**3GPP TSG-RAN2 Meeting #131 *draft R2-2506347***

**Bengaluru, India, August 25-29, 2025**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **1428** | **rev** | **1** | **Current version:** | **18.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Introduction of LTE-based 5G Broadcast Phase 2 |
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| ***Source to WG:*** | , Sanechips |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | LTE\_terr\_bcast\_Ph2-Core |  | ***Date:*** | 2025-09-05 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | Introduction of LTE-based 5G Broadcast Phase 2. |
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| ***Summary of change:*** | Adding stage 2 support for time and frequency interleaving according to latest agreements. |
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| ***Consequences if not approved:*** | The support of LTE-based 5G Broadcast Phase 2 would be missing from specification. |
|  |  |
| ***Clauses affected:*** | 15.1.1, 15.3.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 36.211 CR 0576TS 36.212 CR 0376TS 36.213 CR 1448TS 36.331 CR 5143TS 36.306 CR 1920TS 36.321 CR 1593 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ... |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |   |

First Change

# 15 MBMS

## 15.1 General

### 15.1.0 Overview

In E-UTRAN, MBMS can be provided with single frequency network mode of operation (MBSFN) either on a frequency layer shared with non-MBMS services (set of cells supporting both unicast and MBMS transmissions i.e. set of "MBMS/Unicast-mixed cells") or on a frequency layer dedicated for MBMS (set of cells supporting MBMS transmission only i.e. set of "MBMS-dedicated cells").

MBMS reception is possible for UEs in RRC\_IDLE state, or except for NB- IoT UEs, BL UEs or UEs in enhanced coverage, in RRC\_CONNECTED state. Whenever receiving MBMS services, a user shall be notified of an incoming call, and originating calls shall be possible.

ROHC for MBMS is supported by upper layers (outside of Access Stratum) and only for Mission Critical services, as described in TS 23.280 [77].

RNs do not support MBMS.

HeNBs do not support MBMS.

For NB-IoT UEs, BL UEs or UEs in enhanced coverage:

- MBMS is provided in "MBMS/Unicast-mixed cells" with single-cell transmission.

- MBMS reception is possible only for UEs in RRC\_IDLE state.

- Whenever receiving MBMS services, a user shall be notified of an incoming call, and originating calls shall be possible:

- Mobile Terminated call has higher priority than MBMS reception;

- Mobile Originated signalling has higher priority than MBMS reception;

- Other cases are left to UE implementation.

### 15.1.1 E-MBMS Logical Architecture



Figure 15.1.1-1: E-MBMS Logical Architecture

Figure 15.1.1-1 depicts the E-MBMS Logical Architecture.

**Multi-cell/multicast Coordination Entity (MCE)**

The MCE is a logical entity – this does not preclude the possibility that it may be part of another network element – whose functions are:

- the admission control and the allocation of the radio resources used by all eNBs in the MBSFN area for multi-cell MBMS transmissions using MBSFN operation. The MCE decides not to establish the radio bearer(s) of the new MBMS service(s) if the radio resources are not sufficient for the corresponding MBMS service(s) or may pre-empt radio resources from other radio bearer(s) of ongoing MBMS service(s) according to ARP. Besides allocation of the time/ frequency radio resources this also includes deciding the further details of the radio configuration e.g. the modulation and coding scheme.

- deciding on whether to use SC-PTM or MBSFN.

- counting and acquisition of counting results for MBMS service(s).

- resumption of MBMS session(s) within MBSFN area(s) based on e.g. the ARP and/or the counting results for the corresponding MBMS service(s).

- suspension of MBMS session(s) within MBSFN area(s) based e.g. the ARP and/or on the counting results for the corresponding MBMS service(s).

- deciding on whether to use time or frequency interleaving and configuring the parameters of time interleaving.

NOTE: In case of distributed MCE architecture, the MCE manages the above functions for a single eNB of a MBSFN. The coordination of the functions between MCEs is provided by OAM, if needed.

The MCE is involved in MBMS Session Control Signalling. The MCE does not perform UE - MCE signalling.

An eNB is served by a single MCE.

**E-MBMS Gateway (MBMS GW)**

The MBMS GW is a logical entity – this does not preclude the possibility that it may be part of another network element – that is present between the BMSC and eNBs whose principal functions is the sending/broadcasting of MBMS packets to each eNB transmitting the service. The MBMS GW uses IP Multicast as the means of forwarding MBMS user data to the eNB. The MBMS GW performs MBMS Session Control Signalling (Session start/update/stop) towards the E-UTRAN via MME.

**Control Plane Interfaces**

***"M3" Interface: MCE – MME***

An Application Part is defined for this interface between MME and MCE. This application part allows for MBMS Session Control Signalling on E-RAB level (i.e. does not convey radio configuration data). The procedures comprise e.g. MBMS Session Start and Stop. SCTP is used as signalling transport i.e. Point-to-Point signalling is applied.

***"M2" Interface: MCE – eNB***

An Application Part is defined for this interface, which conveys at least radio configuration data for the multi-cell transmission mode eNBs and Session Control Signalling. SCTP is used as signalling transport i.e. Point-to-Point signalling is applied.

**User Plane Interface**

***"M1" Interface: MBMS GW – eNB***

This interface is a pure user plane interface. Consequently no Control Plane Application Part is defined for this interface. IP Multicast is used for point-to-multipoint delivery of user packets.

**Deployment consideration**

The two envisaged alternatives are shown in Figure 15.1.1-2.

The architecture on the right part is defined as the "distributed MCE architecture". In this architecture, a MCE is part of the eNB and the M2 interface should be kept between the MCE and the corresponding eNB.

The architecture on the left part is defined as the "centralized MCE architecture". In this architecture, the MCE is a logical entity which means it can be deployed as a stand-alone physical entity or collocated in another physical entity e.g. eNB. In both cases of the centralized MCE architecture, the M2 interface is kept between the MCE and all eNB(s) belonging to the corresponding MBSFN area.



Figure 15.1.1-2: eMBMS Architecture deployment alternatives

**MBMS for V2X**

When MBMS is used to deliver downlink V2X messages, the localized MBMS specified in TS 23.285 [72] may be used to improve latency if desired.

Single TMGI in non-overlapped MBMS service areas or multiple TMGIs in overlapped MBMS service areas may be used to support small MBMS areas for V2X.

### 15.1.2 E-MBMS User Plane Protocol Architecture

The overall U-plane architecture of content synchronization is shown in Figure 15.1.2-1. This architecture is based on the functional allocation for Unicast and the SYNC protocol layer is defined additionally on transport network layer to support content synchronization mechanism.



Figure 15.1.2-1: The overall u-plane architecture of the MBMS content synchronization

The SYNC protocol is defined as a protocol to carry additional information that enable eNBs to identify the timing for radio frame transmission and detect packet loss. Every E-MBMS service uses its own SYNC entity. The SYNC protocol is applicable to DL and is terminated in the BM-SC.

### 15.1.3 E-MBMS Control Plane Protocol Architecture

The E-MBMS C-plane protocol architecture is shown in Figure 15.1.3-1.



Figure 15.1.3-1: The E-MBMS c-plane architecture

MCCH is terminated in the eNB on the network side. How to achieve the synchronisation of MCCH signalling is described in clause 15.3.8.

Next Change

## 15.3 MBMS Transmission

### 15.3.1 General

Transmission of a MBMS in E-UTRAN uses either MBSFN transmission or SC-PTM transmission. The MCE makes the decision on whether to use SC-PTM or MBSFN for each MBMS session.

### 15.3.2 Single-cell transmission

Single-cell transmission of MBMS is characterized by:

- MBMS is transmitted in the coverage of a single cell;

- One SC-MCCH and one or more SC-MTCH(s) are mapped on DL-SCH;

- Scheduling is done by the eNB;

- SC-MCCH and SC-MTCH transmissions are each indicated by a logical channel specific RNTI on PDCCH (there is a one-to-one mapping between TMGI and G-RNTI used for the reception of the DL-SCH to which a SC-MTCH is mapped);

- A single transmission is used for DL-SCH (i.e. neither blind HARQ repetitions nor RLC quick repeat) on which SC-MCCH or SC-MTCH is mapped;

- SC-MCCH and SC-MTCH use the RLC-UM mode.

For each SC-MTCH, the following scheduling information is provided on SC-MCCH:

- **SC-MTCH scheduling cycle**;

- **SC-MTCH on-duration**: duration in downlink subframes that the UE waits for, after waking up from DRX, to receive PDCCHs. If the UE successfully decodes a PDCCH indicating the DL-SCH to which this SC-MTCH is mapped, the UE stays awake and starts the inactivity timer;

- **SC-MTCH inactivity-timer**: duration in downlink subframes that the UE waits to successfully decode a PDCCH, from the last successful decoding of a PDCCH indicating the DL-SCH to which this SC-MTCH is mapped, failing which it re-enters DRX. The UE shall restart the inactivity timer following a single successful decoding of a PDCCH.

NOTE 1: The SC-PTM reception opportunities are independent of the unicast DRX scheme.

NOTE 2: The SC-MTCH inactivity-timer may be set to 0.

NOTE 3: Although the above parameters are per SC-MTCH (i.e. per MBMS service), the network may configure the same scheduling pattern for multiple SC-MTCHs (i.e. multiple MBMS services).

NOTE 4: For NB-IoT UEs, the definition of the above parameters does not apply.

NOTE 5: For BL UEs and UEs in enhanced coverage, the definition of the above parameters does not apply.

For BL UEs, UEs in enhanced coverage and NB-IoT UEs, when multi-TB scheduling is configured, a single MPDCCH/NPDCCH can indicate scheduling of multiple downlink transmissions.

### 15.3.3 Multi-cell transmission

Multi-cell transmission of MBMS is characterized by:

- Synchronous transmission of MBMS within its MBSFN Area;

- Combining of MBMS transmission from multiple cells is supported;

- Scheduling of each MCH is done by the MCE;

- A single transmission is used for MCH (i.e. neither blind HARQ repetitions nor RLC quick repeat);

- A single Transport Block is used per TTI for MCH transmission, that TB uses all the MBSFN resources in that subframe;

- Time/frequency interleaving for MCH can be configured by the MCE, and time interleaving is supported for each MBMS session for MCH but not across different MBMS sessions;

- MTCH and MCCH can be multiplexed on the same MCH (if no time interleaving is configured) and are mapped on MCH for p-t-m transmission;

- MTCH and MCCH use the RLC-UM mode;

- The MAC subheader indicates the LCID for MTCH and MCCH;

- The MBSFN Synchronization Area, the MBSFN Area, and the MBSFN cells are semi-statically configured e.g. by O&M;

- MBSFN areas are static, unless changed by O&M (i.e. no dynamic change of areas);

NOTE: The UE is not required to receive services from more than one MBSFN Area simultaneously and may support only a limited number of MTCHs.

NOTE: In case the configured time-interleaved PMCH transmission exceeds a UE’s capability in terms of soft buffer size or maximum TBS supported in a TTI, the UE is not expected to receive the corresponding time-interleaved PMCH transmission.

Multiple MBMS services can be mapped to the same MCH and one MCH contains data belonging to only one MBSFN Area. An MBSFN Area contains one or more MCHs. An MCH specific MCS is used for all subframes of the MCH that do not use the MCS indicated in BCCH. All MCHs have the same coverage area.

For MCCH and MTCH, the UE shall not perform RLC re-establishment at cell change between cells of the same MBSFN area. Within the MBSFN subframes, all MCHs within the same MBSFN area occupy a pattern of subframes, not necessarily adjacent in time, that is common for all these MCHs and is therefore called the Common Subframe Allocation (CSA) Pattern. The CSA pattern is periodically repeated with the CSA period. The actual MCH subframe allocation (MSA) for every MCH carrying MTCH is defined by the CSA pattern, the CSA period, and the MSA end, that are all signalled on MCCH. The MSA end indicates the last subframe of the MCH within the CSA period. Consequently, the MCHs are time multiplexed within the CSA period, which finally defines the interleaving degree between the MCHs. It shall be possible for MCHs to not use all MBSFN resources signalled as part of the Rel-8 MBSFN signalling. Further, such MBSFN resource can be shared for more than one purpose (MBMS, Positioning, etc.). During one MCH scheduling period (MSP), which is configurable per MCH, the eNB applies MAC multiplexing of different MTCHs and optionally MCCH to be transmitted on this MCH, if time interleaving is not configured.

MCH scheduling information (MSI) is provided per MCH to indicate which subframes are used by each MTCH during the MSP, and to indicate whether transmission for an MTCH is going to be, or has been, suspended by the eNode B. The following principles are used for the MSI:

- it is used both when services are multiplexed onto the MCH and when only a single service is transmitted on the MCH;

- it is generated by the eNB and provided once at the beginning of the MSP;

- it has higher scheduling priority than the MCCH and, when needed, it appears first in the PDU;

- it allows the receiver to determine what subframes are used by every MTCH, sessions are scheduled in the order in which they are included in the MCCH session list;

- it is carried in a MAC control element which cannot be segmented;

- it carries the mapping of MTCHs to the subframes of the associated MSP. This mapping is based on the indexing of subframes belonging to one MSP;

- it carries an indication of whether the transmission of an MTCH is to be suspended by the eNode B.

The content synchronization for multi-cell transmission is provided by the following principles:

1. All eNBs in a given MBSFN Synchronization Area have a synchronized radio frame timing such that the radio frames are transmitted at the same time and have the same SFN.

2. All eNBs have the same configuration of RLC/MAC/PHY for each MBMS service, and identical information (e.g. time information, transmission order/priority information/time interleaving/frequency interleaving) such that synchronized MCH scheduling in the eNBs is ensured. These are indicated in advance by the MCE.

3. An E-MBMS GW sends/broadcasts MBMS packet with the SYNC protocol to each eNB transmitting the service.

4. The SYNC protocol provides additional information so that the eNBs identify the transmission radio frame(s). The E-MBMS GW does not need accurate knowledge of radio resource allocation in terms of exact time division (e.g. exact start time of the radio frame transmission).

5. eNB buffers MBMS packet and waits for the transmission timing indicated in the SYNC protocol.

6. The segmentation/concatenation is needed for MBMS packets and should be totally up to the RLC/MAC layer in eNB.

7. The SYNC protocol provides means to detect packet loss(es) and supports a recovery mechanism robust against loss of consecutive PDU packets (MBMS Packets with SYNC Header).

8. For the packet loss case the transmission of radio blocks potentially impacted by the lost packet should be muted.

9. The mechanism supports indication or detection of MBMS data burst termination (e.g. to identify and alternately use available spare resources related to pauses in the MBMS PDU data flow).

10. If two or more consecutive SYNC SDUs within a SYNC bearer are not received by the eNB, or if no SYNC PDUs of Type 0 or 3 are received for some synchronization sequence, the eNB may mute the exact subframes impacted by lost SYNC PDUs using information provided by SYNC protocol. If not muting only those exact subframes, the eNB stops transmitting the associated MCH from the subframe corresponding to the consecutive losses until the end of the corresponding MSP and it does not transmit in the subframe corresponding to the MSI of that MSP.

11. The eNB sets VT(US) to zero in the RLC UM entity corresponding to an MCCH at its modification period boundary.

12. The eNB sets VT(US) to zero in each RLC UM entity corresponding to an MTCH at the beginning of its MSP.

13. The eNB sets every bit in the MAC padding on MCH to "0".

14. The eNB's RLC concatenates as many RLC SDUs from the same radio bearer as possible.

15. The eNB's MAC multiplexes as many RLC PDUs as fit in the Transport Block.

16. The eNB sets every padding bit in the RLC UM PDU corresponding to an MTCH or MCCH to "0".

17. A MAC PDU including a MAC subheader for a MTCH MAC SDU always includes non-zero size of MTCH MAC SDU.

18. A MAC PDU including a MAC subheader for a MSI MAC control element always includes non-zero size of MSI MAC control element.

End of Changes