed discussions to later questions. |
| Intel | Agree with rapporteur’s description of Option 2. For 2-b), our understanding is that UE can receive the PTM configuration in RRC\_CONNECTED as well. |

# 4 Common aspects for both option 1 and 2

Previously we agreed the following

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 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.

So in the next two issues we discuss how this is done.

## Common issue 1 How does network switch multicast receiving UE(s) from RRC\_CONNECTED to RRC\_INACTIVE?

This issue assumes UE staying in the same cell (i.e., without mobility).

As per the previous agreement, network may move a multicast receiving UE from RRC\_CONNECTED to RRC\_INACTIVE. The most straightforward way seems to be using dedicated RRC signaling (i.e. RRC release message with suspendConfig) for such indication.

**Q3: Do you agree that dedicated RRC signalling (i.e. RRC release message with suspendConfig) is used for switching a multicast receiving UE from RRC\_CONNECTED to RRC\_INACTIVE (details FFS)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes |  |
| ZTE | Yes | the RRC state transitioning framework defined in Rel-15 shall be followed. |
| Samsung | Yes | RRCRelease with suspendConfig seems sufficient and efficient to handle  specific multicast sessions among both activated and deactivated ones at time of RRC state transition |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | Yes |  |
| MediaTek | Yes |  |
| Lenovo | Yes |  |
| CATT | Yes |  |
| Intel | Yes | We’d like to note that for option 2, there is no change to the legacy dedicated RRC signalling which switches UE from RRC\_CONNECTED to RRC\_INACTIVE. |

## Common issue 2 How does network switch multicast receiving UE(s) from RRC\_INACTIVE to RRC\_CONNECTED?

This issue assumes UE staying in the same cell (i.e., without mobility).

As per the previous agreement, network may move multicast receiving UEs from RRC\_INACTIVE to RRC\_CONNECTED, and then UE continues the multicast reception in CONNECTED. In Rel-17, group paging is used to indicate multicast session activation to the UEs, it seems useful to discuss whether the group paging can be used for such cases, and whether it needs to be enhanced.

**Q4: Do you agree that group paging is used to switch UEs receiving multicast from RRC\_INACTIVE to RRC\_CONNECTED, and UEs continue the multicast reception in CONNECTED?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes |  |
| ZTE | See comments | The scenario of Q4 needs to be clarified.  - In the description of Q4, it is saying “UEs continue the multicast reception in CONNECTED”. One might assume UEs have already started receiving the multicast in RRC\_INACTIVE. Thus, the scenario of Q4 is different from the session activation case.  - If the above understanding is correct, if needed (e.g., air interface becomes less congested), group paging or unicast paging can be used to initiate UE RRC state transitioning. depending on network implementation. |
| Samsung | Yes | Group paging for Rel-18 UE should provide an indication about   * RRC state change required or not for non-activated multicast session reception when paged in RRC\_INACTIVE   Group paging for Rel-18 UE is same as legacy Rel-17 Group paging for activation when the multicast session is already activated in RRC\_INACTIVE i.e. UE goes to RRC\_CONNECTED by default.  Just to add to the Q4, Group paging is multicast session specific and is applicable to all UEs that pertain to that specific multicast session. |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | Yes, see comments | We think the main use case for multicast reception in Inactive is congestion during mission critical emergency. During congestion the gNB would typically not trigger group paging. When congestion is over the gNB can trigger group paging when the session is activated. |
| MediaTek | Yes | For Rel-18, if UE is already receiving multicast in RRC INACTIVE, UE may ignore the group paging message. |
| Lenovo | Yes |  |
| CATT | Yes |  |
| Intel | Yes |  |

**Q5: Whether group paging mechanism needs to be enhanced, if your answer to the previous question is YES?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes | The enhancement is used to differentiate the group paging for a multicast activation from the group paging for the RRC state switching. |
| Kyocera | Yes | We think a set of UEs (i.e., not all UEs) needs to be paged, according to the RAN2 agreements, e.g., “*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 Rel-17 group paging pages all UEs which are interested in a TMGI, so we assume the Rel-18 group paging needs to have a selectivity of UEs. |
| ZTE | See comments | Maybe not.  For the assumed scenario in our answer to Q4, UE receives the multicast before and after state transitioning, there might be no need to enhance group paging. |
| Samsung | Yes | For the case of non-activated multicast session in RRC\_INACTIVE, whether RRC state  change required or not along with group notification (for activation), needs to be indicated |
| Qualcomm | Yes | Rel-18 network should be able to selectively indicate to a subset of UEs to move to CONNECTED. Several options are possible which can be discussed further:   * Default Rel-18 behavior would be same as Rel-17, i.e. in absence of any enhancements, all UEs would move to CONNECTED. * To selectively move a subset of UEs, group paging can include a flag to indicate whether to continue to receive the service in INACTIVE (see Q9 below). Then a NAS-level indicator, such as ‘high priority service’ or ‘high priority UE’ can be defined, and only such Rel-18 UE/service would move to CONNECTED state upon receiving group paging with the enhancement indicator. (In absence of such indicator, it is default Rel-17 behavior.) * UE-specific paging can also be used to selectively move a subset of UEs to CONNECTED (and remaining UEs remain in INACTIVE to receive the service). |
| Xiaomi | See comments | Maybe not.  That depends on whether all UEs who are configured for INACTIVE multicast reception need to be switched from INACTIVE to CONNECTED upon receiving the group paging. If all UEs needs to be switched to CONNECTED mode, there is no need to enhance the group paging as the legacy behavior is the same, if not, it seems the paging message needs to indicate which UE needs to be switched to CONNECTED while others can stay in INACTIVE state. |
| Ericsson | No | * There is no motivation to get a Rel-18 UE that is able to receive multicast in Inactive, back to connected mode while the session is deactivated * The gNB has the possibility to use UE individual RAN paging to get some/prioritized Rel-18 UE that are able to receive multicast in Inactive, back to connected mode when the session is activated (instead of using RAN group paging) * When congestion is over we assume that gNB can use group paging to get all UEs back to connected mode when a session is activated. |
| MediaTek | Maybe no | If some UEs need to be indicated to stay in INACTIVE state, it should be notified and configured earlier, e,g, when UE joined multicast session.  At least the unicast paging seems better than group paging to inform part of UEs to stay in INACTIVE state.  Our intention is not to make the group paging too complicated, and the backward compatibility for Rel-17 multicast UE also need to be considered. |
| Lenovo | Yes | The UE needs to be informed that whether continues staying in RRC\_INACTIVE or enters RRC\_CONNECTED for multicast reception via paging.  For PTM configuration update, the UE needs to be informed whether it needs to return RRC\_CONNECTED for PTM configuration update or not via paging.  It is FFS that individual paging or group paging is used. |
| CATT | Yes, see comments | For Q4 and Q5, we understand the question is for the case when UEs have been receiving multicast in RRC\_INACTIVE, and then network decides to move the UEs to RRC\_CONNECTED, and UEs continue the multicast reception in RRC\_CONNECTED. This is different from the case of session activation.  For the case addressing by Q4 and Q5, we think group paging should be used to move the UEs receiving multicast from RRC\_INACTIVE to RRC\_CONNECTED, and we think group paging needs to enhanced for this purpose (i.e., cannot reuse Rel-17 group paging due to some potential error case for Rel-18 UEs if receiving group paging message more than one times). |
| Intel | No | For an already activated multicast session, receiving a group paging for the corresponding TMGI switches the UE from RRC\_INACTIVE to RRC\_CONNECTED.  For a non-activated multicast session, if gNB determines that UE should receive the service in RRC\_CONNECTED, gNB can use the group paging. If gNB determines that the UE should receive the service in RRC\_INACTIVE, gNB can use MCCH to indicate the activation of multicast session (similar to broadcast case that MCCH can indicate the start of a broadcast session). |

## Common issue 3 Applicable area of the PTM configurations

Previously we agreed that

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).

Based on this, even though the exact ways of informing the UE may be different, it can be generally assumed possible 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). For the sake of easy discussion, we call it the applicable area of the PTM configurations for UE in RRC\_INACTIVE.

Furthermore, Rapporteur understands that for solution 2, having such kind of applicable area may not be an essential requirement but it is more of an enhancement.

**Q6: Do you agree it is possible that for 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)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes | It’s better to support the same PTM configuration is applied in a certain area to simplify the UE mobility and the MBS session interruption time. |
| Kyocera | Yes | We think such an area-specific PTM configuration is beneficial for UE power saving and NW congestion avoidance. |
| ZTE | Probably no. | For the same multicast, it is difficult to coordinate between cells to achieve the same PTM configuration, such as search space, CFR, and other dynamic radio resource as each cell very likely experience distinct traffic and radio resource configuration. |
| Samsung | Yes |  |
| Qualcomm | Yes | Such an area-specific PTM configuration is beneficial for UE power saving and reducing signaling overhead. |
| Xiaomi | Yes |  |
| Ericsson | See comments | * Question: we agree that it is useful for the UE to know if a multicast session has the same PTM config in a neighbour cell. In Rel-17 broadcast there is also a general indication if broadcast is supported in the neighbour cell, i.e. such general indication is not pursued for multicast? We agree with that, i.e. not sure how this would be used, but it would be good if the rapporteur can clarify. * We think this needs to be coordinated with RAN3 concerning CU-DU-gNB boundaries, and required signalling (if any). For the congestion use case it would be beneficial if this can be done dynamically, i.e. when and where congestion arises in RAN. But that might increase the complexity of the solution. We are not sure if this can be in the Rel-17 broadcast way with MBS service area indicated by CN, i.e. the area should be determined by RAN. |
| MediaTek | Yes | It would be better to reduce the times of PTM configuration update. However it depends on network implementation |
| Lenovo | Yes |  |
| CATT | Yes, see comments | We understand this is a general question but not on specific signaling design. For the question from Ericsson we think that is one possible option, i.e., the same PTM configuration applies to the current and the neighbor cell(s).  We generally think such concept of applicable area of the PTM configurations would be essential for at least for Option 1. But the complexity/feasibility to align the PTM configurations between cells should be decided by RAN3. |
| Intel | No | In Rel-17 MBS, area specific MCCH is not supported. We don’t see the need to support area specific PTM configuration for multicast. |

**Q7: If your answer to Q6 is YES, do you agree network configures such applicable area of the PTM configurations for UE in RRC\_INACTIVE, so that UE knows whether its previously obtained configurations are still applicable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes |  |
| Samsung | See comment | We think PTM configurations and applicable area can be configured together i.e. Applicable  area can also be configured along with multicast configuration in RRCRelease with suspendConfig message |
| Qualcomm | See comments | We think it should be possible to configure applicable area along with PTM configuration, and the configuration can be same or different between CONNECTED and INACTIVE. E.g. if the configurations are provided using RRCReconfiguration, and a different PTM configuration for INACTIVE is not indicated (e.g. in RRCRelease) then the configuration can continue to apply. Furthermore, if same configuration is used for CONNECTED and INACTIVE, it can be specified to ignore irrelevant parameters for INACTIVE operation while being in INACTIVE e.g. HARQ feedback configurations. |
| Xiaomi | Yes |  |
| Ericsson | See comment | * See also our comments to Q6 * This should be optional for the NW to configure (just like Rel-17 broadcast neighbour cell info), i.e. if not configured the UE resumes in the target cell. |
| MediaTek | Yes |  |
| Lenovo | Yes, see comments | We may need to discuss the solution further:   1. A common PTM configurations for all the cells of the area 2. Per PTM configurations per cell for the area a list cells.   Solution 1 needs more NW coordination. |
| CATT | Yes | If such applicable area of the PTM configurations are supported then we think it should be configured by the network.  Then we think detailed configurations can be FFS, e.g., after we progress on Q6. |
|  |  |  |

## Common issue 4 Whether and how to notify the session state change to UEs in INACTIVE?

For multicast reception in INACTIVE, session state transition may be further discussed.

Session activation

Previously RAN2 agreed

 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.

Here scenario 2 can be further discussed in the following.

Rapporteur understands that since Rel-17 already supports that network uses group paging to indicate session activation to UEs, it is natural that Rel-18 supports similar indication.

**Q8: Do you agree Rel-18 UE in INACTIVE should be informed when the session is activated (Details FFS)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes |  |
| ZTE | Yes | In Rel-17, UE will be informed when the session state transition from inactive to active, we don't see a reason to change so. |
| Samsung | Yes | Group paging is straightforward solution for Rel-18 UE as well |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | See comment | We agree that via SIB/MCCH the UE could be notified, but we think that this is optional for the NW to configure, i.e. congestion is temporary and this UE power saving enhancement is not strictly needed to ensure service continuity, which is the main objective. Furthermore we expect that during congestion/emergency the session will remain active, i.e. do not expect frequency activation/de-activation, i.e. no need to notify.  As indicated in earlier reply: during congestion the gNB would not trigger group paging. |
| MediaTek | Yes |  |
| Lenovo | Yes |  |
| CATT | Yes |  |
| Intel | Yes |  |

Then next question is what is the difference between the Rel-17 and Rel-18 UE behaviour when such session activation notification is received. As per Scenario #2 in the above agreement, it is possible that Rel-18 UEs stay in RRC\_INACTIVE and continues with multicast reception after the session is activated.

**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)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes | In Option 1, we don’t think any new indication in the group paging, but we assume RRC Release in response to RRC Resume Request can work for this purpose, i.e., it’s same as indicating the UE to receive the multicast session in INACTIVE.  In Option 2, we wonder if some new indication is needed in either group paging or MCCH. |
| ZTE | See comments | We are a bit confused by the description to Q9 and Q9 itself.  1/ For scenario #2, UE starts multicast reception in RRC\_INACTIVE instead of "continues" with multicast reception. Maybe this part shall be updated to avoid any ambiguity.  2/ before answering Q9 , we think it is better to achieve a common understanding first on why does the UE have to be informed in RRC\_INACTIVE. In some cases, "Whether the session can be received in RRC\_INACTIVE" might be known to the UE before transitioning to inactive state, or even during RRC resume. If network decides to delivery the PTM config through MCCH, using group paging to indicate that might be a good idea to avoid UE's RACH. |
| Samsung | Yes | UE may have multicast session in deactivated state in RRC\_INACTIVE and upon activation, it needs to be informed as was the case with Rel17 |
| Qualcomm | Yes | See also Q5 above |
| Xiaomi | Yes |  |
| Ericsson | See comment | * Similar as ZTE we are a bit confused about the question * RAN2 agreed that if the **UE has a valid PTM configuration**, the UE can start receiving multicast while remaining in Inactive * Q9 is asking that in case the UE does not have a valid PTM configuration, the UE can remain in Inactive and start receiving multicast, i.e. the PTM configuration is provided via SIB/MCCH? The question should be clarified. |
| MediaTek | See comment | We think this information should be informed to UE earlier (e.g. when UE join in multicast session), so that the PTM configuration can be pre-configured and UE can make earlier preparation. |
| Lenovo | Yes, see comments | We may need to discuss when PTM configuration is provided to UE. Following R17 procedure, the NW only gets the MBS session QoS parameters when session activation, which implies that NW can only provide PTM configuration to UE when session activation. Some coordination with RAN3 to solve the issue may be needed. |
| CATT | FFS, see comments | Generally, it should be clear that whether a UE can receive multicast in INACTIVE is configured/controlled by the network. Then there are possible options when it comes to detailed way of configuring the UE(s):  Alt. 1 –The availability of a valid PTM configuration in UE is used to explicitly indicate whether a UE can receive multicast in INACTIVE  Alt. 2 – Group paging is used (e.g., via group paging upon session activation)  We understand the Q9 is basically asking whether alt. 2 is supported or not. On this particular question we do not have strong view but we’d suggest companies to express their views on this. |
| Intel | No | This question is related to Q5. If gNB determines that UE should receive the service in RRC\_CONNECTED, gNB can use the group paging. If gNB determines that the UE should receive the service in RRC\_INACTIVE, gNB can use MCCH to indicate the activation of multicast session (similar to broadcast case that MCCH can indicate the start of a broadcast session). |

**Q10: Do you agree group paging is used for the above indications (i.e., session activation indications, and/or whether multicast can be received in INACTIVE), with details FFS, if your answer to Q9 is Yes?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Not sure | As we commented in Q9 above, we assume it depends on which Option to be applied. |
| ZTE | See comments | Group paging for session activation shall always be supported as in Rel-17.  As for "whether multicast can be received in INACTIVE", please refer to our answer to Q10, i.e., we are not sure network has to inform UE when UE is in RRC\_INACTIVE, by group paging. We need to discuss this first in Q9. |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | No, see comment | Paging cannot be used to indicate a valid/full PTM configuration to the UE in Inactive. |
| MediaTek | Partially | Also see the comment in Q9. The session activation can be indicated by group paging message, but whether multicast can be received in INACTIVE can be indicated to UE earlier (i.e. when UE join in the session and in CONNECTED state). The initial full PTM configuration can be indicated with this information. |
| Lenovo | see comments | For whether multicast can be received in INACTIVE, it is FFS whether group paging or UE individual paging is used. |
| CATT | Yes | Please also see our comments to the previous question.  If we only support Alt. 1 and do not support Alt. 2 in Rel-18, then perhaps we could reuse the Rel-17 group paging for indication of session activation (we could discuss if there is any issue for this at all). But if we also support Alt. 2 then perhaps we need to discuss how to enhance the group paging to indicate whether multicast can be received in INACTIVE upon multicast session activation. |
|  |  |  |

In Rel-18, it may be possible that UEs in INACTIVE are informed on the session deactivation, session release. This is discussed in the following.

Session deactivation

**Q11: Do you agree UEs in INACTIVE should be informed when the multicast session is deactivated?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes | We think it’s beneficial for UE to stop receiving MTCH as soon as possible, when the multicast session is deactivated. We assume it’s something like the SC-PTM Stop Indication MAC CE in LTE. |
| ZTE | See  comments | UE is not aware of the session status at access layer. UE is only aware whether radio resources e.g., MRB, are configured or not. that being said, UE shall be informed to release the PTM config (maybe we can agree on this guideline first):  - In Rel-17, UE will be informed when the multicast session state transition from active to inactive through RRCReconfiguration (e.g., release all MRBs).  - In Rel-18, following the same principle, RRC\_INAVTIVE UEs also need to be informed to release the PTM config.  What matters is how UE is informed on the PTM config release due to session deactivation. It depends on how the PTM configuration is delivered, or which option to take, which can be our next step. |
| Samsung | Yes | UE should not be moved to RRC\_CONNECTED just to be informed that session is deactivated |
| Qualcomm | Yes | This relates to session deactivation, but not temporary data inactivity of an activated multicast session. |
| Xiaomi | Yes |  |
| Ericsson | No, see comment | This is not essential to handle a high numbers of UEs in connected mode, i.e. it should be left to the gNB implementation whether the UE is informed about this. There is no inter-operability issue when this is not supported. |
| MediaTek | No | Not necessary. Although it helps UE a little bit quicker stop receiving MTCH. It may bring much enhancement to group paging and potential compatibility impact to Rel-17 multicast. (i.e., the group paging may use for session activation/deactivation/release/PTM configuration update).  When the session is deactivated, UE can detect the interruption and send RRCResumeRequest to check if there is a PTM configuration update or session deactivate/release and get these information from RRCRelease. |
| Lenovo | Yes |  |
| CATT | Yes | We think it is useful that UEs in INACTIVE are informed when the multicast session is deactivated. UE should stop G-RNTI monitoring when session is deactivated,same as the R17 UE behavior for such case.And we think it is not a effcient way to release the PTM configuration when the session is deactivated as UE has to re-acquire the PTM configuration when the session is activated again. |
| Intel | No | In Rel-17 MBS, in SA2 TS 23.247 clause 7.2.5.3, there is a note that “*There is no explicit "deactivation" indication to the UE, how the UE is changed to IDLE state is defined in TS 38.300 [9].*” RAN side operation (as in CR RP-222611) is that “*When an MBS multicast session is deactivated, the gNB may move the UE to RRC\_ IDLE or RRC\_INACTIVE state*”.  For Rel-18 UE receiving multicast in RRC\_INACTIVE, we don’ see anything needs to be explicitly done in AS layer regarding session deactivation. It is up to gNB implementation e.g. to stop providing the relevant configuration in MCCH when option 2 is used. |

**Q12: Do you agree group paging is used for the above session deactivation indication to the UEs (details FFS), if your answer to Q11 is Yes?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Not sure | As we commented in Q11, it’s possible to use MAC CE as in legacy. So, we think RAN2 needs more discussion on this. |
| ZTE | See comments | There are various options for session deactivation indication:  Option 1: To avoid a large number of UEs transition state from RRC\_INACTIVE to RRC\_CONNECTED at the same time, UE paging can be considered to indicate multicast session deactivation.  Option 2: Group paging can be considered to indicate multicast session deactivation, but different delivery method of PTM configuration may cause different enhancements on group paging.  Option 3: MCCH can do the job implicitly or explicitly, if option 2 is to be taken. |
| Samsung | Yes | Group paging is efficient for indicating deactivation as well |
| Qualcomm | See comments | Group paging or short message are potential options. |
| Xiaomi | Yes |  |
| Ericsson | No | In case there is a need for things like PTM config change, session status change notification (or any other enhancement), then we prefer to use the MCCH, i.e. we prefer to use one signalling option for Rel-18.  PS: in Rel-17 we did not do a proper analysis what is the possible impact on paging reliability with group paging, i.e. the legacy Paging message size is increased significantly when a list of TMGIs is included, which may reduce the paging performance at the cell border or in bad/indoor coverage. |
| MediaTek | No | See the comment in Q11 |
| TD Tech, Chengdu TD Tech | See our comments | Consider the comments from Kyocera, ZTE, Ericsson and Media Tek, we are Ok with the following options:  Option 1: Group paging is used to send the deactivation indication.  Option 2：A new MAC CE is used to carry the multicast session deactivation indication, where the new MAC CE is sent with GC-PDSCH scrambled by G-RNTI and G-RNTI is used to identify the multicast session over Uu.  Option 3: MCCH is used to carry the deactivation indication.  For option 3，there are two types of MCCH:  Type1-MCCH: is cell specific.  If at least one multicast session is provided in RRC\_INACTIVE in a cell, one type 1-MCCH can be configured in the cell. This MCCH is used to carry the PTM configuration informations of all multicast sessions provided in RRC\_INACTVE in the cell. The configuration information of this MCCH is sent by a SIB.  Type 2-MCCH: MBS session specific MCCH.  If one multicast session is provided in RRC\_INACTIVE in a cell, one type2-MCCH is configured for carrying the related RRC signaling of the multicast session with the PTM mode, such as the deactivation indication and the PTM configuration information update. The configuration information of this MCCH is sent to UE through the dedicated RRC signaling along with the other configuration information of UE ( such as MRBs and MTCHs of the multicast session) after UE joins the multicast session for the first time and before UE is switched into RRC\_INACTIVE by gNB.  From our point of view, type2-MCCH (multicast session specific MCCH) is better than type1-MCCH (cell specific MCCH) because Type2-MCCH is configured through the dedicated RRC signaling. |
| Lenovo | Yes |  |
| CATT | Yes | Detailed signaling design can be further discussed.  It is straightforward to take R17 group paging as baseline.  Furthermore, we think it is not efficient and it will increase latency if session deactivation leads to PTM configuration release. So indication by the presence of the PTM configuration in MCCH is not optimal. |
| Intel | No | In option 2 (MCCH approach), the absence of related MBS session information in MCCH indicates the deactivation. |

Session release

**Q13: Do you agree UEs in INACTIVE should be informed by RAN when the multicast session is released?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
| Kyocera | Yes | We have the same comment as Q11 above. |
| ZTE | Yes | In Rel-17, if the multicast session is released, RRC\_INACTIVE UE will be informed to resume RRC connection and then receive a NAS message about session release (i.e., PDU session modification).  In Rel-18, the same principle applies. |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| Ericsson | See comment | Yes, the same mechanism can be re-used in Rel-18, but we think that the gNB would not trigger group paging during congestion. |
| MediaTek | Maybe | Network can use group paging to notify UE, or UE can detect the interruption and send RRCResumeRequest by itself. |
| Lenovo | Yes |  |
| CATT | Yes | The indication is necessary as UE should stop G-RNTI monitoring when session is released. The NAS level procedure for session release to indicate UE to leave the session group is in CT1 scope. |
| Intel | Yes | Agree with ZTE. |

**Q14: Do you agree group paging is used for the above session release indication to the UEs (details FFS), if your answer to Q13 is Yes?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Yes or no | | Comments if any |
| TD Tech, Chengdu TD Tech | Yes | |  |
| Kyocera | Not sure | | We have the same comment as Q12 above. |
| ZTE | See comments | | UE needs to resume RRC connection to receive the NAS message anyway. Group paging or unicast paging, it is up to network choice. |
| Samsung | Yes | | It is in line with SA2 progress |
| Qualcomm | Yes | | Group paging indication seems sufficient. Whether UE needs to go to CONNECTED and update NAS can be decided by SA2/CT1, and outside of RAN2 discussion scope. |
| Xiaomi | Yes |  | |
| Ericsson | See comment | Similar view as ZTE, i.e. up to gNB implementation to use group paging, UE individual paging, or discard the paging message. | |
| MediaTek | Maybe | | The same comment as Q13 above |
| TD Tech, Chengdu TD Tech | See our comments | | We are Ok with the following options:  Option 1: Group paging is used to send the deactivation indication.  Option 2：A new MAC CE is used to carry the multicast session deactivation indication, where the new MAC CE is sent with GC-PDSCH scrambled by G-RNTI and G-RNTI is used to identify the multicast session over Uu.  Option 3: MCCH is used to carry the deactivation indication.  For option 3，there are two types of MCCH:  Type1-MCCH: is cell specific.  If at least one multicast session is provided in RRC\_INACTIVE in a cell, one type 1-MCCH can be configured in the cell. This MCCH is used to carry the PTM configuration informations of all multicast sessions provided in RRC\_INACTVE in the cell. The configuration information of this MCCH is sent by a SIB.  Type 2-MCCH: MBS session specific MCCH.  If one multicast session is provided in RRC\_INACTIVE in a cell, one type2-MCCH is configured for carrying the related RRC signaling of the multicast session with the PTM mode, such as the deactivation indication and the PTM configuration information update. The configuration information of this MCCH is sent to UE through the dedicated RRC signaling along with the other configuration information of UE ( such as MRBs and MTCHs of the multicast session) after UE joins the multicast session for the first time and before UE is switched into RRC\_INACTIVE by gNB. |
| Lenovo | See comments | | The UE needs to return RRC connection but it is not necessary to provide an indication in paging message. |
| CATT | Yes | | It is straightforward to take R17 group paging as baseline. |
| Intel | See comments | | Agree with ZTE. |

## Other common issues

**Q15: Do you see any other common issues for both options?**

|  |  |
| --- | --- |
| Company | Comments if any |
| TD Tech, Chengdu TD Tech | For option 2, only one MCCH is configured for multicast sessions in RRC\_INACTIVE in a cell. This multicast MCCH can be same or different as the MCCH for broadcast sessions. Correspondingly the SIB for the multicast MCCH can be same or different as SIB20.  If option 2 is supported, the PTM configuration for RRC\_INACTIVE per G-RNTI is transmitted periodically.  In order to improve the spectrum efficiency, option 3 can be used as an improved option 2.  Option 3: the solution is based on RRC dedicated signaling + multicast session specific MCCH.  If one multicast session is provided in RRC\_INACTIVE in a cell, one specific MCCH is configured to carry the signaling of the multicast session with PTM mode. The configuration information of MCCH along with the other configuration information (such as the configuration information of MRBs/MTCHs/DCCH/DTCHs ) is sent to UE through the dedicated signaling after UE joins the multicast session and before UE is switched into RRC\_INACTIVE by gNB.  Compared with option 2, instead of sending the related signaling periodically, option 3 can send the related signaling via the MCCH once or several times. Compared with option 1, option 3 avoids using the random access procedure. Option 3 can also be regarded as an improved option 1.  We hope option 3 can be discussed with option 1 and option 2. The description of option 3 can be given as below.  3-a) For a multicast session provided in RRC\_INACTIVE, one MCCH is configured to send the related signaling of the multicast session with PTM mode (such as PTM configuration update, neighbor cell configuration information and so on).  3-b) UE can receive the related signaling no matter which RRC state it is in.  3-c) The configuration information of MCCH is sent to UE through dedicated signaling after UE joins the multicast session and before UE is switched into RRC\_INACTIVE by gNB.  3-d) There’s usually no need to change the MCCH configuration during the multicast session duration. (Reason: MCCH uses UM mode RLC entity and can have a fixed logical channel ID during the multicast session duration. MCCH and MTCHs share the same L1 (GC-PDCCH/GC-PDSCH/CFR/CORESET/CSS) configuration) |
| Kyocera | RAN2 agreed “*HARQ feedback and PTP are not supported for multicast reception in RRC\_INACTIVE*”, which implies the reliability of multicast session is not ensured in INACTIVE. On the other hand, QoS management of multicast session is still important as some contributions pointed out in the last meeting. So, we wonder if some enhancements are needed for the UE to transition to Connected when it experiences a poor reception quality. |
| Qualcomm | The above questions only cover the deactivation of session. However, temporary data inactivity in multicast while in RRC\_INACTIVE for activated multicast sessions is not addressed. For such sessions, solutions would be beneficial to enable UE not to monitor the DL channels all the time, however MRB configurations should not be released. |
| Lenovo | For service continuity, whether PDCP SN should be continuous when UE moves among cells needs to be discussed. |
|  |  |
|  |  |

# 5 Issues specific for Option 1 and 2

In this section, we further discuss the specific issues of Option 1 and 2, respectively.

## 5.1 Further analysis of Option 1

**Issue 1-1 How to inform the UE when network changes the PTM configurations**

There are some scenarios where configuration update might be needed for UE in inactive state configured with multicast reception, such as PTM configuration parameters updates due to for example session update triggered by CN or PTM transmission switch on/off toward RRC inactive UE in preconfigured area/cells due to UE mobility in such area.

When UE is in RRC\_INACTIVE, it is not possible to reach it via dedicated RRC signaling. The current specification supports that network uses individual paging to move the UE from RRC\_INACTIVE to RRC\_CONNECTED for such configuration updates. Then the next question is whether group paging can be used to inform that the PTM configurations will be changed by the network (Details FFS).

**Q16: Do you agree that with Option 1, 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)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No | Such method is time consuming and has heavy signaling load. |
| Kyocera | Yes | We think it’s a natural way in Option 1. We assume such a PTM configuration update does not happen often, so we’re wondering if it’s really a critical issue in practice at the end. |
| ZTE | Yes but | The reason we think option 1 might be flawed in case of large number of UEs. |
| Samsung | Yes | PTM configuration change is expected to happen less likely given only common multicast parameters from PTM configuration are utilized in RRC\_INACTIVE. Given this, we do not think there may be frequent state transitions. |
| Qualcomm | Yes | Such configuration change is expected to be less frequent. |
| Xiaomi | Yes |  |
| Ericsson | No, see comments | As indicated earlier we do not think this is an option during congestion, which is the main use case for this feature. |
| MediaTek | No | The same reason as above, i.e., UE can trigger RRC connection resume procedure when it detects the interruption, to check whether there is configuration update or session deactivate/release. |
| TD Tech, Chengdu TD Tech | See the comments | We suggest an improved option 1 is used instead. That is, dedicated signaling + multicast session specific MCCH is used. In detail, MCCH is used to send the updated PTM configuration, where MCCH is configured for the multicast session and the MCCH configuration information is sent to UE through dedicated signaling after UE joins the multicast session and before UE is switched into RRC\_INACTIVE. |
| Lenovo | Yes |  |
| CATT | Yes | We think if Option 1 is supported then network should have means to inform UE about the configuration change. |
| Intel | Yes |  |

**Issue 1-2 How to handle the cases when a large number of UEs in the cell needs PTM configurations update?**

Based on issue 1-1, we need to further discuss the cases with a large number of UEs in the cell. After group paging is received by these UEs, they may need to trigger RRC resume in order to obtain the updated configurations. The following procedure may cause very high system load.

**Q17: Do you agree that for Option 1, enhancements are needed for cases when a large number of UEs in the cell needs PTM configurations update?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes | If Yes is decided for Q16, a possible enhancement is listed as below.  The PTM configuration for RRC\_INACTIVE is carried by the group paging. When UE finds the group paging, it can obtain the PTM configuration information at the same time. UE has no need to enter into RRC\_CONNECTED through random access procedure. |
| Kyocera | Yes | We think the issue is the PRACH collision due to many transmissions from multiple UEs at the same time. We assume some sort of staggered PRACH attempts would be one of enhancements. Though, we’re wondering if the PTM configuration update is really happens often in practice, as commented in Q16 above. |
| ZTE | No for now | Not sure what we can do to avoid RACH and signaling overhead for an already congested cell. |
| Samsung | Yes | Configuration update should be less frequent including the case of termination of multicast support in RRC\_INACTIVE. However, RAN2 should consider UAC enhancements if the concern is that a large number of UEs may need to transit to RRC\_CONNECTED at the same time (this is equally applicable to any case of group paging for activation, configuration update or RRC state change required for a multicast session) |
| Qualcomm | Maybe | Agree with Samsung’s comment above. |
| Ericsson | Yes | During congestion the UE should stay in Inactive, i.e. RACH enhancements are not needed. But in case there is a need to indicate PTM config change then SIB/MCCH can be configured. |
| MediaTek | Maybe | UAC enhancement may be helpful. With the resume cause of update PTM configuration, RRCRelease message can carry the configuration, and UE can stay in INACTIVE state. |
| TD Tech, Chengdu TD Tech | See the comments | We suggest an improved option 1 is used instead. That is, dedicated signaling + multicast session specific MCCH is used. In detail, MCCH is used to send the updated PTM configuration, where MCCH is configured for the multicast session and the MCCH configuration information is sent to UE through dedicated signaling after UE joins the multicast session and before UE is switched into RRC\_INACTIVE.  Dedicated signaling + multicast session specific MCCH can avoid using the random access precodre. |
| Lenovo | Maybe | UAC enhancements and new RRC cause may be helpful.  RACH optimization seem not necessary as we discussed in Rel-17. |
| CATT | Yes | The cases when the number of UEs in the cell are large is quite important to this objective, so we think if Option 1 is supported this issue should be properly addressed. |
| Intel | See comments | Our understanding is that the congestion issue is a critical drawback of option 1. Before discussing any solutions, we need to consider solution direction (e.g. option 2) which do not have such issue. |

**Other issues specific for option 1**

**Q18: Do you see any other issues specific for option 1?**

|  |  |
| --- | --- |
| Company | Comments if any |
| TD Tech, Chengdu TD Tech | Option 1 is not suitable for UE in RRC\_INACTIVE. Re-enter into RRC\_CONNECTED is time consuming and generates heavy signaling load. An alternative solution is to send the PTM configuration information with group paging. |
| ZTE | How about the mobility? |
| Qualcomm | Mobility is a key aspect. One way is for RAN to provide a list of cells with common PTM configurations, or include neighbor-cell PTM configurations similar to CHO configurations.  Not all cells a RAN notification area needs to provide such configuration, and in such case if UE is moving to a cell for which PTM configurations for INACTIVE is not provided, it could either be that the cell does not support the service (the cell has not joined the multicast service tree), or that it is not loaded and providing the service in RRC\_CONNECTED state. |
| MediaTek | Although we may have applicable area for PTM configurations to reduce the times of PTM configuration update, the discussion for mobility is still needed for UE receives multicast in RRC INACTIVE. |
| TD Tech, Chengdu TD Tech | We suggest an improved option 1 is used instead. That is, dedicated signaling + multicast session specific MCCH is used. |
| Lenovo | Regarding mobility, we think per PTM configuration per cell within a certain area would be a good solution. |
| CATT | According to the scope of the post email, we think it is better to focus on PTM configuration related aspects. Discussion on mobility can be based on companies’ papers. |

## 5.2 Further analysis of Option 2

**Issue 2-1 Is there security concern when UE can obtain all the PTM configurations for a multicast service via Option 2?**

Some companies raised concern on security when UE can obtain all the PTM configurations for a multicast service. The main reason is that for R17 multicast, UE needs to join the session and obtain all the related PTM configurations when it is in RRC\_CONNECTED. While with Option 2, there is not restriction, so that practically any UE could decode the SIB and then obtain the related PTM configurations from the corresponding MCCH. On the other hand, there is also view that the security can be ensured based on service layer mechanism so no need to enhance in RAN. It seems useful to discuss this aspect.

**Q19: Do you think there is an issue that a UE can obtain all the PTM configurations for a multicast service via Option 2? And if yes, please describe what is the security issue on the condition that security is enabled by service layer.**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No | The service layer security is protected |
| Kyocera | Maybe No | We think LTE eMBMS can handle the multicast sessions with upper layer security protection, whereby LTE eMBMS (SC-PTM) is quite similar to Option 2. So, we think there was no security concern at least in the past. But the up-to-date risks may be consulted with SA3, if needed. |
| ZTE | No | No issue found. Also, if the exposed TMGI is a concern, we can always use other temporary identity. |
| Samsung | Yes | There may be increased vulnerability for multicast session with Man-in-Middle attack when unprotected SIB/MCCH messages carrying PTM configurations for multicast (this configuration is also shared by dedicated signalling for other UEs in Connected mode). Any scheme which educates an attacker more about the system configuration is problematic from security perspective.  Unlike broadcast, multicast may cater to critical and public safety services. Note that MCCH signalling is not protected by application/service layer security either. Here we are only concerned with RAN signalling security aspect and not application traffic security. |
| Qualcomm | Yes | Agree with Samsung’s comment – we cannot assume that similar level of security is expected for some services which naturally could use ‘broadcast’ vs some services which would need to use ‘multicast’ (e.g. mission critical and public safety). This is also why UE needs to ‘join’ (and get authenticated) for ‘multicast’ but the same does not apply to ‘broadcast’. Anyone being able to get ‘multicast’ configuration without first joining that session effectively changes it to a ‘broadcast’ service! |
| Xiaomi | Yes | As we raised during the last meeting online discussion, there is security issue for option2 which can cause the configuration failure due to the combination of the configuration provided by the fake gNB MCCH and the dedicated configuration provided in CONNECTED. This is different from the Rel-17 broadcast mode which totally follow the MCCH configuration.  In details, the expected procedure is as follows, if the fake gNB send the multicast configuration via MCCH, then    Consequence1: If the UE combines the stored multicast configuration with the multicast configuration via MCCH, this will cause an internal unexpected failure of the UE.  Consequence2: If the UE combines the multicast configuration via RRCReconfiguration with the multicast configuration via MCCH, the UE will trigger RRC connection reestablishment. And then the RRC connection reestablishment will fail as the UE will use the multicast configuration via MCCH for reestablishment. Then the UE will enter IDLE. |
| Ericsson | Yes | Security on the service layer, if available, can protect the content. But still there could be a problem with the PTM config obtained from a fake gNB as indicated by companies above. |
| MediaTek | Yes | We hope the similar security mechanism can be used for both Rel-17 and Rel-18 multicast in RAN, since multicast is not provided to all UEs in the service area, as defined in the spec.  Also, it is not friendly for UE power saving if UE obtain the PTM configuration from SIB-MCCH way and receive multicast service normally then denied to access at the service layer.  Otherwise, we can just use broadcast instead and the enhancement for multicast seems unnecessary. |
| TD Tech, Chengdu TD Tech | See the comments | In order to solve the concerns from Samsung, QC, Xiaomi, Ericsson and Media Tek on SIB+MCCH , we suggest to support the solution based on dedicated signaling + multicast session specific MCCH.  A specific MCCH is configured for a multicast session provided in RRC\_INACTIVE and the MCCH configuration information is sent to UE through dedicated signaling after UE joins the multicast session and before UE is switched into RRC\_INACTIVE.  Dedicated signaling + multicast session specific MCCH has the following benefits:   1. Avoid using SIB and avoid broadcasting the PTM configuration information of the multicast session in RRC\_INACTIVE 2. Avoid using the random access procedure, thus avoiding the random access collision problem and long delay problem. |
| Lenovo | Yes | We tend to agree as indicated by companies above that there could be problem with PTM configuration from a fake gNB. |
| CATT | Not sure | We think if security is enabled by service layer, then perhaps RAN does not need to handle the issue. But we are open to discuss this. |
| Intel | No | Multicast service data can be protected by security in service layer. Regarding the concerns on the fake gNB, our understanding is that SA3 is working on security enhancements against fake gNB and we expect that solutions developed by SA3 would be applicable for all use cases including MBS. |

Then companies are encouraged to share their views regarding the considered solution if they see an issue here.

**Q20: If your answer to Q19 is YES, please share your comments regarding how to solve the issue (e.g., using some form of mixed solution as mentioned by the previous agreement, or consult SA3, or other possible ways, etc.).**

|  |  |
| --- | --- |
| Company | How to solve the issue, if your answer to the previous question is Yes. |
| TD Tech, Chengdu TD Tech | Not needed for option 2 |
| Samsung | We prefer option 1 (i.e. dedicated signalling based PTM configuration) which is simple and secure.  As we understand SA3 is also concerned with the broadcast signalling security and potential False-Base-Station / Man-in-Middle attacks. However, solution progress for this in SA3 may be quite long term (presently it is Rel-18 study item in SA3). Given this, RAN2 should adopt option 1 based approach. |
| Qualcomm | We prefer option 1 for the reasons explained above. We already have broadcast solution in Rel-17 which can be received in not only INACTIVE but also IDLE for services that do not need UE to explicitly join the session. So, there is no reason to re-specify it with a different name. |
| Xiaomi | If the MCCH message is considered for PTM configuration delivery, we should consult SA3. |
| Ericsson | We have similar understanding as SS about SA3 discussions. Besides this long term SA3 solution, we are not sure what is a secure way to enable e.g. PTM config change while the UE remains in Inactive (and we think it is problematic when the UEs access during congestion). It seems that similar security concern can be identified if activation/deactivation is indicated via (group) Paging/Short Message, i.e. an attacker can cause the UEs to stop listening? |
| MediaTek | This can be solved by delivering a “service specific MCCH” via dedicated signaling rather than SIB. UE may get this information from RRC when joins the multicast session. (The “service specific MCCH” may also have neighbor cell information to solve the mobility issue)  Meanwhile, we still prefer option 1. |
| TD Tech, Chengdu TD Tech | See the comment for Q19 |
| Lenovo | We would prefer option 1. But we can consult with SA3 to check the security issue. |
|  |  |

**Issue 2-2 Design for MCCH and change notification for option 2**

If option 2 is adopted, the most straightforward way is to reuse Rel-17 MCCH message design and change notification mechanism as baseline, with necessary extensions.

**Q21: Do you see any issue if option 2 reuses the same Rel-17 MCCH channel?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No |  |
| Kyocera | Yes |  |
| ZTE | No | If SIB+MCCH can also be supported in RRC\_CONNECTED,  - monitoring MCCH constantly can be an overhead for UE. This might not be needed since UE is already in RRC\_CONNECTED state, and no need for all multicast service utilizing the same MCCH modification period. |
| Samsung | No | Assuming if option 2 is agreed. However, additional DCI bits may be needed for change notification |
| Qualcomm | See comments | Once it is guaranteed that only the UEs that have joined the multicast session can receive this, reusing same Rel-17 MCCH channel can be ok. |
| Xiaomi | See comments | We’d like to postpone this question before the security issue for option2 is confirmed. |
| Ericsson | See comments | We are not sure about the possible security concerns |
| MediaTek | Yes | (if option2 is confirmed)  The legacy MCCH channel for broadcast provides the list of all services in a certain area with much information which may neither not secure enough nor not need for receiving a certain multicast service. Therefore this “multicast MCCH” should be re-designed and specifically used for certain multicast service (and delete the redundant information).  If UE want to receive other multicast service, UE shall join in the multicast session first (to get authorized) and may get the corresponding “service specific MCCH” via dedicated signaling. |
| Lenovo | NO | In case that if option 2 is agreed |
| CATT | No | We think for Option 2 the baseline should be to reuse the Rel-17 MCCH channel. |
| Intel | No |  |

**Q22: Do you see any issue if option 2 reuses the Rel-17 MCCH message (with necessary extensions)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No | But we think several modification periods can be configured for the associated MCCH due to the fact that different multicast sessions have different delay requirements and so on. |
| Kyocera | No, but… | We think the motivations of multicast reception in INACTIVE are NW congestion avoidance and UE power saving, according to the contributions submitted in the last meeting. We think MCCH causes additional signalling overhead for NW and additional DRX activity for UEs, which are both not aligned with the motivations. |
| ZTE | Not now | reusing the existing MCCH (even there is no broadcast service at current cell) could work.  The necessary extensions need to be clarified but could be done later. |
| Samsung | Yes | We understand option 2 (MCCH message) carries multiple MRB configurations commonly for all UEs and a specific UE needs to know which multicast configurations are for this UE. That is, with option 2 it is not clear how a specific UE can be configured for a new multicast session. Though, UE may know applicable multicast session for reception in RRC\_INACTIVE with dedicated signalling. This implies option 2 is not self-sufficient and works only as additional approach to option 1 e.g. MCCH can provide updated configuration for multicast session(s) indicated by dedicated signalling earlier. |
| Qualcomm | See comments | Once it is guaranteed that only the UEs that have joined the multicast session can receive this, and the UEs are somehow made aware which (subset of) MRB configuration is applicable to them, reusing Rel-17 MCCH message may be ok. However, need may be identified later for a multicast-specific MCCH message in this case depending on what configurations need to be provided. So, any agreements on this would be premature at this time. |
| Xiaomi | See comments | We’d like to postpone this question before the security issue for option2 is confirmed. |
| Ericsson | See comment | Same view as SS, i.e. MCCH does not work stand-alone, i.e. in combination with option 1 |
| MediaTek | Yes | See the comment in Q21. |
| Lenovo | See comments | We share the same view with Samsung. |
| CATT | No | We think for Option 2 the baseline should be to reuse the Rel-17 MCCH message with necessary extension (details FFS). |
| Intel | No |  |

Rapporteur understands the change notification mechanism or its enhancements could be discussed in a later stage when the above issues are clearer.

**Other issues specific for option 2**

**Q23: Do you see any other issues specific for option 2?**

|  |  |
| --- | --- |
| Company | Comments if any |
| TD Tech, Chengdu TD Tech | If the PTM configuration information for RRC\_INACTIVE per G-RNTI is sent on a MCCH, several modification/repetition periods can be used for different service types. |
| Samsung | BWP usage for SIB/MCCH may not coincide with BWP used for multicast session transmission. There may be some latency in availing configuration based on SIB/MCCH periodicity and/or increased signalling traffic |
| Qualcomm | Our main concern with option 2 is how to make sure UEs that have not joined multicast session are prohibited from receiving the configuration and the service, as that is the main principle of multicast system design which differentiates it from broadcast.  Further, if multiple MRB configurations are broadcasted, how to make sure only a subset of it is used by a certain UE (based on which services it has been authorized to). |
| Xiaomi | We’d like to postpone this question before the security issue for option2 is confirmed. |
| Ericsson | The MCCH size with multiple PTM configurations, and the ASN.1 impact needs further study/discussion. |
| Lenovo | Service continuity: in R17 broadcast, the old MRB is released and a new MRB is setup when cell reselection happens from an old cell to a new cell. |

# 6 Conclusions

TBD

# 7 Reference

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[4] R2-2207047 Considerations for Multicast Reception in RRC\_INACTIVE Samsung discussion Rel-18

[5] R2-2207191 Discussion on RAN based Notification Area for Multicast Mobility in RRC Inactive State TCL Communication Ltd. discussion Rel-18

[6] R2-2207204 Overview considerations on Multicast reception in RRC\_INACTIVE NEC Europe Ltd discussion Rel-18 NR\_MBS\_enh-Core

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[9] R2-2207412 State transition for UEs receiving Multicast in RRC\_INACTIVE state TCL Communication Ltd. discussion

[10] R2-2207415 PTM configuration for UEs receiving Multicast in RRC\_INACTIVE state TCL Communication Ltd. discussion

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[20] R2-2207730 PTM Configuration in RRC\_INACTIVE SHARP Corporation discussion NR\_MBS\_enh-Core

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[25] R2-2208312 Multicast reception in RRC\_INACTIVE LG Electronics Inc. discussion Rel-18

[26] R2-2208374 MBS support in RRC\_INACTIVE InterDigital, Inc. discussion Rel-18 NR\_MBS\_enh-Core

[27] R2-2208441 Initial consideration on multicast reception in RRC\_INACTIVE CMCC discussion Rel-18 NR\_MBS\_enh-Core

[28] R2-2208499 Multicast reception in RRC\_INACTIVE Intel Corporation discussion Rel-18 NR\_MBS\_enh-Core

[29] R2-2208520 Discussion on user plane aspects for support of multicast in RRC\_INACTIVE LG Electronics Inc. discussion Rel-18 NR\_MBS\_enh-Core

[30] R2-2208633 Multicast reception in RRC\_INACTIVE ZTE, Sanechips discussion Rel-18 NR\_MBS\_enh-Core

[31] Draft meeting report R2\_119-e