**3GPP TSG- Meeting # *1042***

**Toulouse, , - revision of agreed S2-2209289**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.247** | **CR** | **0139** | **rev** | **4**  | **Current version:** | **17.4.0** |  |
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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 |  | Core Network | **X** |

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|  |
| ***Title:***  | CR on MTK or MSK processing |
|  |  |
| ***Source to WG:*** |  Nokia, Nokia Shanghai-Bell, Huawei, HiSilicon, Ericsson |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5MBS |  | ***Date:*** | 2022-11-04 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | LS from SA3 (S3-222391) provides the feedback on MSK/MTK update issues. The relevant responses from SA3 can be highlighted as follows:1. Both the MSK and MTK are sent in the same messages or at least using the same signalling channel to reduce the complexity. In other words, during UE join processing, the MSK and MTK will be sent to the UE via PDU session modification command message from SMF to the UE. 2. SA3 agrees with the suggestion from SA2 that the impacts on MBS session creation can be described as well, and SA3 will make clearer references to related messages in the MBS session management procedures in clause 7.1.1 of TS 23.247, and reuse the existing messages in those procedures.In other words, SA2 can update the spec to reflect SA3 specification, e.g., Session join/establish/update/creation procedures |
|  |  |
| ***Summary of change:*** | 1. Update Session join/establish/update/creation procedures, to reflect the content of the LS from SA3. 2. Update the associating services to reflect the LS from SA3.  |
|  |  |
| ***Consequences if not approved:*** | SA2 spec does not support MSK/MTK related processing.  |
|  |  |
| ***Clauses affected:*** | 6.13, 7.1.1.2, 7.1.1.6, 7.2.1.3, 7.2.6, 9.1.3.1, 9.1.3.3, 9.1.3.4, 9.1.3.6, 9.1.3.7 |
|  |  |
|  | **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:*** | Revision 2: Updates to call flows in clause 7 are added |

\* \* \* \* First change \* \* \* \*

## 6.13 MBS Security function

Security function may be used to protect MBS related signalling/data. Detailed descriptions of security requirements, procedures and handling for 5G Multicast/Broadcast Service (MBS) are provided in TS 33.501 [20].

MBS security function is implemented in the MBSF/MBSTF so that it can be applied only when MBSF/MBSTF are used (i.e. Configuration option 2 and 3). For configuration option 1 how to support MBS security is out of 3GPP scope.

The following additions for MBS multicast control plane procedures in the present specification apply if the MBS security function for multicast as defined in TS 33.501 [20] is used:

- The multicast session security context, as defined in TS 33.501 [20], is used to protect MBS traffic of an MBS session. During the session establishment and when a UE joins, the multicast session security context contains MSK and MTK.

- The UEs in the MBS session use the received multicast session security context to process the protected MBS traffic.

- MBSF distributes the multicast session security context to the MB-SMF via the Nmbsmf\_MBSSession\_Create Request or Nmbsmf\_MBSSession\_Update Request message.

- The SMF interacts with the MB-SMF to obtain the multicast session security context. The MB-SMF provides the security context in the Nmbsmf\_MBSSession\_ContextStatusSubscribe response message and in the Nmbsmf\_MBSSession\_ContextStatusNotify request message.

- If the UE is authorized to join the Multicast MBS session, the SMF shall provide the multicast session security context to the UE in N1 SM container if it received the multicast session security context from the MB-SMF.

- When the MSK needs to be updated, MBSF shall send the updated multicast session security context to the MB-SMF, and then the MB-SMF shall trigger the session update as specified in clause 7.2.6 to provide the updated multicast session security context to the UEs in the related MBS session. The updated multicast session security context shall contain an updated MSK and may contain an updated MTK in addition.

NOTE 1: If no MSK but only the MTK is to be updated, the session update described in the previous bullet is not triggered and the MTK is updated as defined in TS 33.501 [20].

NOTE 2: Interaction between MBSF and MBSTF will be defined in TS 33.501 [20] and 26.502 [18].

NOTE 3: Clause 9.1 defines the services for supporting security function for control plane procedure. The additions the user plane procedure to support the security function for multicast and broadcast can be used as defined in TS 33.501 [20].

\* \* \* \* Second change \* \* \* \*

#### 7.1.1.2 MBS Session Creation without PCC

This procedure is used by the AF to start the MBS Session towards 5GC and consist of TMGI allocation, and MBS session creation, and they apply to both multicast and broadcast communications unless otherwise stated.

For multicast, MBS session establishment procedure triggered by UE join requests may follow the MBS session creation procedure to reserve resources towards NG-RAN. For broadcast, the MBS session start procedure to reserve resources towards NG-RAN is triggered by the MBS session creation procedure.

For both broadcast and multicast communication, the TMGI allocation may be separated from the MBS Session creation request.

For multicast communication, TMGI allocation procedure is applicable if TMGI is used as MBS Session ID.



Figure 7.1.1.2-1: MBS Session Creation without PCC

Steps 1 to 6 are optional and only applicable if TMGI is used as MBS Session ID and required to be pre-allocated.

1. AF sends Nnef\_MBSTMGI\_Allocate Request (TMGI number, [MBS service area]) message to NEF/MBSF to request allocation of a TMGI(s) to identify new MBS session(s). The MBS service area indicates the possible service area for those TMGI(s) to be allocated, which may be needed for local MBS.

NOTE 1: Depending on the network deployment and use case, MB-SMF may receive requests from AF directly, or via NEF, or via MBSF, or via NEF and MBSF.

2. NEF/MBSF checks authorization of AF. If geographical area information or civic address information was provided by the AF as MBS service area, NEF/MBSF performs the translation.

NOTE 2: NEF is not required if AF is in trusted domain.

3. NEF/MBSF discovers and selects an MB-SMF using NRF or based on local configuration, possibly based on MBS service area.

4. NEF/MBSF sends an Nmbsmf\_TMGI\_Allocate Request (TMGI number) message to the MB-SMF.

5. MB-SMF allocates TMGI(s) and returns the TMGI(s) to the NEF/MBSF via the Nmbsmf\_TMGI\_Allocate response (TMGI(s), expiration time).

6. The NEF or MBSF responds to the AF by sending an Nnef\_MBSTMGI\_Allocate Response (TMGI(s), expiration time).

7. The AF may perform a Service Announcement towards UEs. The AF informs UEs about MBS Session information with MBS Session ID, e.g. TMGI, SSM, and possibly other information e.g. MBS service area, session description information, etc.

 The MBS service area information can be Cell ID list, TAI list, geographical area information or civic address information. Amongst them, Cell ID list and TAI list shall only be used by AFs who reside in trust domain, and when the AFs are aware of such information.

 The UE needs to be aware if the service is broadcast or multicast to decide if JOIN is to be performed.

8. AF of content provider may provide description for an MBS session (possibly providing information for a previously allocated TMGI to NEF via a Nnef\_MBSSession\_Create request ([MBS Session ID], MBS service type, MBS Service Information, [TMGI allocation request], [MBS service area], [Any UE indication], [start and end time of the MBS session], [MBS session state], [ingress transport address request indication], [Request for location-dependent session], [FSA ID(s)]). If step 1-6 has not been executed before, the AF may provide an MBS Session ID containing an SSM or it may request that the network allocates an MBS Session ID (i.e., TMGI). The AF provides the MBS service type (i.e. either multicast service or broadcast service) and MBS Service Information (as defined in clause 6.14). The AF may provide the "Any UE indication" (indicating whether a multicast MBS session is "open to any UEs"), MBS service area, start and end time of the MBS session and MBS session state (active/inactive). In addition, the AF request may also indicate that the allocation of an ingress transport address is requested and that the AF request is for a location dependent MBS service.

 If geographical area information or civic address information was provided by the AF as MBS service area, NEF/MBSF translates the MBS service area to Cell ID list or TAI list.

 For broadcast communication, the AF may determine MBS FSA ID(s) for the Broadcast MBS session based on business agreements and include them in the description of the MBS session.

NOTE 3: MBS session state is applicable for multicast MBS Session.

9. NEF/MBSF checks authorization of content provider.

10. NEF/MBSF discovers MB-SMF candidates and selects MB-SMF as ingress control node, possibly based on MBS service area. If a TMGI is included in step 8, NEF/MBSF finds MB-SMF based on that TMGI.

11. NEF/MBSF sends Nmbsmf\_MBSSession\_Create Request ([MBS Session ID], MBS service type, [TMGI allocation request], MBS Service Information (as defined in clause 6.14), [MBS service area], [Any UE indication], [start and end time of the MBS session], [MBS session state], [ingress transport address request indication], [FSA ID(s)], [multicast session security context]) to MB-SMF, to request MB-SMF to reserve ingress resources for a MBS distribution session. The NEF/MBSF forwards all parameters it has received from the AF in step 8. If the MBSF decides to insert an MBSTF into the user plane for the MBS session, it also indicates that the allocation of an ingress transport address is requested even if this was not requested in step 8. The request also includes the Any UE indication if provided in step 8. If the MBSF acts as the MBS security function for multicast as defined in TS 33.501 [20], it provides a multicast session security context for the MBS session.

 If requested to do so, or if a source specific multicast is provided as MBS Session ID in step 11, the MB-SMF allocates a TMGI.

 For broadcast communication, if no MBS FSA ID(s) have been received, the MB-SMF selects MBS FSA ID(s) for the Broadcast MBS session based on local configuration.

12. Void.

13. The MB-SMF derives the required QoS parameters locally based on the MBS Service Information.

14. MB-SMF selects the MB-UPF. If the allocation of an ingress transport address was requested in step 11, the MB-SMF requests the MB-UPF to reserve user plane ingress resources. If multicast transport of the MBS data towards RAN nodes is to be used, the MB-SMF also request the MB-UPF to reserve for the outgoing data a tunnel endpoint and the related identifiers (source IP address, SSM and GTP Tunnel ID) and to forward data received at the user plane ingress resource using that tunnel endpoint.

 If the allocation of an ingress transport address was not requested in step 11, the MB-SMF provides the SSM received as MBS Session ID to the MB-UPF and requests the MB-UPF to join the corresponding multicast tree from the content provider. The MB-SMF may also defer the configuration to join the corresponding multicast tree e.g. based on information that the session is inactive, service requirements and MBS start/end time until receiving the first query for the MBS session as part of the establishment procedure in clause 7.2.1.3, or until receiving a request to activate the MBS session via the MBS Session Update procedure in clause 7.1.1.6.

15. If requested, MB-UPF selects an ingress address (IP address and port) and a tunnel endpoint for the outgoing data and provides it to MB-SMF.

16. MB-SMF indicates the possibly allocated ingress address to the NEF/MBSF. MB-SMF may include TMGI if it is allocated in step 11. For broadcast communication, the MB-SMF includes any MBS FSA ID(s) selected in step 11. It also indicates the success or failure of reserving transmission resources.

16a. If a source specific multicast address is provided as MBS Session ID in step 11, the MB-SMF updates its NF profile at the NRF with the serving MBS Session ID. If an MBS service area was received in step 11, the MB-SMF updates its NF profile at the NRF with that information.

NOTE 3: If TMGI is used to represent an MBS Session, MB-SMF does not need to update NRF if the TMGI range(s) supported by an MB-SMF is already included in the MB-SMF profile when MB-SMF register itself into NRF.

17. For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.1 to request the allocation of resources to for the transmission of the broadcast session.

18. [Optional] If the MBSF decides to use an MBSTF, the NEF/MBSF provides the ingress address received in step 16 towards the MBSTF as DL destination. If the allocation of an ingress transport address was requested in step 8, the MBSF requests the MBSTF to allocate the user plane ingress resources. If the allocation of an ingress transport address was not requested in step 8, the MBSF provides the SSM received as Multicast session ID in step 8 and requests the MBSTF to join the corresponding multicast tree from the content provider.

19. [Conditional on step 19] If requested, the MBSTF selects an ingress address (IP address and port) and provides it to NEF/MBSF.

20. The NEF/MBSF-C indicates the possibly allocated ingress address and other parameters (e.g. TMGI) to the AF via an Nnef\_MBSSession\_Create response ([TMGI], [Allocated ingress address])). If MBS Session ID is not provided in step 8, or the MBS Session ID is SSM, the NEF/MBSF provides the allocated TMGI. If AF requested the allocation of an ingress transport address, the message also includes the allocated ingress address. For broadcast communication, the message also includes any MBS FSA ID(s) received in step 17.

21. Same as step 7. The AF may also perform a service announcement at this stage.

22. For multicast communication, depending on configuration UEs can join the MBS Session as specified in clause 7.2.1.

\* \* \* \* Third change \* \* \* \*

#### 7.1.1.6 MBS Session Update without PCC

This procedure is used by the AF to update the MBS service area and/or MBS Service Information. Updating MBS Service Information may lead to addition of new MBS QoS Flow(s), removal of existing MBS QoS Flow(s) or update of existing MBS QoS Flow(s). The procedure applies to both multicast and broadcast communications unless otherwise stated.

If the MBSF acts as the MBS security function for multicast as defined in TS 33.501 [20], it may use this procedure to provide an MSK for the MBS session via the control plane. In this case the MBSF may initiate this procedure and steps 1, 2 and 10 do not apply.

NOTE: The procedure is not applicable if no MSK but only the MTK is to be updated.

For local multicast services and location dependent multicast services, the AF may perform a Service Announcement towards UEs to update the MBS service area before the MBS Session Update procedure is started or after the MBS Session Update procedure is completed.



Figure 7.1.1.6-1: MBS Session Update without PCC

1. AF of content provider initiates MBS Session Update to a NEF/MBSF, e.g. to update MBS service area and/or update MBS Service Information (as defined in clause 6.14), or to activate or deactivate an MBS session. AF may provide updated information for an MBS session (identified by MBS session ID) by sending an Nnef\_MBSSession\_Update Request (MBS Session ID, [MBS Service Information], [MBS service area], [MBS session state (active/inactive)]).

 If geographical area information or civic address information was provided by the AF as MBS service area, NEF/MBSF translates the MBS service area to Cell ID list or TAI list.

2. NEF checks authorization of AF.

3. NEF/MBSF sends Nmbsmf\_MBSSession\_Update Request to MB-SMF forwarding the updated information received from the AF in step 1. If the MBSF acts as the MBS security function for multicast as defined in TS 33.501 [20], it may provide an updated multicast session security context for the MBS session in the Nmbsmf\_MBSSession\_Update Request.

4. The MB-SMF derives any updated QoS parameters locally under consideration of the updated MBS Service Information. This may lead to addition of new MBS QoS Flow(s), removal of existing MBS QoS Flow(s) or update of existing MBS QoS Flow(s).

5-6. MB-SMF may need to update MB-UPF, e.g. if new MBS QoS Flow is to be created, or existing MBS QoS Flow is to be deleted.

7. For broadcast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.3.3. For multicast communication, the MB-SMF continues the procedure towards the AMF and NG-RAN as specified in clause 7.2.5 (for service activation/deactivation), 7.2.6 (for QoS updates and service area updates).

8. If an MBS service area is being updated, the MB-SMF stores the new service area in its profile at the NRF.

9. MB-SMF responds to the NEF/MBSF with a Nmbsmf\_MBSSession\_Update Response.

10. NEF/MBSF responds to the AF with a Nnef\_MBSSession\_Update Response.

\* \* \* \* Fourth change \* \* \* \*

#### 7.2.1.3 Multicast session join and session establishment procedure

The following steps are executed before the UE requests to join the MBS session:

- The MBS Session may have been created in the 5GC (see clause 7.1.1 for details).

- The UE registers in the PLMN or SNPN and may have established a PDU session that can be associated with multicast session(s).

- The UE has known at least the MBS Session ID of a multicast group that the UE can join, e.g. via service announcement.



Figure 7.2.1.3-1: PDU Session modification for UE joining Multicast MBS session

1. To join a multicast group:

- if there is an existing PDU session that can be used to send the UE join request for the multicast MBS Session, the UE sends a PDU Session Modification Request over that PDU session (i.e. associated PDU Session) which additionally contains one or several MBS Session ID(s) and join request. The MBS Session ID(s) indicate the multicast MBS session(s) that UE wants to join.

- if the UE has no appropriate PDU session established with the DNN and S-NSSAI for the multicast MBS session, the UE joins the multicast MBS session by sending PDU Session Establishment Request for associated PDU session together with one or several MBS Session ID(s) and join request. In that case, before step 2, the network proceeds with establishment of the associated PDU session executing steps 4 to 10 of PDU Session Establishment procedure as specified in TS 23.502 [6] clause 4.3.2.2.

2. [Conditional] Based on the received MBS Session ID and join request, the SMF determines this is MBS Session join request.

 If SMF has no information about MBS Session Context for the indicated MBS Session ID(s), SMF discovers and selects an MB-SMF for the MBS Session via the NRF as described in clause 7.1.2. If no MB-SMF is assigned for the MBS Session ID (i.e. the NRF provides empty MB-SMF profile), the SMF may select an MB-SMF and request it to configure the multicast MBS session or the SMF may reject the join request and respond to the UE with an appropriate cause value.

NOTE 1: Details about how the SMF selects an MB-SMF and requests it to configure the multicast MBS session are left to SMF implementation.

3. [Conditional] For each MBS session in step 1, if the SMF has not subscribed to the MBS Session Context, it invokes Nmbsmf\_MBSSession\_ContextStatusSubscribe request (MBS Session ID) towards the MB-SMF to subscribe to events notifications related to the multicast MBS session and to request information about the MBS Session Context. The MB-SMF responds with the information about the indicated multicast MBS session in Nmbsmf\_MBSSession\_ContextStatusSubscribe response (multicast QoS flow information (e.g. QoS profile(s) for the multicast MBS session), [start time], [session state (Active/Inactive)], [Any UE indication], [multicast DL tunnel info], [multicast session security context]).

 If it is the first time for the MB-SMF to receive Nmbsmf\_MBSSession\_ContextStatusSubscribe request of the indicated MBS Session from any SMF, the MB-SMF learns it is the first UE joining the multicast MBS session. For multicast transport between MB-UPF and content provider, if it is the first UE joining the multicast MBS session, and MB-UPF has not joined the multicast tree in the MBS session creation procedure, described in clause 7.1.1, the MB-SMF requests the MB-UPF to join the multicast tree towards the AF/MBSF, otherwise MB-SMF will not send the request to the MB-UPF.

NOTE 2: The MB-SMF can answer the Nmbsmf\_MBSSession\_ContextStatusSubscribe request either based on information received in the MBS session creation procedures in clause 7.1.1 or based on preconfigured information. The pre-configuration also includes information about the MBS session stored in the NRF. If the MB-SMF uses preconfigured information, the pre-configuration also includes MB-UPF configuration.

4. The SMF determines whether the user is authorized to join the Multicast MBS session taking into account the MBS subscription data received from the UDM and the Any UE indication if received from the MB-SMF. The SMF considers the UE as authorized to the Multicast MBS session if the UE is authorized to use multicast MBS services, and if the MBS Session ID(s) in the PDU Session Modification Request is included in the MBS subscription data or Any UE indication is received. If authorization check fails, the SMF rejects the join request with a cause value. If a UE joins prior to the start time of the multicast MBS session, the SMF may accept the join request and indicate to the UE the start time, or it may reject the join request with an appropriate error cause and optionally a back-off timer. If a UE joins while the multicast MBS session is inactive, the SMF accepts the join request.

5. If the join request is accepted, the SMF responds to the AMF through Nsmf\_PDUSession\_UpdateSMContext response (N2 SM information (PDU Session ID, MBS Session ID, [updated PDU Session information], [mapping information between unicast QoS flow(s) and multicast QoS flow (s)]), N1 SM container (PDU Session Modification Command, [multicast session security context])) to:

- create an MBS Session Context for the indicated MBS session in the RAN, if it does not exist in the RAN already; and

- inform the NG-RAN about the relation between the Multicast MBS Session Context and the UE's PDU Session context by including the MBS Session ID and the mapping between the multicast QoS flow(s) and associated QoS flow(s).

 Based on operator policy, the SMF may prepare for 5GC Individual MBS traffic delivery fall-back. The SMF maps the received QoS information of the multicast QoS Flow into PDU Session's unicast QoS Flow information, and includes the information of the QoS Flows and the mapping information about the QoS Flows (termed "associated QoS flow information") in the SM information sent to RAN. The SMF compares the QFIs of the multicast QoS Flows received from the MB-SMF with QFIs in use for the PDU Session and assigns unused QFIs to the PDU Session's unicast QoS Flows corresponding to multicast QoS Flows.

NOTE 3: Detailed information included in N2 SM information will be aligned with by RAN WG3.

NOTE 4: The SMF uses the same QoS in the received MBS QoS Flow QoS information for the associated QoS Flow in the unicast PDU session.

 If the MBS session join procedure was triggered by the UE together with PDU Session Establishment procedure for the associated PDU session, the SMF provides the N2 SM information and N1 SM container for the associated PDU session in Namf\_Communication\_N1N2MessageTransfer service operation towards the AMF, as described in step 11 of clause 4.3.2.2.1 in TS 23.502 [6]. The N2 SM information also includes the MBS Session ID and, if 5GC individual MBS traffic delivery fall-back is supported, the mapping information between unicast QoS flow(s) and multicast QoS flow(s).

 If the join request is rejected, the SMF responds to the AMF through Nsmf\_PDUSession\_UpdateSMContext response (N1 SM container (PDU Session Modification Reject)) and the message will not contain any MBS Session Context or the N2 SM information for the associated PDU session. The PDU Session Modification Reject message is forwarded to the UE via the NG-RAN, and the following steps are skipped.

6. The N2 message, which includes the MBS Session ID(s) the UE has joined and, if applicable, associated QoS Flow, is sent to the NG-RAN.

 If the MBS is supported by NG-RAN, 5GC Shared MBS traffic delivery is adopted. If the MBS is not supported by NG-RAN, 5GC Individual MBS traffic delivery is used if the PDU Session's unicast QoS Flow include QoS Flows for the multicast session.

 If the NG-RAN supports MBS, the NG-RAN uses the MBS Session ID to determine that the PDU Session identified by the PDU Session ID is associated with the indicated multicast MBS session.

 If the NG-RAN supports MBS, the associated unicast QoS flow information, if provided, is not used to allocate the radio resource and CN resource for corresponding QoS flows.

NOTE 6: UE join request via PDU Session signalling will fail if NG-RAN rejects the PDU Session Resource setup request (e.g. due to the number of UEs reaching a limit).

7. [Conditional] If shared tunnel has not been established for the multicast MBS session towards the NG-RAN node, the procedures in clause 7.2.1.4 for the establishment of shared delivery toward NG-RAN node are executed. This step is executed separately for each multicast MBS session.

7a. If the MBS Session is active, the NG-RAN configures radio resources for MBS session.

8. If the MBS Session is active, the NG-RAN node performs AN specific signalling exchange with the UE to configure the UE with radio resources for the multicast MBS session. If the NG-RAN does not support MBS and the MBS Session is active, radio resources are reconfigured for unicast transmission of the MBS data over the associated PDU session. As part of the AN specific signalling exchange, the N1 SM container (PDU Session Modification Command) is provided to the UE.

9. The NG-RAN node sends the PDU session modification response.

 If the MBS is not supported by NG-RAN, the accepted unicast QoS flow is included in the N2 SM information. If the MBS is supported by NG-RAN, the N2 SM information further includes the indication of supporting MBS.

10. The AMF invokes Nsmf\_PDUSession\_UpdateSMContext request ([N2 SM information]) to the SMF.

 Per the indication of whether the NG-RAN supports MBS, the SMF determines whether 5GC Individual MBS traffic delivery is used for multicast data transmission.

NOTE 8: If the shared tunnel is used, no interaction with UPF is needed for the indicated multicast MBS session

[Conditional] This step is used for 5GC Individual MBS traffic delivery, if the related NG-RAN does not support MBS. If a shared tunnel between the UPF (PSA) and MB-UPF for 5GC Individual MBS traffic delivery has not yet been established by the SMF for the multicast MBS session, steps 11a to 11d are executed. Step 11e is executed irrespective of that.

11a. The SMF contacts the UPF to request the creation of a tunnel and provides the MBS Session ID. The UPF indicates to the SMF whether the tunnel for this multicast MBS session is newly allocated (as there can be multiple SMFs interacting with the same UPF for the same multicast MBS Session).

 If the UPF determines to use unicast transport over N19mb, the UPF allocates a DL N19mb Tunnel endpoint for the multicast MBS session if the SMF request is the first one to allocate DL N19mb Tunnel endpoint for the multicast MBS Session in the UPF. The UPF includes the DL Tunnel Info in the response to the SMF. The DL tunnel info includes the downlink tunnel ID and the UPF address.

 If the UPF determines to use multicast transport over N19mb, the UPF joins the multicast distribution if the SMF request is the first one for the MBS Session in the UPF. Steps 11b to 11d are skipped.

11b. If the UPF indicates the DL N19mb Tunnel is newly allocated, the SMF invokes Nmbsmf\_MBSSession\_ContextUpdate request (MBS Session ID, [DL tunnel info]) towards the MB-SMF for establishing the multicast MBS session transport between MB-UPF and UPF.

11c. If the DL tunnel info of the UPF is received, the MB-SMF configures the MB-UPF to transmit the multicast MBS session data towards UPF using the possibly received downlink tunnel ID.

11d. The MB-SMF responds to the SMF through Nmbsmf\_MBSSession\_ContextUpdate response (MBS Session ID, [multicast DL tunnel info]). If the UPF DL tunnel info for unicast transport is not received by the MB-SMF, multicast transport between MB-UPF and UPF is to be used, and the MB-SMF includes the downlink tunnel information with the low layer transport multicast address for the multicast MBS session.

11e. The SMF configures the UPF to forward the received multicast MBS session data within the PDU session. (This step may be combined with step 11a).

12. The SMF responds to the AMF with Nsmf\_PDUSession\_UpdateSMContext response message.

13. The MB-UPF receives multicast PDUs, either directly from the content provider or via the MBSTF that can manipulate the data.

Steps 14 to 16 are for 5GC Shared MBS traffic delivery:

14. The MB-UPF sends multicast PDUs in the N3mb tunnel associated to the multicast MBS session to the NG-RAN. There is only one tunnel per multicast MBS session per MBS service area and NG-RAN node, i.e. all the UEs which have joined the multicast MBS session via the NG-RAN node share this tunnel for reception of the multicast MBS session data.

15. Void.

16. The NG-RAN transmits the multicast MBS session data to the UE(s) via the MBS Radio Bearer using either PTP or PTM transmission.

Steps 17 to 19 are for 5GC Individual MBS traffic delivery:

17. The MB-UPF sends multicast PDUs in the N19mb tunnel associated to the multicast MBS session to the UPF. There is only one tunnel per multicast MBS session and destination UPF, i.e. all associated PDU sessions served by the destination UPF share this tunnel.

18. The UPF forwards the multicast data towards the NG-RAN via unicast (i.e. in the N3 tunnel of the associated PDU Session).

19. The NG-RAN forwards the multicast MBS session data to the UE via unicast (i.e. over the radio bearer(s) corresponding to the associated QoS flow(s) of the associated PDU Session).

NOTE 9: Details of the DL MBS data transmission are described in clause 6.7.

NOTE 10: When the MBSF is involved in the multicast MBS session, the tunnel between MBSTF and MB-UPF has been established in the MBS session creation procedure.

\* \* \* \* Fifth change \* \* \* \*

### 7.2.6 Multicast session update procedure

Multicast MBS session update procedure is invoked by the AF to update the service requirement (result in multicast QoS parameters update and/or multicast QoS flow addition/removal) and/or MBS Service Area for an ongoing Multicast MBS session.

If the MBSF acts as the MBS security function for multicast as defined in TS 33.501 [20], it may use this procedure to provide an updated MSK and optional updated MTK in addition for the MBS session via the control plane.

NOTE: The procedure is not applicable if no MSK but only the MTK is to be updated.

For the interaction between AF or MBSF and MB-SMF, see clause 7.1.1.6 and 7.1.1.7.



Figure 7.2.6-1: Multicast MBS Session update procedure

1. This procedure is triggered by the MB-SMF receiving the updated service requirement, an updated multicast session security context from the MBSF, and/or MBS Service Area for a multicast MBS Session, see clauses 7.1.1.6 and 7.1.1.7.

2. The AF providing the updated service area may also inform UEs at application level about the new service area via a service announcement.

NOTE 1: If a UE is located in a cell which was previously outside the service area and is now inside the updated service area, the UE can join the multicast service as specified in clause 7.2.1.3.

 For QoS updates steps 3 to 7 are performed.

 For MBS Service Area update steps 3 to 7 may be performed to allow NG-RAN to terminate data transmission in the area which is no longer in the MBS Service Area.

3. The MB-SMF invokes Namf\_MBSCommunication\_N2MessageTransfer service operation (MBS Session ID, [Area Session ID], N2 SM message container (TMGI, [QoS profile(s) for multicast MBS session], [MBS Service Area], [Area Session Id])) to the AMF(s).

4. The involved AMF sends N2 MBS session request (N2 SM message container) to NG-RAN nodes handling the multicast MBS session and possible Area Session ID based on the RAN node IDs stored in the AMF for the MBS session.

5. The NG-RAN node updates the QoS profile and/or MBS Service Area for the multicast MBS session based on the N2 MBS session request. If only QoS parameters are updated without multicast QoS flows added/removed, the NG-RAN may also update the QoS parameters of the associating PDU Sessions.

 For MBS Service Area update, the NG-RAN updates the MBS Session Context with the updated MBS Service Area. The NG-RAN stops transmission of the related multicast data in the cell(s) which is within the old MBS Service Area but now outside the updated MBS Service Area. The NG-RAN also configures the UE not to receive the MBS data over the radio interface if the NG-RAN detects the UE(s) was in the previous MBS Service Area but is outside the updated MBS Service Area. If the NG-RAN node no longer serves any cells within the updated MBS service area, it requests to release shared delivery resource as defined in clause 7.2.2.4.

6. The NG-RAN node(s) acknowledges N2 MBS session request by sending an N2 MBS session Response message to the AMF.

7. The AMF invokes the Nmbsmf\_MBSSession\_ContextUpdate () to the MB-SMF.

8. The MB-SMF sends Nmbsmf\_MBSSession\_ContextStatusNotify request (MBS Session ID, [QoS profiles for multicast for MBS session], [MBS Service Area], [Area Session ID], [updated multicast session security context]) to the SMFs. For MBS Service Area updates, if an Area Session ID exists, the MB-SMF provides the MBS Service Area corresponding to the Area Session ID to the SMFs involved in the multicast MBS session. For QoS updates, the MB-SMF notifies SMFs handling all MBS service areas.

9. The SMF determines the affected UEs it serves based on the multicast MBS Session ID and Area Session ID (if provided) received in the step 8.

The subsequent steps 10 to 12 are executed for each affected UE. For QoS updates, steps 10 and 11 are skipped.

10. [Conditional] For an MBS Service Area update, if the SMF previously subscribed at the AMF to notifications about the UE moving in or out of a subscribed "Area Of Interest", the SMF updates the subscription with the new MBS Service Area as area of interest.

11. [Optional] When the MBS Service Area is updated, if the SMF does not have the latest UE location, the SMF queries AMF which then query the NG-RAN for the current location of the UE to determine whether the UE is within the updated MBS Service Area.

12. [Conditional] For QoS Updates, if the 5GC Individual MBS traffic delivery is used, or if the associated QoS flows is to be added/removed, the SMF triggers PDU Session Modification procedure as defined in TS 23.502 [6]. If the 5GC Individual MBS traffic delivery is used, the SMF may also configure the UPF with the updated QoS and/or updated or removed QoS flows.
For MSK updates, the SMF also triggers PDU Session Modification procedure and provides the updated multicast session security context in the N1 SM container.

 For MBS Service Area update, the SMF triggers the PDU Session Modification procedure as defined in TS 23.502 [6] with the following enhancement:

- The SMF also updates the PDU session resources associated to the multicast MBS session with the new MBS service area in an N2 container. The RAN node serving the PDU session starts or terminates transmission of multicast content in cells which are added or removed in the updated service area, respectively, and if necessary, interacts with the MB-SMF to start or terminate the distribution of multicast data to the RAN node.

- Towards the UE, the SMF provides the MBS service area in N1 SM container to the UE. For a UE previously inside the MBS service area but now outside the updated MBS service area of the multicast MBS session, the SMF may alternatively, based on operator policy, inform the UE in the N1 SM container that the UE has been removed from the multicast MBS session.

- Towards the NG-RAN, the SMF provides the updated MBS service area in N2 SM information. For a NG-RAN node supporting MBS, it starts transmission of multicast content in cells which are added in the updated MBS service area if UEs within the Multicast MBS session are within those cells, and if necessary, the NG-RAN interacts with the MB-SMF to start the distribution of multicast data to the RAN node. The RAN node stops transmission of multicast content in cells which are removed from the updated MBS service area, and if necessary, the NG-RAN interacts with the MB-SMF to terminate the distribution of multicast data to the RAN node

- For Individual delivery and a local Multicast MBS session the following applies: For a UE previously inside the service area but now outside the updated MBS service area, the SMF removes associated unicast QoS flows for the multicast MBS session. For a UE previously outside the service area but now inside the updated service area, the SMF adds associated unicast QoS flows for the multicast MBS session to the PDU session resources.

\* \* \* \* Sixth change \* \* \* \*

#### 9.1.3.1 General

**Service description:** The following are the key functionalities of this NF service:

- (between AMF or SMF and MB-SMF) For multicast, NF Service Consumer can use this service to request the reception of MBS data or to terminate the reception of MBS data of a Multicast MBS session, or for a location dependent Multicast MBS session, the part of the MBS multicast session within a service area;

- (between SMF and MB-SMF) For multicast, allow consumer NFs to query information (e.g. QoS information) about MBS Session. This service will be invoked by SMF for UE join event;

- (between SMF (only for multicast) or MBSF/NEF and MB-SMF) Allow consumer NFs to subscribe and unsubscribe for an Event ID and MBS Session, or for a location dependent MBS session, related to the part of the MBS session within a service area (only for MBSF/NEF);

- (between SMF (only for multicast) or MBSF/NEF and MB-SMF) Notifying events on the MBS Session, or for a location dependent MBS session, related to the part of the MBS session within a service area (only for MBSF/NEF), to the subscribed NFs;

- (between MBSF/NEF/AF and MB-SMF) Creation/Modification/Activation/Deactivation/Release of Multicast MBS session, or for a location dependent Multicast MBS session, the part of the Multicast MBS session within a service area; and

- (between MBSF/NEF and MB-SMF) Creation/Modification/Start/Stop/Release of Broadcast MBS sessions, or for a location dependent Broadcast MBS session, the part of the Broadcast MBS session within a service area.

The following events related to MBS Session Context can be subscribed by SMF as consumer NF:

- (between SMF and MB-SMF, only for multicast) QoS change: The event notification is sent when QoS within a Multicast MBS session changes, e.g. adding/removing QoS flow(s);

- (between SMF and MB-SMF only for multicast) multicast session state (Active, Inactive);

- (between SMF and MB-SMF only for multicast) Multicast MBS session service area change (for a location dependent Broadcast MBS session, the notification relates to the part of the Broadcast MBS session within a service area);

- (between SMF and MB-SMF only for multicast) Multicast MBS session release;

- (between SMF and MB-SMF only for multicast) multicast session security context update.

The following events related to an MBS session, or for a location dependent MBS session, related to the part of the MBS session within a service area, can be subscribed by MBSF, NEF, or AF as consumer NF:

- (between MBSF/NEF/AF and MB-SMF) MBS session release due to TMGI expiry;

- (between MBSF/NEF/AF and MB-SMF) Broadcast delivery status.

NOTE: Whether event IDs are needed can be determined by stage 3.

#### 9.1.3.3 Nmbsmf\_MBSSession\_ContextStatusSubscribe service operation

**Service operation name:** Nmbsmf\_MBSSession\_ContextStatusSubscribe

**Description:** Service Consumer NF can use this service operation to request information (e.g. QoS information) about a multicast session and to subscribe to notification of events about the multicast session context.

**Inputs, Required:** MBS Session ID, Notification Target Address, Events ID(s).

**Inputs, Optional:** None.

**Outputs, Required:** None.

**Outputs, Optional:** Event information (e.g. QoS information for multicast session, multicast MBS session state (Active, Inactive), multicast session service area for local multicast service), Start time of multicast MBS session, multicast DL tunnel info, if consumer is SMF: indication that the multicast MBS session allows any UE to join, multicast session security context.

#### 9.1.3.4 Nmbsmf\_MBSSession\_ContextStatusNotify service operation

**Service operation name:** Nmbsmf\_MBSSession\_ContextStatusNotify

**Description:** This service operation, which is applicable to multicast MBS session, is used by the MB-SMF to notify its consumers about events of an MBS Session, or for a location dependent MBS session, related to a service area change.

**Inputs, Required:** MBS Session ID, Event ID.

**Inputs, Optional:** Event information (e.g. QoS information of MBS Session, MBS service area, Area Session ID, updated multicast session security context).

**Outputs, Required:** Operation execution result indication.

**Outputs, Optional:** Cause.

#### 9.1.3.6 Nmbsmf\_MBSSession\_Create service operation

**Service operation name:** Nmbsmf\_MBSSession\_Create

**Description:** Create a new multicast session or broadcast session, or for a location dependent MBS session, the part of the MBS session within a service area. Optionally subscribe to notifications for this MBS session.

**Input, Required:** MBS Session ID (SSM or TMGI) or TMGI allocation request, MBS Service Type (multicast or broadcast).

**Input, Optional:** DNN, S-NSSAI, MBS service area, MBS Service Information (as defined in clause 6.14), Input Transport Address Request, indication that the PCF has to be contacted, MBS start time, MBS termination time. For a multicast session, indication that any UE may join, multicast session security context. For a broadcast session, MBS FSA ID(s). For subscription to notifications event ID(s), Notification Target Address, Request for location dependent MBS session.

**Output, Required:** Result Indication.

**Output, Optional:** TMGI, Expiry Time of the TMGI, Cause, MB-UPF tunnel info, MBS FSA ID(s), Area Session ID.

#### 9.1.3.7 Nmbsmf\_MBSSession\_Update service operation

**Service operation name:** Nmbsmf\_MBSSession\_Update

**Description:** Update the established multicast session or broadcast session, or for a location dependent MBS session, the part of the MBS session within a service area, e.g. QoS update.

**Input, Required:** MBS Session ID.

**Input, Optional:** MBS Service Information (as defined in clause 6.14), MBS service area, for a broadcast session, MBS FSA ID(s), Area Session ID, indication that the PCF has to be contacted. For multicast, session state (Active/Inactive), updated multicast session security context.

**Output, Required:** Result Indication.

**Output, Optional:** Cause, MBS FSA ID(s).

\* \* \* \* End of changes \* \* \* \*