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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| --- | --- |
| Company | Delegate name (email address) |
| 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?**

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| 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. |
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## 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. |
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# 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)?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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## 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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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**Q5: Whether group paging mechanism needs to be enhanced, if your answer to the previous question is YES?**

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| 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. |
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## 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)?**

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| 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. |
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**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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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## 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)?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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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)?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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**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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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**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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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Session release

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

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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**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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | Yes |  |
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## Other common issues

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

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| 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 MCCH per G-RNTI, where G-RNTI is used to identify multicast sessions which are provided in RRC\_INACTIVE.  For option 3, if the multicast sessions associated with a G-RNTI are provided to UE in RRC\_INACTIVE, an MCCH can be configured to send the PTM configuration information of these multicast sessions. Compared with option 2, each time the PTM configuration information associated with this G-RNTI is updated. Option 3 can send the updated PTM configuration information via the MCCH once or several times. The updated PTM configuration information doesn’t need to be send periodically as option 2.  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 G-RNTI associated with the multicast session reception in RRC\_INACTIVE, only one MCCH is configured to send the PTM configuration associated with this G-RNTI. The different G-RNTIs have different MCCHs.  3-b) UE can receive the PTM configuration associated with this G-RNTI no matter which RRC state it is in.  3-c) If the PTM configuration associated this G-RNTI is updated, UE in RRC\_INACTIVE does not need to resume RRC connection but directly receives the updated configuration via the MCCH.  3-d) The MCCH associated with this G-RNTI is sent with PTM mode. |
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# 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)?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No | Such method is time consuming and has heavy signaling load. |
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**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?**

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| 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. |
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**Other issues specific for option 1**

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

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| 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. |
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## 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.**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No | The service layer security is protected |
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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.).**

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| 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 |
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**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?**

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| Company | Yes or no | Comments if any |
| TD Tech, Chengdu TD Tech | No |  |
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**Q22: Do you see any issue if option 2 reuses the Rel-17 MCCH message (with necessary extensions)?**

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| 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. |
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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?**

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| 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. |
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# 6 Conclusions

TBD

# 7 Reference

[1] R2-2206987 Discussion on supporting group scheduling for RRC\_INACTIVE UEs FGI discussion

[2] R2-2206988 Multicast reception in RRC\_INACTIVE state TD Tech Ltd discussion Rel-18

[3] R2-2206997 Discussion on multicast reception in RRC\_INACTIVE state OPPO discussion Rel-18 NR\_MBS\_enh

[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

[7] R2-2207227 Supporting Multicast Reception in RRC\_INACTIVE vivo discussion Rel-18 NR\_MBS\_enh-Core

[8] R2-2207318 Discussion on possible approaches to support multicast for inactive UEs Futurewei discussion Rel-18 NR\_MBS\_enh-Core

[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

[11] R2-2207447 Multicast reception in RRC\_INACTIVE state Apple discussion Rel-18 NR\_MBS\_enh-Core

[12] R2-2207481 Considerations on the multicast reception in RRC\_INACTIVE Beijing Xiaomi Software Tech discussion Rel-18

[13] R2-2207557 MBS inactive principles Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MBS\_enh-Core

[14] R2-2207566 Discussion on multicast enhancement for RRC INACTIVE state MediaTek inc. discussion Rel-18 NR\_MBS\_enh-Core

[15] R2-2207588 Multicast reception in RRC\_INACTIVE Huawei, HiSilicon discussion Rel-18 NR\_MBS\_enh-Core

[16] R2-2207689 Discussion on Multicast Reception in RRC\_INACTIVE Spreadtrum Communications discussion Rel-18

[17] R2-2207698 PTM configuration for multicast reception in RRC\_INACTIVE Lenovo discussion Rel-18

[18] R2-2207699 Mobility and state transition for multicast reception in RRC\_INACTIVE Lenovo discussion Rel-18

[19] R2-2207720 Mobility of UEs receiving multicast in RRC\_INACTIVE state CANON Research Centre France discussion Rel-18 NR\_MBS\_enh-Core

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

[21] R2-2207771 Discussion on multicast reception in RRC\_INACTIVE CATT, CBN discussion Rel-18 NR\_MBS\_enh-Core

[22] R2-2208093 MBS multicast reception in RRC\_INACTIVE Ericsson discussion Rel-18 NR\_MBS\_enh-Core

[23] R2-2208096 Multicast reception by UEs in RRC\_INACTIVE state Qualcomm Incorporated discussion Rel-18 NR\_MBS\_enh-Core

[24] R2-2208289 Multicast reception in RRC INACTIVE Kyocera discussion Rel-18

[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