**SA WG2 Meeting #S2-154 S2-xxx**

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**Source: Nokia, Nokia Shanghai Bell,**

**Title: Updates to Conclusion for key issue 1**

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*Abstract of the contribution: This paper proposes updates to conclusions for key issue 1 based on the incoming RAN3 LS S2-2210195.*

# 1 Introduction

RAN3 LS (S2-2210195) states:

***RAN3 answer to Q1a) If there are significant differences in the quality and reliability of the reception of MBS data between UEs in RRC Connected state and UEs in RRC Inactive state:***

* *The QoS requirements apply to the provision of the multicast session, independently from the strategy a gNB applies to achieve their fulfilment.*

***RAN3 answer to Q1b) If it is possible, as part of the same MBS session, to have some UEs receiving in RRC Connected state, while other UEs receiving in RRC Inactive state***

* *Yes, this is RAN3 assumption and aligned with RAN2 agreement that “It is supported that gNB transmit one multicast session to both UEs in RRC\_CONNECTED and RRC\_INACTIVE in the same cell.”.*

***RAN3 answer to Q1d) Whether the existing QoS parameters of MBS QoS Flow(s) are enough or some additional parameter is needed for NG-RAN to differentiate different MBS session and UE, which can be used by NG-RAN to decide how to deliver the MBS data. And to Q2: SA2 would like to receive feedback on the value of such assistance information from RAN perspective?***

* *The gNB decides whether a UE is configured to receive multicast data in RRC\_INACTIVE.*
* *The gNB may take at least the following information into account when deciding to enable UEs receiving multicast in RRC\_INACTIVE state:*

*the radio capabilities of the UE (whether “multicast over RRC\_INACTIVE” is supported)*

*multicast context information (e.g. the QoS parameters not associated to any specific UE)*

*information available locally at the gNB (e.g. cell load)*

***RAN3 answer to Q4:******SA2 would like to clarify with RAN WGs whether the assumption that IDLE UE will need to transition to connected state to start receiving the MBS data and CN initiated group paging (as defined in Rel-17) is thus still required for such UEs?***

* *Yes, an idle UE will need to transit to connected state and thus, , the CN initiated group paging still needs to be performed.*

***RAN3 answer to Q6: SA2 would like to confirm with RAN WGs the above assumption. (****Regarding the* ***mobility within the RAN Notification Area (RNA)****, SA2 assumes the UE in RRC Inactive state should be able to continue receiving DL multicast MBS data within its RNA and the solution will be determined by RAN WGs as RRC\_INACTIVE mobility is under the remit of RAN WGs.****)***

* *NG-RAN signalling supports service continuity for UEs receiving multicast session data in RRC\_INACTIVE, i.e., a UE is able to continue multicast reception without RRC state transitioning after cell reselection in RRC\_INACTIVE state if the configuration of the new cell is available for the UE. Impact on network interfaces is FFS. Details are under discussion in RAN2 and RAN3.*

RAN2 LS S2-2210191 states

**RAN2 Answer to Q1-a) *If there are significant differences in the quality and reliability of the reception of MBS data between UEs in RRC Connected state and UEs in RRC Inactive state*:**

* The quality and reliability of the reception of MBS data between UEs in RRC\_CONNECTED state and UEs in RRC\_INACTIVE state may or may not be different, as HARQ feedback and PTP transmission are not supported and seamless/lossless mobility is not required for multicast reception in RRC\_INACTIVE.

**RAN2 Answer to Q1-b) *If it is possible, as part of the same MBS session, to have some UEs receiving in RRC Connected state, while other UEs receiving in RRC Inactive state*:**

* Yes, it is supported that gNB transmits service of one multicast session to both UEs in RRC\_CONNECTED and UEs in RRC\_INACTIVE in the same cell. It is assumed the gNB can choose which UEs receive in RRC\_CONNECTED and which in RRC\_INACTIVE**.**

**RAN2 Answer to Q1-c) *If the answer to Q1-b) is yes, will a UE incur MBS data loss while transitioning (under NG-RAN control) between RRC Connected state and RRC Inactive state in the middle of MBS data session? If yes, how long can the reception outage be*:**

* There may or may not be interruptions and data loss during state transition, depending on the solution to provide the PTM configuration and also network implementation.

**RAN2 answer to Q1 d) *Whether the existing QoS parameters of MBS QoS Flow(s) are enough or some additional parameter is needed for NG-RAN to differentiate different MBS session and UE, which can be used by NG-RAN to decide how to deliver the MBS data* and Q2 *SA2 would like to receive feedback on the value of such assistance information from RAN perspective*:**

* For the MBS session handling: the existing MBS session QoS parameters (e.g. ARP, 5QI) can be reused to differentiate different MBS sessions to decide whether the corresponding services can be provided to RRC\_INACTIVE UEs.
* For the case of differentiating different UEs: as the MBS session related QoS parameters are the same for different UEs within the same MBS session, the existing QoS parameters of MBS QoS Flow(s) cannot be used by NG-RAN to differentiate the handling for different UEs. FFS whether additional assistance information is needed, if the handling for different UEs needs to be differentiated which is up to SA2.

**RAN2 answer to Q3 *SA2 would like to ask if the UE radio capability provided directly from UE to NG-RAN will contain the information whether the UE supports Rel-18 MBS capability to receive multicast data in RRC\_INACTIVE state*:**

* Yes, the UE radio capability indicating support of multicast reception in RRC\_INACTIVE state can be reported to RAN, which is subject to the discussion of UE radio capability.

**RAN2 answer to Q4 *SA2 would like to clarify with RAN WGs whether the assumption that IDLE UE will need to transition to connected state to start receiving the MBS data and CN initiated group paging (as defined in Rel-17) is thus still required for such UEs*:**

* Yes, the UEs in RRC\_IDLE need to be transitioned to RRC\_CONNECTED state to start receiving the MBS data and thus the CN initiated group paging is still needed to be performed.

**RAN2 answer to Q5 *When MBS Session is activated and MBS data allowed to be received in RRC\_INACTIVE state, is it possible that the RRC\_INACTIVE UE receives MBS data without going back to RRC connected state? If possible, when the MBS session is being activated, how is the RRC\_INACTIVE UE notified. For group paging initiated for IDLE UEs, does RRC\_INACTIVE UE respond to such paging*:**

* It is possible that the RRC\_INACTIVE UE receives MBS data without going back to RRC\_CONNECTED state when the MBS session is being activated provided the UE has already joined the multicast session and the UE has valid MRB configuration. As a baseline, group paging can be used to inform the RRC\_INACTIVE UE(s) about the session activation. The details are still under discussion in RAN2.
* For group paging initiated for UEs in RRC\_IDLE state, per Rel-17 specification, the RRC\_INACTIVE UEs will also respond if they receive the corresponding paging message. However, for Rel-18, if the MBS session can be received in RRC\_INACTIVE state, the RRC\_INACTIVE UE need not go back to RRC\_CONNECTED state if the UE has already joined the multicast session and the UE has valid configuration. It is FFS how to avoid these UEs going back to RRC\_CONNECTED state when the CN group paging is received.

**RAN2 answer to Q6 *SA2 would like to confirm with RAN WGs the above assumption:*** ***Regarding the mobility within the RAN Notification Area (RNA), SA2 assumes the UE in RRC Inactive state should be able to continue receiving DL multicast MBS data within its RNA and the solution will be determined by RAN WGs as RRC\_INACTIVE mobility is under the remit of RAN WGs*:**

* RAN2 has made the following agreements: Multicast service continuity after cell reselection in RRC\_INACTIVE state (i.e. without resuming RRC connection) will be supported (if the configuration for the multicast session in the new cell is available for the UE). Upon cell reselection to neighbour cells during active multicast session, if the configuration of the session is not available for the new cell for UEs in RRC\_INACTIVE, then the UE is required to resume RRC connection to get the Multicast MRB configuration.

While some clear answers are provided, it is clear from the yellow highlights above that RAN groups are still discussing important aspects:

* Assistance information
* Mobility procedures of inactive UEs within the RNA
* Details of activation procedures

However, sufficient information is available in the interim conclusions and the RAN3 responses to achieve final conclusions in this meeting (that will need to document some RAN dependencies to be resolved during the normative work). For some aspects, in particular assistance information, it is suggested that SA2 decides on its own considering the system aspects.

# 2 Proposal

It is proposed to include the following changes in TR 23.700-47.

\*\*\* 1st Change \*\*\*

## 8.1 Key Issue #1: MBS session reception in RRC Inactive

Editor's note: Feedback from RAN WGs is required to conclude KI#1 for the issue which nee RAN input.

### 8.1.1 conclusions

The following conclusions are agreed for KI#1:

- It is possible to keep some UEs within the same MBS session in RRC\_CONNECTED and some in RRC\_INACTIVE state. NG-RAN nodes take the responsibility to determine (e.g. during congestion) which UE(s) within an MBS multicast session will be moved from CM-CONNECTED with RRC CONNECTED to CM-CONNECTED with RRC Inactive state and still receive MBS session data.

- The 5GC provides information about the MBS session as specified for Rel-17 and may provide additional assistance information to help NG-RAN to determine whether to apply delivery enabling reception by UEs in RRC\_Inactive state for an MBS session and which UE(s) to be moved to RRC Inactive state.

- The assistance information includes recommendations whether to enable delivery for reception in RRC\_Inactive state for an MBS session and information about UEs that should preferably be kept in RRC\_Connected state, i.e. the MBS session level and UE level assistance information, and may be provided by the AF to 5GC and then to NG-RAN.

- NG-RAN use the MBS session level and UE level assistance information as help for the decisions on whether to enable delivery for reception in RRC\_INACTIVE state for an MBS session and/or on which UEs to keep in RRC\_CONNECTED or. RRC\_INACTIVE state. How NG-RAN performs those decisions is up to NG-RAN implementation.

NOTE 1: How the NG-RAN handles the situation without assistance information for RRC Inactive multicast MBS data reception is to be determined by RAN WGs.

NOTE 2: What is defined in clause 5.3.3.2.5 of TS 23.501 [2] for "RRC Inactive Assistance Information" is sent by AMF to NG-RAN and may be used by NG-RAN together with any other MBS session level assistance information and UE level assistance information for deciding whether to send a UE to RRC Inactive state.

* For MBS session level assistance information for RAN to determine whether to apply delivery enabling reception by UEs in RRC\_Inactive state, the following applies:
* The AF provides the MBS session level assistance information to MB-SMF via the MBS session creation procedure.
* The MB-SMF provides the MBS session level assistance information to NG-RAN during the shared tunnel establishment procedure.
  + For UE level assistance information to help NG-RAN to determine which UE(s) to be moved to RRC Inactive state, the following applies.
* The UE level assistance information indicates UEs that are preferably kept in RRC Connected state and is provided by the AF, and received by the SMF(s) handling related UEs.
* The SMF(s) provide the received UE level assistance information to NG-RAN node as part of the PDU session information of related UEs in N2 SM Info sent to NG-RAN via AMF.

- When the MBS session is activated, the UEs in RRC Inactive state in cells, where the MBS session is delivered allowing RRC-inactive reception, should be able to remain in RRC Inactive state for receiving the MBS session data.

- For group paging, the network notifies which MBS session is to be activated.

- How NG-RAN notifies the UE that the MBS session is re-activated and whether the MBS session is allowed to be received in RRC-inactive state will be decided by RAN WGs.

- When the UE moves outside the RNA, the UE performs UE Triggered Connection Resume in RRC Inactive procedure to the target RAN node as per existing procedures in TS 23.502 [3].

- When the UE receives the MBS data in RRC Inactive state and move out of the RNA area but Connection resume fails, it follows existing procedures and transition to CM-IDLE. When the UE transition to CM-IDLE since is not able to receive the MBS multicast data at the new cell, the UE initiates the mobility registration update or Service Request procedure and activates the associated PDU session, so that the shared tunnel (if not already established) or the individual delivery can be established towards the NG-RAN node for multicast data delivery to the UE.

- When the UE moves outside the RA, the UE performs mobility registration procedure and as per the existing procedure in TS 23.501 [2] clause 5.3.3.2.5 for "Mobile initiated NAS signalling procedure" for UEs in CM-CONNECTED with RRC Inactive state, the UE will resume the RRC Connection.

- During the handover procedure, the SMF includes the "MBS assistance information for RRC Inactive" in N2 SM Info and sends to NG-RAN via AMF.

The following requirements, which need be supported by RAN WG, are concluded:

- Backward compatibility with Rel-17 UEs not supporting the RRC\_Inactive reception of MBS multicast data needs to be ensured.

- RAN WG2 define UE radio capability for MBS reception in RRC\_INACTIVE state.

- NG-RAN nodes decide for which MBS sessions to apply delivery enabling reception in RRC\_Inactive state. The NG RAN nodes handling RRC-Connected UE in an MBS multicast session also decides whether the UEs can transition to RRC\_Inactive state and may consider assistance information from the 5G core network for that decision. How NG-RAN performs those decisions is up to NG-RAN implementation.

- When the MBS session is activated, the UE in RRC Inactive state in cells where the MBS session is delivered in the delivery mode for RRC-inactive reception should be able to remain in RRC Inactive state for receiving the MBS session data.

- When the UE is in RRC Inactive state and moves within the RNA, it shall be able to continue receiving DL multicast MBS data unless it leaves the MBS service area.