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Foreword

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

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1 Scope

The present document is part of a series of Technical Specifications (TSs) that specify charging functionality and charging management in GSM/UMTS networks. The GSM/UMTS core network charging architecture and principles are specified in TS 32.240 [1], which provides an umbrella for other charging management TSs that specify:

- the content of the CDRs per domain / subsystem / service (offline charging);
- the content of real-time charging messages per domain / subsystem / service (online charging);
- the functionality of online and offline charging for those domains / subsystems / services;
- the interfaces that are used in the charging framework to transfer the charging information (i.e. CDRs or charging events).

The complete document structure for these TSs is defined in TS 32.240 [1].

The present document specifies the Offline and Online Charging description for the Multimedia Broadcast and Multicast Service (MBMS), based on the functional stage 2 description in TS 23.246 [200].
This charging description includes the offline and online charging architecture and scenarios specific to MBMS, as well as the mapping of the common 3GPP charging architecture specified in TS 32.240 [1] onto MBMS.
It further specifies the structure and content of the CDRs for offline charging, and the charging events for online charging. The present document is related to other 3GPP charging TSs as follows:

- The common 3GPP charging architecture is specified in TS 32.240 [1];
- The parameters, abstract syntax and encoding rules for the CDRs are specified in TS 32.298 [51];
- A transaction based mechanism for the transfer of CDRs within the network is specified in TS 32.295 [54];
- The file based mechanism used to transfer the CDRs from the network to the operator''s billing domain (e.g. the billing system or a mediation device) is specified in TS 32.297 [52];
- The 3GPP Diameter application that is used for MBMS offline and online charging is specified in TS 32.299 [50].

All terms, definitions and abbreviations used in the present document, that are common across 3GPP TSs, are defined in the 3GPP Vocabulary, TR 21.905 [100]. Those that are common across charging management in GSM/UMTS domains or subsystems are provided in the umbrella document TS 32.240 [1] and are copied into clause 3 of the present document for ease of reading. Finally, those items that are specific to the present document are defined exclusively in the present document.

Furthermore, requirements that govern the charging work are specified in TS 22.115 [101].

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.240: "Telecommunication management; Charging management; Charging architecture and principles".

[2] - [9] Void.

[10] 3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".

[11] 3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

[12] - [19] Void.

[20] 3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".

[21] - [29] Void.

[30] 3GPP TS 32.270: "Telecommunication management; Charging management; Multimedia Messaging Service (MMS) charging".

[31] - [49] Void.

[50] 3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging application".

[51] 3GPP TS 32.298: "Telecommunication management; Charging management; Charging Data Record (CDR) parameter description".

[52] 3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Record (CDR) file format and transfer".

[53] Void.

[54] 3GPP TS 32.295: "Telecommunication management; Charging management; Charging Data Record (CDR) transfer".

[55] - [99] Void.

[100] 3GPP TR 21.905: "Vocabulary for 3GPP specifications".

[101] 3GPP TS 22.115: "Service aspects; Charging and billing".

[102] - [199] Void.

[200] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[201] 3GPP TS 22.146: "Multimedia Broadcast/Multicast Service (MBMS); Stage 1".

[202] 3GPP TS 22.246: "Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1".

[203] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[204] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [100], TS 32.240 [1], TS 23.246 [200] and the following apply:

2G- / 3G-: prefixes 2G- and 3G- refer to functionality that supports only GSM or UMTS, respectively, e.g. 2G-SGSN refers only to the GSM functionality of an SGSN.

accounting: process of apportioning charges between the Home Environment, Serving Network and Subscriber.

Advice of Charge (AoC): real-time display of the network utilization charges incurred by the Mobile Station (MS). The charges are displayed in the form of charging units. If a unit price is stored by the MS then the display may also include the equivalent charge in the home currency.

AoC service: combination of one or more services, both basic and supplementary, together with a number of other charging relevant parameters to define a customized service for the purpose of Advice of Charge (AoC).

billing: function whereby CDRs generated by the charging function(s) are transformed into bills requiring payment.

Billing Domain (BD): part of the operator network, which is outside the core network, that receives and processes CDR files from the core network charging functions.
It includes functions that can provide billing mediation and billing or other (e.g. statistical) end applications.
It is only applicable to offline charging (see "Online Charging System" for equivalent functionality in online charging).

CDR field categories: the CDR fields are defined in the present document. CDR fields may be operator provisionable and are divided into the following categories:

- **Mandatory (M):** field that shall always be present in the CDR.
- **Conditional (C):** field that shall be present in a CDR if certain conditions are met.
- **Operator Provisionable: Mandatory (O_M):** field that, if provisioned by the operator, shall always be present in the CDR.
- **Operator Provisionable: Conditional (O_C):** field that, if provisioned by the operator, shall be present in a CDR if certain conditions are met.

chargeable event: activity utilizing telecommunications network infrastructure and related services for:

- user to user communication (e.g. a single call, a data communication session or a short message); or
- user to network communication (e.g. service profile administration); or
- inter-network communication (e.g. transferring calls, signalling, or short messages); or
- mobility (e.g. roaming or inter-system handover); and
- that the network operator may want to charge for.

charged party: user involved in a chargeable event that has to pay parts or the whole charges of the chargeable event, or a third party paying the charges caused by one or all users involved in the chargeable event, or a network operator.

charging: function within the telecommunications network and the associated OCS/BD components whereby information related to a chargeable event is collected, formatted, transferred and evaluated in order to make it possible

to determine usage for which the charged party may be billed (offline charging) or the subscribers account balance may be debited (online charging).

Charging Data Record (CDR): formatted collection of information about a chargeable event (e.g. time of call set-up, duration of the call, amount of data transferred, etc.) for use in billing and accounting.
For each party to be charged for parts of or all charges of a chargeable event a separate CDR shall be generated, i.e. more than one CDR may be generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged.

charging function: entity inside the core network domain, subsystem or service that is involved in charging for that domain, subsystem or service

Fully Qualified Partial CDR (FQPC): partial CDR that contains a complete set of the fields specified in the present document.
This includes all the mandatory and conditional fields as well as those fields that the PLMN operator has provisioned to be included in the CDR. The first Partial CDR is a FQPC.

GPRS: packet switched bearer and radio services for GSM and UMTS systems.

GTP': GPRS protocol used for CDR transport. It is derived from GTP with enhancements to improve transport reliability necessary for CDRs.

NOTE: This protocol is not used for tunnelling.

inter-system change: change of radio access between different radio access technologies such as GSM and UMTS.

middle tier TS: term used for the 3GPP charging TSs that specify the domain / subsystem / service specific, online and offline, charging functionality.
These are all the TSs in the numbering range from TS 32.250 to TS 32.27x, e.g. TS 32.250 [10] for the CS domain, or TS 32.270 [30] for the MMS service. Currently, there is only one "tier 1" TS in 3GPP, which is TS 32.240 [1] that specifies the charging architecture and principles. Finally, there are a number of top tier TSs in the 32.29x numbering range ([50] ff) that specify common charging aspects such as parameter definitions, encoding rules, the common billing domain interface or common charging applications.

near real time: near real time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than one (1) minute.

offline charging: charging mechanism where charging information **does not** affect, in real-time, the service rendered.

online charging: charging mechanism where charging information can affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with bearer/session/service control is required.

Online Charging System (OCS): the entity that performs real-time Credit-Control.
Its functionality includes transaction handling, rating, online correlation and management of subscriber account balances.

packet switched domain: domain within GSM / UMTS in which data is transferred in packet switched mode. Corresponds to the term "GPRS".

partial CDR: CDR that provides charging information on part of a subscriber session.
A long session may be covered by several partial CDRs. Two formats are considered for Partial CDRs.
One that contains all of the necessary fields; the second has a reduced format.

real time: real time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than one (1) second.

Reduced Partial CDR (RPC): partial CDRs that only provide mandatory fields and information regarding changes in the session parameters relative to the previous CDR.

EXAMPLE: Location information is not repeated in these CDRs if the subscriber did not change its location.

settlement: payment of amounts resulting from the accounting process.

subscriber: entity (associated with one or more users) that is engaged in a subscription with a service provider.
The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of users authorized to enjoy these services, and also to set the limits relative to the use that associated users make of these services.

successful call: connection that reaches the communication or data transfer phase e.g. the "answered" state for speech connections.
All other connection attempts are regarded as unsuccessful.

tariff period: part of one (calendar) day during which a particular tariff is applied.
Defined by the time at which the period commences (the switch-over time) and the tariff to be applied after switch-over.

tariff: set of parameters defining the network utilization charges for the use of a particular bearer / session / service.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Bmb	Reference point for the CDR file transfer from the MBMS CGF to the BD
Bo	Reference point for the CDR file transfer from the OCF CGF to the BD
Bp	Reference point for the CDR file transfer from the GPRS CGF to the BD
Bx	Reference point between any (generic) 3GPP domain, subsystem or service CGF and the BD
Ga	Reference point for CDR transfer between a CDF and the CGF
Gi	Interface between the Packet-Switched domain and an external packet data network
Gn	Interface between two GSNs within the same PLMN
Gp	Interface between two GSNs in different PLMNs
kbit/s	Kilobits per second. 1 kbit/s = 2^{10} bits per second
Mbit/s	Megabits per second. 1 Mbit/s = 2^{20} bits per second
Rf	Offline charging reference point between a BM-SC and the CDF
Ro	Online charging reference point between a BM-SC and the OCS

3.3 Abbreviations

For the purposes of the present document, the abbreviations defined in TR 21.905 [50], TS 32.240 [1], TS 23.246 [200] and the following apply:

ABNF	Augmented Backus-Naur Form
ACA	ACcounting-Answer
ACR	ACcounting-Request
AF	Application Function
AMF	Account balance Management Function
AoC	Advice of Charge
AVP	Attribute Value Pair
BCF	Bearer Charging Function
BCSM	Basic Call State Model
BD	Billing Domain
BMD	Billing Mediation Device
BM-SC	Broadcast Multicast - Service Centre
BS	Billing System
CAI	Charge Advice Information
CCA	Credit-Control-Answer
CCR	Credit-Control-Request
CDF	Charging Data Function
CDR	Charging Data Record
CG	Charging Gateway
CGF	Charging Gateway Function
CSE	CAMEL Service Environment
CTF	Charging Trigger Function
DRP	Data Record Packet
ECF	Event Charging Function
ECUR	Event Charging with Unit Reservation
EDP	Event Detection Point
EPS	Evolved Packet System
FCI	Furnish Charging Information
FQPC	Fully Qualified Partial CDR
FTAM	File Transfer, Access and Management

GTP'	The GPRS protocol used for CDR transport. It is derived from GTP with enhancements to improve transport reliability necessary for CDRs
IEC	Immediate Event Charging
IHOSS:OSP	Internet Hosted Octet Stream Service: Octet Stream Protocol
MBMS GW	Multimedia Broadcast Multicast Service Gateway
M-CDR	Mobility management generated - Charging Data Record
MME	Mobility Management Entity
OAM&P	Operations, Administration, Maintenance and Provisioning
OCS	Online Charging System
PT	Protocol Type (Field in GTP' header)
RF	Rating Function
RPC	Reduced Partial CDR
SCI	Subscriber Controlled Input
SCI	Send Charging Information
SCUR	Session Charging with Unit Reservation
TAP	Transferred Account Procedure
TDP	Trigger Detection Point
TID	Tunnel IDentifier
TLV	Type, Length, Value (GTP header format)
TMGI	Temporary Mobile Group Identifier
TV	Type, Value
VAS	Value Added Service
VASP	Value Added Service Provider

4 Architecture considerations

4.1 High level MBMS architecture

The high level MBMS architecture is as defined in TS 23.246 [200].

The following clauses detail only service level charging. MBMS related aspects of bearer level charging are defined in TS 32.251 [11].

4.2 MBMS offline charging architecture

Figure 4.2.1 depicts the MBMS offline charging architecture. As defined in TS 32.240 [1], the BM-SC contains an integrated CTF that generates charging events that are passed to the CDF via the Rf reference point.

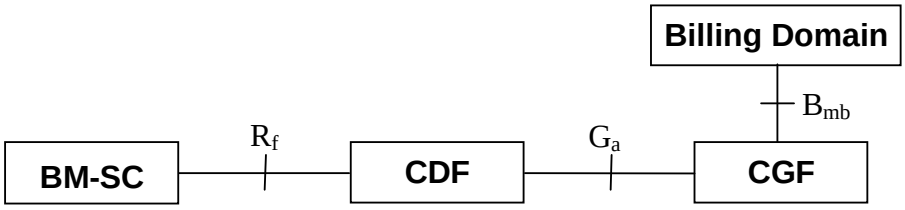

Figure 4.2.1: Charging architecture for MBMS offline charging

4.3 MBMS online charging architecture

Figure 4.3.1 depicts the MBMS online charging architecture.

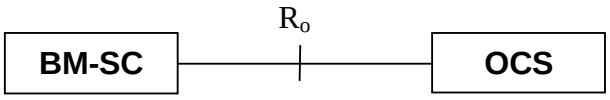

Figure 4.3.1: Charging architecture for MBMS online charging

For online charging, the BM-SC utilizes the R_o interface and the protocol and application towards the OCS is as specified in TS 32.299 [50] and the present document.

5 MBMS charging principles and scenarios

5.1 MBMS charging principles

5.1.1 General principles for GPRS

A Multimedia Broadcast and Multicast Service consists of an MBMS user service, as defined in TS 22.246 [202] and TS 26.346 [203], that is delivered over one or more MBMS Bearer Services, as defined in TS 22.146 [201] and TS 23.246 [200].

NOTE: MBMS Bearer Service is referred in TS 22.246 [202] as MBMS transport service.

The BM-SC shall collect charging information for mobile subscribers receiving services through MBMS and/or for content providers delivering content through MBMS. Transactions involving the content provider (or VASP) shall be possible.

The BM-SC collects charging related information, such as:

- Identification of the source of content;
- Type of user service (streaming, download or carousel);
- Type of bearer service used to deliver content (broadcast or multicast);
- Identification of subscribers receiving service;
- Delivery notification from individual subscribers.

NOTE: Carousel services are not considered in the present document in the current 3GPP release.

Table 5.1.1.1 shows the parties to be charged for the different MBMS Bearer Services used as identified by TS 22.246 [202] and TS 22.146 [201].

Table 5.1.1.1: Charging requirements for service delivery

Service Aspects	MBMS Bearer Service used	
	Multicast (one or more)	Broadcast (one or more)
User Service (Content)	Receiving subscriber	Receiving subscriber
Bearer Service (Transport)	Content provider and/or receiving subscriber	Content provider

The user service, as shown in table 5.1.1.1, shall be charged either by subscription (out of scope of the present document) or as a one time event charge (e.g. key management). Charging associated with the user service may be treated independently from charging associated with the transport of the user service.

Charging for the bearer service may be based on the session information (e.g. QoS, media type, and service area) and one of the following, as described in TS 22.146 [201]:

- Session duration (time from the MBMS Session Start procedure to MBMS Session Stop procedure as defined in TS 23.246 [200]);
- Volume of data of a session;
- Duration of time whilst a subscriber is registered to receive a user service (or from Join to Leave);
- Volume of data transferred whilst a subscriber is registered to receive a user service (from Join to Leave).

Table 5.1.1.2 shows the applicability of the accounting measurements to the different bearer services used.

Table 5.1.1.2: Applicability of accounting measurements

Accounting measurement	Applicable to (Yes / No)	
	Broadcast Service	Multicast Service
Session Duration	Yes	Yes
Volume of data of a session	Yes	Yes
Duration of time whilst a subscriber is registered to receive a session	No	Yes
Volume of data transferred whilst a subscriber is registered to receive a session	No	Yes

5.1.1A General principles for EPS

The BM-SC shall collect charging information for mobile subscribers receiving services through MBMS and/or for content providers delivering content through MBMS. Transactions involving the content provider (or VASP) shall be possible.

NOTE: General principles are dependant on 3GPP WG SA2 work in TS 23.246 [200].

The BM-SC collects charging related information, such as:

- Identification of the source of content;
- Type of user service (streaming, download or carousel);
- Type of bearer service used to deliver content (broadcast or enhanced broadcast).

NOTE: Carousel services are not considered in the present document in the current 3GPP release.

Table 5.1.1A.1 shows the parties to be charged for the different MBMS Bearer Services used as identified by TS 22.246 [202] and TS 22.146 [201].

Table 5.1.1A.1: Charging requirements for service delivery

Service Aspects	MBMS Bearer Service used	
	Enhanced Broadcast (one or more)	Broadcast (one or more)
User Service (Content)	Receiving subscriber	Receiving subscriber
Bearer Service (Transport)	Content provider	Content provider

The user service, as shown in table 5.1.1A.1, shall be charged either by subscription (out of scope of the present document) or as a one time event charge (e.g. key management). Charging associated with the user service may be treated independently from charging associated with the transport of the user service.

Charging for the bearer service may be based on the session information (e.g. QoS, media type, and service area) and one of the following, as described in TS 22.146 [201]:

- Session duration (time from the MBMS Session Start procedure to MBMS Session Stop procedure as defined in TS 23.246 [200]).
- Volume of data of a session.

Table 5.1.1A.2 shows the applicability of the accounting measurements to the different bearer services used.

Table 5.1.1A.2: Applicability of accounting measurements

Accounting measurement	Applicable to (Yes / No)	
	Broadcast Service	Enhanced Broadcast Service
Session Duration	Yes	Yes
Volume of data of a session	Yes	Yes
Duration of time whilst a subscriber is registered to receive a session	No	No
Volume of data transferred whilst a subscriber is registered to receive a session	No	No

5.1.2 Triggers for generation of charging information

- Bearer service initiation/termination.
- Key management.

5.2 MBMS offline charging scenarios

5.2.1 Basic principles

As described in clause 5.1, charging may be based on events (such as key management) or based on MBMS sessions. However, as large numbers of users are expected to use services delivered using MBMS, generation of charging information should be performed in a manner that ensures the charging entities and billing domain are not overloaded.

Charging information shall be generated for subscribers and/or for content providers.

This reporting is achieved by sending Charging Data Request [Start, Interim, Stop and Event] from the BM-SC to the CDF.

The Diameter client (BM-SC) uses Charging Data Request [Start, Interim and Stop] in procedures related to both subscriber and content provider charging.

In table 5.2.1.1, table 5.2.1.2 and table 5.2.1.3, the terms "configurable" implies that operators may enable or disable the generation of an Charging Data Request message by the IMS node in response to a particular trigger.

Table 5.2.1.1: Charging Data Request messages for subscriber charging for GPRS

Message	Trigger	Mandatory/ Configurable
Charging Data Request [Start]	Authorization of UE to MBMS Bearer Service (for multicast only)	Mandatory
	Reception of first Session Start Response from any GGSN (for broadcast only)	Configurable
Charging Data Request [Interim]	Authorization of MBMS UE context activation (for multicast only)	Configurable
	Reception of first Session Start Response from any GGSN (for multicast only)	Configurable
	Reception of first Session Stop Response from any GGSN (for multicast only)	Configurable
	Expiration of AVP [Acct-Interim-Interval]	Configurable
	Reception of MBMS UE context modification	Configurable
Charging Data Request [Stop]	Reception of Leave Indication from UE (for multicast only)	Mandatory
	Reception of first Session Stop Response from any GGSN (for broadcast only)	Configurable
	Implementation dependent for termination of MBMS User Service	Configurable
Charging Data Request [Event]	Implementation dependent for MBMS User Service charging	Configurable

Table 5.2.1.2: Charging Data Request messages for content provider charging for GPRS

Message	Trigger	Mandatory/ Configurable
Charging Data Request [Start]	First Session Start Response from any GGSN	Mandatory
Charging Data Request [Interim]	Registration or Deregistration Request received from any GGSN	Configurable
	Deregistration Response received from any GGSN	Configurable
	Expiration of AVP [Acct-Interim-Interval]	Configurable
Charging Data Request [Stop]	First Session Stop Response from any GGSN	Mandatory

Table 5.2.1.3: Charging Data Request messages for content provider charging for EPS

Message	Trigger	Mandatory/ Configurable
Charging Data Request [Start]	First Session Start Response from any MBMS GW.	Mandatory
Charging Data Request [Interim]	Deregistration Response received from any MBMS GW.	Configurable
	Expiration of AVP [Acct-Interim-Interval]	Configurable
Charging Data Request [Stop]	First Session Stop Response from any MBMS GW.	Mandatory

5.2.2 Rf message flows

5.2.2.1 Broadcast service

5.2.2.1.1 User service charging

An MBMS user service that is delivered using a broadcast bearer may be Event charged or Session charged.
As there is no 3GPP specified signalling for a UE to activate or deactivate the Broadcast Service, it is MBMS user service dependent (e.g. key management) when the ACR is triggered.
The Event based and Session based offline charging flows are as defined in TS 32.299 [50].

5.2.2.1.2 Session Start for GPRS

Where charging for the content provider is applied for GPRS, the procedure in figure 5.2.2.1.2.1 applies.

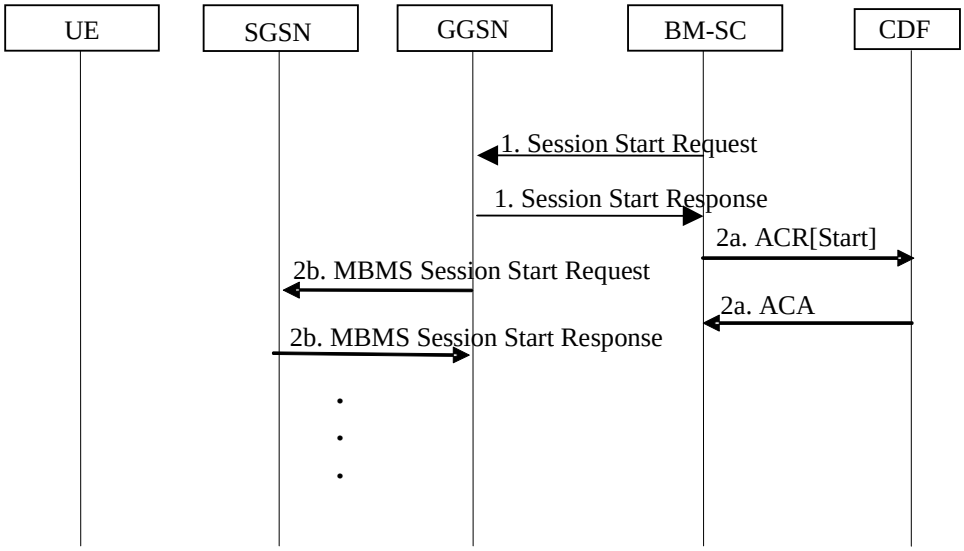

Figure 5.2.2.1.2.1: Rf interaction during Broadcast Session Start Procedure for a broadcast bearer

1) The BM-SC performs the MBMS Session Start procedure as described in TS 23.246 [200].

2a) On receiving the first MBMS Session Start Response from any GGSN, the BM-SC sends a Charging Data Request.

2b) The remainder of the MBMS Session Start procedure may occur in parallel with the Charging Data RequestCharging Data Request procedure in 2a).

The full details of the MBMS Session Start procedure for the broadcast bearer are described in TS 23.246 [200].

5.2.2.1.2A Session Start for EPS

Figure 5.2.2.1.2A.1 shows the charging interaction for EPS during the MBMS Session Start procedure for a broadcast bearer.

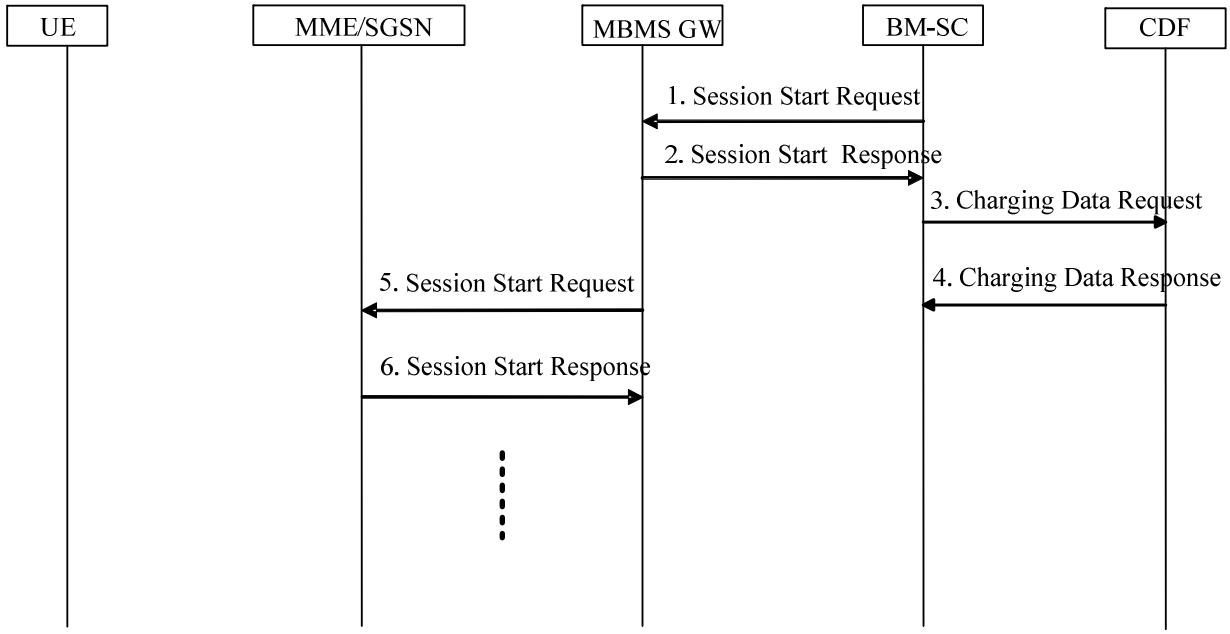

Figure 5.2.2.1.2A.1: Rf interaction during Broadcast Session Start Procedure for a broadcast bearer

1-2) The BM-SC performs the MBMS Session Start procedure as described in TS 23.246 [200].

3-4) On receiving the first MBMS Session Start Response from any MBMS GW, the BM-SC sends an Charging Data Request.

5-6) The remainder of the MBMS Session Start procedure may occur in parallel with the Charging Data Request procedure in 3-4).

The full details of the MBMS Session Start procedure for the broadcast bearer are described in TS 23.246 [200].

5.2.2.1.2B Void

5.2.2.1.3 Session Stop for GPRS

Figure 5.2.2.1.3.1 shows the charging interaction for GPRS during the MBMS Session Stop procedure for a broadcast bearer.

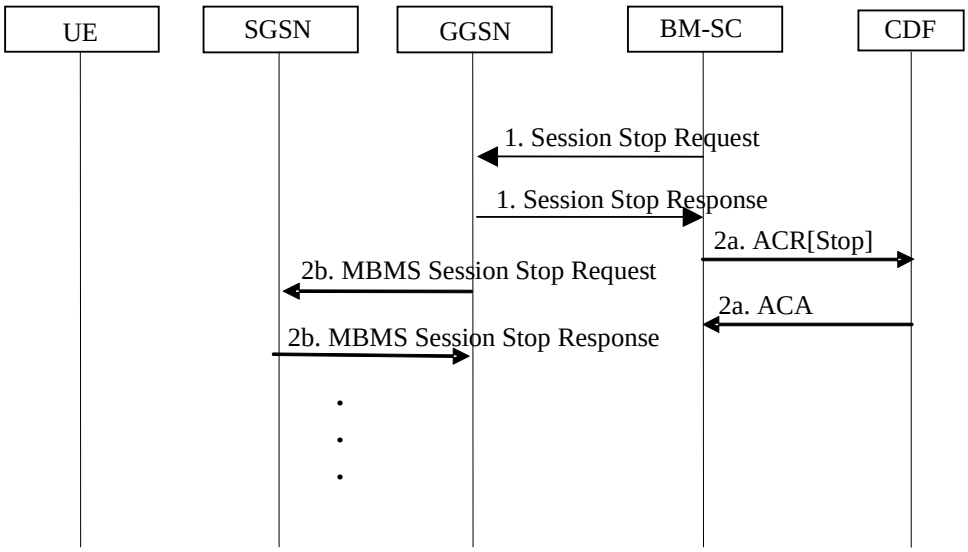

Figure 5.2.2.1.3.1: Rf interaction during MBMS Session Stop procedure for a broadcast bearer

1) The BM-SC performs the MBMS Session Stop procedure as described in TS 23.246 [200].

2a) On receiving a Session Stop Response from any GGSN, the BM-SC sends a Charging Data Request.

2b) The remainder of the MBMS Session Stop procedure occurs in parallel with the Charging Data Request procedure in 2a).

The full details of the MBMS Session Stop procedure for the broadcast bearer are described in TS 23.246 [200].

5.2.2.1.3A Session Stop for E-UTRAN

Figure 5.2.2.1.3A.1 shows the charging interaction for EPS during the MBMS Session Stop procedure for a broadcast bearer.

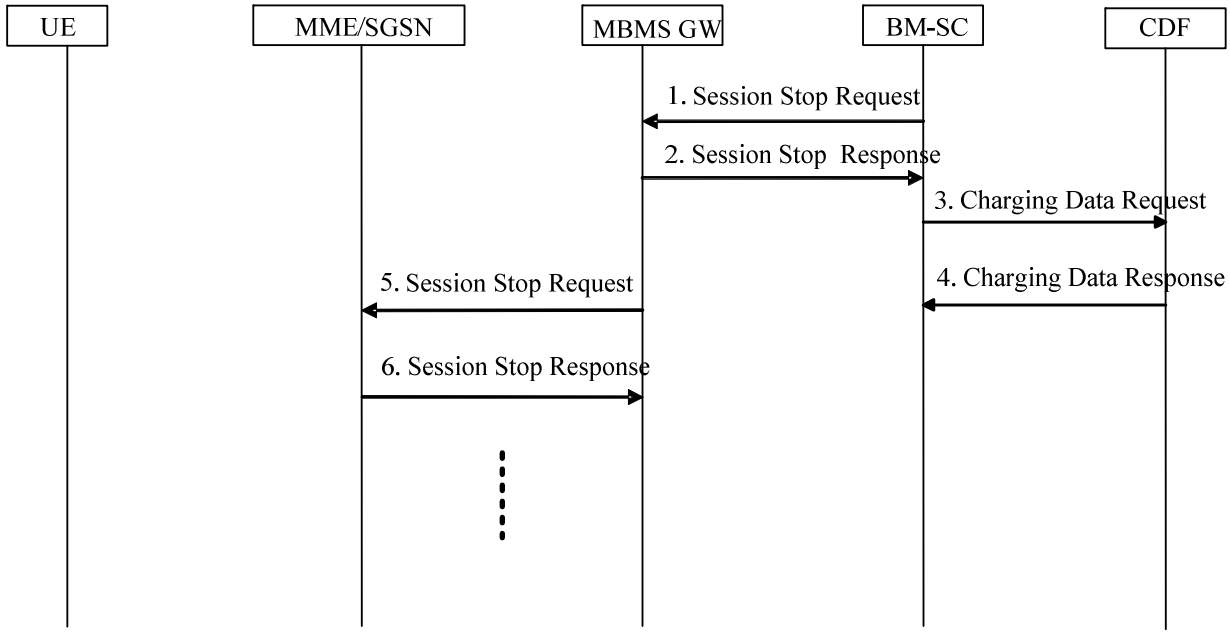

Figure 5.2.2.1.3A.1: Rf interaction during MBMS Session Stop procedure for a broadcast bearer

1-2) The BM-SC performs the MBMS Session Stop procedure as described in TS 23.246 [200].

3-4) On receiving the first MBMS Session Stop Response from any MBMS GW, the BM-SC sends a Charging Data Request.

5-6) The remainder of the MBMS Session Stop procedure may occur in parallel with the Charging Data Request procedure in 3-4).

The full details of the MBMS Session Stop procedure for the broadcast bearer are described in TS 23.246 [200].

5.2.2.1.3B Void

5.2.2.1.4 BM-SC initiated Registration and Deregistration

BM-SC initiated Registration and Deregistration are handled through OAM&P towards the GGSNs (and subsequent nodes) and therefore Rf interactions (Charging Data Request [Start] and Charging Data Request [Stop] respectively) may be triggered when the Registration and De-registration is triggered through OAM&P. These Rf interactions should only occur for sessions that have already started.

5.2.2.1.5 Session Update for EPS with E-UTRAN and UTRAN

Figure 5.2.2.1.5.1 shows the charging interaction for EPS during the MBMS Session Update procedure for a broadcast bearer

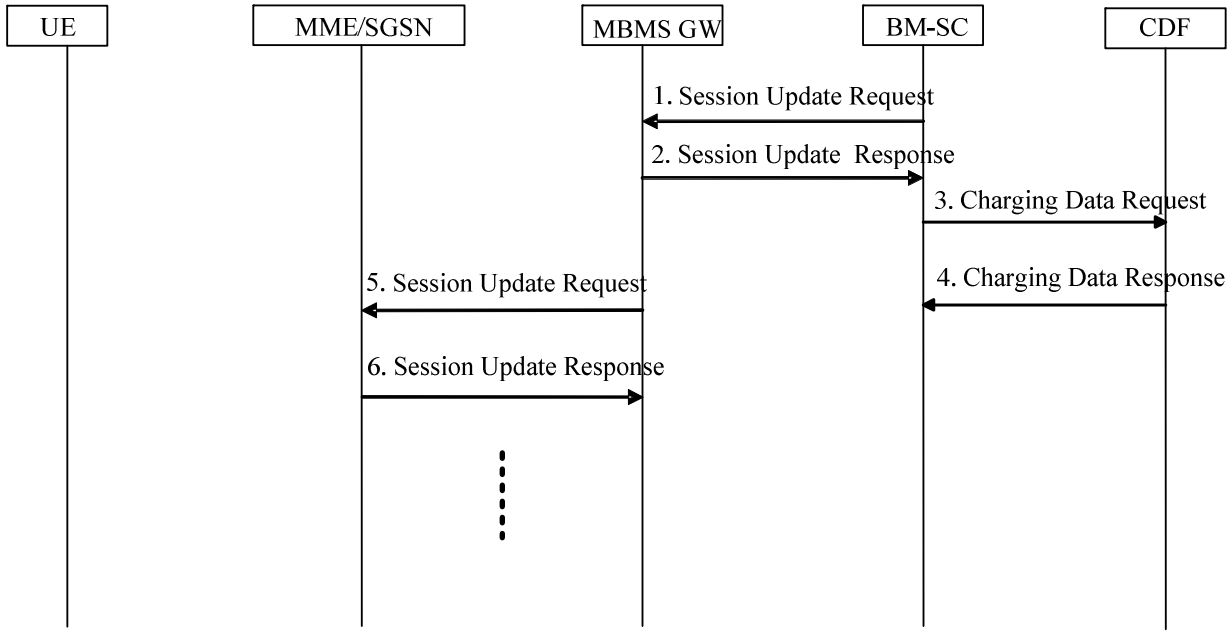

Figure 5.2.2.1.5.1: Rf interaction during Broadcast Session Update Procedure for a broadcast bearer

1-2) The BM-SC performs the MBMS Session Update procedure as described in TS 23.246 [200].

3-4) On receiving the first MBMS Session Update Response from any MBMS GW, the BM-SC sends a Charging Data Request.

5-6) The remainder of the MBMS Session Update procedure may occur in parallel with the Charging Data Request procedure in 3-4).

The full details of the MBMS Session Update procedure for the broadcast bearer are described in TS 23.246 [200].

5.2.2.2 Multicast Service

5.2.2.2.1 Session Start

Figure 5.2.2.2.1.1 shows the charging interaction during the MBMS Session Start procedure for a multicast bearer.

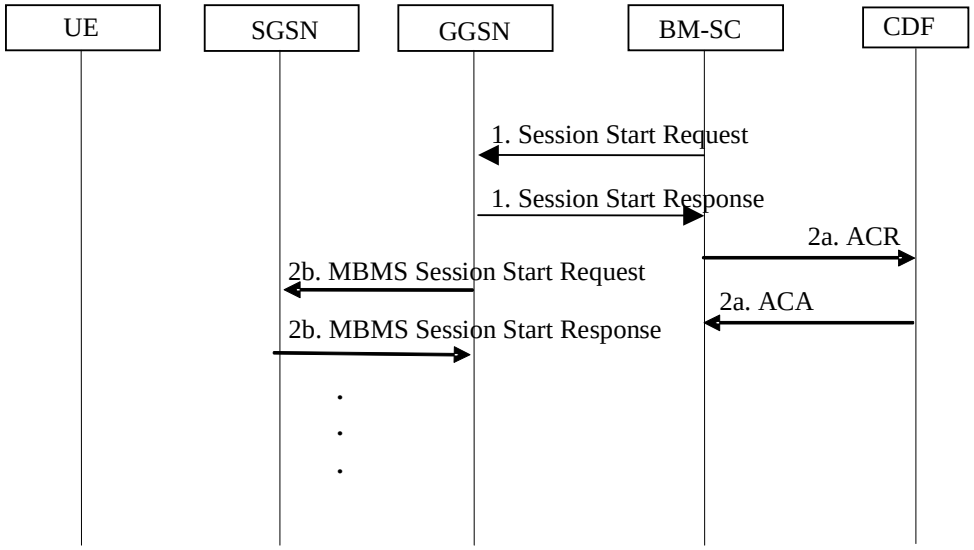

Figure 5.2.2.2.1.1: Rf interaction during MBMS Session Start procedure for a multicast bearer

1) The BM-SC performs the MBMS Session Start procedure as described in TS 23.246 [200].

2a) On receiving the first Session Start Response from any GGSN, the BM-SC sends an Charging Data Request. The accounting request may be for subscriber and/or content provider charging. For subscriber charging, the Charging Data Request shall be "Interim". For content provider charging, the ACR shall be "Start". It shall be possible to send one Charging Data Request message for multiple subscribers of the same Multicast Service, but the procedure in the BM-SC to group subscribers is implementation dependent.

2b) The remainder of the MBMS Session Start procedure occurs in parallel with the Charging Data Request procedure in 2a.

The full details of the MBMS Session Start procedure for the multicast bearer are described in TS 23.246 [200].

5.2.2.2.2 Session Stop

Figure 5.2.2.2.2.1 shows the charging interaction during the MBMS Session Stop procedure for a multicast bearer.

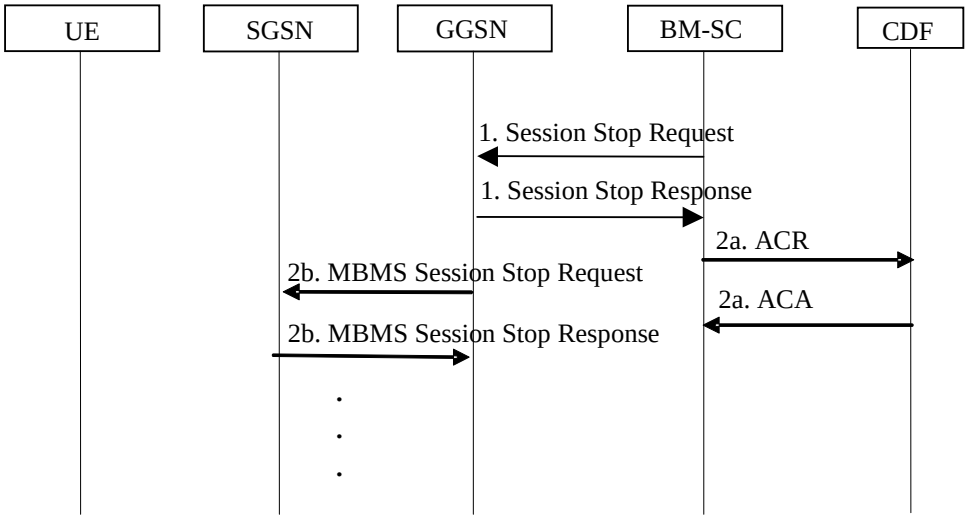

Figure 5.2.2.2.2.1: Rf interaction during MBMS Session Stop procedure for a multicast bearer

1) The BM-SC performs the MBMS Session Stop procedure as described in TS 23.246 [200].

2a) On receiving the first Session Stop Response from any GGSN, the BM-SC sends a Charging Data Request. For subscriber charging, the Charging Data Request shall be Charging Data Request [Interim] and it shall be possible to send one Charging Data Request message for multiple or all subscribers of the same Multicast Service, that are still active, and is implementation and service dependent.
For content provider charging, the Charging Data Request shall be Charging Data Request [Stop].

2b) The remainder of the MBMS Session Stop procedure occurs in parallel with the ACR procedure in 2a).

The full details of the Session Stop procedure for the multicast bearer are described in TS 23.246 [200].

5.2.2.2.3 BM-SC initiated MBMS Deregistration

Figure 5.2.2.2.3.1 shows the charging interaction during the BM-SC initiated MBMS Deregistration procedure for a multicast bearer for an already started session.

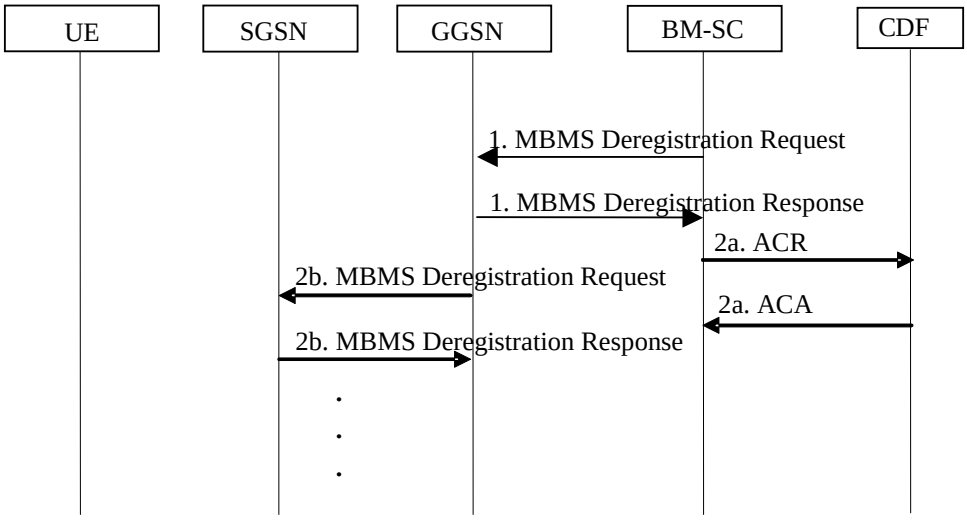

Figure 5.2.2.2.3.1: Rf interaction during BM-SC initiated MBMS Deregistration procedure for a multicast bearer

1) The BM-SC performs the MBMS Deregistration procedure as described in TS 23.246 [200].
The BM-SC sends a De-registration Request message to all GGSNs contained in the "list of downstream nodes" parameter of the corresponding MBMS Bearer Context to indicate the session is terminated.

2a) On receiving an MBMS Deregistration Response from the GGSN, the BM-SC sends an Charging Data Request [Stop].

2b) The remainder of the MBMS Deregistration procedure occurs in parallel with the Charging Data Request procedure in 2a.

The full details of the MBMS Deregistration procedure for the multicast bearer are described in TS 23.246 [200].

5.2.2.2.4 UE Activation

Figure 5.2.2.2.4.1 should apply to subscriber's that activate the Multicast Service.

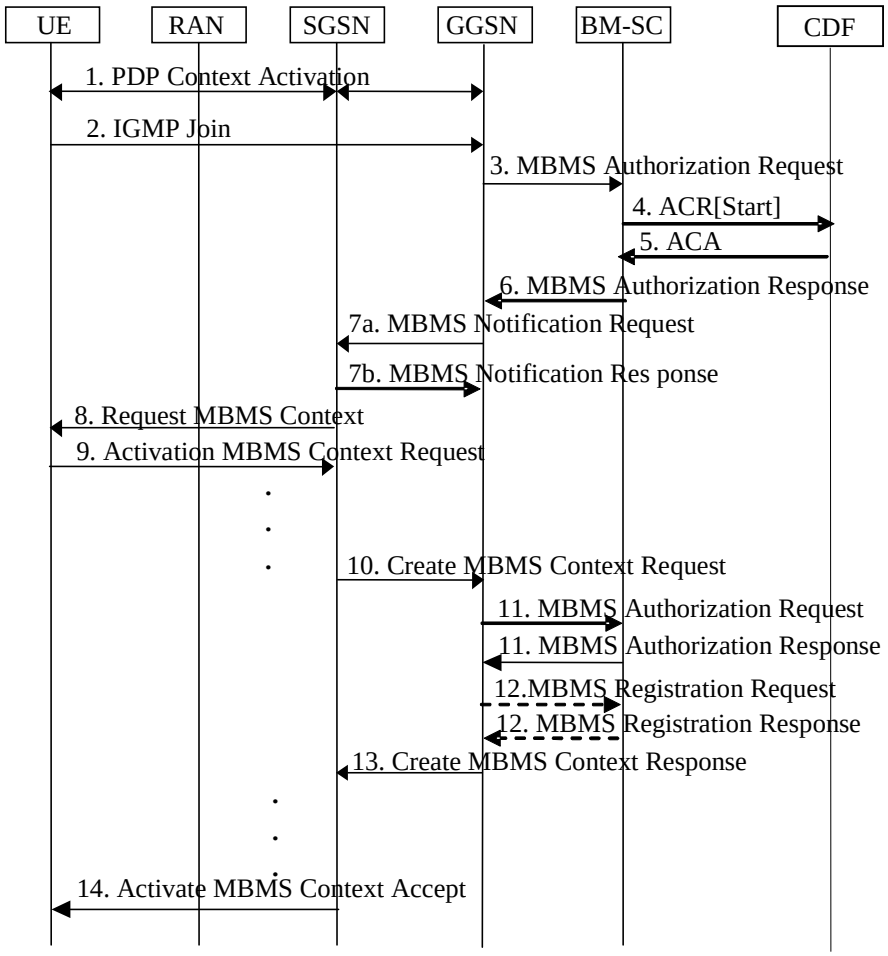

Figure 5.2.2.2.4.1: Rf interaction during MBMS Multicast Service Activation procedure for a multicast bearer

Full details of the activation procedure are described in the MBMS Multicast Service Activation procedure in TS 23.246 [200].

5.2.2.2.5 UE Deactivation

Figure 5.2.2.2.5.1 should only apply to subscriber's that deactivate the Multicast Service before the session has stopped, i.e. before the MBMS Session Stop procedure is invoked.

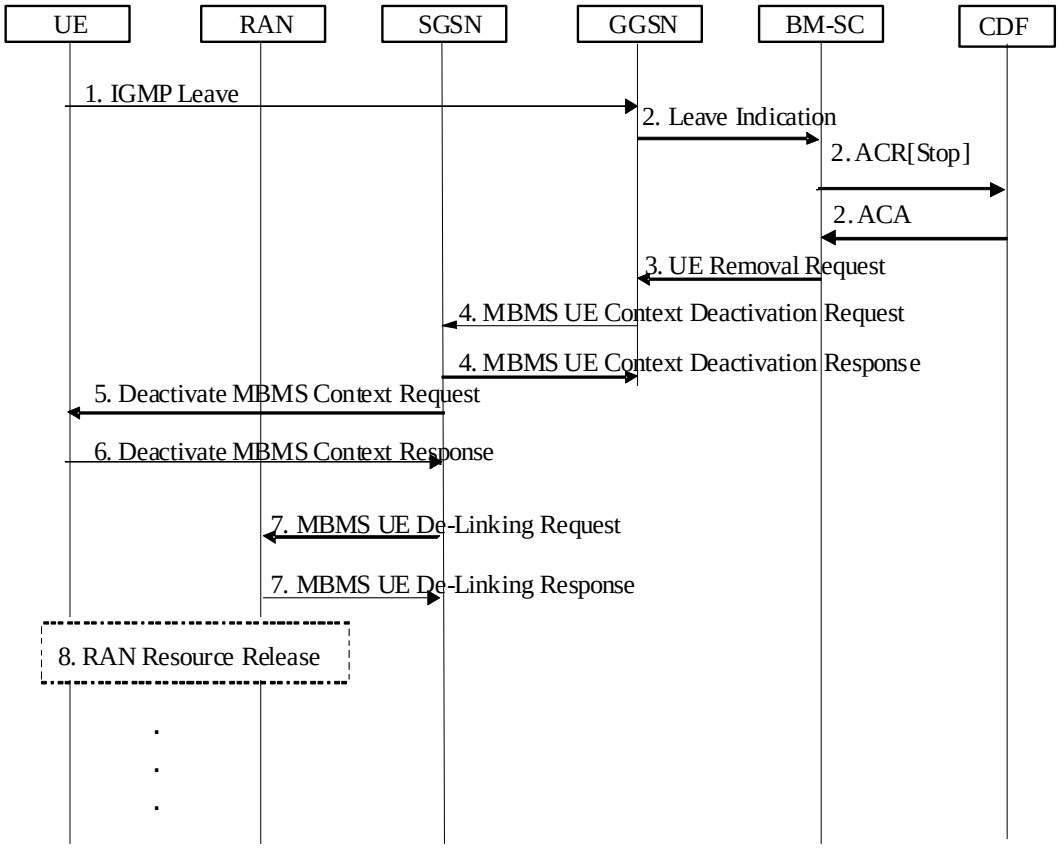

Figure 5.2.2.2.5.1: Rf interaction during MBMS Multicast Service Deactivation procedure for a multicast bearer

Full details of the deactivation procedure are described in the MBMS Multicast Service Deactivation procedure in TS 23.246 [200].

5.2.3 CDR generation

5.2.3.1 CDRs related to MBMS subscribers

5.2.3.1.1 Triggers for S-BMSC-CDR charging information collection

An S-BMSC-CDR is used to collect charging information related to the MBMS Bearer Service information for a UE/MS in the BM-SC. A CDR is generated for each MBMS Bearer Service used and for each subscriber using the MBMS Bearer Service.

An S-BMSC-CDR shall be opened at UE activation as triggered by an ACR[Start]. The volume for the MBMS bearer context is counted in downlink direction.

The subsequent clauses identify in detail the conditions for adding information to, and closing the BMSC-CDR for generation towards the CGF.

5.2.3.1.2 Triggers for S-BMSC-CDR charging information addition

A new container shall be added to the S-BMSC-CDR on encountering some trigger conditions.
Table 5.2.3.1.2.1 identifies which conditions are supported to permit addition of a new container to the S-BMSC-CDR. The start time of the new container shall indicate the time, whichever is later, at which the first Session Start Response was received, MBMS UE context activation, or the last partial CDR was closed.

Table 5.2.3.1.2.1: Triggers for S-BMSC-CDR addition

Closure Conditions	Description/Behaviour
Tariff Time Change	On reaching the Tariff Time Change a set of "List of Traffic Data Volumes" containers, i.e. all active traffic data flow containers, shall be added to the CDR.
Session Start	A Traffic Data Volume container may be added when an MBMS Session Start is performed
Session Stop	A Traffic Data Volume container may be added when an MBMS Session Stop is performed.
MBMS UE context modification	A Traffic Data Volume container may be added when an MBMS UE context modification is received by the BM-SC. See note 1.
CDR Closure	All active "List of Traffic Data Volumes" containers shall be added to the eG-CDR.
NOTE 1: One trigger for modification of MBMS UE context is as a result of inter-system (RAT) change and there is no reliable mechanism to report the change at the actual time of change. This is due to the UE remaining in IDLE mode from the core network perspective. NOTE 2: MBMS charging is based on the volume of downlink data. Therefore the ""List of Traffic Data Volumes"" shall not count data volumes in uplink direction.	

NOTE: One trigger for modification of MBMS UE context is as a result of inter-system (RAT) change and there is no reliable mechanism to report the change at the actual time of change. This is due to the UE remaining in IDLE mode from the core network perspective.

5.2.3.1.3 Triggers for S-BMSC-CDR closure

The S-BMSC-CDR shall be closed on encountering some trigger conditions.
Table 5.2.3.1.3.1 identifies which conditions are supported to permit closure of the S-BMSC-CDR.

Table 5.2.3.1.3.1: Triggers for S-BMSC-CDR closure

Closure Conditions	Description/Behaviour
Service Deactivation	Deactivation of the MBMS service in the BM-SC shall result in the CDR being closed. The trigger condition covers: - UE initiated deactivation; - termination of the MBMS User Service - any abnormal release.
Charging Data Request[Stop]	On reception of Charging Data Request[Stop], a CDR is closed.
Partial Record Reason	OAM&P reasons permit the closure of the CDR for internal reasons. The trigger condition covers: - data volume limit; - time (duration) limit; - maximum number of charging condition changes; - management intervention.

The Partial Record generation trigger thresholds are those associated with the Charging Characteristics.
The Partial Record generation trigger thresholds are configuration parameters defined per charging characteristics profile by the operator through OAM&P means.

5.2.3.2 CDRs related to content provider

5.2.3.2.1 Triggers for BMSC-CDR charging information collection

A C-BMSC-CDR is used to collect charging information related to the MBMS Bearer Service information for a content provider to the BM-SC. A C-BMSC-CDR is generated for each MBMS Bearer Service.

A C-BMSC-CDR shall be opened at MBMS Session Start as triggered by an Charging Data Request[Start]. The volume for the MBMS bearer context is counted in downlink direction. Not all of the charging information to be collected is static, and may be dependent on dynamic (de-)registration of packet-switched nodes to the MBMS bearer context.

The subsequent clauses identify in detail the conditions for adding information to, and closing the C-BMSC-CDR for passing towards the CGF.

5.2.3.2.2 Triggers for C-BMSC-CDR charging information addition

A new container shall be added to the C-BMSC-CDR on encountering some trigger conditions.
Table 5.2.3.2.2.1 identifies which conditions are supported to permit addition of a new container to the C-BMSC-CDR.

Table 5.2.3.2.2.1: Triggers for C-BMSC-CDR addition

Closure Conditions	Description/Behaviour
Tariff Time Change	On reaching the Tariff Time Change a set of "List of Traffic Data Volumes" containers, i.e. all active service data flow containers, shall be added to the CDR.
CDR Closure	All active "List of Traffic Data Volumes" containers shall be added to the eG-CDR.
NOTE: MBMS charging is based on the volume of downlink data. Therefore the ""List of Traffic Data Volumes"" shall not count data volumes in uplink direction.	

5.2.3.2.3 Triggers for C-BMSC-CDR closure

The C-BMSC-CDR shall be closed on encountering some trigger conditions.
Table 5.2.3.2.3 identifies which conditions are supported to permit closure of the C-BMSC-CDR.

Table 5.2.3.2.3: Triggers for C-BMSC-CDR closure

Closure Conditions	Description/Behaviour
Service Deactivation	Deactivation of the MBMS service in the BM-SC shall result in the CDR being closed. The trigger condition covers: - MBMS Session Stop; - termination of the MBMS User Service - any abnormal release.
Charging Data Request[Stop]	On reception of aCharging Data Request [Stop], the CDR shall be closed.
Partial Record Reason	OAM&P reasons permit the closure of the CDR for internal reasons. The trigger condition covers: - data volume limit; - time (duration) limit; - change in list of downstream nodes; - management intervention; - MBMS service area; - access indicator.

The Partial Record generation trigger thresholds are configuration parameters defined per charging characteristics profile by the operator through OAM&P means.

5.2.4 Ga record transfer flows

For further details on the G_a protocol application refer to TS 32.295 [54].

5.2.5 Bmb CDR file transfer

The CGF transfers the CDR files to the BD as described in TS 32.297 [52].
For further details on the Bmb protocol application refer to TS 32.297 [52].

5.3 MBMS online charging scenarios

5.3.1 Basic principles

MBMS online charging uses the Credit-Control application as specified in TS 32.299 [50] and in the present document.

Online charging of content providers is not supported in this release of the present document.

The type of online interaction used is dependent on the user service type, bearer type and whether delivery notification is required. Table 5.3.1.1 shows this dependency.

Table 5.3.1: Online interaction dependency on MBMS service parameters

User Service Type	Bearer Service Type	Delivery Notification	Online Interaction
Key Management	N/A	N/A	IEC
Streaming	Broadcast	N/A	Operator Configurable
Streaming	Multicast	N/A	SCUR
Download	Broadcast	Required	Operator Configurable
Download	Multicast	Required	Operator Configurable
Download	Broadcast	Not required	Operator Configurable
Download	Multicast	Not required	Operator Configurable
NOTE: Operator configurable options imply that IEC, SCUR and ECUR should be supported			

It is not possible to perform charging transactions in a load efficient manner as in offline charging (see clause 5.2). Therefore, one online charging interaction is necessary for each user.

5.3.2 Ro message flows

5.3.2.1 Broadcast Service

5.3.2.1.1 User service charging

An MBMS user service that is delivered using a broadcast bearer may be Event charged or Session charged.
As there is no 3GPP specified signalling for a UE to activate or deactivate the Broadcast Service, it is MBMS user service dependent (e.g. key management) when the Charging Data Request is triggered.
The Event based or Session based online charging flows are as defined in TS 32.299 [50].

5.3.2.1.2 Session Start

As online charging does not apply to content provider, this scenario is not applicable.

5.3.2.1.3 Session Stop

As online charging does not apply to content provider, this scenario is not applicable.

5.3.2.1.4 BM-SC initiated Registration and Deregistration

As online charging does not apply to content provider, this scenario is not applicable.

5.3.2.2 Multicast Service

5.3.2.2.1 Session Start

Figure 5.3.2.2.1.1 shows the charging interaction during the MBMS Session Start procedure for a multicast bearer.

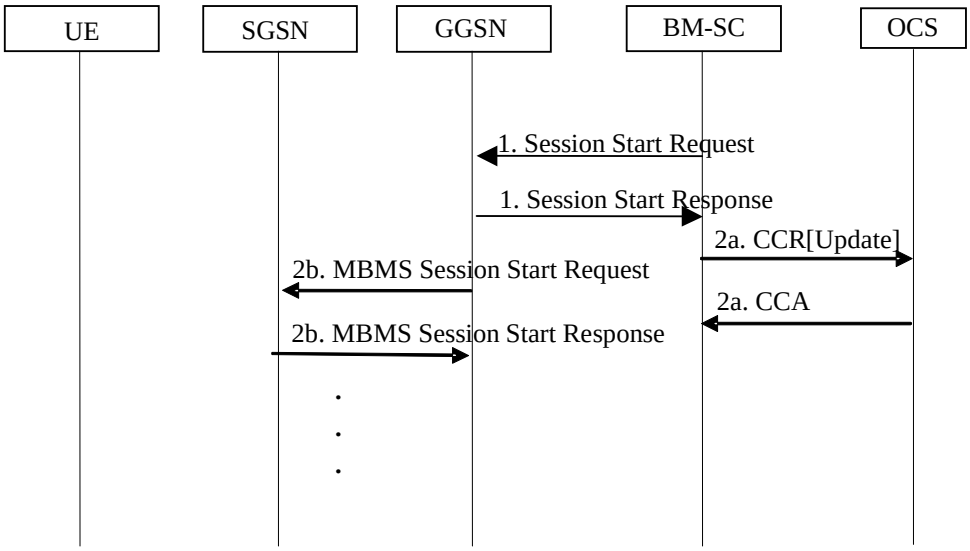

Figure 5.3.2.2.1.1: Ro interaction during MBMS Session Start procedure for a multicast bearer

1) The BM-SC performs the MBMS Session Start procedure as described in TS 23.246 [200].

2a) On receiving the first Session Start Response from any GGSN, the BM-SC sends a Debit / Reserve Units Request for each subscriber that has joined the service.

2b) The remainder of the MBMS Session Start procedure occurs in parallel with the Debit / Reserve Units Request procedure in 2a.

The full details of the MBMS Session Start procedure for the multicast bearer are described in TS 23.246 [200].

5.3.2.2.2 Session Stop

Figure 5.3.2.2.2.1 shows the charging interaction during the MBMS Session Stop procedure for a multicast bearer.

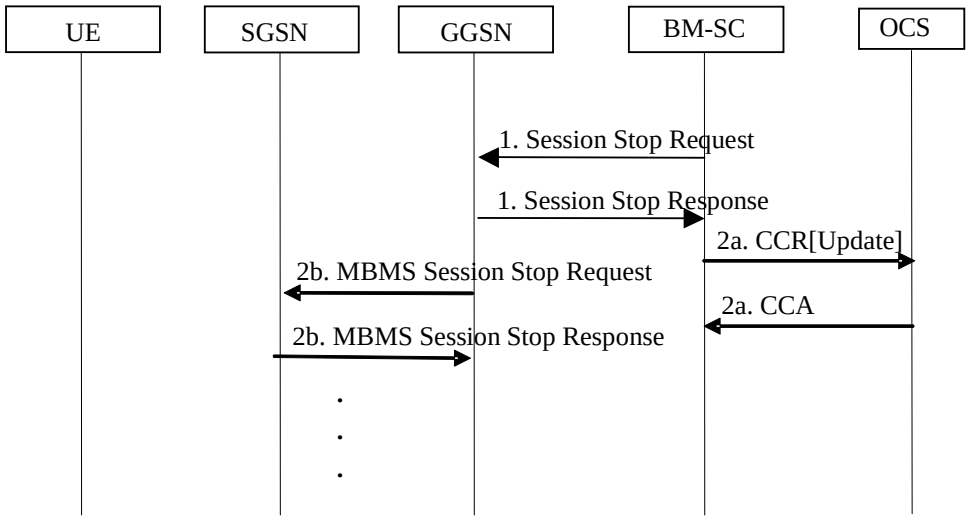

Figure 5.3.2.2.2.1: Ro interaction during MBMS Session Stop procedure for a multicast bearer

1) The BM-SC performs the MBMS Session Stop procedure as described in TS 23.246 [200].

2a) On receiving the first Session Stop Response from any GGSN, the BM-SC sends a Debit / Reserve Units Request for each subscriber that is still joined to the service.

2b) The remainder of the MBMS Session Stop procedure occurs in parallel with the Debit / Reserve Units Request procedure in 2a.

The full details of the Session Stop procedure for the multicast bearer are described in TS 23.246 [200].

5.3.2.2.3 BM-SC initiated MBMS Deregistration

Figure 5.3.2.2.3.1 shows the charging interaction during the BM-SC initiated MBMS Deregistration procedure for a multicast bearer for an already started session.

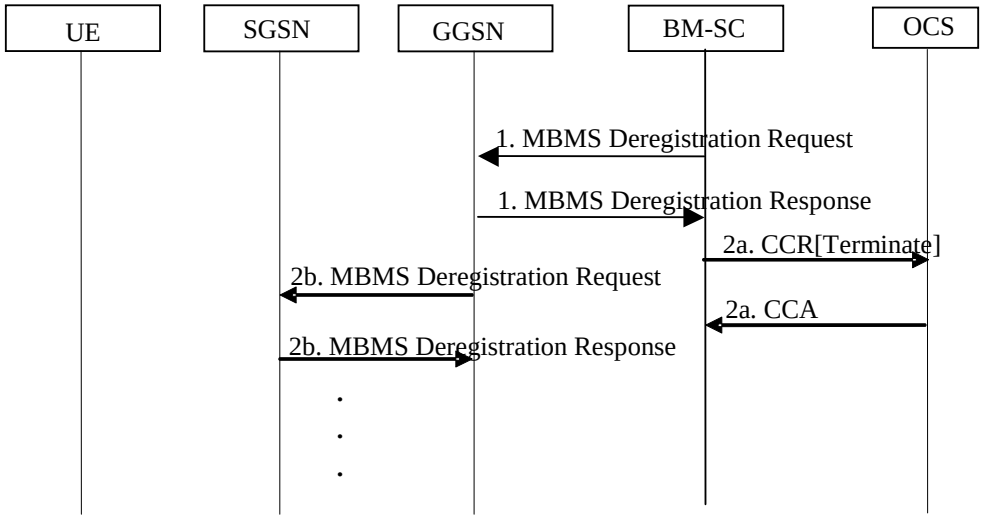

Figure 5.3.2.2.3.1: Ro interaction during BM-SC initiated MBMS Deregistration procedure for a multicast bearer

1) The BM-SC performs the MBMS Deregistration procedure as described in TS 23.246 [200].
The BM-SC sends a Deregistration Request message to all GGSNs contained in the "list of downstream nodes" parameter of the corresponding MBMS Bearer Context to indicate the session is terminated.

2a) On receiving an MBMS Deregistration Response from the GGSN, the BM-SC sends a Debit / Reserve Units Request [Terminate] for each subscriber that has joined the service.

2b) The remainder of the MBMS Deregistration procedure occurs in parallel with the Debit / Reserve Units Request procedure in 2a).

The full details of the MBMS Deregistration procedure for the multicast bearer are described in TS 23.246 [200].

5.3.2.2.4 UE Activation

Figure 5.3.2.2.4.1 applies to subscribers that activate the Multicast Service.

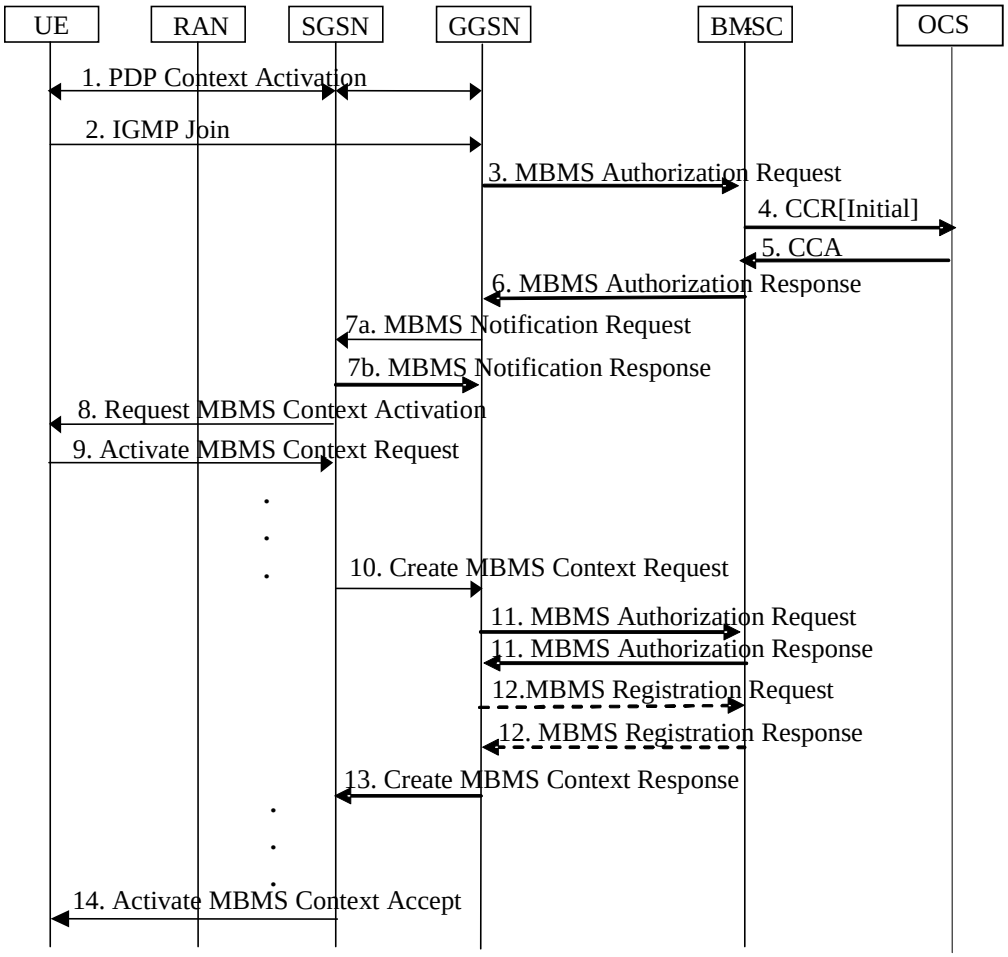

Figure 5.3.2.2.4.1: Ro interaction during MBMS Multicast Service Activation procedure for a multicast bearer

Full details of the activation procedure are described in the MBMS Multicast Service Activation procedure in TS 23.246 [200].

5.3.2.2.5 UE Deactivation

Figure 5.3.2.2.5.1 applies to subscribers that deregister from the Multicast Service before the session has stopped, i.e. before the MBMS Session Stop procedure is invoked.
This procedure is optionally applied, if the deactivation occurs after the MBMS Session Stop procedure, depending on the charging model applied.

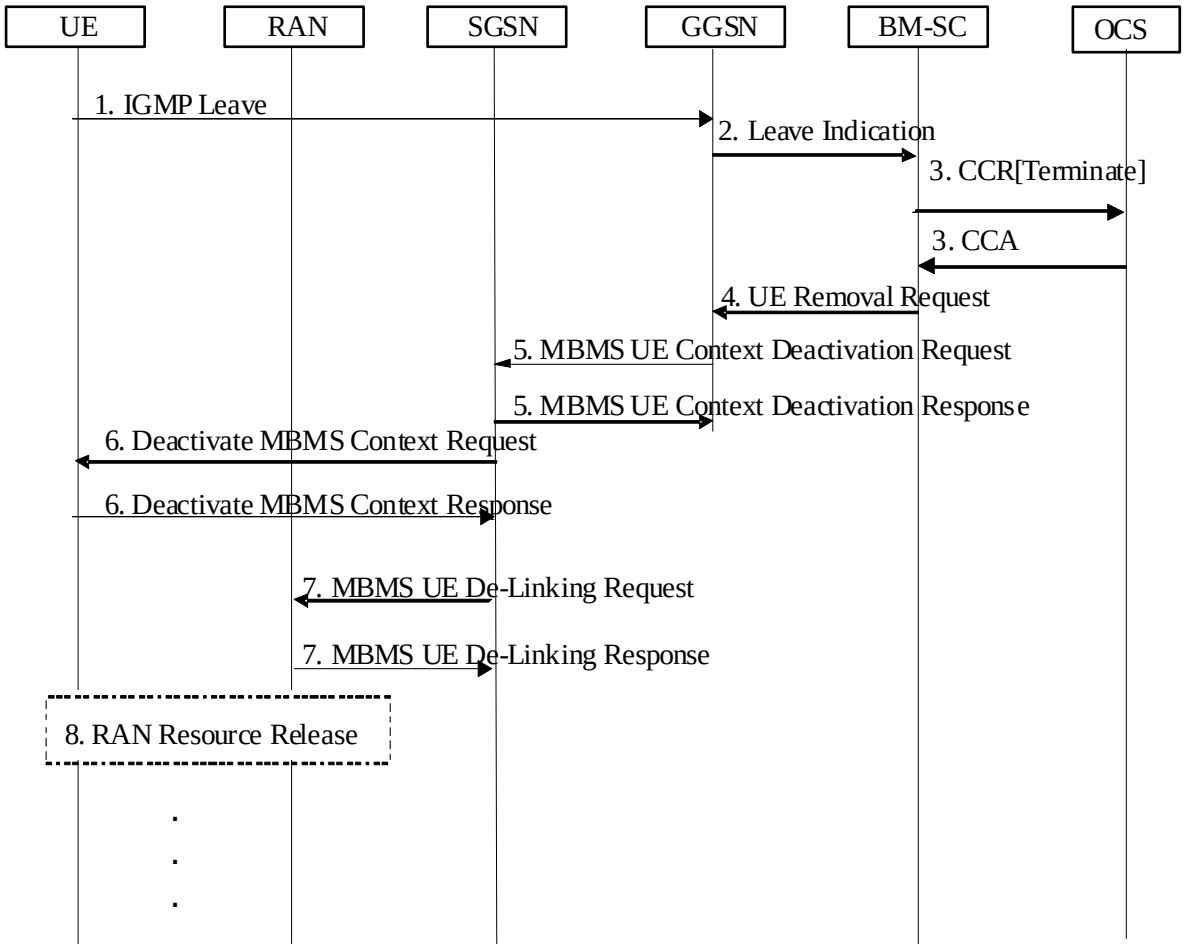

Figure 5.3.2.2.5: Ro interaction during MBMS Multicast Service Deactivation procedure for a multicast bearer

Full details of the deactivation procedure are described in the MBMS Multicast Service Deactivation procedure in TS 23.246 [200].

5.3.3 Credit-Control related

5.3.3.1 Triggers for stopping for an MBMS service Credit-Control session

In addition to message flows in clause 5.3.2, a Debit / Reserve Units Request [Terminate] is sent to OCS when:

a) Session termination is indicated by the OCS (e.g. Credit Limit Reached);

b) Abort-Session-Request is received from the OCS, this also results in the deactivation of the MBMS UE Context (from step 4 of clause 5.3.2.2.5), if one exists for the session being terminated.

5.3.3.2 Triggers for providing interim information for a MBMS service Credit-Control session

In addition to the message flows in clause 5.3.2, a Debit / Reserve Units Request [Update] is sent to OCS when:

a) Granted quota runs out;

b) Validity time for granted quota expires;

c) Update is requested by the OCS;

d) Change of charging conditions occur and according re-authorisation trigger re-authorisation is needed;

e) Management intervention.

6 Definition of charging information

6.1 Data description for MBMS offline charging

6.1.1 Rf message contents

6.1.1.1 Summary of offline charging message formats

The BM-SC generates accounting information that can be transferred to the CDF. For this purpose, the MBMS Charging Data transfer operation employs the Charging Data Request and Charging Data Response messages. The request can be of type start, stop, interim and event. The Charging Data Request message includes all charging information and the answer is just an acknowledgement of the request message.
Detailed information about the offline charging application is described in TS 32.299 [50].

The following clauses describe the different information elements used in the Charging Data messages.

Table 6.1.1.1.1 describes the use of these messages for offline charging.

Table 6.1.1.1.1: Offline charging messages reference table

Message	Source	Destination
Charging Data Request	BM-SC	CDF
Charging Data Response	CDF	BM-SC

6.1.1.2 Structure for the Rf message formats

6.1.1.2.1 Charging Data Request message

Table 6.1.1.2.1 illustrates the basic structure of a Diameter ACR message as used for MBMS offline charging.

Table 6.1.1.2.1: ACR message contents for offline charging

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Destination Domain	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Session Identifier	M	Used as described in TS 32.299 [50].
User Name	O_C	Used as described in TS 32.299 [50].
Destination Host	O_C	Used as described in TS 32.299 [50].
Operation Interval	O_C	Used as described in TS 32.299 [50].
Origination State	O_C	Used as described in TS 32.299 [50].
Origination Timestamp	O_C	Used as described in TS 32.299 [50].
Proxy Information	-	Not used.
Route Information	-	Not used .
Operation Token	O_M	Used as described in TS 32.299 [50]
Service Information	O_M	Described in TS 32.299 [50]
Subscriber Identifier	O_M	Used as described in TS 32.299 [50]. As a minimum the IMSI and the MSISDN have to be included for subscriber charging.
PS Information	O_C	Described in TS 32.251 [11] .
IMS Information	O_C	Described in TS 32.260 [20] .
MBMS Information	O_M	Described in clause 6.3.

Information Element	Category	Description
NOTE: For structured IEs only the "IE" is listed in this table. Detailed description of the IEs is provided according to "Description" column.		

6.1.1.2.2 Charging Data Response message

Table 6.1.1.2.2 illustrates the basic structure of a Charging Data Response message as used for MBMS charging. This message is always used by the CDF as specified below, regardless of the BM-SC it is received from and the Charging Data Request record type that is being replied to.

Table 6.1.1.2.2: Charging Data Response message contents for offline charging

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Operation Result	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Operation Identifier	O_M	Used as described in TS 32.299 [50].
Operation Interval	O_C	Used as described in TS 32.299 [50].
Origination State	O_C	Used as described in TS 32.299 [50].
Origination Timestamp	O_C	Used as described in TS 32.299 [50].
Proxy Information	-	Not used.

6.1.2 Ga message contents

6.1.3 CDR description on the Bmb interface

6.1.3.1 CDR description for subscriber charging

Table 6.1.3.1.1: Subscriber BM-SC data (S-BMSC-CDR)

Field	Category	Description
Record Type	M	S-BM-SC record.
Served IMSI	M	IMSI of the served party. This may be obtained from the Subscription Id field, identified by a type of IMSI, of the ACR message.
GGSN Address used	C	The control plane IP address of the GGSN used for MBMS UE context activation. Present only for multicast.
Access Point Name Network Identifier	O_C	The logical name of the connected access point to the external packet data network (network identifier part of APN). Present only for multicast.
Served PDP Address	O_M	Represents the IP Multicast address associated with the MBMS bearer context.
List of Traffic Data Volumes	O_M	A list of changes in charging conditions (including MBMS UE context modifications) for this MBMS Bearer Service, each change is time stamped. Charging conditions are used to categorize traffic volumes, such as per tariff period. Initial and subsequently changed QoS and corresponding data volumes are also listed. See note below.
Record Opening Time	M	Time stamp when UE activation occurs or record opening time on subsequent partial records.
Duration	M	Duration of this record.
Cause for Record Closing	M	The reason for the release of record.
Diagnostics	O_M	A more detailed reason for the release of the connection.
Record Sequence Number	C	Partial record sequence number, only present in case of partial records.
Node ID	O_M	Name of the recording entity.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.
Local Record Sequence Number	O_M	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
Served MSISDN	O_M	The primary MSISDN of the subscriber. This may be obtained from the Subscription Id field, identified by a type of E.164, of the ACR message.
Bearer Service Description	O_C	Holds the Session portion of the SDP data exchanged between the BMSC and UE during the notification phased.
MBMS Information	O_M	A set of fields hold the MBMS specific parameters. The details are defined in clause 6.3.1.2.
Service Context Id	O_M	Holds the context information to which the CDR belongs.
NOTE: MBMS charging is based on the volume of downlink data. Therefore the "List of Traffic Data Volumes" shall not count data volumes in uplink direction.		

6.1.3.2 CDR description for content provider charging

Table 6.1.3.2.1: Content provider BM-SC data (C-BMSC-CDR)

Field	Category	Description
Record Type	M	C-BM-SC record.
Content Provider Id	M	Identity of the content provider. This may be obtained from the Subscription ID field of the Accounting Request message.
List of Downstream Nodes	M	A list of the control plane IP address of the GGSN/MBMS GWs used by the MBMS Bearer Service.
Access Point Name Network Identifier	O_C	The logical name of the connected access point to the external packet data network (network identifier part of APN). Present only for multicast.
PDP/PDN Type	O_M	This field indicates PDN type (i.e. IPv4 or IPv6).
Served PDP/PDN Address	O_M	Represents the IP Multicast address used to transmit the MBMS user service, i.e. IPv4 or IPv6, if available.
List of Traffic Data Volumes	O_M	A list of changes in charging conditions (including MBMS UE context modifications) for this MBMS Bearer Service, each change is time stamped. Charging conditions are used to categorize traffic volumes, such as per tariff period. Initial and subsequently changed QoS and corresponding data volumes are also listed. See note below.
Record Opening Time	M	Time stamp when MBMS Bearer Context is activated (i.e. MBMS Session Start) or record opening time on subsequent partial records.
Duration	M	Duration of this record.
Cause for Record Closing	M	The reason for the release of record.
Diagnostics	O_M	A more detailed reason for the release of the connection.
Record Sequence Number	C	Partial record sequence number, only present in case of partial records.
Node ID	O_M	Name of the recording entity.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.
Local Record Sequence Number	O_M	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
Recipient Address List	O_C	The address(es) of the recipients registered to receive the bearer service.
Bearer Service Description	O_C	Holds the Session portion of the SDP data exchanged between the BMSC and UE during the notification phased, see IMS-Information in table 6.3.1.1.
MBMS Information	O_M	A set of fields hold the MBMS specific parameters. The details are defined in clause 6.3.1.2.
Service Context Id	O_M	Holds the context information to which the CDR belongs.
NOTE: MBMS charging is based on the volume of downlink data. Therefore the "List of Traffic Data Volumes" shall not count data volumes in uplink direction.		

6.2 Data description for MBMS online charging

6.2.1 Ro message contents

6.2.1.1 Summary of message formats

MBMS Online Charging use Debit / Reserve Units Request and Debit / Reserve Units Request messages defined in TS 32.299 [50]. The Debit / Reserve Units Request triggers the rating of the MBMS service and reserves units on the user's account.
The Debit / Reserve Units Response is a response including any reserved units or an error code if the user is out of credit.
Detailed information about the online charging application is described in TS 32.299 [50].

The Debit / Reserve Units Request for the "intermediate interrogation" and "final interrogation" reports the actual number of "units" that were used, from what was previously reserved. This determines the actual amount debited from the subscriber's account.

The following clauses describe the different fields used in the Debit / Reserve Units messages.

Table 6.2.1.1 describes the use of these messages for online charging.

Table 6.2.1.1: Online charging messages reference table

Message	Source	Destination
Debit / Reserve Units Request	BM-SC	OCS
Debit / Reserve Units Response	OCS	BM-SC

6.2.1.2 Structure for the message formats

6.2.1.2.1 Debit / Reserve Units Request message

Table 6.2.1.2.1.1 illustrates the basic structure of a Debit / Reserve Units Request message from the BM-SC as used for MBMS online charging.

Table 6.2.1.2.1.1: Debit / Reserve Units Request message contents

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Destination Domain	M	Used as described in TS 32.299 [50].
Operation Identifier	M	Used as described in TS 32.299 [50].
Operation Token	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Destination Host	O_C	Used as described in TS 32.299 [50].
User Name	O_C	Used as described in TS 32.299 [50].
Origination State	O_C	Used as described in TS 32.299 [50].
Origination Timestamp	O_C	Used as described in TS 32.299 [50].
Subscriber Identifier	O_C	Used as described in TS 32.299 [50]. As a minimum the IMSI and the MSISDN have to be included.
Termination Cause	O_C	Used as described in TS 32.299 [50].
Destination Host	O_C	Used as described in TS 32.299 [50].
Requested Action	O_C	Used as described in TS 32.299 [50].
Multiple Operation	O_M	Used as described in TS 32.299 [50].
Multiple Unit Operation	O_C	Used as described in TS 32.299 [50].
Subscriber Equipment Number	O_C	Used as described in TS 32.299 [50].
Service Information	O_M	Defined in TS 32.299 [50]
PS Information	O_C	Used as described in TS 32.251 [11] .
IMS Information	O_c	Used as described in TS 32.260 [20] .
MBMS Information	O_M	Described in clause 6.3

6.2.1.2.2 Debit / Reserve Units Response message

Table 6.2.1.2.2.1 illustrates the basic structure of a Debit / Reserve Units Response message as used for the BM-SC. This message is always used by the OCS as specified below, independent of the receiving BM-SC and the Debit / Reserve Units Request request type that is being replied to.

Table 6.2.1.2.2.1: Debit / Reserve Units Response message

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Operation Result	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Operation Identifier	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Operation Number	O_C	Used as described in TS 32.299 [50].
Operation Failover	O_C	Used as described in TS 32.299 [50].
Multiple-Services-Credit-Control	O_C	Used as described in TS 32.299 [50].
Operation Failure Action	O_C	Used as described in TS 32.299 [50].
Operation Event Failure Action	O_C	Used as described in TS 32.299 [50].
Redirection Host	O_C	Used as described in TS 32.299 [50].
Redirection Host Usage	O_C	Used as described in TS 32.299 [50].
Redirection Cache Time	O_C	Used as described in TS 32.299 [50].
Proxy Information	O_C	Used as described in TS 32.299 [50].
Route Information	O_C	Used as described in TS 32.299 [50].
Failed parameter	O_C	Used as described in TS 32.299 [50].

6.3 MBMS charging specific parameters

6.3.1 Definition of the MBMS charging information

6.3.1.0 General

The MBMS Information parameter used for MBMS charging is provided in the Service Information parameter.

6.3.1.1 MBMS charging information assignment for Service Information

The components that are used for MBMS charging are provided in the Service Information as described in table 6.3.1.1.1.

Table 6.3.1.1.1: Components of the Service Information used for MBMS charging

Information Element	Category	Description
Service Information	O_M	A set of fields hold the specific parameter as defined in TS 32.299 [50]. For MBMS Charging the PS Information and IMS Information are used.
Subscriber Identifier	O_C	This field contains the identification of the charged party (e.g. IMSI, MSISDN, Content Provider Id).
PS Information	O_C	A set of fields hold the PS specific parameters. The details are defined in TS 32.251 [11].
Node Id	O_C	Used as defined in TS 32.251 [11].
PDP/PDN Type	O_C	Used as defined in TS 32.251 [11]. See note.
Served PDP/PDN Address	O_C	Used as defined in TS 32.251 [11]. See note.
GGSN Address	O_C	Used as defined in TS 32.251 [11].
3GPP SGSN MCC MNC	O_C	Used as defined in TS 32.251 [11].
RAT Type	O_C	Used as defined in TS 32.251 [11].
Called Station Id	O_C	The logical name of the connected access point to the external packet data network (network identifier part of APN). Present only for multicast.
Traffic Data Volumes	O_C	Used as defined in TS 32.251 [11].
Change Condition	O_C	This field holds the reason for sending ACR from the BM-SC.
Diagnostics	O_C	This field holds a more detailed reason for the release of the MBMS bearer, and complements the "Change Condition" information.
IMS Information	O_C	A set of fields hold the MBMS Bearer Service specific parameters within the scope of the present document. The details are defined in TS 32.260 [20].
SDP Session Description	O_C	Used as defined in TS 32.260 [20].
SDP Media Components	O_C	Used as defined in TS 32.260 [20].
MBMS Information	O_M	A set of fields hold the MBMS specific parameters. The details are defined in clause 6.3.1.2.
NOTE: The PDP/PDN Type and Served PDP/PDN Address represent the MBMS Bearer Service, i.e. IP multicast address.		

6.3.1.2 Definition of the MBMS Information

MBMS specific charging information is provided within the MBMS Information.
The detailed structure of the MBMS Information can be found in table 6.3.1.2.1.

Table 6.3.1.2.1: Structure of the MBMS Information

Information Element	Category	Description
TMGI	O_M	Used as defined in TS 29.061 [204].
MBMS Service Type	O_M	Used as defined in TS 29.061 [204].
MBMS User Service Type	O_c	This IE indicates type of service the MBMS user service that is being delivered. Only available in the BM-SC.

Information Element	Category	Description
File Repair Supported	O_C	This IE indicates whether the MBMS user service supports point-to-point file repair. Only available in the BM-SC.
Required MBMS Bearer Capabilities	O_C	Used as defined in TS 29.061 [204].
MBMS 2G 3G Indicator	O_C	Used as defined in TS 29.061 [204].
RAI	O_C	Used as defined in TS 29.061 [204]. Only available in the BM-SC.
MBMS Service Area	O_C	Used as defined in TS 29.061 [204].
MBMS Session Identity	O_C	Used as defined in TS 29.061 [204].
MBMS GW Address	O_C	This IE holds the IP address of the MBMS GW that generated the Charging Id when MBMS GW is stand-alone.
CN IP Multicast Distribution	Oc	Used as defined in TS 29.061 [204].
MBMS Access Indicator	Oc	Used as defined in TS 29.061 [204].
MBMS Charged Party	Oc	This IE indicates whether the content provider or receiving subscriber is being charged. Only available in the BM-SC for offline charging.
Recipient Address	Oc	This IE indicates the MSISDN of a recipient registered to receive the bearer service. This field is repeated for each recipient.

6.3.2 Formal parameter description

6.3.2.1 MBMS charging information for CDRs

The detailed definitions, abstract syntax and encoding of the MBMS CDR parameters are specified in TS 32.298 [51].

6.3.2.2 MBMS charging information for charging events

The detailed charging event parameter definitions are specified in TS 32.299 [50].

6.4 Bindings for MBMS offline charging

This clause aims to describe the mapping between the Diameter messages AVP and CDR parameters for MBMS offline charging.

Table 6.4.1: Bindings of Accounting AVP to BMSC-CDR parameter

S-/C-BMSC-CDR parameter	Information Element	AVP
	Service Information	**Service-Information**
Served IMSI	Subscriber Identifier	Subscription-Id
Served MSISDN	Subscriber Identifier	Subscription-Id
Content Provider Id	Subscriber Identifier	Subscription-Id
	PS Information	**PS-Information**
Node Id	Node Id	Node-Id
PDP/PDN Type	PDP/PDN Type	3GPP-PDP-Type
Served PDP/PDN Address	Served PDP/PDN Address	PDP-Address
GGSN Address Used	GGSN Address	GGSN-Address
List of Downstream Nodes	GGSN Address	GGSN-Address
Access Point Name Network Identifier	Called Station Id	Called-Station-Id
List of Traffic Data Volumes	Traffic Data Volumes	Traffic-Data-Volumes
Cause for Record Closing	Change Condition	Change-Condition
Diagnostics	Diagnostics	Diagnostics
	IMS Information	**IMS-Information**
Bearer Service Description	SDP Session Description	SDP-Session-Description
	SDP Media Components	SDP-Media-Component
MBMS Information	**MBMS Information**	**MBMS-Information**
TMGI	TMGI	TMGI
MBMS Service Type	MBMS Service Type	MBMS-Service-Type
File Repair Supported	File Repair Supported	File-Repair-Supported
Required MBMS Bearer Capabilities	Required MBMS Bearer Capabilities	Required-MBMS-Bearer-Capabilities
MBMS 2G 3G Indicator	MBMS 2G 3G Indicator	MBMS-2G-3G-Indicator
RAI	RAI	RAI
MBMS Service Area	MBMS Service Area	MBMS-Service-Area
MBMS Session Identity	MBMS Session Identity	MBMS-Session-Identity
MBMS GW Address	MBMS GW Address	MBMS-GW-Address
CN IP Multicast Distribution	CN IP Multicast Distribution	CN-IP-Multicast-Distribution
MBMS Access Indicator	MBMS Access Indicator	MBMS-Access-Indicator
Record Type	MBMS Charged Party	MBMS-Charged-Party
Recipient Address List	Recipient Address	MSISDN

NOTE: The whole set of S-/C-BMSC-CDR parameters is described in the TS 32.298 [51]. The following fields are generated at the CDF: Record Opening Time, Duration, Record Sequence Number, Local Record Sequence Number.

Annex A (informative): Bibliography

a) The 3GPP charging specifications

- 3GPP TS 32.252: "Telecommunication management; Charging management; Wireless Local Area Network (WLAN) charging".
- 3GPP TS 32.271: "Telecommunication management; Charging management; Location Services (LCS) charging".
- 3GPP TS 32.272: "Telecommunication management; Charging management; Push-to-talk over Cellular (PoC) charging".
- 3GPP TS 32.274: "Telecommunication management; Charging management; Short Message Service (SMS) charging".
- 3GPP TS 32.275: "Telecommunication management; Charging management; MultiMedia Telephony (MMTel) charging".
- 3GPP TS 32.276: "Telecommunication management; Charging management; Voice Call Service Charging".
- 3GPP TS 32.280: "Telecommunication management; Charging management; Advice of Charge (AoC) service".
- 3GPP TS 32.296: "Telecommunication management; Charging management; Online Charging System (OCS): Applications and interfaces".
- 3GPP TS 32.293: "Telecommunication management; Charging management; Proxy Function".

b) Common 3GPP specifications

- 3GPP TS 22.101: "Service aspects; Service principles".
- 3GPP TS 23.002: "Network architecture".
- 3GPP TS 23.003: "Numbering, addressing and identification".
- 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

c) other Domain and Service specific 3GPP / ETSI specifications

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d) Relevant ITU Recommendations

- ITU-T Recommendation D.93: "Charging and accounting in the international land mobile telephone service (provided via cellular radio systems)".
- ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- ITU-T Recommendation Q.767: "Application of the ISDN user part of CCITT signalling system No.7 for international ISDN interconnections".
- ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- ITU-T Recommendation X.121: "International numbering plan for public data networks".

e) Relevant IETF RFCs

- IETF RFC 959 (1985): "File Transfer Protocol".

- IETF RFC 3588 (2003): "Diameter Base Protocol".
- IETF RFC 4006 (2005): "Diameter Credit-Control Application".
- IETF RFC 1350 (1992): "The TFTP Protocol (Revision 2)".

Annex B (informative): Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Cat	Old	New
Mar 2005	SA_27	SP-050034	--	--	Submitted to TSG SA#27 for Information	--	1.0.0	
Jun 2005	SA_28	SP-050280	--	--	Submitted to TSG SA#28 for Approval	--	2.0.0	6.0.0
Sep 2005	SA_29	SP-050439	0001	--	Corrections on MBMS offline charging trigger conditions	F	6.0.0	6.1.0
Dec 2005	SA_30	SP-050703	0002	--	Align with common Diameter handling principles in 32.299	F	6.1.0	6.2.0
Dec 2005	SA_30	SP-050703	0003	--	Correction of PS information usage in MBMS - Align with 29.061 and 23.060	F	6.1.0	6.2.0
Mar 2006	SA_31	SP-060083	0004	--	Correction to MBMS behaviour as a result of OCS controlled service termination	F	6.2.0	6.3.0
Jun 2006	SA_32	SP-060242	0005	--	Correction of the BMSC-CDR charging information collection description	F	6.3.0	6.4.0
Jun 2006	SA_32	SP-060242	0006	--	Align BM-SC initiated MBMS De-registration procedure with 23.246	F	6.3.0	6.4.0
Jun 2006	SA_32	SP-060417	0007	1	Correct List of Traffic Volume in MBMS charging	F	6.3.0	6.4.0
Sep 2006	SA_33	SP-060522	0008	--	Resolve outstanding "Editor's notes" in MBMS charging	F	6.4.0	6.5.0
Dec 2006	SA_34	SP-060704	0009	-	Correction on MBMS Information - Align with 23.246	F	6.5.0	6.6.0
Dec 2006	SA_34	SP-060718	0010	--	Add an identifier for the service initiating offline Diameter Accounting	B	6.6.0	7.0.0
Dec 2006	SA_34	SP-060718	0011	--	Add an identifier for the served user in offline Diameter Accounting	B	6.6.0	7.0.0
Dec 2008	SA_42	SP-080841	0012	-	Correction on Multiple Service Indication category	F	7.0.0	7.1.0
Dec 2008	SA_42	--	--	--	Upgrade to Release 8	--	7.1.0	8.0.0
Jun 2009	SA_44	SP-090296	0013	--	MBMS charging in EPS alignment in CDR description	B	8.0.0	9.0.0
Jun 2009	SA_44	SP-090296	0014	--	MBMS charging in EPS alignment in Abbreviations and charging principle	B	8.0.0	9.0.0
Jun 2009	SA_44	SP-090296	0015	--	Add message flow for UTRAN access in eMBMS charging	B	8.0.0	9.0.0
Sep 2009	SA-45	SP-090536	0017	--	Addition of multicast delivery related contents in MBMS charging	A	9.0.0	9.1.0
Dec 2009	SA-46	SP-090724	0018	--	Add session update procedure for EPS	B	9.1.0	9.2.0
Dec 2009	SA-46	SP-090724	0019	--	Clean up of session start and session stop procedures for EPS	D	9.1.0	9.2.0
Dec 2009	SA-46	SP-090724	0020	--	Add MBMS access indicator	B	9.1.0	9.2.0
Dec 2009	SA-46	SP-090724	0021	--	Add new triggers for C-MBSC-CDR closure for EPS	B	9.1.0	9.2.0
Mar 2011	-	-	-	-	Update to Rel-10 version (MCC)	-	9.2.0	10.0.0
2012-09	-	-	-	-	Update to Rel-11 version (MCC)	-	10.0.0	11.0.0
2013-12	SA-62	SP-130676	0025	-	Correction for use of Destination-Host AVP in ACR	A	11.0.0	11.1.0
2014-07	-	-	-	-	Rapporteur/MCC: General editorial changes and clean-up.	-	11.1.0	11.1.1
2014-09	SA-65	SP-140569	0030	1	Corrections for MBMS offline charging using Diameter	A	11.1.0	11.2.0
		SP-140564	0027	1	Corrections for alignment between charging specifications	F	11.2.0	12.0.0

History

Document history		
V12.0.0	October 2014	Publication