**3GPP TSG-RAN WG2 Meeting #124R2*-*2313694**

**Chicago, USA, Nov. 13th – 17th, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **0732** | **rev** | **1** | **Current version:** | **17.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of eMBS in TS 38.300 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CMCC | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MBS\_enh-Core | | | | |  | ***Date:*** | | | 2023-11-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | This CR introduces the enhancements specified for support of MBS in Rel-18 | | | | | | | | |
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| ***Summary of change:*** | | Introduction of multicast reception for UEs in RRC\_INACTIVE state and shared processing for simultaneous reception of broadcast and unicast. | | | | | | | | |
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| ***Consequences if not approved:*** | | Rel-18 MBS enhancement is not supported in NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 16.10.4,16.10.5.1, 16.10.5.2, 16.10.5.3.X(new), 16.10.5.4, 16.10.5.6, 16.10.5.7, 16.10.6.X(new), 16.10.6.Y(new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.331 CR 4490  TS 38.321 CR 1701  TS 38.323 CR 0130  TS 38.304 CR 0355  TS 38.306 CR 1015 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*First Modified Subclause*

### 16.10.4 Group Scheduling

The following logical channels are used for MBS delivery:

- MTCH: A PTM downlink channel for transmitting MBS data of either multicast session or broadcast session from the network to the UE;

- DTCH: A PTP channel defined in clause 6.2.2 for transmitting MBS data of a multicast session from the network to the UE;

- MCCH: A PTM downlink channel used for transmitting MBS broadcast or MBS multicast control information associated to one or several MTCH(s) from the network to the UE. Broadcast MCCH and multicast MCCH are independent channels. The multicast MCCH is used only for multicast reception in RRC\_INACTIVE state.

The following connections between logical channels and transport channels for PTM transmission exist:

- MCCH can be mapped to DL-SCH;

- MTCH can be mapped to DL-SCH.

The following depicts the usage of RNTI for PTM transmission:

- A UE can receive different services using same or different G-RNTIs;

- A UE can receive different services using same or different G-CS-RNTIs.

*Next Modified Subclause*

### 16.10.5 Multicast Handling

#### 16.10.5.1 Session Management

There are two delivery modes as specified in TS 23.247 [45]:

- 5GC Shared MBS traffic delivery;

- 5GC Individual MBS traffic delivery.

As specified in TS 23.247 [45], if the gNB supports MBS, the network shall use the 5GC Shared MBS traffic delivery in which case an MBS Session Resource context for a multicast session is setup in the gNB when the first UE joins the multicast session.

For 5GC Shared MBS traffic delivery mode, shared NG-U resources are used to provide MBS user data to the gNB. The gNB initiates the Multicast Distribution Setup procedure towards the 5GC, to allocate shared NG-U resources for a multicast session. In case multiple MBS session areas as specified in TS 23.247 [45] are associated with the same multicast session for location dependent MBS services, multiple NG-U shared resources are established for the same multicast session per MBS Area Session ID served by the gNB.

A shared NG-U resource applies one of the following transport options:

- unicast transport;

- multicast transport.

For 5GC Shared MBS traffic delivery an MBS Session Resource comprises one or several MRBs. If minimisation of data loss is applied for a given MRB, synchronisation of allocation of PDCP COUNT values is applied by either or a combination of the following methods:

- derivation of the PDCP COUNT values by means of a DL MBS QFI Sequence Number provided on NG-U. Synchronisation in terms of MBS QoS flow to MRB mapping and PDCP SN size of the corresponding MRB among gNBs are achieved by means of network implementation.

- deployment of a Shared NG-U Termination at NG-RAN, shared among gNBs, which comprises a common entity for assignment of PDCP COUNT values. Synchronisation in terms of MBS QoS flow to MRB mapping and PDCP SN size of the corresponding MRB among gNBs may be achieved by means of network implementation.

If PDCP COUNT values are derived from a DL MBS QFI Sequence Number provided on NG-U and only one QoS Flow is mapped to an MRB, the gNB shall set the PDCP COUNT value of PDCP PDU to the value of the DL MBS QFI Sequence Number provided with the received packet over NG-U. If PDCP COUNT values are derived from a DL MBS QFI Sequence Number provided on NG-U and multiple QoS Flows are mapped to an MRB, the gNB may derive the PDCP COUNT value of the PDCP PDU from the sum of the DL MBS QFI Sequence Numbers of the QoS Flows mapped to this MRB.

NOTE: Synchronisation of PDCP COUNT values in case user data for MBS QoS flows mapped to the same MRB arrive over NG-U at different gNBs in different order or in case of loss of data over NG-U, and related handling of minimisation of data loss is left to implementation.

As specified in TS 23.247 [45], the gNB may receive from the 5GC MBS Assistance Information associated with a multicast MBS session for a UE, which assists the gNB in configuring the UE properly. The MBS Assistance Information indicates that the UE is expected to require dedicated resources very frequently. Based on this information, the gNB may decide the RRC state of the UE. The QoS requirements of the multicast session apply regardless of the RRC state within which the UE receives multicast session data.

*Next Modified Subclause*

#### 16.10.5.2 Configuration

A UE can be configured to receive data of MBS multicast session in RRC\_CONNECTED state or RRC\_INACTIVE state. To receive the multicast service, the UE needs to perform MBS Session Join procedure as specified in TS 23.247 [45]. It is up to gNB to decide whether the UE receives data of MBS multicast session in RRC\_CONNECTED state or RRC\_ INACTIVE state. The gNB moves the UE from RRC\_CONNECTED state to RRC\_INACTIVE state via *RRCRelease* message, and moves the UE from RRC\_INACTIVE state to RRC\_CONNECTED state via group notification or UE-specific paging.

If the UE which joined a multicast session is in RRC\_CONNECTED state and when the multicast session is activated, the gNB may send *RRCReconfiguration* message with relevant MBS configuration for the multicast session to the UE.

If the gNB configures the UE to receive the MBS multicast session in RRC\_INACTIVE state, the gNB may provide the PTM configuration via *RRCRelease* message for the MBS multicast session as well as information which multicast service(s) can be continued to be received in RRC\_INACTIVE state. The UE doesn’t suspend MRBs of the multicast session indicated to be continued to be received in RRC\_INACTIVE state. Multicast MCCH is used in case a cell supports updating PTM configuration or providing PTM configuration to UEs in RRC\_INACTIVE state moved from other cells. Otherwise, multicast MCCH can be optionally present.

A notification mechanism is used to announce the change of the multicast MCCH contents due to multicast session modification or session deactivation or due to neighbouring cell information modification. The scheduling information for multicast MCCH reception is provided via *SIBx* and optionally via *RRCRelease* message.

When there is temporarily no data to be sent to the UEs for a multicast session that is active, the gNB may move the UE to RRC\_INACTIVE state. When an MBS multicast session is deactivated, the gNB may move the UE in RRC\_CONNECTED state to RRC\_IDLE or RRC\_INACTIVE state. For UEs receiving data of MBS multicast session in RRC\_INACTIVE state, the gNB notifies the UE to stop monitoring PDCCH addressed by corresponding G-RNTI via *RRCRelease message* or multicast MCCH when there is temporarily no data to be sent or when the session is deactivated. gNBs supporting MBS use a group notification mechanism to notify the UEs in RRC\_IDLE or RRC\_INACTIVE state when a multicast session has been activated by the CN. gNBs supporting MBS use a group notification mechanism to notify the UEs in RRC\_INACTIVE state when the session is already activated and the gNB has multicast session data to deliver. If the UE receiving data of MBS multicast session in RRC\_INACTIVE state in a cell is notified to stop monitoring PDCCH addressed by G-RNTI for all the joined multicast sessions, the UE does not monitor PDCCH addressed by multicast-MCCH-RNTI until the group notification is received. Upon reception of the group notification, the UEs reconnect to the network or resume the connection and transition to RRC\_CONNECTED state from either RRC\_IDLE state or RRC\_INACTIVE state. Upon reception of the group notification that indicates to allow the multicast reception in RRC\_INACTIVE state, the UE stays in RRC\_INACTIVE state and behaves as specified in TS 38.331 [12]. If the UE is notified by both group notification and the UE-specific paging, the UE follows the UE-specific paging and goes to RRC\_CONNECTED state.

The group notification is addressed with P-RNTI on PDCCH, and the paging channels are monitored by the UE as described in clause 9.2.5. Paging message for group notification contains MBS session ID which is utilized to page all UEs in RRC\_IDLE and RRC\_INACTIVE states that joined the associated MBS multicast session, i.e., UEs are not paged individually. The UE stops monitoring for group notifications related to a specific multicast session, i.e., stops checking for the MBS session ID in the Paging message, when the UE enters RRC\_CONNECTED state. The UE does not monitor for group notifications for these cases, i.e., once this UE leaves this multicast session or the network requests the UE to leave, or the network releases the multicast session.

If the UE in RRC\_IDLE state that joined an MBS multicast session is camping on the gNB not supporting MBS, the UE may be notified about multicast session activation or data availability by CN-initiated paging where CN pages each UE individually, as described in clause 9.2.5. If the UE in RRC\_INACTIVE state that joined MBS multicast session is camping on the gNB not supporting MBS, the UE may be notified about data availability individually by RAN-initiated paging, as described in clause 9.2.5.

*Next Modified Subclause (new)*

##### 16.10.5.3.X Service Continuity in RRC\_INACTIVE

Mobility procedures for multicast reception allow the UE in RRC\_INACTIVE state to continue receiving MBS service(s) when changing cells without resuming RRC connection if the PTM configuration of the new cell can be acquired by the UE from the multicast MCCH after cell reselection. During an active MBS multicast session, the UE is required to resume RRC connection to get the PTM configuration if the PTM configuration is not provided on the multicast MCCH of the new cell. Even if the UE in RRC\_INACTIVE state received indication to stop monitoring PDCCH addressed by G-RNTI for an MBS multicast session in the source cell, the UE acquires MCCH in the reselected cell after cell reselection.

The gNB may indicate in the multicast MCCH the list of neighbour cells providing the same MBS multicast service(s) for UEs in RRC\_INACTIVE state as provided in the serving cell. This allows the UE, e.g., to resume RRC connection without reading *SIBx* and multicast MCCH of the neighbour cell, if the interested service which is activated is not available to the UE in RRC\_INACTIVE state.

The gNB may provide an indication on cell PDCP COUNT synchronization for an MBS session with PTM configuration in *RRCRelease* message. If indicated by the gNB, all cells within the RNA are synchronized in terms of PDCP COUNT value to the MRBs of the corresponding MBS service, and the order of MRBs within the list of multicast MRB configuration for the same MBS multicast session in the multicast MCCH message of the last serving cell and (re)selected cell within the RNA should be consistent. Upon reselection to a cell indicated as synchronized in terms of PDCP COUNT value, the UE doesn’t initialize the PDCP state variables. Otherwise, the UE initializes the PDCP state variables as defined in TS 38.323 [8].

The UE may be configured with dedicated frequency priorities in *RRCRelease* message which the UE applies during cell reselection while receiving data of MBS multicast session in RRC\_INACTIVE state.

The UE receiving multicast session(s) in RRC\_INACTIVE state triggers RRC connection resumption if the latest measured RSRP or RSRQ of the serving cell becomes lower than the threshold configured by the network. The threshold can be configured per MBS session via *RRCRelease* message or multicast MCCH.

*Next Modified Subclause*

#### 16.10.5.4 Reception of MBS Multicast data

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

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

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

If a UE is configured with both PTM and PTP transmissions, a gNB dynamically decides whether to deliver multicast data by PTM leg and/or PTP leg for a given UE based on the protocol stack defined in clause 16.10.3, based on information such as MBS Session QoS requirements, number of joined UEs, UE individual feedback on reception quality, and other criteria. The same QoS requirements apply regardless of the decision.

PTP transmission is not supported for MBS multicast session data reception for UEs in RRC\_INACTIVE state.

SPS is not supported for MBS multicast session data reception for UEs in RRC\_INACTIVE state.

*Next Modified Subclause*

16.10.5.6 DRX

The following DRX configurations for PTM/PTP transmission by RRC\_CONNECTED UEs are possible:

- For PTM transmission, multicast DRX is configured per G-RNTI/G-CS-RNTI which is independent of UE-specific DRX;

- For PTP transmission, UE-specific DRX is reused, i.e., UE-specific DRX is used for both unicast transmission and PTP transmission of MBS multicast. For PTM retransmission via PTP, UE monitors PDCCH scrambled by C-RNTI/CS-RNTI during UE-specific DRX's Active Time.

The following DRX configuration for PTM transmission by RRC\_INACTIVE UEs is possible:

- For PTM transmission, multicast DRX is configured per G-RNTI.

*Next Modified Subclause*

#### 16.10.5.7 Physical Layer

A CFR configured by *RRCReconfiguration* message is defined for multicast scheduling as an 'MBS frequency region' with a number of contiguous PRBs confined within and with the same numerology as the DL BWP, and multicast scheduling may have specific characteristics (e.g., PDCCH, PDSCH and SPS configurations). The CFR for the multicast reception in RRC\_INACTIVE state and the CFR for broadcast can be configured differently. If one CFR is not completely contained within the other CFR, the UE in RRC\_INACTIVE state is not required to receive both broadcast and multicast simultaneously.

Two HARQ-ACK reporting modes are defined for MBS:

- For the first HARQ-ACK reporting mode, the UE generates HARQ-ACK information with ACK value when a UE correctly decodes a transport block or detects a DCI format indicating an SPS PDSCH release; otherwise, the UE generates HARQ-ACK information with NACK value.

- For the second HARQ-ACK reporting mode, the UE does not transmit a PUCCH that would include only HARQ-ACK information with ACK values.

HARQ-ACK feedback for multicast can be enabled or disabled by higher layer configuration per G-RNTI or per G-CS-RNTI and/or indication in the DCI scheduling multicast transmission.

HARQ feedback is not supported for MBS multicast session data reception for UEs in RRC\_INACTIVE state.

*Next Modified Subclause (new)*

#### 16.10.6.X Shared processing for MBS broadcast and unicast reception

If the UE in RRC\_CONNECTED state is receiving or interested to receive an MBS broadcast service from a non-serving cell as described in TS 38.306 [11] , the UE may use MBS Interest Indication message to inform the serving gNB about the parameters used for the non-serving cell broadcast reception as described in TS 38.331 [12]. The gNB may enable the sending of the MBS Interest Indication by including an indication in SIB1. The UE may indicate to the serving cell the UE capability for receiving MBS broadcast service from a non-serving cell. It is up to gNB implementation to consider the MBS Interest Indication and the UE capability for receiving MBS broadcast service from a non-serving cell, if indicated, when scheduling the UE.

In case the UE only reports the frequency for broadcast service reception from the non-serving cell in MBS Interest Indication due to some parameters (e.g., SCS, bandwidth) not being available, the UE may transmit updated MBS Interest Indication once the parameters are available to the UE. It is up to network implementation on how to enable the UE to acquire these parameters from the non-serving cell.

*Next Modified Subclause (new)*

16.10.6.Y Support of Resource Sharing across multiple Broadcast MBS sessions in RAN Sharing Scenario

NGAP supports resource sharing efficient scheme for broadcast delivery in RAN sharing. Such scheme enables the gNB to identify broadcast MBS sessions from different PLMNs providing identical content. The identification is based on information provided by the involved 5GCs in the Associated Session ID as specified in TS 23.247 [x].

If in the MBS Broadcast Setup Request message an Associated Session ID is received from a 5GC participating in RAN sharing, the gNB uses it to determine whether MBS Session resources can be shared with a broadcast MBS session(s) associated with the same Associated Session ID requested from another 5GC participating in RAN sharing.

The identification of MBS Broadcast Sessions providing identical content may also be based on implementation specific configuration as specified in TS 23.247 [45].

The gNB applying this resource efficiency scheme:

- may decide whether NG-U resources are established towards all involved 5GCs or only some of them.

- resolves different QoS requirements or different S-NSSAIs received from the participating 5GCs in an implementation specific way.

The gNB may also trigger the NGAP Broadcast Session Transport procedure towards one 5GC participating in RAN sharing to set up NG-U resources to maintain NG-U connectivity as specified in TS 23.247 [45].

End of Changes