**3GPP TSG-SA2 Meeting #166 *S2-2412570***

**Orlando, United States, 18th Nov 2024 - 22nd Nov 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **23.247** | **CR** | **0372** | **rev** | **1** | **Current version:** | **18.7.0** |  |
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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 |  | Radio Access Network | **x** | Core Network | **x** |

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|  |
| ***Title:***  | MBS broadcast support for NTN |
|  |  |
| ***Source to WG:*** | Nokia, Huawei, HiSilicon |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | TEI19, NR\_NTN\_Ph3-Core |  | ***Date:*** | 2024-10-29 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | In incoming LS S2-2411305, RAN3 informs about MBS broadcast for NTN related agreements they reached for the NR\_NTN\_Ph3-Core WI: RAN3 agreed that the AMF can indicate to the gNb a small area list that can denote an area smaller than a cell. In addition, the a MBS service area can be denoted by mapped cell IDs.The MB-SMF selects AMFs based on the service area information, and the AMFs in turn select NR-RAN nodes based on that information. The following related issues need to be considered: MB-SMF and AMFs so far are not capable of using small area list for the selection and it seems desirable to avoid that they need new related extensive configured information. |
|  |  |
| ***Summary of change:*** | Procedures to support MBS broadcast over NTN are added.For NTN, an MBS service area may be denoted in the 5GC and towards NG-RAN via mapped Cell IDs..For NTN, an MBS service areas can also be denoted in the 5GC with small area list as defined in TS 38.413 [15] that is provided in combination with TAIs and/or cell IDs, for instance to denote a MBS service area smaller than cells; the small area list is used to further restrict the area denoted by TAIs and/or cell IDs. |
|  |  |
| ***Consequences if not approved:*** | Missing support for MBS broadcast over NTN leads to missalignment with NG-RAN specifications. |
|  |  |
| ***Clauses affected:*** | 4.1, new 6.X, 7.1.1.2, 7.1.1.6, 7.3.1, 7.3.3, 9.4.3.2 |
|  |  |
|  | **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

## 4.1 Overview of multicast and broadcast communication

Multicast and Broadcast Service (MBS) is a point-to-multipoint service in which data is transmitted from a single source entity to multiple recipients, either to all users in a Broadcast service area, or to users in a multicast group as defined in TS 22.146 [2]. The corresponding types of MBS session are:

- Broadcast MBS session

- Multicast MBS session.

The MBS architecture defined in clause 5 follows the 5G System architectural principles as defined in TS 23.501 [5], enabling distribution of the MBS data from the 5GS ingress to NG-RAN node(s) and then to the UE. The MBS architecture provides:

- Efficient usage of RAN and CN resources, with an emphasis on radio interface efficiency;

- Efficient transport for a variety of multicast and broadcast services.

Multicast/Broadcast Service for roaming is not supported in this release.

Interaction between Multicast/Broadcast Service and support of deployments topologies with specific SMF Service Areas is not specified in this Release.

NOTE 1: For broadcast service over multiple MB-SMF Service Areas, mechanism of location dependent broadcast MBS Sessions is assumed to be applied.

The collection and reporting of MBS specific charging information are specified in TS 32.255 [29] for PDU session charging and TS 32.279 [30] for MBS session charging.

Transmission of Broadcast MBS Session is supported over NR non-terrestrial networks (NTN) as defined in TS 38.300 [9].

The MBS also provides functionalities such as local MBS service and location dependent MBS service, authorization of multicast MBS and QoS differentiation. Refer to clause 6 for more details.

MBS traffic is delivered from a single data source (e.g. Application Service Provider) to multiple UEs. Depending on many factors, there are several delivery methods which may be used to deliver the MBS traffic in the 5GS.

NOTE 2: For clarity, delivery methods are not referred to as unicast/multicast/broadcast but as described below. The term "unicast delivery" refers to a mechanism by which application data and signalling between the UE and the application server are delivered using PDU Session within the 3GPP network and using individual UE and application server addresses (e.g. IP addresses) between the 3GPP network and the application server. It is not equivalent to 5GC Individual MBS traffic delivery method defined in this clause.

Between 5GC and NG-RAN, there are two possible delivery methods to transmit the MBS data:

- 5GC Individual MBS traffic delivery method: This method is only applied for multicast MBS sessions. 5GC receives a single copy of MBS data packets and delivers separate copies of those MBS data packets to individual UEs via per-UE PDU sessions, hence for each such UE one PDU session is required to be associated with a Multicast MBS session.

- 5GC Shared MBS traffic delivery method: This method is applied for both broadcast and multicast MBS sessions. 5GC receives a single copy of MBS data packets and delivers a single copy of those MBS packets to an NG-RAN node, which then delivers the packets to one or multiple UEs.

The 5GC Shared MBS traffic delivery method is required in all MBS deployments. The 5GC Individual MBS traffic delivery method is required to enable mobility when there is an NG-RAN deployment with non-homogeneous support of MBS.

For the Multicast MBS session, a single copy of MBS data packets received by the CN may be delivered via 5GC Individual MBS traffic delivery method for some UE(s) and via 5GC Shared MBS traffic delivery method for other UEs.

Between the NG-RAN and the UE, two delivery methods are available for the transmission of MBS data packets over radio interface:

- Point-to-Point (PTP) delivery method: NG-RAN delivers separate copies of MBS data packets over radio interface to individual UE(s).

- Point-to-Multipoint (PTM) delivery method: NG-RAN delivers a single copy of MBS data packets over radio interface to multiple UEs.

NG-RAN may use a combination of PTP/PTM to deliver an MBS data packets to UEs.

NOTE 3: The PTP and PTM delivery methods are defined in RAN WGs.

As depicted in the following figure, 5GC Shared MBS traffic delivery method (with PTP or PTM delivery) and 5GC Individual MBS traffic delivery method may be used at the same time for a multicast MBS session.



Figure 4.1‑1: Delivery methods

For MBS broadcast communication, only 5GC Shared MBS traffic delivery method with PTM delivery is applicable.

For MBS multicast communication, if the NG-RAN node supports MBS, the network shall use the 5GC Shared MBS traffic delivery method for MBS data transmission.

NOTE 4: The exception is when the UE moves between NG-RAN node not supporting MBS (with 5GC Individual MBS traffic delivery method) and NG-RAN node supporting MBS, there is temporary co-existence between 5GC Shared MBS traffic delivery method and 5GC Individual MBS traffic delivery method. Refer to clause 6.3 for details.

For MBS multicast communication, the switching between 5GC Shared MBS traffic delivery method and 5GC Individual MBS traffic delivery method is supported. The UE mobility between RAN nodes both supporting MBS, and between a RAN node supporting MBS and a RAN node not supporting MBS is supported, for details see clause 6.3.

For MBS multicast communication, the switching between PTP and PTM delivery methods for 5GC Shared MBS traffic delivery shall be supported. NG-RAN is the decision point for switching between PTP and PTM delivery methods.

2nd change

### 6.9.1 MBS Session Context

The MBS Session Context contains all information describing a particular MBS session in the 5GS and is created in each node involved in the delivery of the MBS data.

The content of the Multicast MBS Session Context is described in Table 6.9.1-1.

Table 6.9.1-1: Multicast MBS Session Context

| Parameter | Description | NG-RAN | AMF | SMF | MB-SMF |
| --- | --- | --- | --- | --- | --- |
| State | State of MBS session ('Active' or 'Inactive' or 'Configured') | X(note 2) |  | X(note 2) | X |
| SSM (source specific IP multicast address) | IP multicast address identifying the MBS session. |  |  | X(note 1) | X(note 1) |
| TMGI | Temporary Mobile Group Identity allocated to the MBS Session. | X | X | x | X |
| Area Session Identifier | Used for MBS session with location dependent content. When present, the Area Session Identifier together with the TMGI uniquely identify the MBS Session in a specific MBS service area. | X(note 1) | X | X(note 1) | X(note 1) |
| MB-SMF | The MB-SMF that handles the MBS session. |  | X | X |  |
| QoS information | QoS information of the MBS session. | X |  | X | X |
| MBS Service Area | Area over which the MBS session data is distributed (i.e. Cell ID list or TAI list). | X(note 1) |  | X(note 1) | X(note 1) |
| NG-RAN Node ID(s) | NG-RAN nodes which are involved in the Multicast MBS session |  | X |  | X(note 1, note 4) |
| AMF | The AMF(s) which are selected for the MBS session | X |  |  | X |
| IP multicast and source address for data distribution | IP addresses identifying the SSM user plane transport for shared delivery from MB-UPF to NG-RAN and for individual delivery from MB-UPF to UPF when the IP multicast transport is used. | X (note 1) |  | X(note 1)  | X(note 1) |
| TEID for IP multicast distribution | Tunnel ID allocated by MB-UPF used for receiving the multicast data for shared delivery by NG-RAN and for individual delivery by UPF when the IP multicast transport is used. | X |  | X | X(note 1) |
| SMF | The SMF(s) that manages the associated PDU session. |  |  |  | X |
| UE ID | ID identifying the UE that successfully join the Multicast MBS session. For NG-RAN it is NGAP UE ID and for SMF it is SUPI.  | X(note 3) |  | X(note 3) |  |
| NG-RAN IP unicast distribution | The IP addresses and TEID of NG-RAN used for the user plane between NG-RAN and MB-UPF and between MB-UPF and UPF when Point to Point tunnel is used. | X (note 1) |  | X(note 1)  | X(note 1, note 4) |
| PCF | The MB-PCF that provides policy control for the MBS session. |  |  |  | X (note 1) |
| NOTE 1: It is an optional parameter.NOTE 2: The value 'Configured' is not applicable for NG-RAN and SMF.NOTE 3: the UE ID is available within the UE Context which contains the MBS information.NOTE 4: The Parameter needs to be stored in deployments with shared NG-U termination(s) if unicast transport is used. |

In Broadcast MBS session, an MBS Session Context is created in the NG-RAN, AMF, MB-SMF and MBSF as a result of the MBS Session Start procedure.

The content of the Broadcast MBS Session Context is described in Table 6.9.1-2.

Table 6.9.1-2: Broadcast MBS Session context

| Parameter | Description | NG-RAN | AMF | MB-SMF |
| --- | --- | --- | --- | --- |
| TMGI | Temporary Mobile Group Identity allocated to the MBS Session. | X | X | X |
| Area Session Identifier  | Used for MBS session with location dependent content. When present, the Area Session Identifier together with the TMGI uniquely identify the MBS Session in a specific MBS service area. | X(note 1) | X(note 1) | X(note 1) |
| AMF | The AMF(s) which are selected for the MBS session | X |  | X |
| MB-SMF | The MB-SMF that handles the MBS session. |  | X |  |
| QoS information | QoS information for the MBS Session, including the QoS parameters of QoS flows. | X |  | X |
| MBS Service Area(NOTE X) | Area over which the MBS session data is distributed (i.e. Cell ID list, TAI list, or small area list). | X | X | X |
| NG-RAN Node ID(s) | NG-RAN nodes which are selected for the Broadcast MBS session |  | X | X(note 1, note 2) |
| IP multicast address for data distribution  | IP addresses identifying the SSM user plane transport used for shared delivery from MB-UPF to NG-RAN when the IP multicast transport is used. | X(note 1) |  | X(note 1) |
| TEID for IP multicast distribution | Tunnel ID allocated by MB-UPF used for receiving the broadcast data for shared delivery by NG-RAN when the IP multicast transport is used. | X |  | X(note 1) |
| NG-RAN IP unicast distribution | IP address and TEID of NG-RAN used for the user plane from NG-RAN to MB-UPF when Point to Point tunnel is used. | X(note 1) |  | X(note 1, note 2) |
| PCF | The PCF that provides policy control for the MBS session. |  |  | X(note 1) |
| MBS FSA ID | MBS Frequency Selection Area (FSA) ID is used for broadcast MBS sessions to guide the frequency selection of the UE. | X |  | X |
| Associated Session ID | Associated Session ID is used by NG-RAN in network sharing to identify MBS sessions via different CNs transmitting the same content. | X(note 1) |  | X(note 1) |
| NOTE 1: It is an optional parameter.NOTE 2: The Parameter needs to be stored in deployments with shared NG-U termination(s) if unicast transport is used.NOTE X: The case of MBS service area includes small area list only applies to NR NTN. |

3rd change

## 6.X Support of Broadcast MBS Session over NR non-terrestrial networks

TS 38.300 [9] defines NG-RAN procedures to support Broadcast MBS Session over NR NTN.

For NR NTN, an MBS service area may additionally includes a small area list as defined in TS 38.413 [15]. Such MBS service area provided towards NG-RAN denotes an MBS service area smaller than cells, and restrict the reception as defined in TS 38.300 [9].

Based on the received geographical area from AF and local configuration, the NEF may include the small area list in MBS service area, and provides to the MB-SMF as part of the MBS session creation procedure (see Clause 7.1.1.2).

NOTE 1: The small area list is transparently transmitted in 5GC without impacting the existing procedures of broadcast MBS Session.

NOTE 2: Location-depedent MBS services for broadcast communication over NR NTN is not supported in this release.

4th 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.

 If the NEF/MBSF discovers MB-SMF candidates based on MBS service area, and the MBS service area cannot be covered by the MB-SMF service area of a single MB-SMF, the NEF/MBSF rejects the TMGI allocation with an error information indicating that the MBS service area cannot be covered by the MB-SMF service area of a single MB-SMF. Based on the MB-SMF service areas received from the NRF, the NEF/MBSF may divide the requested MBS service area into several groups of MBS service area, while each group can be served by one MB-SMF. The NEF/MBSF may include the groups of MBS service area in the response to the AF. The subsequent steps are not executed.

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)], [Associated Session Identifier], [NR RedCap UE Information]). If steps 1-6 have 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.

 For broadcast communication, to support resource sharing across MBS Sessions during network sharing (see clause 6.18), the AF may include Associated Session Identifier in this step to enable NG-RAN to identify the broadcast MBS sessions from multiple CNs delivering the same content.

NOTE 3: The same QoS requirements are assumed to be provided by the AF for the broadcast MBS Sessions via multiple CNs delivering the same content.

NOTE 4: MBS session state is applicable for multicast MBS Session.

 For broadcast communication, the AF may include the information that the broadcast MBS session is intended for NR RedCap UEs only or both for NR RedCap UEs and non-RedCap UEs in the "NR RedCap UE Information" parameter (as defined in clause 6.19).

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.

 If the NEF/MBSF discovers MB-SMF candidates based on MBS service area, and the MBS service area is not covered by the MB-SMF service area of a single MB-SMF, the NEF/MBSF rejects the TMGI allocation with an error information indicating that the MBS service area cannot be covered by the MB-SMF service area of a single MB-SMF. Based on the MB-SMF service areas received from the NRF, the NEF/MBSF may divide the requested MBS service area into several groups of MBS service area, while each group can be served by one MB-SMF. The NEF/MBSF may include the groups of MBS service area in the response to the AF. The flow continues in step 20 below.

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)], [Associated Session Identifier], [multicast session security context], [NR RedCap UE Information]) 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.

 If the MBS service area received in this step cannot be covered by the MB-SMF service area of the MB-SMF, the MB-SMF reduces the MBS service area to be within the MB-SMF service area and continues the procedure using the reduced MBS service area.

 If the MBS service area received in step 8 is geographical area information and the NEF/MBSF determines the received MBS service area is for NR NTN based on local configuration, the MBS service area sent by the NEF/MBSF to MB-SMF also includes geographical area information as the small area list.

 For broadcast communication, the NEF/MBSF forwards the "NR RedCap UE Information" parameter, if received from the AF.

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. The MB-SMF sends an Nmbsmf\_MBSSession\_Create response ([TMGI], [Allocated ingress address], [Information of area reduction]).

 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.

 If the MB-SMF reduces the service area in step 11, the MB-SMF includes result information in the response indicating that the MBS service area cannot be covered by the MB-SMF service area of a single MB-SMF, and includes the Information of area reduction that relates to the reduced MBS service area.

NOTE 5: Details of the Information of area reduction is defined by stage 3.

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 6: 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 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], [Information of area reduction]). 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.

 If the NEF/MBSF rejects the TMGI allocation in step 10, or receives the result information in step 16 indicating that the MBS service area cannot be covered by the MB-SMF service area of the MB-SMF, the NEF/MBSF includes that result information, and forwards the Information of area reduction.

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.

5th 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)], [NR RedCap UE Information]).

 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 subsequently update "NR RedCap UE Information" parameter.

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.

 If the MBS service area is not covered by the MB-SMF service area of the MB-SMF, the MB-SMF reduces the MBS service area to be within the MB-SMF service area and continues the procedure with the reduced MBS service area.

 For broadcast communication, the NEF/MBSF forwards "NR RedCap UE Information" parameter to the MB-SMF, if received.

 If the MBS service area received in step 1 is geographical area information and the NEF/MBSF determines the received MBS service area is for NR NTN based on local configuration, the MBS service area sent by the NEF/MBSF to MB-SMF also includes geographical area information as the small area list.

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 ([Information of area reduction]).

 If the MB-SMF reduces the MBS service area in step 3, the MB-SMF includes result information in the response indicating that the MBS service area cannot be covered by the MB-SMF service area of the MB-SMF, and includes the Information of area reduction that relates to the reduced MBS service area.

NOTE: Details of the Information of area reduction is defined by stage 3.

10. NEF/MBSF responds to the AF with a Nnef\_MBSSession\_Update Response ([MBS service area information]).

 If the NEF/MBSF receives the result information in step 9 indicating that the MBS service area cannot be covered by the MB-SMF service area of the MB-SMF, the NEF/MBSF includes that result information, and the Information of area reduction.

6th change

### 7.3.1 MBS Session Start for Broadcast

The Broadcast MBS Session Start follows the common procedure specified in clause 7.1.1.2 or clause 7.1.1.3, which consist of TMGI Allocation and MBS Session Create. It is possible for AF to allocate TMGI once but create the MBS Session for multiple times. A combined procedure to perform both TMGI allocation and MBS Session Create is available.

The TMGI Allocation is used by AF to obtain the TMGI as MBS Session ID (i.e. TMGI) and perform service announcement towards UEs.

The MBS Session Create (with MBS service type set to broadcast service) is used by the AF to indicate the impending start of the transmission of MBS data, and to provide the session attributes, so that resources for the MBS Session are set up in the MB-UPF and in the NG-RAN for 5GC Shared MBS traffic delivery. The MBS Session Create can be used if TMGI has not been allocated. In this case, MB-SMF will allocate a unique TMGI for the AF and then start the MBS Session.

NOTE 1: When the multicast transport between NG-RAN and MB-UPF is described below, source specific multicasting is assumed.

To receive the data of broadcast communication service, the UE is either preconfigured with needed configuration (see TS 24.575 [26] for UE pre-configuration) for the UE to receive MBS service, or provisioned with the configuration of Broadcast MBS session on application level (service announcement as described in TS 26.502 [18] and TS 26.517 [22]). If the needed configuration is pre-configured, the UE does not need to interact with network.



Figure 7.3.1-1: MBS Session Establishment for Broadcast

0 Based on OAM configuration, RAN nodes announce in SIBs over the radio interface information about the MBS FSA IDs and frequencies of neighbouring cells.

1. To establish broadcast MBS session, the AF performs TMGI allocation and MBS session creation as specified in clause 7.1.1.2 or 7.1.1.3. The MBS service type indicates to be broadcast service. The MBS FSA ID(s) of a broadcast MBS session are communicated in the service announcement towards the UE. The UE compares those MBS FSA IDs(s) with the MBS FSA ID(s) in SIBs for frequency selection.

2. The MB-SMF may use NRF to discover the AMF(s) supporting MBS based on the MBS service area and select the appropriate one(s). Then the MB-SMF sends the Namf\_MBSBroadcast\_ContextCreate (TMGI, N2 SM information ([LL SSM], 5G QoS Profile, [NR RedCap UE Information]), MBS service area, [MBS FSA ID(s)]) messages to the selected AMF(s) in parallel if the service type is broadcast service. The MB-SMF may include a maximum response time in the request.

 If the MB-SMF receives the "NR RedCap UE Information" parameter (as defined in clause 6.19) from the AF (which may be via NEF/MBSF), the MB-SMF includes the "NR RedCap UE Information" parameter in N2 SM information.

 For NR NTN, if the MB-SMF receives an MBS service area from AF (which may be via NEF/MBSF) containing a small area list, the MB-SMF forwards the small area list as part of the MBS service area to the selected AMF(s).

3. The AMF transfers the MBS Session Resource Setup Request message, which contains the N2 SM information in the received Namf\_MBSBroadcast\_ContextCreate Request to all NG-RANs which support MBS in the MBS service area. The AMF includes the MBS service area.

4. NG-RAN creates a Broadcast MBS Session Context and stores the TMGI and the QoS Profile in the MBS Session Context. The LL SSM are optional parameters and only provided by MB-SMF to NG-RAN if N3mb multicast transport is configured to be used in the 5GC. If MBS FSA ID(s) were received, the NG-RAN may use those MBS FSA ID(s)s to determine cells/frequencies within the MBS service area to broadcast MBS session data based on OAM configuration about the MBS FSA IDs and related frequencies.

 If N2 SM information contains "NR RedCap UE Information", the NG-RAN determines that the related MBS service is intended to be received by NR RedCap UEs only, or both by NR RedCap UEs and non-RedCap UEs, and allocates the appropriate radio resources as defined in TS 38.331 [28].

Depending on the NG-RAN's preference to use multicast or unicast transport over N3mb and the availability of the LL SSM, step 5a or step 5b is executed.

5a. If NG-RAN prefers to use N3mb multicast transport (and if LL SSM is available in NG-RAN), the NG-RAN joins the multicast group (i.e. LL SSM).

5b. If NG-RAN prefers to use N3mb unicast transport (or if the LL SSM is not available in NG-RAN) between the NG-RAN and MB-UPF, NG-RAN allocates its N3mb DL Tunnel endpoint to receive downlink MBS session data.

6. The NG-RAN reports successful establishment of the MBS Session resources (which may include multiple MBS QoS Flows) by sending MBS Session Resource Setup Response (TMGI, N2 SM information ([N3mb DL Tunnel Info])) message(s) to the AMF. If NG-RAN prefers to use N3mb unicast transport (or if the LL SSM is not available in NG-RAN) between the NG-RAN and MB-UPF, NG-RAN provides its N3mb DL Tunnel Info as part of the N2 SM information. For more details, refer to TS 38.413 [15].

7. The AMF transfers the Namf\_MBSBroadcast\_ContextCreate Response () to the MB-SMF. The AMF should respond success when it receives the first success response from the NG-RAN(s). And if all NG-RAN(s) report failure, the AMF should respond failure. The MB-SMF stores the AMF(s) which responds success in the MBS Session Context as the downstream nodes. If the AMF receives the NG-RAN response(s) from all involved NG-RAN(s), the AMF should include an indication of completion of the operation in all NG-RANs. If received from NG-RAN node, the N3mb DL Tunnel Info and NG-RAN ID are included in the response.

8. [Conditional] If N3mb unicast transport is to be used (i.e. N3mb DL Tunnel Info is present in the Namf\_MBSBroadcast\_ContextCreate Response message from AMF) in a deployment where NG-RAN nodes share a common user plane entity, the MB-SMF only establishes the shared tunnel towards the DL GTP tunnel endpoint if the shared tunnel has not yet been established (as determined based on the stored DL GTP Tunnel endpoint(s) for the MBS session). The MB-SMF also stores the received DL GTP Tunnel and corresponding NG-RAN Node ID for the MBS session. For the deployment where NG-RAN nodes do not share a common user plane entity, the DL GTP tunnel will not be used by other NG-RAN nodes. In a deployment where NG-RAN nodes do not share a common user plane entity, the MB-SMF always establishes the shared tunnel towards the DL GTP tunnel endpoint.

 To establish the shared tunnel towards the DL GTP tunnel endpoint, the MB-SMF sends an N4mb Session Modification Request to the MB-UPF to allocate the N3mb unicast transport tunnel for a replicated MBS stream for the MBS Session.

8a-8b. If the AF subscribed to a Delivery Status Indication (see clause 7.3.5), the MB-SMF notifies the AF as specified in step 2 of clause 7.3.5. The MB-SMF notifies the AF directly by invoking Nmbsmf\_MBSSession\_StatusNotify service operation, or the MB-SMF notifies the AF via NEF/MBSF (if deployed) by invoking Nmbsmf\_MBSSession\_StatusNotify service operation to the NEF/MBSF which then invokes Nnef\_MBSSession\_StatusNotify service operation to the AF.

9. NG-RAN broadcasts the TMGI representing the MBS service over radio interface. If the NG-RAN receives in step 3 an MBS service area information containg a small area list (for NTN), the NG-RAN broadcast the small area list towards UEs, and the UEs only renders the MBS session while they are in that area. Step 9 can take place in parallel with step 6.

10. Another NG-RAN may report successful establishment of the MBS Session resources (which may include multiple MBS QoS Flows) by sending MBS Session Resource Setup Response (TMGI, N2 SM information ([N3mb DL Tunnel Info])) message after the AMF transferred the Namf\_MBSBroadcast\_ContextCreate Response () to the MB-SMF.

11. The AMF transfers the Namf\_MBSBroadcast\_ContextStatusNotify request () to the MB-SMF. When the AMF receives the response from all NG-RAN nodes, the AMF includes an indication of the completion of the operation. If the AMF does not receive responses from all NG-RAN nodes before the maximum response time elapses since the reception of the Namf\_MBSBroadcast\_ContextCreate Request, then the AMF should transfer the Namf\_MBSBroadcast\_ContextStatusNotify request () which indicates partial success or failure.

12. [Conditional] If N3mb unicast transport is to be used (i.e. N3mb DL Tunnel Info is present in the MBS Session Start Response message from AMF), the handling in MB-SMF and MB-UPF is the same as specified in step 8.

13. The AF starts transmitting the DL media stream to MB-UPF using the N6mb Tunnel, or optionally un-tunnelled i.e. as an IP multicast stream using the HL MC address.

14. The MB-UPF transmits the media stream to NG-RAN via N3mb multicast transport or unicast transport.

15. The NG-RAN transmits the received DL media stream using DL PTM resources.

NOTE 2: Step 6-8 and 2-4 are comparable to step 2-5 and 6-7 in clause 7.2.1.4, respectively.

7th change

### 7.3.3 MBS Session Update for Broadcast

The MBS Session Update for broadcast is used by the AF to update the broadcast area or service requirements of the MBS Session which 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).



Figure 7.3.3-1: MBS Session Update for Broadcast

1. The AF starts MBS session update procedure by sending Nnef\_MBSSession\_Update Request to the NEF/MBSF with TMGI (steps 1-6 and steps 9-10 in Figure 7.1.1.6-1, or steps 1-12 and steps 15-16 in Figure 7.1.1.7-1). The AF may adjust service requirement and/or broadcast area. The service requirements adjustment 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).

2. The MB-SMF sends Namf\_MBSBroadcast\_ContextUpdate Request (TMGI, N2 SM information (MBS Session ID, [MBS QoS profile], [service area(s)], [Area Session ID(s)], [MBS IP Multicast Tunnel Info(s)], [MBS FSA ID(s)], [NR RedCap UE Information]), [updated MBS service area]) to the AMFs. For a location dependent service, the MB-SMF may provide information about several location areas. If the broadcast area is updated, the MB-SMF may use NRF to discover the AMF(s) based on the new broadcast area and select the appropriate one(s). The MB-SMF may include a maximum response time in the request.

 Depending on the change of the MBS service area, the MB-SMF may send Namf\_MBSBroadcast\_ContextCreate to some AMFs in the new MBS service area, Namf\_MBSBroadcast\_ContextRelease to some other AMFs in the old MBS service area.

 The MB-SMF includes the "NR RedCap UE Information" parameter in N2 SM information, if received.

 For NR NTN, if the MB-SMF receives an MBS service area information containg a small area list, the MB-SMF forwards the small area list as part of the MBS service area to the selected AMF(s).

3. The AMF sends MBS Session Resource Update to NG-RANs with TMGI, the updated 5G QoS Profile and the updated MBS service area.

 Depending on the change of the MBS service area, the AMF may send MBS Session Resource Setup to some NG-RANs in new MBS service area (see clause 7.3.1) and MBS Session Resource Release to some other NG-RANs in old MBS service area.

 If the AMF receives (for NTN) an MBS service area information containg a small area list in combination with TAIs and/or cell IDs, the AMF uses the TAIs and/or cell IDs to select the NG-RAN nodes. The AMF provides the MBS service area information towards NG-RAN.

4. The NG-RAN updates MBS Session Context.

 If N2 SM information contains "NR RedCap UE Information" for the broadcast MBS session, the NG-RAN may update the radio resources accordingly as specified in TS 38.331 [28].

5. The NG-RAN reports successful update of the MBS Session resources (which may include multiple MBS QoS Flows) by sending MBS Session Resource Update Response (TMGI, N2 SM information ([N3mb DL Tunnel Info])) message(s) to the AMF. N3mb DL Tunnel Info is only available when unicast transport applies between MB-UPF and NG-RAN and the NG-RAN wants the transport to be changed. The NG-RAN should be ready to receive using the N3mb DL tunnel. For more details, refer to TS 38.413 [15].

6. The AMF sends Namf\_MBSBroadcast\_ContextUpdate Response to the MB-SMF. If the AMF received the NG-RAN responses from all involved NG-RAN(s), the AMF should include an indication of completion of the operation in all NG-RANs. If received from NG-RAN node, the N3mb DL Tunnel Info and corresponding NG-RAN ID are included in the response.

6a. [Conditional] If MBS service area is changed in such a manner that NG-RAN nodes are added or removed from handling the MBS session, and N3mb unicast transport is used.

- In a deployment where NG-RAN nodes share a common user plane entity, the MB-SMF perform as following:

- For the NG-RAN node to be added, the MB-SMF only establishes the shared tunnel towards the DL GTP tunnel endpoint if the shared tunnel has not yet been established (as determined based on the stored DL GTP Tunnel endpoint(s) for the MBS session). The MB-SMF also stores the received DL GTP Tunnel and corresponding NG-RAN Node ID for the MBS session.

- For the NG-RAN node to be removed, the MB-SMF removes the received NG-RAN Node ID and possibly DL GTP tunnel endpoint from the stored NG-RAN Node ID(s) for the DL GTP tunnel endpoint for the MBS session, and checks whether the DL GTP tunnel is in use by other NG-RAN nodes based on the stored NG-RAN Node ID(s) for DL GTP tunnel endpoint for the MBS session. If the related DL GTP tunnel is not in use by other NG-RAN nodes, the N3mb unicast transport tunnel shall be removed.

- In a deployment where NG-RAN nodes do not share a common user plane entity, the MB-SMF always establishes or releases the shared tunnel towards the DL GTP tunnel endpoint if NG-RAN nodes are added or removed from handling the MBS session.

 If the N3mb unicast transport tunnel need to be added or removed, the SMF sends an N4mb Session Modification Request to the MB-UPF to establish or release the N3mb unicast transport tunnel for establishing, or releasing the MBS stream for the MBS Session.

7. The NG-RAN updates the MBS Session. It takes place in parallel with step 5 to step 6.

8 Another NG-RAN may report successful update of the MBS Session resources (which may include multiple MBS QoS Flows) by sending MBS Session Resource Update Response (TMGI, N2 SM information ([N3mb DL Tunnel Info])) message after the AMF transferred the Namf\_MBSBroadcast\_ContextUpdate Response () to the MB-SMF. N3mb DL Tunnel Info is only available when unicast transport applies between MB-UPF and NG-RAN and the NG-RAN wants the transport to be changed. The NG-RAN should be ready to receive using the N3mb DL tunnel. For more details, refer to TS 38.413 [15].

9. The AMF transfers the Namf\_MBSBroadcast\_ContextStatusNotify request () to the MB-SMF. When the AMF receives the response from all NG-RAN nodes, the AMF should include an indication of completion of the operation in all NG-RANs. If the AMF does not receive responses from all NG-RAN nodes before the maximum response time elapses since the reception of the Namf\_MBSBroadcast\_ContextUpdate Request, then the AMF should transfer the Namf\_MBSBroadcast\_ContextStatusNotify request () which indicates partial success or failure. If received from NG-RAN node, the N3mb DL Tunnel Info and corresponding NG-RAN ID are included in the request.

10. [Conditional] If MBS service area is changed in such a manner that NG-RAN nodes are added or removed from handling the MBS session, and N3mb unicast transport is used, the MB-SMF establishes or releases the shared delivery tunnel via unicast N3mb transport for the MBS Session in the same manner as described in step 6a.

End of changes