**3GPP TSG-SA2 Meeting # 148E** **(e-meeting) *S2-2108680r07***

**Elbonia, November 15 – 19, 2021 (revision of S2-2108014)**

|  |
| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.247** | **CR** | **0021** | **rev** | **2** | **Current version:** | **17.0.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

|  |
| --- |
|  |
| ***Title:***  | Clarification of the local MBS service |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, [LG Electronics], Nokia, Nokia Shanghai-Bell, [Samsung, ZTE,vivo] |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5MBS  |  | ***Date:*** | 2021-10-11 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-17 |
|  | *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 canbe 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | 1. For location dependent MBS session, the SMF get the MB-SMF profile include all related area session ID and MBS service area it support. Similar the UE also get the whole MBS servcie area for the MBS session based on the service announcment. However for the UE joining procedure only one area session ID and its related MBS service area need be included and sent to NG-RAN node. It is not need to send other Area Session ID and MBS service Area to the NG-RAN. Thus some unnecessary plural description need be removed.
2. To support the individual delivery, the SMF need subscribe the UE mobility event from AMF.
3. For the location dependent MBS session, the Area Session ID and MBS service area are also need be registered to NRF. So it is unsuitable to assume if the MBS session ID is TMGI, the registration can be skipped.
4. Add new clause about the local MBS session activation and termination of the local MBS session.
5. For the broadcast MBS service, there are no SMF need be involved. So the NOTE about the MB-SMF need be same for the one SMF service area is unclear on how these two are related.

Clause 6.2 (for local MBS service and location dependent service) is the high-level feature description. However, some description is quite procedure oriented, e.g. how to determine a joined UE is IN or OUT of an MBS service area, what service operations are more for procedures, how the NG-RAN behave. It’s proposed to move the details to the procedures.How to determine UE’s presence in an MBS service area is common for multiple procedures related to multicast MBS, and it is proposed to introduce a new sub-clause to describe the system behavior.1. In clause 7.2.4.2.2 (see below), the following text “*for the UE”* is incorrect and it isproposed to say “…*procedure is performed as defined…*.”

For local MBS, the configuration procedure **for the UE** is optional and performed as defined in clause 7.1.1.2 with the following additionsRev 2: 1. Clause 6.2.1 the subscription also applies to the shared delivery to let the SMF be aware that the UE need be removed from the MBS session.
2. Adrress the Editor’s Note related to mobility procedure, which is also analized in S2-2108679. .
3. Add two new clause related to the UE is removed from the MBS session.
4. Add a new clause related to the Inactivate MBS session state mobility handling.

All the change introduced in the Rev2 are in yellow highlight in the change part or clause title(If whole clause change is new). |
|  |  |
| ***Summary of change:*** | 1. Remove unnecessary plural description
2. Add the UE mobility event subscritption description
3. Remove the MB-SMF can skip the registration part description.
4. Add new clause about the local MBS session activation and termination of the local MBS session.
5. Remove unclear NOTE description.

Rev 2: 1. Clause 6.2.1 the subscription also applies to the shared delivery to let the SMF be aware that the UE need be removed from the MBS session.
2. Adrress the Editor’s Note related to mobility procedure.
3. Add two new clause related to the UE is removed from the MBS session.
4. *Add* a new clause related to the Inactivate MBS session state mobility handling.
 |
|  |  |
| ***Consequences if not approved:*** | Local MBS for individual delivery will not be supported for the Activtion, procedure. |
|  |  |
| ***Clauses affected:*** | 6.2.1, 6.2.2, 6.2.3, 7.2.4.1, 7.2.4.2.1, 7.2.4.2.2, 7.2.4.2.3, 7.2.4.2.4, 7.2.4.2.5, 7.2.4.3.1, 7.2.4.3.2, 7.2.4.3.3, 7.2.4.3.4, 7.2.4.3.5, 7.2.4.x, 7.3.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ... |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* \* 1st change \* \* \* \*

## 6.2 Local MBS service and Location dependent MBS service

### 6.2.1 General

A Local MBS service is an MBS service provided in one MBS service area. A location dependent MBS service is an MBS service provided in several MBS service area(s). An MBS service area is identified by a cell list or a tracking area list. The MBS service area could be geographical area information or civic address information, and NEF/MBSF translates the location information to Cell ID list or TAI list as MBS service area, see clause 7.1.1.2.

The MBS service area may be updated by the AF for both multicast MBS Session and broadcast MBS Session as specified in clause 7.1.1.6.

.

### 6.2.2 Local MBS service

For a local MBS service, only UEs within the MBS service area may receive content data, while UEs outside the MBS service area are not allowed to receive location specific content. For multicast MBS service, UEs outside the MBS service area are not allowed to join the MBS service, and the network shall not deliver location specific content anymore to the UEs moved out of the MBS service area. Depending on policy, for the multicast MBS service the network may remove UEs outside the MBS service area of the MBS session from the MBS session context after a grace period ). The SMF may subscribe at the AMF to notifications about UE moving in or out of a subscribed "Area Of Interest"" event.

For multicast communication, local MBS may be supported via 5GC Individual MBS traffic delivery towards RAN nodes not supporting MBS. If the SMF obtains a notification that the UE is no longer in the MBS service area, the SMF terminates the 5GC Individual MBS traffic delivery towards the UE.

The UE shall be able to obtain service area information of the local multicast service via MBS service announcement or via NAS signalling (UE Session Join Accept/Reject including Cell ID list or TAI list). If the UE Session Join procedure fails due to the UE being outside the MBS service area, the UE does not attempt to join the multicast session again until the UE moves inside the MBS service area. When the UE Session Join succeeds and if the multicast session is deactivated, the UE does not perform monitoring the session activation notification and any other information related to the multicast session identified by an MBS Session ID over the radio if outside the MBS service area.

NOTE: Broadcast communication service is the service provided simultaneously to all UEs in a geographical area, therefore for broadcast it is naturally a local MBS service.

### 6.2.3 Location dependent MBS service

A location dependent MBS is identified by MBS Session ID, and provided in several MBS service areas. The location dependent MBS service enables distribution of different content data to different MBS service areas. The same MBS Session ID is used but a different Area Session ID is used for each MBS service area. The Area Session ID is used, in combination with MBS Session ID, to uniquely identify the service area specific part of the content data of the MBS service within 5GS. The network supports the location-dependent content distribution for the location dependent MBS services, while UEs are only aware of the MBS Session ID (i.e. UEs are not required to be aware of the Area Session IDs). When UE moves to a new MBS service area, content data from the new MBS service area shall be delivered to the UE, and the network ceases to deliver the content data from the old MBS service areas to the UE. For multicast MBS service, UEs outside the combined MBS service area (consisting of the area covered by all MBS service areas of the location dependent MBS service) are not allowed to join the MBS service. When UE moves out of an MBS service area and there is no other MBS service area for the MBS session, the network ceases to deliver the content data to the UE. Depending on policy, for the multicast MBS service the network may remove UEs outside the combined MBS service area of the MBS Session from the multicast MBS session context after a grace period The SMF may subscribe at the AMF to notifications about UE moving in or out of the combinedMBS service area of the location dependent MBS session.

For multicast communication towards an NG-RAN supporting MBS, the NG-RAN node handles mobility of UEs within the MBS session between MBS service areas served by the same NG-RAN autonomously .

For multicast communication, location dependent MBS services may be supported via 5GC Individual MBS traffic delivery towards RAN nodes not supporting MBS.. If the SMF determines that the UE is in another MBS service area of the multicast session, the SMF configures the UPF to send multicast data relating to the new MBS service area towards the UE..

Information about different MBS service areas for a location dependent MBS service may be provided by one or several AFs or may be configured. Different ingress points for location dependent points for the MBS session are supported for different MBS service area dependent content of the MBS session; different MB-SMFs and/or MB-UPF may be assigned for different MBS service areas in an MBS session. When the different MB-SMFs are assigned for different MBS service areas in an MBS session, the same TMGI is allocated for this MBS session.

The Area Session ID is allocated by MB-SMF in MBS Session configuration procedure. MB-SMF allocates Area Session ID for each MBS services area which is unique within the MBS session. MB-SMF needs to further ensure there is no MBS service area overlapping with other MBS service areas that share the same MBS session ID.

NOTE 1: In this release, deployments topologies with specific SMF Service Areas are not supported, as a result, location dependent service using multicast communication is not supported when a UE moves outside its SMF service area.

NOTE 2: For location dependent service provided in different MBS service areas within the same SMF service area, it is assumed that one MB-SMF is used for an MBS Session.

NOTE 3: An example of Location-dependent MBS is a nationwide weather forecast service with local weather reports.

NOTE 4: Area Session ID is equivalent to Flow ID as specified in TS 23.246 [8].

\* \* \* \* Next change \* \* \* \*

### 7.2.4 Support of Local multicast service and Location dependent multicast service

#### 7.2.4.1 General

The clause captures the procedural enhancement to supportLocation-dependent MBS service and the Local MBS service described in clause 6.2.

#### 7.2.4.2 Support of location-dependent multicast service

##### 7.2.4.2.1 UE join location dependent multicast session and establishment procedure

The location dependent multicast session join and establishment procedure is performed as defined in clause 7.2.1 with the following additions:

- The location dependent multicast session is configured as described in clause 7.2.4.2.2.

- The UE may have information about the location dependent multicast service including the combined MBS service areas of the location dependent MBS service.

- If the UE determines that it is in the combined MBS service area based on the information about local multicast service e.g. obtained via Service Announcement, the UE sends Join Request to join the multicast group. If the UE determines that it is outside the combined MBS service area, the UE does not send the Join Request.

- If SMF has no information about the multicast MBS session context for the indicated MBS Session ID, the SMF requests MB-SMF information via Nnrf\_NFDiscovery\_Request Request (MBS Session ID, UE location), the NRF provides information about the MB-SMF(s) serving the multicast session at the indicated location and service areas and service area IDs for the multicast session, via Nnrf\_NFDiscovery\_Request Response (MB-SMF profile (Area Session ID(s), MBS service area(s)). The SMF selects the MB-SMF based on the location area where the UE is residing and interacts with MB-SMF to retrieve QoS information of the multicast QoS flow(s) for the MBS Session ID.

- The SMF check whether the UE is inside the combined MBS service area(s) of the MBS session (consisting of all MBS service areas of the MBS session) by comparing the User Location Information of the UE with the MBS service areas received from the MB-SMF. If the UE is out of the combined MBS service area, the SMF reject the multicast session join request.

Editor´s note: How the AMF provides the ULI information to the SMF is FFS.

- If the Join Request from the UE is accepted, the SMF subscribes at the AMF using the Namf\_EventExposure service to notifications about the "UE moving in or out of a subscribed "Area Of Interest"" event. The SMF supplies the combined MBS service area (consisting of all the MBS service areas) of the location-dependent MBS session as Area Of Interest.

- The SMF requests the AMF to transfer an N2 message to the RAN node using the Nsmf\_PDUSession\_UpdateSMContext response, to provide the NG-RAN with multicast session information which additionally includes the Area Session ID and MBS service areaassociated with the cell where UE camps. .

- If the NG-RAN node supports MBS, the NG-RAN uses the received MBS Session ID and Area Session ID to determine the local multicast session context and whether the user plane for the local multicast session is already established. If the target RAN determines the shared delivery is not established for the MBS session ID and area session ID, the target NG-RAN initiates the shared delivery establishment as specified in clause 7.2.1.4. The MB-SMF provides MBS service area information (Area session ID(s), MBS service area(s)) associated with the same MBS session to NG-RAN in the shared delivery establishment response.

Editor´s note: It is FFS whether the MB-SMF provides only the service areas associated with the target RAN node or all service areas associated with the MBS session in the shared delivery establishment response message.

.

- If the NG-RAN node serving the UE does not support MBS and UE is in the MBS service area, the SMF may apply individual delivery towards the UE. The SMF configures the UPF to send data related to the multicast session and service area via individual delivery within a PDU session of the UE. The SMF additionally subscribes at the AMF using the Namf\_EventExposure service to notifications about UE location changes (e.g. for a small MBS service area), or to notifications about the "UE moving in or out of a subscribed "Area Of Interest"" event. In the later case the SMF supplies the service area associated with the multicast session where the UE resides as Area Of Interest.

Editor’s note: SMF subscribing to the AMF even “Area Of Interest” is described repeatedly, clean up is needed in future meeting.

##### 7.2.4.2.2 Configuration for location-dependent MBS

For location-dependent MBS, the configuration procedure is performed as defined in clause 7.1.1.2 with the following additions:

- Multiple AFs may start the same multicast session with different content in different MBS service areas. The NEF selects MB-SMF as ingress control node(s) for different MBS service areas.

- If presented, the NEF maps possible external identifiers for MBS service areas to network-internal identifiers (e.g. list of cells, TAIs).

- MB-SMF allocates Area Session ID, and updates its NF profile towards the NRF with the MBS Session ID, MBS service area and Area Session ID.

NOTE: For a location dependent service provided in different MBS service areas within the same SMF service area, it is assumed that one MB-SMF is used for an MBS Session.

- The policy of Multicast session is determined based on the service requirements per MBSSession.MB-SMF associate the same service requirement QoS flow in different Area Session with the same QFI.

- The MB-SMF may select the MB-UPF based on the MBS service area.

- The combined MBS service area(s) for the MBS session are indicated to the UE in the Service Announcement as defined in clause 6.11.

##### 7.2.4.2.3 Handover procedure

Editor’s note: The RAN specific behavior in this clause requires RAN collaboration and confirmation.

Editor’s note: Whether SMF need to send MBS service are to NG-RAN is FFS.

Editor’s note: SMF subscring/unsubscribing to AMF event AOI is repeatedly described and need cleaup

The Handover procedure for the UE is performed as defined in clause 7.2.3.2, 7.2.3.3, and 7.2.3.4 with the following additions:

-

- If the UE is camping at Source RAN and receiving multicast data corresponding to the MBS Session ID and Area Session ID via the 5GC Shared MBS traffic delivery before the handover, for the Xn Handover (comparing with the clause 7.2.3.2), the following applies:

- The Source RAN node includes MBS Session ID, Area Session ID and MBS service area where the UE resides to the Target RAN node.

NOTE 1: During the handover procedure the associated QoS flow is established towards a NG RAN node not supporting MBS regardless whether the UE is still in the MBS service area associated with the original area session ID or not

- If the UE is camping at Source RAN and receiving multicast data corresponding to the MBS Session ID and Area Session ID via the 5GC Shared MBS traffic delivery before the handover, for the N2 Handover (comparing with the clause 7.2.3.2), the following applies:

- The source RAN node includes MBS session area information (MBS Session ID, Area Session ID and MBS service area where the UE resides) to the Target RAN node in Handover Required message.

- The SMF forwards the transparent information and may also include MBS session area information (MBS Session ID, Area Session ID and MBS service area) to the Target RAN in Handover request.

NOTE 2: The SMF cannot determine the UE location and a possible new service area at this stage...

* If the UE is camping at Source RAN and receiving multicast data corresponding to the MBS Session ID and Area Session ID via the 5GC Individual MBS traffic delivery before the Handover, for the Xn/N2 handover procedure (comparing with the clause 7.2.3.4), the following applies:

NOTE 3: During the Xn handover procedure, the associated QoS flow is established at Target RAN side regardless whether the UE is still in the MBS service area associated with the original area session ID or not.

* For the N2 handover procedure, the SMF includes MBS session area information (MBS Session ID, Area Session ID, and MBS service area) associated with the last known service area of the UE in N2 SM information to the Target RAN node in Handover Request message.

- If the Target RAN node support MBS, it determines whether to establish the resources for multicast distribution for the received MBS Session ID and Area Session ID, based on MBS Session ID, Area Session ID, MBS service area, and based on the location of the UE. If UE is not in the MBS service area provided by the source RAN (if source RAN support MBS) or SMF (if source RAN not support MBS), the Target RAN does not allocate RAN resources for the multicast MBS Session to the UE.

 - If the target RAN node support MBS, when it determines the shared delivery is not established for the multicast session ID and area session ID, the target NG-RAN initiates the shared delivery establishment as specified in clause 7.2.1.4. The MB-SMF provides MBS session area information (Area session ID(s), MBS service area(s)) associated with the MBS session to the NG-RAN in the shared delivery establishment reply.

Editor´s note: It is FFS whether the MB-SMF provides only the service areas associated with the target RAN node or all service areas associated with the MBS session in the shared delivery establishment response message.

NOTE 4: If the target RAN does not support MBS, the associated QoS flow is established at target RAN side during the handover procedure regardless whether the UE is still in the MBS service area associated with the original area session ID or not.

* If the target RAN supports MBS, but the Source RAN did not support MBS, the SMF configures the UPF to stop sending data related to the multicast session and service area via unicast delivery within a PDU session of the UE. The SMF unsubscribes at the AMF using the Namf\_EventExposure service to notifications about UE location changes, or to notifications about the "UE moving in or out of a subscribed "Area Of Interest"" event (for an individual service area).

NOTE 4: If the UE is still in the MBS session, the subscription for the UE entering or leaving the complete service area does not need to be changed

* When the AMF receives the User Location Information from target RAN node via the the Path Switch Request message or Handover Notify message, the AMF provide it to the SMF. When the SMF get the User Location Information, the SMF checks the MBS service area of the UE camping cell by comparing the User Location Information received received from AMF with the MBS service areas received from the MB-SMF. The SMF uses the determined service area and user location as follows:
* The SMF updates the area session ID in the locally stored the UE MBS session context with the corresponding area session ID if the area session ID is changed.
* If the target RAN does not support MBS, the Source RAN supported MBS, and the UE is in a service area of the MBS session, the SMF applies individual delivery towards the UE. The SMF configures the UPF to send data related to the multicast session and service area via unicast delivery within a PDU session of the UE. The SMF additionally subscribes at the AMF using the Namf\_EventExposure service to notifications about UE location changes, or to notifications about the "UE moving in or out of a subscribed "Area Of Interest"" event. In the later case the SMF supplies the service area of the multicast session as Area Of Interest. If associated QoS flows are not yet included in the PDU session, the SMF updates the PDU session with associated QoS flows.
* If the UE has moved toanother MBS service area of the MBS session,
* If the target NG-RAN node support MBS and RAN resource has not been allocated, the SMF provides the MBS session information related to the new Area session ID to NG-RAN. For Xn handover, the SMF uses the Path Switch reply message. For N2 handover, the SMF updates the PDU session after the completion of the handover procedure. Per the received the MBS session information, the 5GC shared delivery is established.
* If the target NG-RAN node does not support MBS, the SMF updates the UPF to forward the MBS data packet from the tunnel associated with the old Area session ID to the new Area session ID. If the SMF did not configure the UPF to receive the MBS data packet from the tunnel associated with the new Area session ID before, the SMF informs the MB-SMF of the new Area session ID and UPF DL N19mb Tunnel information. MB-SMF configure the MB-UPF to transmit the multicast session data towards UPF using the received downlink tunnel ID. If the SMF subscribed to the "Area Of Interest" event, the SMF also updates the subscription with the new service area as "area of interest".
* If the UE has moved out of all theMBS service areas of the MBS session,
* If the target NG-RAN node does not support MBS, the SMF deletes the associated QoS flow from NG-RAN and UPF after the completion of the handover.
* Per operator’s policy (e.g. when a local configured timer expires since the UE left the whole MBS service area), the SMF may remove the UE from the MBS session as defined in clause 7.2.4.2.7.

\* \* \* \* Next change \* \* \* \*

##### 7.2.4.2.4 Activation of location dependent MBS session

When the location dependent MBS session is activated, the MBS session is activated in the whole MBS service area of the MBS session. It is not supported that the same MBS session is in active state in one MBS service area but in inactive state in another MBS service area.

For the location dependent MBS session activation, the differences comparing to the procedure defined in clause 7.2.5.2 are as below.

* The SMF invokes Namf\_MT\_EnableGroupReachability service operation to AMF, which includes the whole MBS service area associated with the MBS session, i.e. the sum of all MBS service area associated with the MBS session ID regardless of the Area session ID.
* For the UE in CM-IDLE state, when the AMF triggers the paging, it take the receiving MBS service area information into account. Only the NG-RAN node which is included in the MBS service area need trigger the paging.
* SMF checks whether the UE is in or out of the MBS service area based on the change notification or UE location information included in Nsmf\_PDUSession\_UpdateSMContext Request or Namf\_MT\_UEReachabilityInfoNotify message. Based on that information, the SMF determines how to activate the MBS session same as the handling defined in clause 7.2.4.2.3
* When the SMF provides the MBS session information to the NG-RAN nodes, it includes the MBS service area, and Area Session ID, in the N2 SM information.
* \* \* \* \* Next change \* \* \* \*

7.2.4.2.5 UE location change handling within the same NG-RAN node between cells belonging to different MBS service areas during Individual delivery

For multicast communication, location dependent MBS services may be supported via 5GC Individual MBS traffic delivery towards RAN nodes not supporting MBS. The SMF additionally subscribes at the AMF to notifications about the "UE location"(e.g. for a small MBS service area) or UE moving in or out of a subscribed "Area Of Interest" event (with a a single service area as area of interest) using the Namf\_EventExposure service. If the SMF obtains a notification about the UE location, it checks whether the UE is still in the MBS service area of the multicast session. If the UE is no longer in the current MBS service area, the SMF determines whether the UE is in another MBS service area of the multicast session; If so, the SMF configures the UPF to send multicast data relating to the new MBS service area towards the UE. If the SMF terminates the 5GC Individual MBS traffic delivery towards the UE, it unsubscribes at the AMF from the notifications about the UE location or "UE moving in or out of a subscribed "Area Of Interest" event using the Namf\_EventExposure service.

If UE has moved out of the MBS service area corresponding to the original Area Session ID, the SMF checks whether UE is in MBS service area corresponding to a new Area Session ID within the same MBS session.

* For the case UE is out of the original MBS service area but in another MBS service area of the MBS session,
* If the RAN node does not support MBS, the SMF updates the UPF to forward the MBS data packet from the tunnel associated with the old Area session ID to the new Area session ID. If the SMF does not configure the UPF receiving the MBS data packet from the tunnel associated with the new Area session ID before, the SMF informes the MB-SMF of the new Area session ID and UPF DL N19mb Tunnel information. The MB-SMF configure the MB-UPF to transmit the multicast session data towards UPF using the received downlink tunnel ID.
* The SMF updates the AMF of the area of interest event subscription by supplying the new MBS service area as Area Of Interest.
* For the case UE is out of all the MBS service areas of the MBS session,
* If RAN node does not support MBS, the SMF delete the associated QoS flow from NG-RAN and UPF.
* Per operator’s policy (e.g. when a local configured timer expires since the UE left the whole MBS service area), the SMF may remove the UE from the MBS session as defined in clause 7.2.2.3
* For the case UE comes back to the MBS service area of the multicast MBS session after moving out of the whole MBS service area of the multicast MBS session before,
* If the UE is still in the multicast MBS session adds the associated QoS flow from NG-RAN and UPF.

Besides the condition as defined in clause 7.2.2.3, per operator's policy (e.g. when a local configured timer expires since the UE left the whole MBS service area) the SMF may remove the UE from the location dependent MBS session if the UE is out of the whole service area of the MBS session. When the UE is removed from the location dependent MBS session, the SMF also unsubscribes to the AMF from the notifications about the "UE moving in or out of a subscribed Area Of Interest" event.

7.2.4.3.6 UE location change handling by SMF for shared delivery

SMF checks whether the new UE location is inside or outside the combined MBS service area of the MBS session.

* For the case UE is out of the combined MBS service area of the MBS session,
* If RAN node does not support MBS, the SMF delete the associated QoS flow from the RAN node and the UPF.
* Per operator’s policy (e.g. when a local configured timer expires since the UE left the whole MBS service area of the MBS session) the SMF may remove the UE from the multicast MBS session as defined in clause 7.2.2.3.
* For the case UE comes back to the combined MBS service area of the multicast MBS session after moving out of the MBS service area of the multicast MBS session before,
* If the UE is still in the multicast MBS session and the multicast MBS session is in the "Active" state, the SMF tries to activate the multicast MBS session towards the UE.

Besides the condition as defined in clause 7.2.2.3, per operator's policy (e.g. when a local configured timer expires since the UE left the MBS service area) the SMF may remove the UE from the limited areaMBS session if the UE is out of the service area of the MBS session. When the UE is removed from the limited area MBS session, the SMF also unsubscribes to the AMF from the notifications about the "UE moving in or out of a subscribed Area Of Interest" event.

\* \* \* \* Next change \* \* \* \*

7.2.4.2.7 UE mobility within the same NG-RAN between cells belonging to different MBS service areas

Editor’s Note: How UE mobility within the same NG-RAN between cells belonging to different MBS service areas is handled may need further clarification if needed.

The RAN node handles content switching due to mobility between service areas it serves autonomously. If the first UE enters a new location area the RAN node requests shared delivery from the MB-SMF for the corresponding area session ID. If the last UE leaves a location area the RAN node requests the termination of shared delivery from the MB-SMF for the corresponding area session ID.

UE mobility can happen within the same NG-RAN between cells in or out of the copmbined MBS service area,

- the NG-RAN detects whether the UE is IN or OUT of the combined MBS service area, the NG-RAN notifies the SMF

- Location reporting control procedure is required so that NG-RAN can report whether the UE is IN or OUT of the combined MBS service area. When the SMF knows the UE is IN or OUT of the combined MBS service area, the SMF beahaves as in clause 7.2.4.2.6.

\* \* \* \* Next change \* \* \* \*

\* \* \* \* Next change \* \* \* \*

##### 7.2.4.2.7 SMF removing joined UEs from location dependent MBS session

Editor’s note: Whether this clause is needed need further check. The conditions for UE leave or network requested leave should be clarified in 7.2.4, e.g. due to UE mobility. 7.2.2.3 can be reference for the actual leave procedure.

Besides the condition as defined in clause 7.2.2.3, per operator's policy (e.g. when a local configured timer expires since the UE left the whole MBS service area) the SMF may remove the UE from the location dependent MBS session if the UE is out of the whole service area of the MBS session. When the UE is removed from the location dependent MBS session, the SMF also unsubscribes to the AMF from the notifications about the "UE moving in or out of a subscribed Area Of Interest" event related to that MBS session.

\* \* \* \* Next change \* \* \* \*

#### 7.2.4.3 Support of multicast service available within a limited area

##### 7.2.4.3.1 Local MBS service area information provided by AF

For local multicast services, the MBS service area information is provided to the UE and the 5GC as specified in clauses 7.1.1.2 and 7.1.1.3 with the following differences and clarifications:

- For the Service Announcement, MBS service area information is included unless it is preconfigured.

- When performing the MBS session request to the 5GC, the MBS service area information for a multicast session is provided by the AF unless it is preconfigured.

##### 7.2.4.3.2 Multicast session join and session establishment procedure for multicast service available within a limited area

For the case that the multicast service is only available within a limited area, the UEs outside the MBS service area are not allowed to join the multicast service.

The multicast session join and session establishment for multicast service available within a limited area are performed as specified in clause 7.2.1.3 with the following differences and clarifications:

- The local multicast session has been configured where the AF provided the MBS service area information as specified in clause 7.2.4.3.1.

- The UE may have information about local multicast service including MBS service area and local MBS service indication via Service Announcement as specified in clause 7.2.4.3.1.

- In step 1, if the UE determines that it is in the MBS service area based on the information about local multicast service e.g. obtained via Service Announcement, the UE sends the PDU Session Modification Request (MBS Session ID) as a Join Request to join the multicast group. If the UE determines that it is outside the MBS service area, the UE does not send the Join Request.

Editor´s note: How the AMF provides the ULI information to the SMF is FFS.

- In step 4, the SMF obtains the MBS service area (i.e. Cell ID list or TAI list) of the indicated MBS session from the MB-SMF, and the SMF determines the indicated MBS session corresponds to local multicast service based on the MBS service area.

- In step 5, the SMF checks whether the UE is inside or outside the MBS service area.

- The SMF determines whether the UE is inside the MBS service area by comparing the User Location Information of the UE received together with the join request with the MBS service area received from the MB-SMF.

- If the SMF detects that the UE is inside the MBS service area, the SMF continues the process of multicast session join as specified in clause 7.2.1.3 with the following additions:

- The SMF sends the UE a PDU Session Modification Command indicating a Join Accept as a response to the Join Request. The Joint Accept includes the MBS service area (i.e. Cell ID list or TAI list).

- The multicast session information sent by the SMF to the NG-RAN includes the MBS service area (i.e. Cell ID list or TAI list).

- If the RAN node serving the UE does not support MBS the SMF applies individual delivery towards the UE. The SMF configures the UPF to send data related to the multicast session via individual delivery within a PDU session of the UE.

- If the SMF detects that the UE is outside the MBS service area, the SMF rejects the multicast session join, so sends a Join Reject to the UE indicating that the MBS join is rejected. The Joint Reject includes the reject reason (outside of local service area) and the MBS service area (i.e. Cell ID list or TAI list).

 In this case, the MBS Session establishment (i.e. resources establishment for MBS traffic delivery) for the UE is not performed.

NOTE 1: There may be the case that the UE determines that it is inside the MBS service area based on the geographical area information or civic address information as MBS service area information provided by the AF, so sends a Join Request but the UE is outside the MBS service area.

NOTE 2: Which SM NAS message is used to deliver the Join Reject (e.g. PDU Session Modification Reject) is defined in stage 3 specifications.

- If the Join Request from the UE is accepted, the SMF subscribes to the UE mobility event notification from the AMF (e.g. UE moving into or out of Area Of Interest, which is set by MBS service area), by invoking Namf\_EventExposure\_Subscribe service operation as specified in clause 5.2.2.3.2 of TS 23.502 [6]. The SMF supplies the service area associated with the multicast session as Area Of Interest.

- For the UE that received the Join Reject from the SMF, later, if the UE detects that it is inside the MBS service area based on the MBS service area provided in the Join Reject, the UE sends the PDU Session Modification Request (MBS Session ID) to join the multicast group.

##### 7.2.4.3.3 Handover procedure with limited area MBS session

The Handover procedure for the UE is performed as defined in clause 7.2.3 with the following additions:

- If the UE is camping at the Source RAN node and receiving multicast data corresponding to the MBS Session ID via the 5GC Shared MBS traffic delivery before the Handover, for Xn based handover in clause 7.2.3.2, the Source RAN node includes MBS Session ID and MBS service area to the Target RAN node during Handover Preparation phase. For N2 based handover in clause 7.2.3.3, this step corresponds to Handover Request and Handover Required message, respectively.

NOTE 1: During the Xn or N2 handover procedures, if the target RAN node does not support MBS, the associated QoS flow is established at the Target RAN side regardless whether the UE is still in the MBS service area.

- If the UE is camping at the Source RAN node and receiving multicast data corresponding to the MBS Session ID via the 5GC individual MBS traffic delivery before the Handover, for the N2 Handover in clause 7.2.3.4, the SMF includes MBS session area information (MBS Session ID and MBS service area) in N2 SM information to the Target RAN node in Handover request.

- If the Target RAN node support MBS, it determines whether to establish the resources for multicast distribution for MBS Session ID, based on the received MBS Session ID, and location of the UE. If UE is not in the in the MBS service area provided by (if source RAN support MBS) or SMF (if source RAN not support MBS), the Target RAN does not allocate RAN resources for the multicast MBS Session to the UE.

- If the target RAN node support MBS, when it determines that the UE is in the location area and that the shared delivery is not established for the multicast session ID, the target NG-RAN initiates the shared delivery establishment as specified in clause 7.2.1.4.

* When the AMF receives the User Location Information from target RAN node via the the Path Switch Request message or Handover Notify message, the AMF provide it to the SMF. When the SMF get the User Location Information, the SMF check the MBS service area of UE camping cell by comparing the User Location Information received received from AMF with the MBS service area received from the MB-SMF. The SMF uses the determined UE location and and user location as follows:
* The SMF determines whether the UE is outside the MBS service area by comparing the received Cell ID and tracking area ID with the MBS service area received from the MB-SMF.
* If the UE is inside the the MBS service area, the SMF applies individual delivery towards the UE. If associated QoS flows are not yet included in the PDU session, the SMF updates the PDU session with associated QoS flows. If the SMF did not configure the UPF to receive the MBS data packet from the tunnel associated with the multicast session before before, the SMF informs the MB-SMF of the MBS session and UPF DL N19mb Tunnel information. MB-SMF configure the MB-UPF to transmit the multicast session data towards UPF using the received downlink tunnel ID
* If the UE is out of the service area of the MBS session,
* If the target NG-RAN node does not support MBS, the SMF deletes the associated QoS flow from NG-RAN node and the UPF.
* Per operator’s policy (e.g. when a local configured timer expires since the UE left the whole MBS service area of the MBS session) the SMF may remove the UE from the MBS session as defined in clause 7.2.4.3.6.

\* \* \* \* Next change \* \* \* \*

##### 7.2.4.3.4 Activation of limited area MBS session

For the limited area MBS session activation, the differences comparing to the procedure defined in clause 7.2.5.2 are as below.

* The SMF invokes Namf\_MT\_EnableGroupReachability service operation to AMF, which include the MBS service area associated with the MBS session.
* For the UE in CM-IDLE state, when the AMF triggers the paging, it take the receiving MBS service area information into account. Only the NG-RAN node which is included in the MBS service area need trigger the paging.
* SMF checks whether the UE is in or out of the MBS service area based on the change notification or UE location information included in Nsmf\_PDUSession\_UpdateSMContext Request or Namf\_MT\_UEReachabilityInfoNotify message.Based on that information, the SMF determines how to activate the MBS session same as the handling when the SMF get the User Location Information defined in clause 7.2.4.3.3.
* When the SMF provides the MBS session information to the NG-RAN nodes, it includes the MBS service area in the N2 SM information.

\* \* \* \* Next change \* \* \* \*

7.2.4.3.5 UE location change handling by SMF

SMF checks whether the new UE location is inside or outside the MBS service area of the MBS session.

* For the case UE is out of the MBS service area of the MBS session,
* If RAN node does not support MBS, the SMF delete the associated QoS flow from the RAN node and the UPF.
* Per operator’s policy (e.g. when a local configured timer expires since the UE left the whole MBS service area of the MBS session) the SMF may remove the UE from the multicast MBS session as defined in clause 7.2.2.3.
* For the case UE comes back to the MBS service area of the multicast MBS session after moving out of the MBS service area of the multicast MBS session before,
* If the UE is still in the multicast MBS session and the multicast MBS session is in the "Active" state, the SMF tries to activate the multicast MBS session towards the UE.

Besides the condition as defined in clause 7.2.2.3, per operator's policy (e.g. when a local configured timer expires since the UE left the MBS service area) the SMF may remove the UE from the limited areaMBS session if the UE is out of the service area of the MBS session. When the UE is removed from the limited area MBS session, the SMF also unsubscribes to the AMF from the notifications about the "UE moving in or out of a subscribed Area Of Interest" event.

##### 7.2.4.3.6 UE mobility within the same NG-RAN between cells inor out of the MBS service areas

If UE mobility can happen within the same NG-RAN between cells in or out of the service area,

- the NG-RAN detects whether the UE is IN or OUT of an MBS service, the NG-RAN notifies the SMF

- Location reporting control procedure is required so that NG-RAN can report whether the UE is IN or OUT of MBS service area. When the SMF knows the UE is IN or OUT of an MBS service, the SMF beahaves as in clause 7.2.4.3.5.

7.2.4.3.7 SMF removing joined UEs from limited area MBS session

Editor’s note: Whether this separate clause is needed need further check. The conditions for UE leave or network requested leave should be clarified in 7.2.4, e.g. due to UE mobility. 7.2.2.3 can be reference for the actual leave procedure.

Besides the condition as defined in clause 7.2.2.3, per operator's policy (e.g. when a local configured timer expires since the UE left the MBS service area) the SMF may remove the UE from the limited areaMBS session if the UE is out of the service area of the MBS session. When the UE is removed from the limited area MBS session, the SMF also unsubscribes to the AMF from the notifications about the "UE moving in or out of a subscribed Area Of Interest" event related to the MBS session.

\* \* \* \* Next change \* \* \* \*

### 7.3.4 Support for Local Broadcast Service and Location dependent Broadcast Service

The clause describes procedures to support the Local broadcast service and the Location dependent broadcast service as described in clause 6.2.

The configuration procedure is performed as defined in clause 7.1.1.2 with the following additions:

- Multiple AFs may start the same broadcast session with different content in different MBS service areas. The NEF selects MB-SMF as ingress control node(s) for different MBS service areas.

- If presented, the NEF maps possible external identifiers for MBS service areas to network-internal identifiers (e.g. list of cells, TAIs).

- MB-SMF allocates Area Session ID, and updates its NF profile towards the NRF with the TMGI and Area Session ID.

- The policy of broadcast session is determined based on the service requirements per MBS service area.

- The MB-SMF may select the MB-UPF based on the MBS service area.

- The MBS service area(s) are indicated to the UE in the Service Announcement as defined in clause 6.11.

The MBS session establishment procedure is performed as defined in clause 7.3.1 with the following additions:

- MB-SMF requests the AMF to transfer an N2 message (i.e. MBS Session Resource Setup Request) to the NG-RAN nodes of the MBS service area with broadcast session information which additionally includes the Area Session ID and MBS service area.

- The NG-RAN uses the received MBS Session ID and Area Session ID to determine the local broadcast session context.

\* \* \* \* End of change \* \* \* \*