TSG-RAN meeting #22 RP-030653
Maui, Hawaii, 9-12 December 2003

Presentation of Specification to TSG

Presentation to:	**TSG RAN Meeting #22**
Document for presentation:	**TS25.346 Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (Stage-2) Version 2.4.0**
Presented for:	**Information**

Abstract of document:

This document is part of the Release 6"Introduction of the Multimedia Broadcast Multicast Service (MBMS) in RAN" and it is linked to the corresponding TS 22.146 "Multimedia Broadcast Multicast Service; Stage-1" and the SA2 TS23.246 Multimedia Broadcast/Multicast Service (MBMS); Architecture and Functional Description.

The purpose of the present document is to define the architecture of the MBMS in the UTRAN and help to define required changes in the existing specifications and potentially identify new required specifications.

Changes since last presentation to TSG RAN Meeting #20:

The TS25.346 was presented in TSG RAN #20 for approval. In that moment it was concluded that the TS25.346 is not yet on sufficient level for approval and cannot be put under change control.

Since then several MBMS discussions have taken place, thus the TS25.346 version 2.4.0 (with revision marks), now includes all agreed changes after RAN2 #39 and RAN3 #39 meetings, and it has been reviewed on email review on RAN2 reflector.

Following key agreements summarizes the enhancements done since TSG RAN #20 in RAN2: MBMS UE capability, MBMS notification, transport and physical channels, RACH access control in counting, principles of UE mobility, and usage of RFC-3095 U-mode in PDCP. More detailed list of enhancements since TSG RAN #21 is included in WI status report (RP-030570).

The RAN3 has continued its work on Iu, Iur and Iub issues so that the stability of the existing procedures have been increased and on few items like, RNC Registration, RNC De-registration and CN De-Registration are already identified and so that final conclusions are only required.

Outstanding Issues:

As also reported with more details in MBMS work item report, the TS25.346 has been enhanced in several places, since TSG RAN #20, so that the content and the structure of the TS has been stabilized. Furthermore, the size, severity and complexity of the open issues listed in WI status report has been decreased

It is commonly understood in RAN WG2, that after RAN WG2 #40 and #41 meetings, the TS25.346 will be in good shape for approval in TSG RAN #23 in March 04.

Contentious Issues:

3GPP TS 25.346 V2.43.0 (2003-110)

Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (Stage-2); (Release 6)

Keywords
MBMS, UTRAN

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This document is part of the Release 6 "**Introduction of the Multimedia Broadcast Multicast Service (MBMS) in RAN**" and it is linked to the corresponding TS 22.146 "Multimedia Broadcast Multicast Service; Stage-1" [2] and the SA2 WI "Multimedia Broadcast/Multicast Service Architecture" the work of which is reflected in TS 23.246 [3].

The purpose of the present document is to help the TSG RAN and TSG GERAN specify the changes to existing specifications and potentially identify new ones that are needed for the introduction of the "**Introduction of the Multimedia Broadcast Multicast Service (MBMS) in RAN**" feature for Release 6.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] 3GPP TR 21.905: " Vocabulary for 3GPP Specifications ".

[2] 3GPP TS 22.146: “Multimedia Broadcast/Multicast Service; Stage 1”.

[3] 3GPP TS 23.246: "Multimedia Broadcast Multicast Service; Architecture and Functional Description".

[4] 3GPP TR 25.992: "Multimedia Broadcast Multicast Service (MBMS); UTRAN/GERAN Requirements".

[5] 3GPP TS 23.236: “Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes”

[6] 3GPP TS 33.246: “3G Security; Security of Multimedia Broadcast/Multicast Service (MBMS)”

[7] 3GPP TS 25.301: “Radio Interface Protocol Architecture”

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

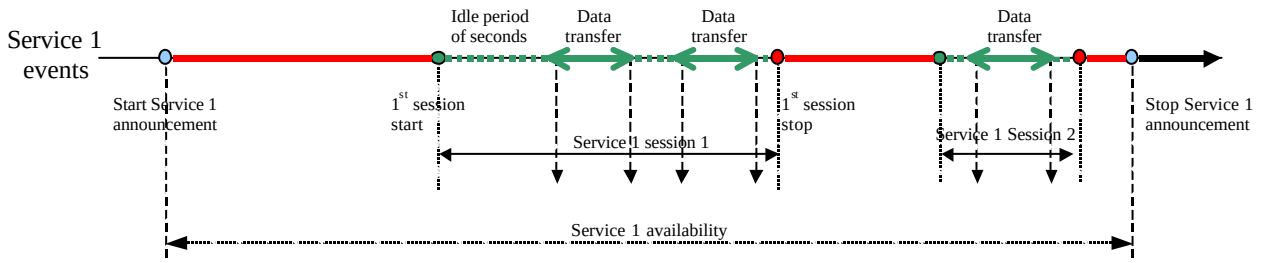

Figure 1: MBMS Timeline, based on [3].

MBMS session start is the point at which the BM-SC is ready to send data.

MBMS notification informs the UEs about forthcoming and about ongoing data transfer.

MBMS session stop is the point at which the BM-SC determines that there will be no more data to send for some period of time.

Data transfer is the phase when MBMS data are transferred to the UEs.

MBMS service availability is the phase between start of service announcement and the end of the last session or stop of service announcement.

MBMS Iu data bearer denotes the data bearer established between SGSN and RNC to transport MBMS data

MBMS radio bearer denotes the data bearer established between RNC and UE(s) to transport MBMS data

MBMS RAB denotes both, the MBMS Iu data bearer and the MBMS radio bearer

MBMS Service Context contains the necessary information for the UTRAN to control the MBMS Service in UTRAN.

MBMS Iu signalling connection denotes the signalling connection established between the RNC and the CN node to serve one MBMS Service Context.

MBMS Service Announcement: Mechanism to allow users to be informed about the MBMS services available [3]

Pool area: see definition in ref.[5]

MBMS Multicast Service Activation: see description in ref.[3]

3.2 Symbols

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TS 21.905 [1] and the following apply:

MBMS	Multimedia Broadcast Multicast Service
MBMS service ID	Multimedia Broadcast Multicast Service service Identity
MCCH	MBMS Control Channel
MTCH	MBMS Traffic Channel
p-t-p	Point-to-Point
p-t-m	Point-to-Multipoint

4 Background and Introduction

Following RAN/SA#15 it was concluded that the service requirements [2] of MBMS are considered as stable enough and the work on the architectural aspects have progressed to the extend that the work in RAN can be initiated.

5 MBMS UTRAN Architecture

5.1 MBMS UTRAN Architecture Principles

5.1.1 ~~One Context per~~ MBMS Service Context in CRNC

Each RNC which is controlling cell within an MBMS Multicast area maintains an MBMS Service Context for each MBMS service.

1 Each CRNC MBMS Service Context is associated with an MBMS service ID.

2 The CRNC MBMS Service Context contains a list of connected mode UEs which are present in each cell of the CRNC and which have activated an MBMS service. The list includes at least the U-RNTI of the UEs.

NOTE: The MBMS Service Context in the CRNC contains no information about Idle mode UEs.

3 The MBMS Service Context is created in the CRNC either

- if the SGSN informs the RNC that a UE has activated the MBMS Service in a cell controlled by the CRNC by the UE Linking procedure. In this case, the CRNC is the SRNC of the UE,
- or if the RNC is notified of an MBMS Session Start,
- or if the RNC serves as a Drift RNC for a PMM-Connected UE and receives from a SRNC a UE Link containing the Service Id of the concerned MBMS Service.

Note: It is FFS whether this can happen only during an MBMS Session or also before/between MBMS Sessions.

- Other cases are FFS.

4 The MBMS Service Context is released by the CRNC either

- if the MBMS Service Context does not contain any UE information after a UE Unlinking procedure from a SGSN and there is no active MBMS Session for the concerned MBMS Service,
- or if the MBMS Service Context does not contain any UE Link at the time of a Session Stop
- or if the RNC receives a CN initiated MBMS Deregistration Request (FFS).
- Other cases are FFS.

5 Associated functionalities:

5.1 Bearer type selection for MBMS transmissions based on information in the CRNC MBMS Service Context. The decision process requires inter-working with Radio Resource Management and with the UE's SRNC in the case of p-t-p bearers.

5.2 MBMS RB control for p-t-m bearers in each cell, based on information in the CRNC MBMS Service Context.

5.3 Update of the MBMS Service Context when a PMM-connected UE, which has activated an MBMS Service, has entered a cell. Update of the MBMS Service Context via Iur can be done by MBMS Attach procedure.

5.4 Update of the MBMS Service Context when a PMM-connected UE, which has activated an MBMS Service, has left a cell. Update of the MBMS Service Context via Iur can be done by MBMS Detach procedure.

Note: It is FFS whether the update of the MBMS Service Context via the Iur interface can be done only during MBMS Sessions or also before/between MBMS Sessions.

5.1.2 ~~One~~ MBMS Iu ~~flow~~ bearer ~~per RNC per MBMS Service~~

For each MBMS service, data is transferred via an MBMS RAB between the UE and the SGSN. For each MBMS service, data is transferred via one MBMS Iu bearer between RNC and the SGSN in the whole service area.

1 One MBMS Iu bearer is established per MBMS service at MBMS Session Start or when the RNC needs to send data on the radio interface due to the presence of UEs.

2 Regarding Iu flex, the current working assumption in SA2 is that the RNC is permitted to receive multiple Iu flows and decides to take one of them. This is [FFS].

3 Because of the dedicated channels and Iur mobility, there is a need to send MBMS data to an RNC which is not necessarily part of the service area. This is [FFS].

4 The MBMS Iu bearer on Iu is established per MBMS service and not per UE individually.

5 Each connected mode UE with an activated MBMS service has its UE context bind to the MBMS Iu bearer.

6 There could be several MBMS RBs linked to one MBMS Iu bearer (i.e. one MBMS Iu bearer on Iu maybe mapped to multiple DTCH and/or or p-t-m traffic channels over the radio -interface).

5.1.3 Mapping of Iu ~~Flow~~ bearer to p-t-p and ~~may be mapped to~~ p-t-m ~~C~~connections

The service specific MBMS RAB on Iu may be mapped to p-t-m bearers in order to provide MBMS data via common channels.

1 The MBMS control function in the CRNC may decide to establish a p-t-m connection, if the number of multicast users in a cell exceeds a certain operator-defined threshold.

2 The MBMS control function in the CRNC may decide to establish a p-t-m connection depending on the congestion scenario expected for a specific cell (e.g. in hotspot areas where no bearer type switching is needed).

3 The MBMS control function in the CRNC establishes an MBMS RB by sending service specific signalling messages (e.g. MBMS RB Setup message) to all the UEs in the cell listening MBMS control channel (MCCH). UEs with activated service(s) may then execute the RB set-up.

4 MBMS data is transferred on a MBMS traffic channel (MTCH) to all the UEs which have executed the RB setup.

5 The MBMS control function in the CRNC releases the MBMS RB (e.g. MBMS RB Release) when the data transfer has been finished or it has been interrupted by the CRNC.

6 p-t- p transmission of MBMS data should use the DTCH as defined for other dedicated services.

7 p-t-m reception applies to all RRC states and modes, subject to UE capability.

5.1.4 One PDCP entity shared among multiple cells within one RNS

For each MBMS service, a group of multiple cells belonging to one RNS shares one PDCP entity over p-t-m transmission. The group of multiple cells is called 'MBMS Cell Group'.

1. There are one or more MBMS Cell Groups per MBMS service per RNS. The MBMS Cell Groups are managed by the CRNC.

2. There are one or more cells pertaining to the same RNS for one MBMS Cell Group.

3. For each MBMS service, the MBMS Cell Group Identifier (MBMS CG-Id) is used to uniquely identify a group of multiple cells sharing the same PDCP entity within an RNS.

4. For each MBMS service, the MBMS CG-Id together with the identifier of the controlling RNC (CRNC-Id) constitutes the MBMS UTRAN Cell Group Identifier (MBMS UCG-Id).

5. Each cell sends the MBMS UCG-Id to UEs for each MBMS service. The MBMS UCG-Id is used to uniquely identify an MBMS Cell Group in the UTRAN and UE.

5.1.5 MBMS Notification

MBMS notification is based on the UE dedicated Rel99 paging occasion. The UE receives the MBMS notification indicators in the last 12 bits of the rel99 PICH frame or in one frame in the MBMS specific PICH. Based on the MBMS notification indicators the UE determines whether it shall receive the rest of the MBMS notification in MCCH or not.

In low MBMS load the last 12 bits of the rel99 PICH frame are utilized and in high MBMS load a MBMS specific PICH can be configured in the cell.

UTRAN should repeat the MBMS notification indicators in PICH frames constantly (either the 12 bits or the frame in MBMS specific PICH) at least for the longest DRX cycle used by the MBMS joined UEs in the cell, thus guaranteeing that each MBMS joined UE has received the MBMS notification indicators from PICH at least once.

5.1.64 Counting

A notification may be generated in the RNC and may be transmitted at the start of, as well as, during an ongoing MBMS session. It is used to notify a given MBMS service group of subscribers/UEs and not individual ones.

In cells where selection between MBMS p-t-m and p-t-p channels is expected to be performed (i.e. operator defined user threshold ? 0) for specific services, counting may be performed.

1. The need for counting is indicated in the notification, and achieved by requesting UEs, belonging to the same MBMS service group, to establish an RRC connection.
2. The exact number of UEs that need to be brought to RRC connected mode is an RRM issue.
3. Since it is desirable in a specific cell, to avoid bringing a large number of UEs for counting purposes to RRC connected mode at the same time (RACH load, etc), RRM may control the load due to the RRC connection establishment requests, by setting an access "probability factor".
4. Following counting, the number of subscribers that need to be maintained in RRC connected mode or for which the RNC releases their connection, is also an RRM issue.
5. For a given MBMS service, the counting indication in the notification may be switched on and off, on per-cell basis.
6. The RNC may use notification to indicate counting during an ongoing MBMS session (term used is re-counting).
7. The RNC receives via Iu from CN information (service ID) about UEs who are in RRC Connected mode, and have joined the service. This information may be used for counting purposes.

5.1.75 UE Linking

UE Linking denotes the process where a UE is linked to an MBMS service context in the SRNC.

MBMS UE linking procedure is performed in following cases.

1. When the UE is moved to PMM CONNECTED and sets up a PS RAB This may happen at any point in time during the whole service availability (i.e. before, during and between Sessions).
2. When the UE joins the service and is in PMM CONNECTED due to an existing PS RAB. This may happen at any point in time during the whole service availability (i.e. before, during and between Sessions).

3. When the UE is moved to PMM CONNECTED only for MBMS purpose, e.g. to response counting/recounting indication or response ptp bearer indication from RNC. This may happen at any point in time during MBMS sessions.

Keeping UEs in PMM CONNECTED only for MBMS between sessions is implementation specific. The UE linking is performed via UE dedicated Iu procedures. An entry for the UE is added to the MBMS service context in the SRNC. If the MBMS service context doesn't exist yet it needs to be created.

In case the UE consumes radio resources from a drift RNC, the UE Linking needs to be performed via Iur. It is [FFS] when the UE Linking via Iur is performed.

NOTE: The MBMS Attach/Detach procedure provides the UE Linking/Unlinking functionality via Iur.

NOTE: An additional function needs to be provided to unlink a UE from an MBMS service context via Iu.

5.1.8~~6~~ Session Start and Session Stop

At MBMS Session Start and MBMS Session Stop the RNC receives a respective request from the CN. The MBMS Session Start Request shall contain the Service Id and MBMS Session Attributes (MBMS Multicast Area Information, QoS parameters, …). The MBMS Session Start Request triggers the RNC to notify a given MBMS service group of subscribers/UEs of the MBMS Session Start. The MBMS Session Stop Request may trigger the RNC to notify a given MBMS service group of subscribers/UEs of the MBMS Session Stop.

The MBMS Session Start and Session Stop procedures provide the setup and release of the MBMS RAB in the following way:

The MBMS Session Start Request shall contain all information necessary to setup an MBMS RAB. When the RNC receives an MBMS Session Start Request, it shall either inform the sending CN node in an appropriate response if it has executed the MBMS Iu data bearer setup.

The RNC may not execute the MBMS Iu data bearer setup for a given Iu interface in case of Iu flex. The RNC may reject the procedure if it doesn't have enough resources available for that MBMS Service. In those cases the CN node shall be informed accordingly.

Note: It is FFS whether RNC may not execute the MBMS Iu data bearer setup if there is no UE with activated MBMS service for the service.

In case of Iu flex, the RNC might receive more than one MBMS Session Start Request for an MBMS Service and shall not set up more than one MBMS Iu bearer for a certain MBMS Service towards a pool area.

When the RNC receives an MBMS Session Stop Request it shall release the associated MBMS RAB resources.

Note: It is FFS whether RNC does not release the MBMS RAB resources when it receives an MBMS Session Stop Request for the purpose of RRM.

5.1.9~~7~~ RNC Registration

RNC Registration for a certain MBMS Service denotes the process where the CN becomes aware of an RNC hosting UEs which have activated that MBMS Service.

Due to UE mobility, a RNC with no MBMS Service Context, can be informed that a PMM-Connected UE, which has joined an MBMS Service, enters a cell via Iur Attach procedure. Then the RNC informs the CN that it would like to receive MBMS Session Start Request messages when applicable for the concerned MBMS Service by sending MBMS Registration Request message.

It results in the set-up of a corresponding MBMS distribution tree, but it does not result in the establishment of Iu user plane, which will be established by the MBMS Session Start procedure.

1. Implicit Registration

   - RNC Registration for Serving RNCs is performed implicitly, i.e due to UE linking and MBMS Multicast Service Activation. No explicit registration procedure needs to be performed.

2. Explicit Registration

- RNC Registration for Drift RNCs is performed explicitly if an RNC becomes a Drift RNC for a UE which has activated an MBMS service and has no MBMS Service Context for that MBMS Service. The DRNC will perform a registration towards its default CN node only.

5.1.10~~8~~ RNC De-Registration

RNC De-Registration for a certain MBMS Service denotes the process where the CN becomes aware that an RNC registered at a CN node does not host any more PMM-Connected UEs which has activated that MBMS Service.

FFS wrt Session. It results in the deletion of a corresponding MBMS Service context but it does not result in the release of Iu bearer, which will be released by the MBMS Session stop procedure.

1. Implicit RNC De-Registration

- RNC De-Registration for Serving RNCs is performed implicitly, i.e due to UE Unlinking and MBMS Multicast Service Deactivation. No explicit de-registration procedure needs to be performed.

2. Explicit RNC De-Registration [FFS]

- RNC De-Registration for Drift RNCs is performed explicitly if a RNC is not acting as a Serving RNC and has ceased to act as a Drift RNC for UEs which has activated an MBMS service, it will perform a de-registration towards the CN node it was registered to.

5.1.11~~9~~ CN De-Registration [FFS]

CN De-Registration denotes the process where the CN informs the RNC that a certain MBMS service is no longer available. CN De-Registration should result in releasing of all associated MBMS Service Contexts and resources.

5.2 Protocol structure

5.2.1 MBMS User Plane Protocol Stack Architecture

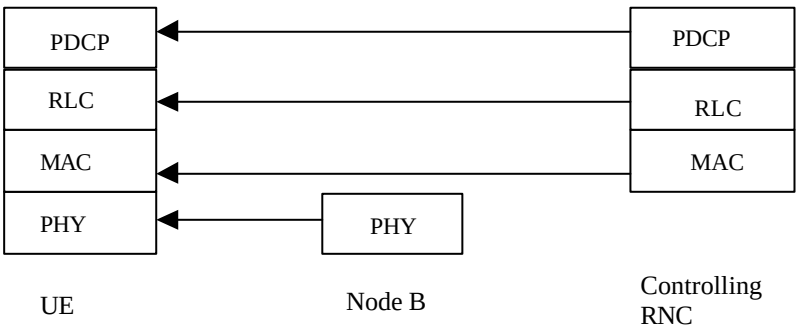

Figure 2: Protocol Stack for MTCH

Figure 1 illustrates the protocol termination for MTCH in MBMS.

PDCP sub-layer performs header compression/decompression for the MBMS traffic.

PDCP sub-layer may operate with RFC 3095 header compression protocol. In that case, header compression should be performed under RFC 3095 U-mode.

In the UTRAN side, there is one PDCP entity per cell supporting MBMS or MBMS Cell Group for each MBMS service in each RNS. The shared PDCP entity in the UTRAN duplicates all PDCP PDUs to every RLC entity for every cell belonging to one MBMS Cell Group.

In the UTRAN, there is one RLC entity for each MBMS service in each cell and one MAC entity for each cell.

In the UE side, there is one PDCP and RLC entity for each MBMS service in each UE. In each UE there is also one MAC entity.

The need for a new sublayer-2 is [FFS].

5.2.2 MBMS Control Plane Protocol Stack Architecture

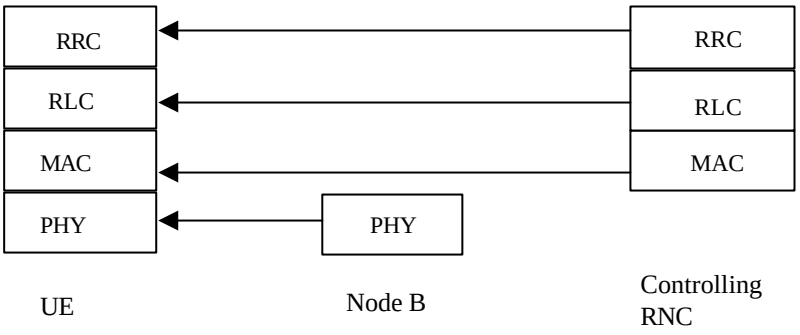

Figure 3: Protocol Stack for MCCH

Figure 2 illustrates the protocol termination for MCCH in MBMS.

MBMS functionalities are included in MAC and RRC.

5.3 MAC architecture

5.3.1 UTRAN MAC Architecture to support MBMS

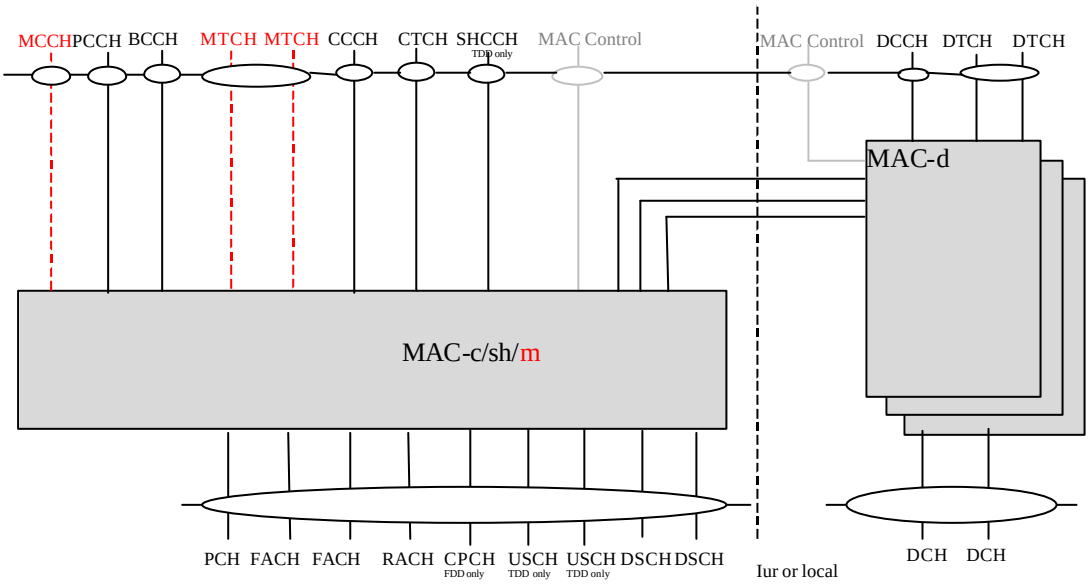

Figure 4: UTRAN MAC architecture

To support MBMS user and control plane transmission, a multicast functionality is added in the MAC c/sh, entitled "MAC m", to take care of scheduling of MBMS related transport channels. In addition, two logical channels are considered for MBMS: MCCH and MTCH. Both logical channels are mapped on FACH.

5.3.2 MAC-c/sh/m architecture: UTRAN side

Figure 4 illustrates the MAC-m additions to the MAC-c/sh architecture in the UTRAN side, needed to transmit MBMS data over a common transport channel (FACH).

MAC-c/sh/m is located in the controlling RNC. The following functionalities are covered:

- Scheduling – Priority Handling: This function manages common transport resources between MBMS and non-MBMS data flow(s) according to their priority [FFS].
- TCTF MUX: This function handles insertion of the TCTF field in the MAC header and also the respective mapping between logical channels (i.e. MTCH and MCCH) and transport channels. The TCTF field indicates which type of logical channel (i.e. MTCH and MCCH) is used.
- Addition of MBMS-ID: For p-t-m type of logical channels, the MBMS-ID field in the MAC header is used to distinguish between MBMS services.
- TFC selection: Transport format combination selection is done for a common transport channel (FACH) mapped to MTCH and MCCH.

There is one MAC-c/sh/m entity in the UTRAN for each cell.

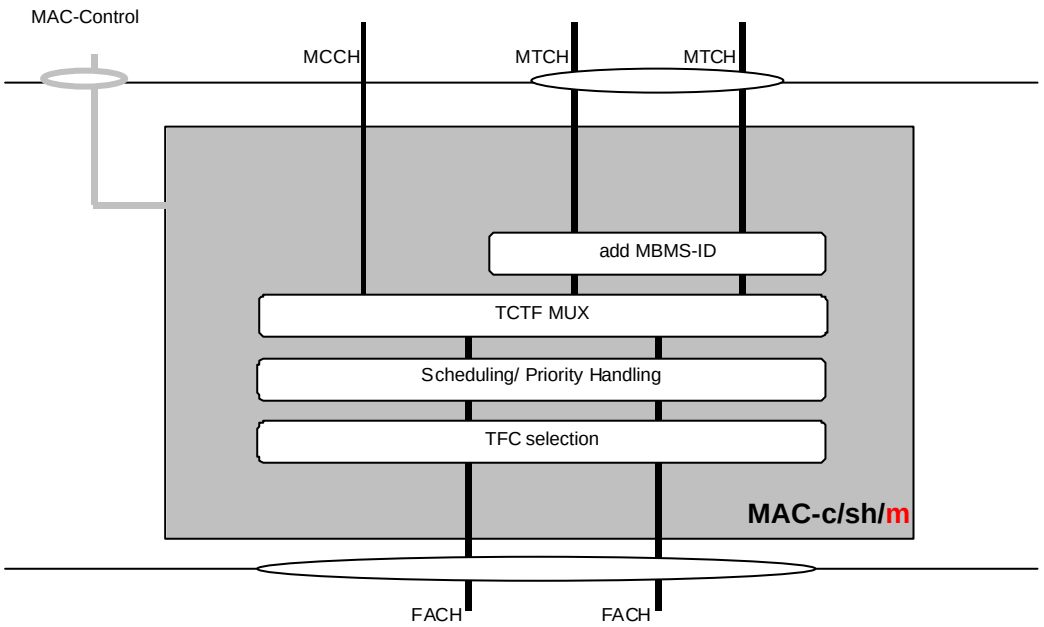

Figure 5: UTRAN side MAC-m architecture additions to MAC-c/sh

5.3.3 MAC-c/sh/m architecture: UE side

Figure 5 illustrates the MAC-m additions to the MAC-c/sh architecture in the UE side, needed to receive MBMS data over a transport channel (FACH).

The following functionalities are covered:

- TCTF DEMUX: This function handles detection and deletion of the TCTF field in the MAC header, and also the respective mapping between logical channels (i.e. MTCH and MCCH) and transport channels. The TCTF field indicates which type of logical channel (i.e. MTCH and MCCH) is used.
- Reading of MBMS-ID: The MBMS-ID identifies data to a specific MBMS service.

There is one MAC-c/sh/m entity in each UE.

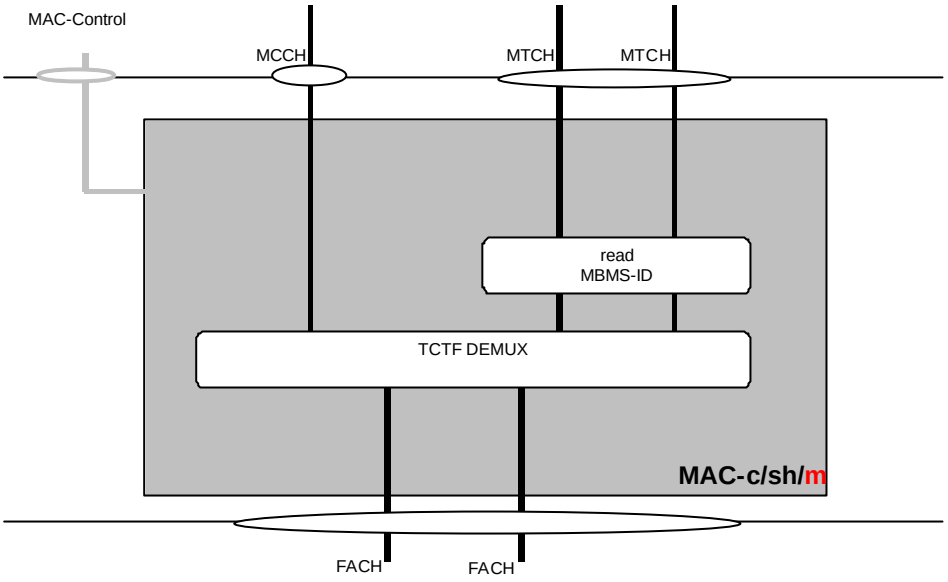

Figure 6: UE side MAC-m additions to MAC-c/sh

5.4 MBMS Physical layer model

6 MBMS Channel Structure

Two types of channels are used to provide the MBMS service:

- Point-to-point channel
- Point-to-multipoint channel

6.1 Point-to-Point Channel

A point-to-point channel is used to transfer MBMS specific control/user plane information as well as dedicated control/user plane information between the network and a UE in RRC Connected Mode. It is used only for the multicast mode of MBMS.

For a UE in Cell_DCH, DCCH or DTCH is used, allowing all existing mappings to transport channels.

For a UE in Cell_FACH, DCCH or DTCH, which is mapped to FACH is used [FFS]. FACH is mapped to SCCPCH.

A detailed description of point-to-point channels is given in [7].

6.2 Point-to-multipoint channel

A point-to-multipoint channel is used to transfer MBMS specific control/user plane information between the network and UEs in RRC Connected or Idle Mode. It is used for broadcast or multicast mode of MBMS.

6.2.1 Logical Channels

6.2.1.1 MBMS Control Channel (MCCH)

This logical channel is defined as a p-t-m downlink channel for transfer of control plane information between network and UEs in RRC Connected or Idle Mode. The control plane information on this channel is MBMS specific and is sent to UEs in a cell with an activated (joined) MBMS service.

6.2.1.2 MBMS Traffic Channel (MTCH)

This logical channel is defined as a p-t-m downlink channel for transfer of user plane information between network and UEs in RRC Connected or Idle Mode. The user plane information on this channel is MBMS specific and is sent to UEs in a cell with an activated MBMS service

~~NOTE: Channel names provided are provisional, Figure 3 is expected to change according to the final decision on adapting new or existing multicast logical channels.~~

6.2.2 Transport Channel

FACH is used as a transport channel.

6.2.3 Physical Channel

SCCPCH is used as a physical channel.

MBMS notification utilizes the 12 available bits of the Rel99 PICH frame in low MBMS load cell as presented in Figure 7~~Figure 7~~, the exact coding is FFS.

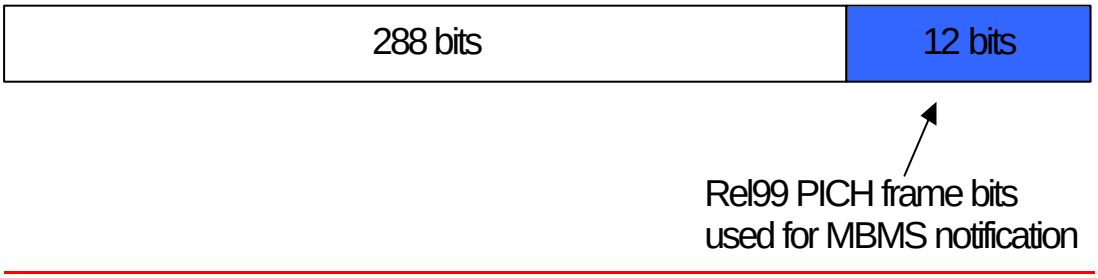

Figure 7: Rel99 PICH frame bits used in MBMS notification

MBMS notification utilizes a MBMS specific PICH in high MBMS load cell. MBMS specific PICH frame is presented in Figure 8~~Figure 8~~ the exact coding is FFS.

Figure 8: MBMS Specific PICH frame used in MBMS notification

6.2.4 Mapping between channels

Only in downlink, the following connections between logical channels and transport channels exist:

- MCCH can be mapped to FACH
- MTCH can be mapped to FACH

The mappings as seen from the UE and UTRAN sides are shown in Figure 9~~Figure 9~~~~Figure 7~~ and Figure 10~~Figure 10~~~~Figure 8~~ respectively.

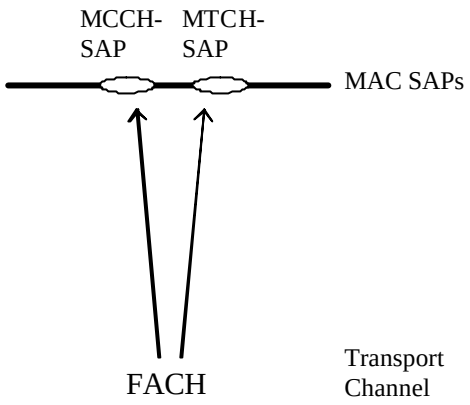

Figure 9~~9~~~~7~~: Logical channels mapped onto transport channel, seen from the UE side

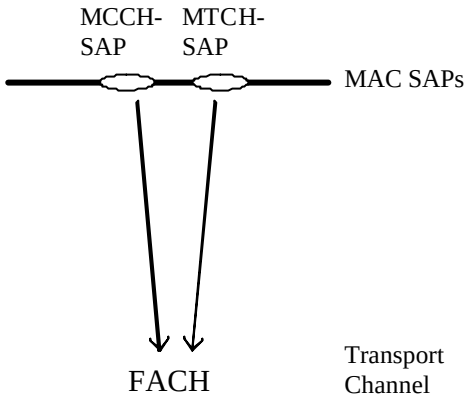

Figure 10~~10~~~~8~~: Logical channels mapped onto transport channel, seen from the UTRAN side

6.2.5 Data Flows through Layer 2

6.2.5.1 Data flow for MCCH mapped to FACH

For MCCH, the RLC mode to be employed is [FFS]. A MAC header is used for logical channel type identification.

6.2.5.2 Data flow for MTCH mapped to FACH

For MTCH, the RLC mode to be employed is [FFS]. A MAC header is used for logical channel type identification and MBMS service identification.

7 MBMS Reception and UE Capability

7.1 UE Capability

The UE MBMS capability is not sent to UTRAN and is subject to UE implementation, including the relation between MBMS capability and actual RRC state which is also a UE implementation. A consequence is that a UE may be counted although its actual capability does not allow to receive MBMS transmissions e.g. because of its current RRC state. Further optimizations to avoid counting UEs uselessly are FFS.

The standard will describe a minimum UE capability requirement in order to allow operators to configure MBMS channels that can be common to all UEs supporting the given service.

There may be a minimum UE capability defined per service category e.g. one for I/B MBMS UEs, one for MBMS video UEs, etc. This is FFS. The list of service categories would also need to be defined.

There are some UE capability requirements that are common to all eventual service categories:

The MBMS capable UE, in idle mode, CELL/URA_PCH and CELL_FACH states, is required to support simultaneous reception of following channels

- two S-CCPCHs
- one S-CCPCH and one PICH

It is also required that MBMS capable UE is capable of receiving two PICHs simultaneously in idle mode and CELL/URA_PCH states.

The standard may restrict further the UE implementation options by defining certain capability combinations (FFS)

7.2 MBMS Reception

The following descriptions add MBMS specific processes to be considered for each RRC State/Mode.

The BCCH contains information regarding the MCCH, while the latter contains information on the MTCH.

In the sub-sections below, how and when the UE reads the MCCH (e.g. usage of discontinuous reception, etc) is [FFS].

7.2.1 MBMS Reception in RRC Idle Mode

In idle mode, the UE shall:

- if the UE supports MBMS and
- if the UE has activated an MBMS service and there is an ongoing session for this service in the cell where the UE is situated, i.e. MTCH and MCCH are available
  - act on RRC messages received on MCCH and:
  - if the MBMS service requires the establishment of an RRC Connection [FFS]:
    - inform upper layers that the MBMS Service requires the establishment of an RRC Connection,
  - if the MBMS service does not require the establishment of an RRC Connection [FFS]:
    - listen to the common transport channel on which the MTCH is mapped.

7.2.2 MBMS Reception in RRC Connected Mode: URA_PCH state

In URA_PCH, the UE shall:

- if the UE supports MBMS and
- if the UE has activated an MBMS service and there is an ongoing session for this service in the URA where the UE is situated, i.e. MTCH and MCCH are available
  - act on RRC messages received on MCCH,
  - for each MBMS service that the UE has activated and where transmission on a MTCH is indicated in the MCCH, listen to the common transport channel on which the MTCH is mapped,

NOTE: reception of multiple MBMS services is subject to UE capability; selection between these when needed is [FFS].

- if on the MCCH is indicated that the MBMS service in the cell requires a cell update:

  - initiate a cell update procedure. The cause to be used in the cell update procedure is [FFS].

7.2.3 MBMS Reception in RRC Connected Mode: CELL_PCH state

In CELL_PCH, the UE shall:

- if the UE supports MBMS and

- if the UE has activated an MBMS service and there is an ongoing session for this service in the cell where the UE is situated, i.e. MTCH and MCCH are available

  - act on RRC messages received on MCCH

  - listen to the common transport channel on which the MTCH is mapped,

7.2.4 MBMS Reception in RRC Connected Mode: CELL_FACH state

In CELL_FACH, the UE shall:

- if the UE supports MBMS and

- if the UE has activated an MBMS service and there is an ongoing session for this service in the cell where the UE is situated, i.e. MTCH and MCCH are available

  - act on RRC messages received on MCCH

  - listen to the common transport channel on which the MTCH is mapped (for UEs with this capability),

NOTE: For UEs in CELL_FACH, UTRAN may decide to send MBMS data over DTCH.

7.2.5 MBMS Reception in RRC Connected Mode: CELL_DCH state

In CELL_DCH, the UE shall,

- if the UE supports MBMS and

- if the UE has activated an MBMS service and there is an ongoing session for this service in the cell where the UE is situated, i.e. MTCH and MCCH are available and

- if the UE has the capabilities:

  - act on RRC messages received on MCCH

  - listen to the common transport channel on which the MTCH is mapped.

NOTE: For UEs in CELL_DCH, UTRAN may decide to send MBMS data over DTCH

8 UTRAN Signalling Flows for MBMS

8.1 MBMS RNC Signalling Flows

8.1.1 MBMS Session Start procedure

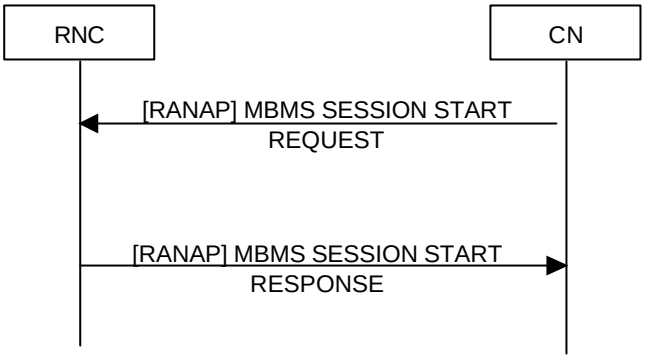

Figure 1111~~0~~: MBMS Session Start procedure. Successful operation.

The MBMS Session Start procedure is initiated by the CN when an MBMS Session is started. The MBMS SESSION START REQUEST is typically sent by a CN node to RNCs hosting at least one UE that has joined the MBMS Service (in case of Iu flex the RNC may receive more than one MBMS SESSION START REQUEST message).

The MBMS SESSION START REQUEST contains the MBMS Service Id, the MBMS Session Attributes (MBMS Multicast Area Information, QoS parameters…) The Multicast/Broadcast Multicast Area Information could include MBMS Service Areas where UEs have to be tracked (counted), and/or a MBMS Service Areas where this is not required.

MBMS Session Start procedure also provides the MBMS Iu Data Bearer Establishment functionality. If the RNC cannot provide resources at all the RNC shall inform the CN accordingly. In case of Iu flex the RNC shall not establish more than one MBMS Iu bearer for a certain service towards a pool area and shall inform the respective CN nodes accordingly.

8.1.2 MBMS Session Stop procedure

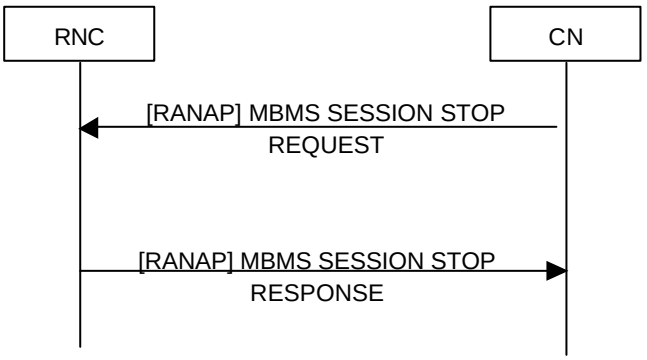

Figure 1212~~10~~: MBMS Session Stop procedure.

This signalling flow depicts the MBMS Session Stop procedure.

This procedure is initiated by the CN to the RNCs with an ongoing MBMS session, when no more data will be sent for that MBMS service for some period of time.

The MBMS Session Stop procedure also provides the MBMS Iu Data Bearer Release functionality

8.1.3 RNC Registration procedure

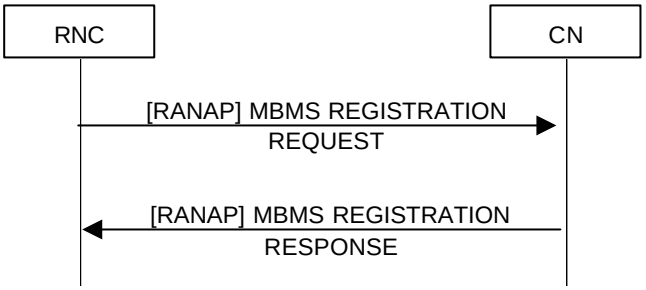

Figure 13~~13~~~~11~~: MBMS Registration procedure.

This signalling flow depicts the MBMS Registration procedure.

This procedure is initiated by the RNC in the case that the RNC is not SRNC for any UE that has joined the MBMS Service, but this RNC is DRNC for PMM-Connected UEs that have joined the MBMS Service and there is no MBMS Service Context for the MBMS Service in this RNC.

Note: It is FFS whether this procedure can be initiated before or between sessions.

8.1.4 RNC De-Registration procedure [FFS]

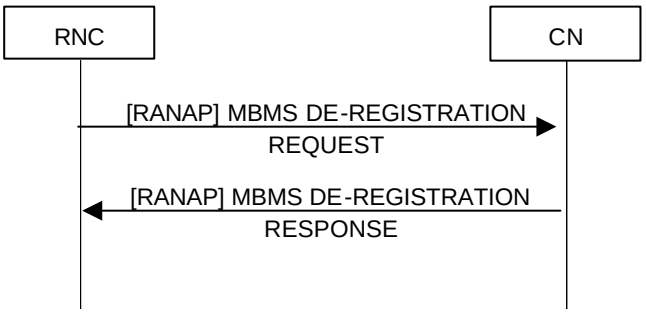

Figure 14~~14~~~~12~~: RNC MBMS De-Registration procedure.

This signalling flow depicts the RNC De-Registration procedure. This procedure is initiated by the RNC towards the CN node it was registered to in case the RNC is not acting as a Serving RNC for any UE that has activated the MBMS Service and has ceased to act as a Drift RNC for UEs which has activated an MBMS service.

Note: It is FFS whether this procedure can be initiated before or between sessions.

8.1.5 CN De-Registration procedure [FFS]

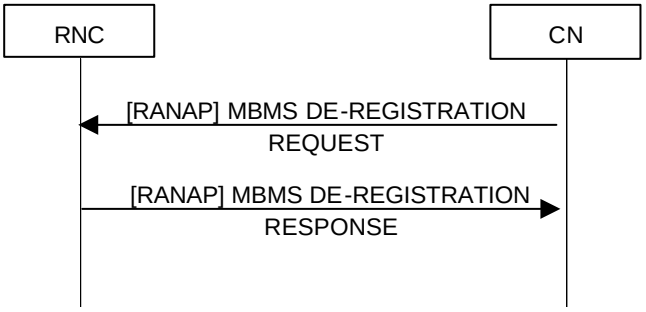

Figure 15~~15~~~~13~~: CN MBMS De-Registration procedure.

This signalling flow depicts the CN De-Registration procedure.

This procedure is initiated by the CN in order to inform the RNC that a certain MBMS Service is no longer available.

8.1.6 Channel Type Switching over Uu

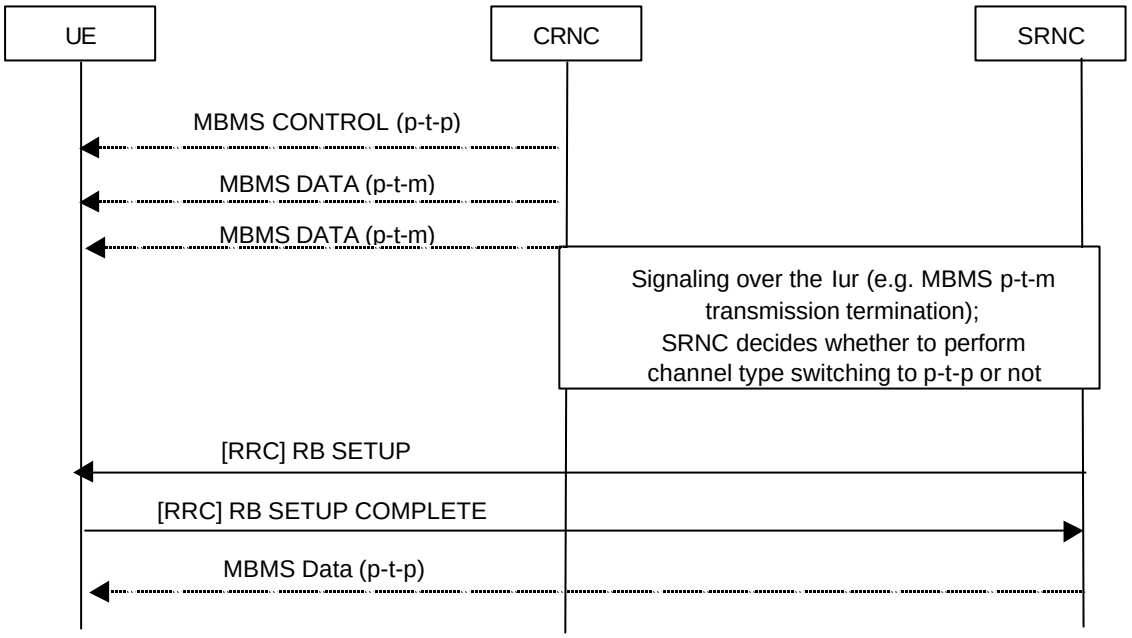

Figure 1616~~14~~: Channel type switching signalling flow from p-t-m to p-t-p.

The CRNC is responsible for the decision regarding having p-t-m transmission or no p-t-m transmission in a cell for a specific MBMS service. The CRNC informs all the SRNCs having UEs in that cell about its decision. The SRNC is the RNC controlling the RRC connection and RBs to a specific UE. In the example shown, the CRNC decided to no longer use p-t-m, then the SRNC decided to perform channel type switching to deliver the MBMS service over DTCH mapped on a dedicated channel. The RB SETUP message contains the MBMS Service Id.

NOTE: the channel type switching in this case includes a change of both transport and logical channels.

8.1.7 MBMS UE Linking

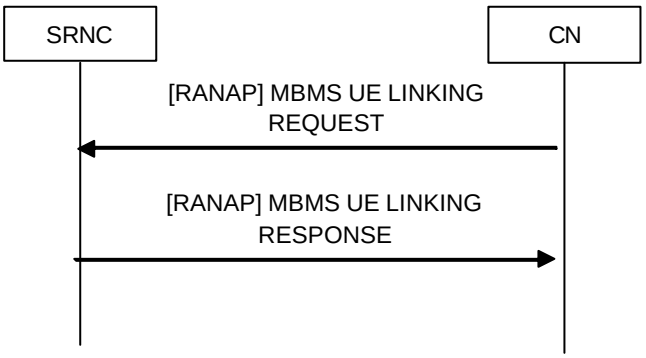

Figure 1717~~15~~: MBMS UE linking signalling flow

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The signalling flow is used to link a specific UE to an MBMS service. The MBMS UE LINKING REQUEST message contains the list of MBMS Service Ids activated by the UE. If there has not been a MBMS service context related to the MBMS service Id then SRNC creates a MBMS service context after this procedure.

8.1.8 MBMS UE De-Linking

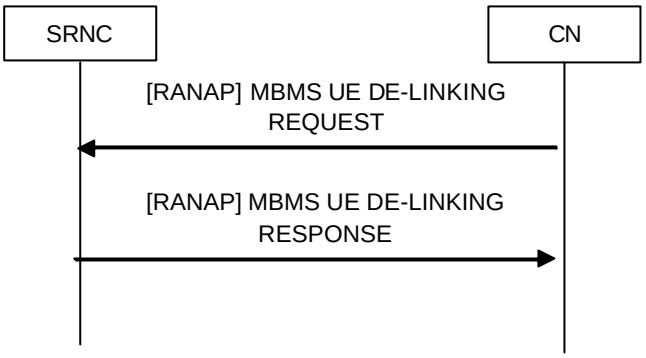

Figure 1818~~16~~: MBMS UE De-linking signalling flow

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The signalling flow is used to remove a specific UE from an MBMS service context. The MBMS UE DE-LINKING REQUEST message contains the list of MBMS Service Ids de-activated by the UE.

8.1.9 MBMS Attach/Detach over Iur

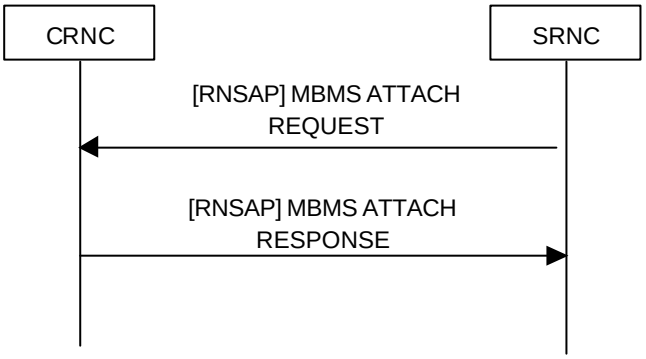

Figure 1919~~17~~: MBMS attach request signalling flow: Successful Operation.

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The purpose of this signalling flow is to allow the CRNC to add a new UE to the total number of UEs in a given cell using a MBMS service. The signalling flow is initiated when an UE with an ongoing MBMS service enters in a new cell controlled by the CRNC. The MBMS ATTACH REQUEST contains the Cell Id of the new cell, the MBMS Service Id, the U-RNTI of the UE [FFS].

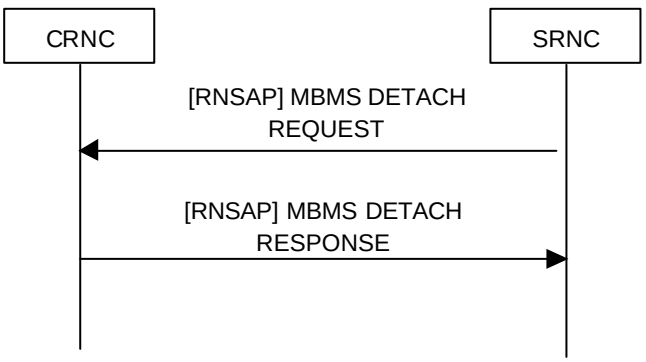

Figure 2020~~18~~: MBMS detach request signalling flow: Successful Operation.

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The purpose of this signalling flow is to allow the CRNC to decrease the total number of UEs receiving an MBMS service in a given cell. The signalling flow is initiated when a UE with an ongoing MBMS service leaves a cell controlled by the CRNC. The MBMS DETACH REQUEST contains the Cell Id of the old cell, the MBMS Service Id, the U-RNTI of the UE [FFS].

8.1.10 MBMS p-t-m Transmission Initiation/Termination over Iur

These signalling flows need further study.

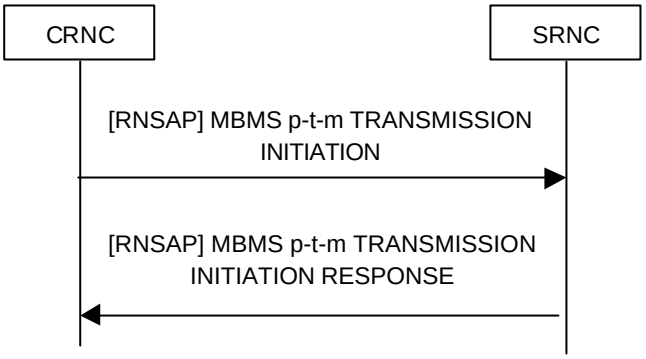

Figure 21219: MBMS p-t-m transmission initiation signalling flow: Successful Operation.

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The purpose of this signalling flow is that the CRNC informs the SRNC when a MBMS Service is delivered over a common transport channel in a cell under the CRNC for a UE connected to the SRNC. The MBMS p-t-m TRANSMISSION INITIATION contains either a list of U-RNTI and MBMS Service Id corresponding to the UEs connected to the SRNC or alternatively the MBMS Service Id and the Cell Id of the cells where the indicated MBMS Services are delivered in broadcast [FFS].

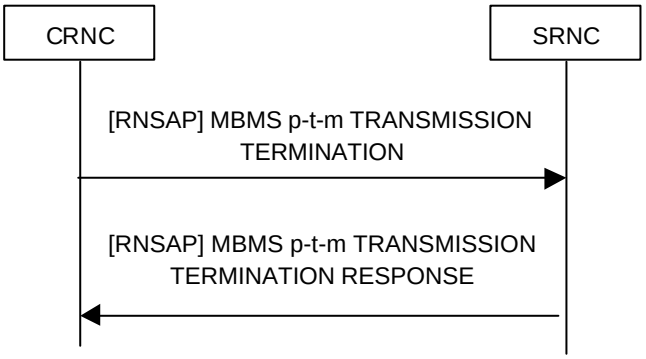

Figure 22220: MBMS p-t-m transmission termination signalling flow: Successful Operation.

This signalling flow is only applicable for handling MBMS to UEs in PMM CONNECTED mode.

The purpose of this signalling flow is that the CRNC informs the SRNC when a MBMS Service is no longer delivered over a common transport channel in a cell under the CRNC for a UE connected to the SRNC. The MBMS p-t-m TRANSMISSION TERMINATION contains either a list of U-RNTI and MBMS Service Id corresponding to the UEs connected to the SRNC or alternatively the MBMS Service Id and the Cell Id of the cells where the indicated MBMS Services are delivered in p-t-m [FFS].

8.2 MBMS Uu Signalling Flows

8.2.1 Broadcast of MBMS System Information

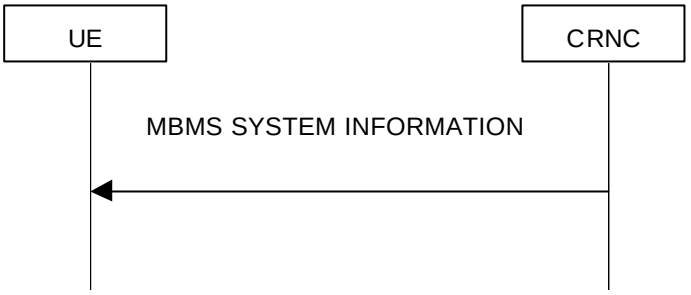

Figure 2323~~21~~: Broadcast of MBMS system information.

This signalling flow is applicable for handling MBMS to UEs in PMM IDLE and CONNECTED mode.

The purpose of the signalling flow is for UTRAN to broadcast MBMS system information to UEs using the BCCH. The MBMS SYSTEM INFORMATION shall be repeatedly transmitted after its first transmission. Upon receiving the first MBMS SYSTEM INFORMATION, the UE shall establish the radio bearer carrying an MCCH.

The MBMS SYSTEM INFORMATION includes:

- Configuration of a radio bearer carrying an MCCH

More information may be included in the MBMS SYSTEM INFORMATION [FFS].

8.2.2 MBMS Service Information~~Availability~~

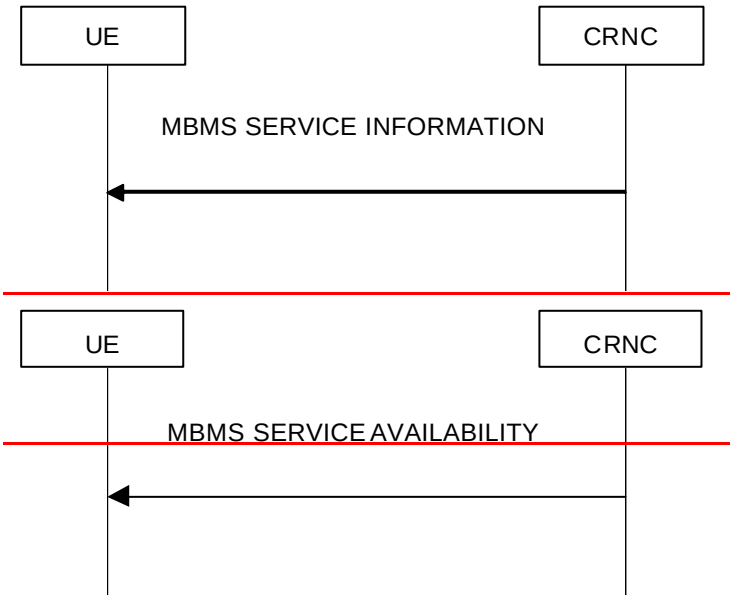

Figure 2424~~22~~: MBMS service information ~~availability~~ signalling flow

This signalling flow is applicable for handling MBMS to UEs in PMM IDLE and CONNECTED mode.

The purpose of the signalling flow is for RNC to inform UEs of ~~the availability of~~ all of MBMS services available in one cell. The MBMS SERVICE INFORMATION message ~~AVAILABILITY information~~ shall be transmitted periodically to support mobility in the MBMS service.

The MBMS SERVICE INFORMATION message ~~AVAILABILITY information~~ contains MBMS service ids and ptm indication. The MBMS service ids indicate the MBMS services which are being served in the cell or the MBMS services which can be served if the UE requests it. Ptm indication indicates that the MBMS service is on ptm in the cell, thus it informs the UE of the need of reception of the MBMS RADIO BEARER INFORMATION message. More information may be included in the MBMS SERVICE INFORMATION ~~AVAILABILITY~~ message. [FFS]

8.2.3 MBMS Radio Bearer Information

Figure 2525~~23~~: MBMS radio bearer information signalling flow

This signalling flow is applicable for handling MBMS to UEs in IDLE and PMM CONNECTED mode.

The purpose of the signalling flow is for the RNC to inform UE(s) regarding the MTCH radio bearer information. MBMS RADIO BEARER INFORMATION is only available for p-t-m transmission. MBMS RADIO BEARER INFORMATION includes MBMS Service Id, MBMS UTRAN Cell Group Identifier, logical channel, transport channel and physical channel information per MBMS service. An MBMS UTRAN Cell Group Identifier is used to indicate to UEs which MBMS Cell Group the cell pertains to. More information may be included in MBMS RADIO BEARER INFORMATION. [FFS]

8.2.4 MBMS Joined Services Indication

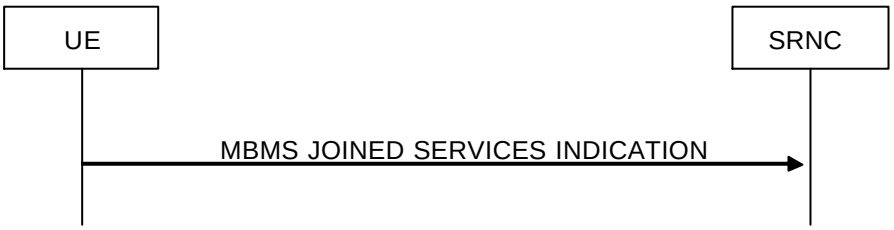

Figure 2626~~24~~: MBMS joined services indication signalling flow

This signalling flow is applicable for handling MBMS to UEs in RRC-Connected, PMM-IDLE state. The MBMS JOINED SERVICES INDICATION message is sent over the DCCH.

The signalling flow is initiated by the UE after entering RRC-Connected, PMM-IDLE state. The purpose of the signalling flow is to enable the UE to inform the SRNC about the MBMS services it has joined. The SRNC will store this information as long as the UE is in RRC-Connected, PMM-IDLE state.

The details regarding when the UE shall trigger this signalling flow (e.g. after how much time in RRC-Connected, PMM-IDLE state), are still FFS.

8.2.5 MBMS PMM-CONNECTED State Required Indication

Figure 2727~~25~~: MBMS PMM-CONNECTED state required indication signalling flow

This signalling flow is applicable for handling MBMS to UEs in RRC-Connected, PMM-IDLE state. The MBMS PMM-CONNECTED STATE REQUIRED INDICATION message is sent over the DCCH.

The signalling flow is initiated by the SRNC after having received an MBMS SESSION START REQUEST message over the Iu interface for an MBMS service that the UE joined according to the latest information received in an MBMS JOINED SERVICES INDICATION message.

When the UE receives the MBMS PMM-CONNECTED STATE REQUIRED INDICATION message, it shall transit to PMM-CONNECTED state.

9 Security for MBMS

Ciphering for MBMS multicast data is done between the BM-SC and the UE as defined in [6]. Therefore, for MBMS ptm data transmissions no radio interface ciphering is applied.

In case of ptp MBMS data transmissions, if the security is activated for the UE the ciphering is also applied for ptp MBMS data RB as for any other RB of the UE.

10 Mobility Procedures for MBMS

One of the requirements in [4] is: “Data loss during cell change should be minimal”. Therefore, when the UE receiving an MBMS session in idle mode or connected mode (not including CELL_DCH) re-selects between cells , it should be possible to provide service continuity to this UE .

The following mechanism has been identified to minimise the data loss on cell change. Additional mechanisms allowing to send the MBMS bearer type notification when new mobiles arrive or leave a cell are [FFS].

10.1 Use of Periodical MBMS Channel Type Notification

In this mechanism, the cell periodically transmits an MBMS Channel Type Notification from the UTRAN, informing all MBMS subscribers if it is currently configured for p-t-m transmission or p-t-p transmission. If it is configured for p-t-m transmission, the channel may also contain the Radio Bearer parameters corresponding to the TMGI of each service. Thus no UE signalling would be required towards the UTRAN.

[However, if it is necessary for the UE to instead initiate reception of the RB parameters, such a mechanism similar to the Cell Update procedure may be more suitable.]

If the cell is configured for p-t-p transmission, then the UE would perform a normal RRC connection establishment.

Additionally, the UE in a cell receiving MBMS p-t-m, could be periodically checking the MBMS Channel Type Notification in neighbour MBMS cells to acquire information about whether p-t-m or p-t-p transmission is required if it accesses that cell.

10.2 UE Actions for Mobility

In CELL_FACH and in CELL_DCH state the RRC operation has priority over MBMS reception, thus UE performs the inter frequency and inter RAT measurements as configured by the SRNC. In Idle mode and in CELL_PCH, URA_PCH states the measurements are performed as configured by the network based on rel5. The MBMS specific measurement occasions to S-CCPCH for UEs in idle mode and in CELL_PCH, URA_PCH states are FFS

When the UE reselects the cell due to the mobility, the UE should check if the interested MBMS service is available in the new cell for the reception of the service. The service is available when the session has been already started, and the service is being served on ptp/ptm in the cell, or the service can be served in the cell if the UE requests it.

If the MBMS service is available in the cell, the UE will perform an action for the service reception in the cell. For example, if the service is on ptp, the idle mode UE will initiate RRC connection setup establishment procedure. Otherwise, the UE does not need to perform such an action in the cell. The UE, which moves to the new cell, will operate according to the RRC state/mode as followings.

Whenever the UE moves between p-t-m cells, UE shall receive an MBMS UCG-Id, which is included in the MBMS RADIO BEARER INFORMATION. If the MBMS UCG-Id received in a new cell is the same as the MBMS UCG-Id received in an old cell, then the UE receives MTCH without re-establishment of its PDCP as the new cell is processed by the same PDCP entity as the old cell. If the MBMS UCG-Ids differs between old on new cell, the UE re-establishes its PDCP entity according to the RADIO BEARER INFORMATION. UE shall be re-established RLC, MAC and physical layer protocol entities upon cell change.

10.2.1 RRC idle mode

Idle mode UE shall:

- if BCCH contains information regarding the MCCH in the new cell;
  - Listen to the MCCH and receive the MBMS SERVICE INFORMATION AVAILABILITY message;
  - if the MBMS SERVICE INFORMATION AVAILABILITY message contains the interested MBMS service id;
    - if MBMS SERVICE INFORMATION AVAILABILITY message indicates that the service is on ptm;
      - Preceive the MBMS RADIO BEARER INFORMATION message and listen to the MTCH;
    - else;
      - initiate RRC connection setup establishment procedure;
  - if the UE receive the MBMS RADIO BEARER INFORMATION message before the MBMS SERVICE INFORMATION AVAILABILITY message and;
  - if MBMS RADIO BEARER INFORMATION message contains the interested MBMS service id;
    - Listen to the MTCH without the need of receiving the MBMS SERVICE INFORMATION AVAILABILITY message.

10.2.2 URA_PCH State

URA_PCH state UE shall:

- Perform URA update procedure if needed;
- if BCCH contains information regarding the MCCH in the new cell;
  - Listen to the MCCH and receive the MBMS SERVICE INFORMATION AVAILABILITY message;

- if MBMS SERVICE INFORMATION AVAILABILITY message contains the interested MBMS service id;

- if MBMS SERVICE INFORMATION AVAILABILITY message indicates that the service is on ptm;

- Preceive the MBMS RADIO BEARER INFORMATION message and listen to the MTCH;

- else;

- initiate cell update procedure

- if the UE receive the MBMS RADIO BEARER INFORMATION message before MBMS SERVICE INFORMATION AVAILABILITY message and;

- if MBMS RADIO BEARER INFORMATION message contains the interested MBMS service id;

- Listen to the MTCH without the need of receiving the MBMS SERVICE INFORMATION AVAILABILITY message.

10.2.3 CELL_PCH

CELL_PCH state UE shall;

- Perform cell update procedure;

- if cell update confirm message contains MBMS radio bearer information;

- Listen to the MBMS radio bearer;

- else;

- if BCCH contains information regarding the MCCH in the new cell;

- Listen to the MCCH and receive the MBMS SERVICE INFORMATION AVAILABILITY message;

- if MBMS SERVICE INFORMATION AVAILABILITY message contains the interested MBMS service id and;

- if MBMS SERVICE INFORMATION AVAILABILITY message indicates that the service is on ptm;

- Preceive the MBMS RADIO BEARER INFORMATION message and listen to the MTCH

- if the UE receive the MBMS RADIO BEARER INFORMATION message before the MBMS SERVICE INFORMATION AVAILABILITY message and;

- if MBMS RADIO BEARER INFORMATION message contains the interested MBMS service id;

- Listen to the MTCH without the need of receiving the MBMS SERVICE INFORMATION AVAILABILITY message.

10.2.4 CELL_FACH

CELL_FACH state UE shall, depending on UE capability;

- Perform cell update procedure

- if cell update confirm message contains MBMS radio bearer information;

- Listen to the MBMS radio bearer;

- else;

- if BCCH contains information regarding the MCCH in the new cell;

- ~~L~~listen to the MCCH and receive the MBMS SERVICE INFORMATION~~AVAILABILITY~~ message;
- ~~I~~if MBMS SERVICE INFORMATION ~~AVAILABILITY~~ message contains the interested MBMS service id and;
  - ~~I~~if MBMS SERVICE INFORMATION ~~AVAILABILITY~~ message indicates that the service is on ptm;~~:~~
    - ~~R~~receive the MBMS RADIO BEARER INFORMATION message and listen to the MTCH;
- ~~I~~if the UE receive the MBMS RADIO BEARER INFORMATION message before the MBMS SERVICE INFORMATION~~AVAILABILITY~~ message and;
- ~~I~~if MBMS RADIO BEARER INFORMATION message contains the interested MBMS service id~~:~~;
  - ~~I~~Listen to the MTCH without the need of receiving the MBMS SERVICE INFORMATION ~~AVAILABILITY~~ message.

10.2.5 CELL_DCH State

CELL_DCH state UE shall~~:~~;

- ~~A~~act on the RRC message received on DCCH in handover.

11 Resource Management for MBMS

11.1 MBMS Access Control Procedure

MCCH messages initiating counting or recounting cause multiple responses from UEs within a cell. This may result in RACH congestion if number of UEs is high in a cell. To avoid this, CRNC may perform MBMS access control procedure during counting or recounting procedure. MBMS access control procedure is described in Figure 28~~Figure 28~~~~Figure 26~~.

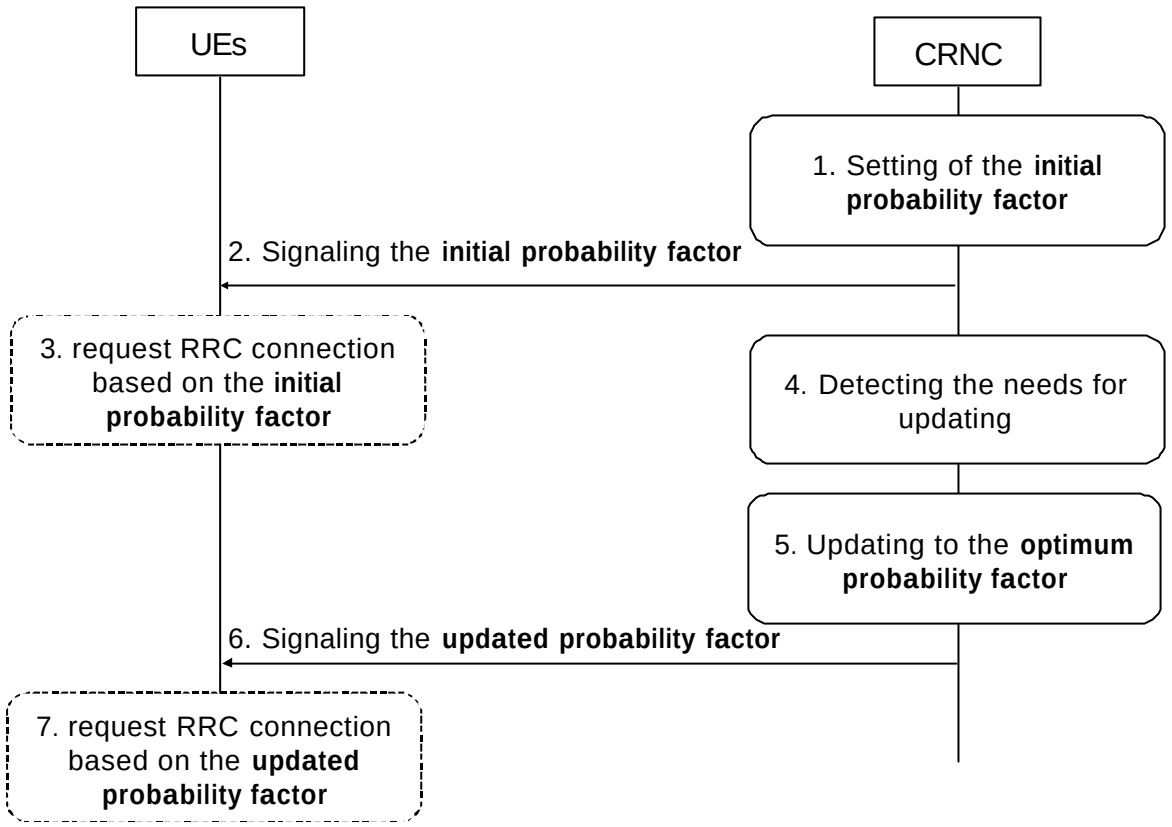

Figure 2828~~26~~: MBMS Access Control Procedure

1. CRNC calculates an initial probability factor for a MBMS service when a MCCH message causing counting or recounting is about to be sent.
2. CRNC includes the probability factor into the MCCH message and sends it to UEs. This can be done in MBMS Group Notification.
3. UEs perform RRC connection request procedure using the probability factor received in step 2. UEs keep listening to MCCH to get updated probability factor until they succeed to establish RRC connection.
4. CRNC detects the probability factor needs to be updated. Detecting mechanism is not to be standardized.
5. CRNC recalculates the probability factor. The way of calculating new probability factor is not to be standardized.
6. CRNC includes the updated probability factor into the MCCH message and sends it to UEs.
7. UEs perform RRC connection request procedure using the new probability factor. UEs keep listening to MCCH to get updated probability factor until they succeed to establish RRC connection.

CRNC and UEs who are still trying to perform the RRC connection request procedure repeat step 3 ~ step 7 until e.g. counting or recounting procedure ends.

Annex <A>: MBMS Phases in UTRAN

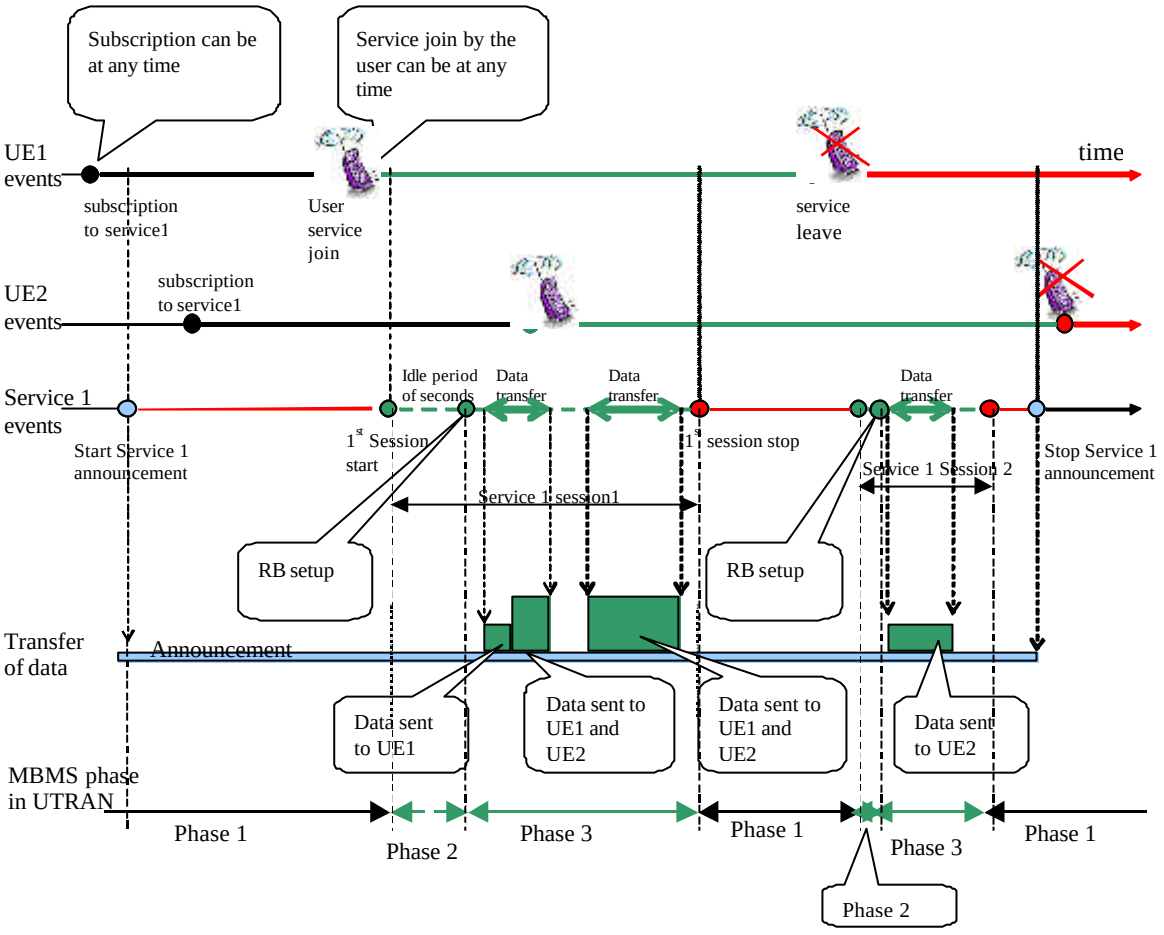

Figure 2929~~27~~: Timeline of MBMS Service

The UTRAN MBMS behavior is divided into 3 phases. Figure 14 illustrates the timeline of an MBMS service with regards to these phases.

A1. MBMS Phase 1

A cell stays in phase 1, if there is no ongoing session for the MBMS service, or if it does not belong to the service area of the service.

. A UE that has joined an MBMS service may regularly try to receive MBMS notification in a cell [FFS]. At this phase the UE does not request service delivery to UTRAN.

A2. MBMS Phase 2

This phase starts when UTRAN receives the MBMS "session start" from CN, and ends when UTRAN initially sets up MBMS radio bearer for the session, or decides not to set up the MBMS radio bearer in a cell.

In this phase, UTRAN transmits notification to UEs about the incoming service and could perform counting procedure to decide the type of MBMS radio bearer. UTRAN decides whether to set up p-t-m, p-t-p radio bearer or no radio bearer, based on the number of UEs that expected to receive the service in the cell. A UE that has joined a MBMS service acts on a RRC message in MCCH.

A3. MBMS Phase 3

This phase starts after initial MBMS radio bearer setup and ends when UTRAN receives the MBMS "session stop" from CN.

In this phase, UTRAN transmits the data for the MBMS service received from CN using, if any, the established radio bearer. If there is no set-up radio bearer, UTRAN waits for service delivery request from UE. Recounting and radio bearer reconfiguration may be performed during this phase.

UTRAN behavior in this phase can be divided into three states: no transmission, p-t-p transmission, and p-t-m transmission. Each cell belonging to the same service area may be in any of three states. With the variation of the number of UEs, the state of a cell may change between the three states. UTRAN may broadcast the state of each cell.

1) No Transmission: In this state of a cell, there is no established radio bearer because there is no UE who wants to receive the service. An MBMS-joined UE in idle mode that moves into the cell of this state requests service delivery to UTRAN.

2) P-t-p Transmission: In this state of a cell, p-t-p radio bearer is established. A UE that has joined a MBMS service may receive MBMS data over p-t-p radio bearer if there is MBMS data to receive.

3) P-t-m Transmission: In this state of a cell, p-t-m radio bearer is established. A UE that has joined a MBMS service may receive MBMS data over p-t-m radio bearer if there is MBMS data to receive.

A4. MBMS Phases and Status Parameters

Table 1 lists the MBMS parameters that need to be broadcast in each MBMS phase. The list is [FFS]

	Phase 1	Phase 2	Phase 3	Description
Service ID	X	O	O	Identity of the Service
Transmission State	X	X	O (NONE/p-t-p/p-t-m)	State of the cell for MBMS transmission
Counting	X	O (On/Off)	O (On/Off)	Whether counting procedure is going on.

Table 1: MBMS Status Parameters

1) Service ID: This parameters indicates is the identity of the service concerned.

2) Transmission state: This parameter indicates to UE(s) the state of the concemed cell while it is in phase 3. According to this parameter, UE entering the cell starts re-configuration of the radio bearer, or requests service delivery to UTRAN. Specifically, if this parameter is set to "p-t-m", UE receives service over p-t-m radio bearer and if set to "p-t-p", UE receives service over p-t-p radio bearer. If it is set to NONE, UE has to request UTRAN to deliver the service.

3) Counting: The counting parameter informs UEs whether counting is required (and is going on) or not. If this parameter is set to "ON", UE should perform RRC connection procedure.

Annex <B>: MBMS Control Information

Table 2 and 3 identifies MBMS control information and describes their mapping on BCCH, MCCH and DCCH.

Information Element	**Description**	***DCCH***	***BCCH***	***MCCH***
MBMS Signalling Radio Bearer Information (MCCH)				

MBMS SRB Info - MCCH Indicator	Information to configure the MBMS signalling radio bearer mapped on S-CCPCH/FACH, this information includes the identification of a FACH transport channel carrying the MCCH.		X	
MBMS Radio Bearer Information (MTCH)				
MBMS RB Info	Information to configure a PTM radio bearer mapped on S-CCPCH/FACH for transmission of an MBMS service.			X
Service related Control Information				
MBMS Service ID(s)	Identifies all MBMS services that are potentially available in one cell (service area indication). Identifies also the MBMS service related to a specific signalling procedure.			X
PTM Indicator	Indicates that a PTM bearer type is established in one cell in order to transmit data for a particular MBMS service and the UE is required read the MBMS RB Info on MCCH.			X
RRC Connection Establishment Indicator	Indicates to idle mode UEs that transition to RRC connected mode is required for counting.			X
Required MBMS RB configuration	Indicates to the UE that an MBMS service is transmitted using a certain RB configuration in order to achieve a specific QoS.			X
RACH Access Probability Factor	Controls RACH access in order to avoid RACH overload if transition to RRC connected mode is required.			X
PMM-CONNECTED State Required Indicator	Indicates to an PMM IDLE state UE in RRC connected mode that it shall transit to PMM CONNECTED state	x		

Table 221: Mapping of MBMS Control Parameters in DL

Information Element	**Description**	***DCCH***
Service related Control Information		
MBMS Service ID(s)	Identifies all MBMS services a PMM IDLE state UE in RRC connected mode has joined	X

Table 3: Mapping of MBMS Control Parameters in UL

Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
8/02	RAN2#31	R2-021846					0.0.1
9/02	RAN2#32	R2-020590			Skeleton Endorsed with some changes in sections from RAN2#31	0.0.1	1.0.0
11/02	RAN2#33	R2-022927			No MBMS Discussions		
1/03	RAN2/3 MBMS AdHoc	R2-030006			R2-022644 and R2-022699	1.0.0	1.1.0
2/03	RAN2#34	R2-030122			Inclusion of R2-030010, R2-030050, figure from R2-030015, mechanism 1 from R2-030062, + editorial changes + principles in section 5.1.3	1.1.0	1.4.0
4/03	RAN2#35	R2-030707			Inclusion of R2-030010 + section 5.1.4 based on agreed bullet points from RAN2#34 + correction of version numbering + addition of "change history" section.	1.4.0	1.5.0
5/03	RAN2/3AdHoc	R2-030882			-R2-030907 "Functional Description on MAC-c/sh/m". -R2-030902 on the "MBMS Control Plane Protocol Stack". -R2-030910 on MBMS UTRAN Phases in Annex A. -R3-030584: only inclusion of sections: 7.1.3 and 7.1.4. In 7.1.3 there is one additional comment regarding the addition of "PMM" whever CONNECTED mode" is mentioned. -R3-030614: Addition of chapter 5.1.x -R3-030615: changes in section 5.1.2. -R3-030615: proposed section 5.1 was reworded.	1.5.0	1.6.0
5/03	RAN2#36				- Inclusion of contribution R2-03930, sections: 7.2.1.1 and 7.2.1.2 from decisions from RAN2/3 MBMS adhoc. - Use of term "MBMS service context" instead of "MBMS context" throughout the document. - Correction of spelling mistake in figure 1: "Protocol Stack for MCTCH" should be: "Protocol Stack for MTCH". - Revision of Appendix A "MBMS Phase 1": Part of the second paragraph has been deleted due to concerns from RAN3. - During the RAN2 MBMS AdHoc it was decided that MCCH and MTCH are to be mapped on FACH. This decision is captured at the bottom of 5.3.1 by adding the sentence "Both logical channels are mapped on FACH". FACH is also mentioned is several places in 5.3.2 (MAC Architecture) as an example (e.g. FACH). The "e.g." has now been deleted.	1.6.0	1.6.1
06/03	TSG RAN #20				The version 2.0.0 identical to version 1.6.1 was presented in TSG RAN plenary meeting for information and approval. The TS was not approved so drafting work will continue in WG2/3 based on version 2.0.0. The changes in version 2.1.0 compared to 2.0.0 are in Section 5.1.4 Counting where point 8 *"The possibility for the RNC to receive the service Id in RRC connection request is [FFS]…"* is removed. This reflects to the decision made in RAN2/3AdHoc 05/03 but was missing from earlier versions, and pointed out by RAN WG2 chairman in reflector and in TSG RAN #20.	2.0.0	2.1.0
09/03	RAN2#37 RAN3#37	R2-031713 R3-031174 R3-031223			Editorial corrections based on R2-031713 included. New chapter *"7. MBMS reception UE Capability"* created and agreed UE capability text inserted to the new chapter *"7.1. UE Capability"* . Modifications based on R3-031174 to the definitions Sections 5.1.1, 5.1.5 and 5.1.6 enhanced and sections 5.1.7, 5.1.8 and 5.1.9 crated, and signalling flows updated in section 7.1.based on R3-031223 Following Editorial enhancements proposed by editor: Chapter 5.3.1.1 and 5.3.1.2 moved to under chapter 6.1.Logical channels and chapter *"5.4 MBMS Reception in RRC States/Modes"* moved under chapter 7. in new chapter *"7.2 MBMS reception "*	2.1.0	2.2.0
10/03	RAN2#38	R2-032116 R2-032074			Chapter *5.2.1 MBMS User Plane Protocol Stack Architecture* enhanced accordingly. Chapter *9 Security for MBMS* enhanced accordingly	2.2.0	2.3.0

		R2-032121 R2-032277 R2-032087 R2-032275 R2-032081 R2-032281 RAN3#38 R3-031421			Chapter *8.2.2 MBMS service availability* enhanced, (message changed to information). Chapter *9.2. UE Actions for Mobility* created and 9.2.4 text *depending UE capability* inserted Chapters *8.2.4. MBMS Joined Services Indication and 8.2.5 MBMS PMM-Connected State Required Indication* created Chapters 6.1. re-formatted, Section 6.2.1-6.2.5 created The MBMS access control procedure inserted in chapter 11.1 *Broadcast of MBMS System Information* signalling flow added. Tables inserted to an informative annex to identify MBMS control information and describe their mapping on transport channels MBMS Time line and MBMS Service announcement definitions included in Section 3.1 Chapter *5.1.1 One Context per MBMS Service in CRNC and 5.1.8 RNC deregistration* updated accordingly Editorial harmonization of terms: MCCH and MTCH used constantly. (NCCH and CTCH removed) In Uu signalling messages CRNC introduced to keep messages send/received in SRNC and CRNC inline.		
11/03	RAN2#39	R2-032350 R2-032398 R2-032667 R2-032666 R2-032497			The Signalling flow MBMS service availability changed to MBMS service information in 8.2.2. Appropriate changes done in 10.2. In the Chapter 7.1. included that MBMS UE must capability to receive two SCCPCH MBMS notification principles chapter created as 5.1.5 and PICH bits used for MBMS notification defined in 6.2.3 physical channels chapters. The number of different protocol entities clarified in chapter 5.2.1. The shared PDCP entity principle created in 5.1.4. Protocol layerre-establishments due to mobility defined in 10.2. UEs measurements are clarified based in working assumption in Section 10.2. Editorial enhancements to chapter names in chapters 5.1.1, 5.1.2 and 5.1.3	2.3.0	2.4.0