Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**MBS Harmonization - ~~Harmonization Ad-Hoc Consensus DRAFT~~**
Date Submitted	**2004-08-30**

Source(s)	Yong Chang, Geun Hwi Lim, B.S.Bae, D.K.Kim Samsung Electronic, Suwon P.O.Box 105, 416, Maetan-3dong, Paldal-gu, Suwon-si,Gyeonggi-do, Korea 442-742	yongchang@samsung.com
	Yongjoo Tcha, Sangho Yi, Seong-Choon Lee KT, 17 Woomyeon-dong, Seocho-gu, Seoul, 137-792, Korea	yjtcha@kt.co.kr
	Chulsik Yoon ETRI	csyoon@etri.re.kr
	Ronny (Yong-Ho) Kim, Kiseon Ryu, BJ Kim, and Changjae Lee LG Electronics,Inc. 533,Hogye-1dong,Dongan-gu, Anyang-shi,Kyongki-do, Korea	[ronnykim, ksryu, beom, cjlee16]@lge.com
	Yigal Leiba Runcom Technologies Ltd. Hacoma 2, Rishon LeZion, Israel	yigall@runcom.co.il
	Yigal Eliaspur Penny Efraim Sagi, Sharon Ben-Porath Intel Corporation	yigal.eliaspur@intel.com
	Jeff Mandin Streetwaves Networking Amatzia 5 Jerusalem, Israel	Voice: 972-50-724-587 Fax: 972-50-724-587 mailto:jeff@streetwaves-networks.com
	Phillip Barber, Broadband Mobile Technologies, 8302 Sebastian Inlet, Frisco, Texas 75035 USA	pbarber@BroadbandMobileTech.com

Re:	IEEE P802.16e/D4-2004
Abstract	MBS Harmonization - ~~Harmonization Ad-Hoc Consensus DRAFT~~
Purpose	Review and Adopt the suggested changes into P802.16e/D4
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent

Procedures	holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

MBS Harmonization

1. Introduction

(1) Definition for Multicast and broadcast service on the cell

Multicast and broadcast service is defined as all MSS successfully registered to the specific multimedia broadcast content on the network level can receive on the cell the encrypted MAC PDUs of the multimedia broadcast content that multiple BSs transmit on the DL anywhere under the given time period.

Current specification for mechanics of multimedia broadcast content for the intended services is generally adequate except for a couple of problems. These problems pertain to network deployments of BS performing synchronized transmissions of jointly scheduled multimedia traffic to achieve macrodiversity of signal reception at MSS—a likely common implementation model for the described services. Such networks require all BS in the same multimedia broadcast content transmission zone (MBS Zone) to transmit the synchronized data PDUs regardless of whether the specific BS currently has MSS subscribing to the service. The BS must make the transmissions to achieve macrodiversity gains for MSS serviced by other BS. Also, the BS may never have serviced any MSS in Normal Operation such that the required broadcast or multicast Service Flow would ever have been created through appropriate MSS DSA-REQ. Thus BS supporting the feature must be able to perform network stimulated Service Flow creation onto CIDs not necessarily associated with any MSS in service at the respective BS. Finally, while it is certainly possible to support these services on common CIDs as in other multicast services provided that these CIDs are common to all BS in the same MBS Zone and provided that the CIDs are appropriately mapped to the SFIDs, optionally placing them on a specific allocated CID range eases implementation and enables MSS in Idle Mode, provided they have requisite security active, to receive the broadcast/multicast transmissions. Support of MSS in Idle Mode access to these services is highly desirable as it matches broadcast/multicast multimedia content that do not require UL activity with Idle Mode MSS that similarly do not require UL activity—freeing-up significant air interface resources in the process. Having these services occur on an allocated CID range enables MSS in Idle Mode to detect the presence of such traffic in the DL-MAP during its normal scanning events without having to re-enter the network. There are already adequate mechanisms through Idle Mode management to notify MSS in Idle Mode of multimedia broadcast or multicast traffic that my interest it is pending.

(2) Requirements for the multicast and broadcast service on the cell

There are several basic requirements for MBS(multicast and broadcast service) on the cell. These requirements are listed below:

- ← **Power saving**: The MSS regardless of its current mode (e.g., awake mode, idle mode) shall save its power consumption during the period that the MSS is receiving MBS. There may be a mechanism for saving MSS's power during the period that the MSS is receiving the multicast and broadcast content from the BS.
- ← **Mobility**: The MSS shall be provided seamless connection for MBS when the MSS moves across the BSs boundaries.
- ← **MBS Zone**: MBS content may be transmitted to all or some selected MBS zone of the network. That is, the geographical zones to transmit the MBS content may be configured differently.
- ← **Security**: MBS contents may be securely delivered to the only authorized users. Encryption keys for MAC PDU of the MBS content may be the same over multiple BSs.

(3) Multicast and Broadcast service operation

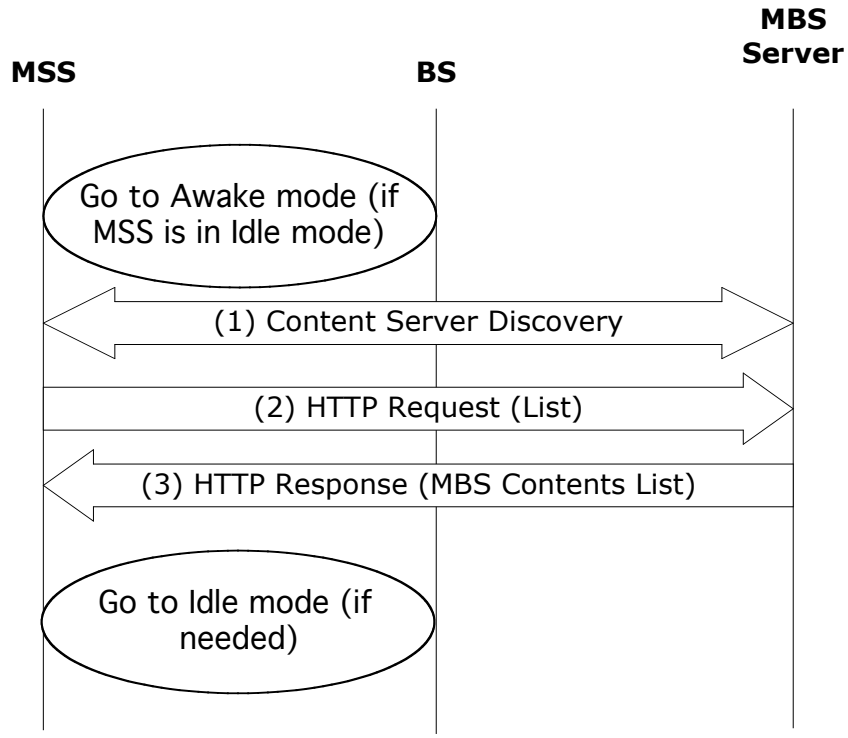
← **MBS Information Acquisition**

(1) If MSS is in Idle Mode and determines to seek MBS content or MSS powers–up; MSS re-enters the network into Normal Operation.

(2) MSS sends a [HTTP] Request for MBS list to one or more MBS Content Server(s).

(3) MBS Content Server(s) sends an [HTTP] Response including MBS contents list, which includes some lists of MBS content name, Multicast IP addr./port no. (If MBS packets are delivered in IP packet), etc.

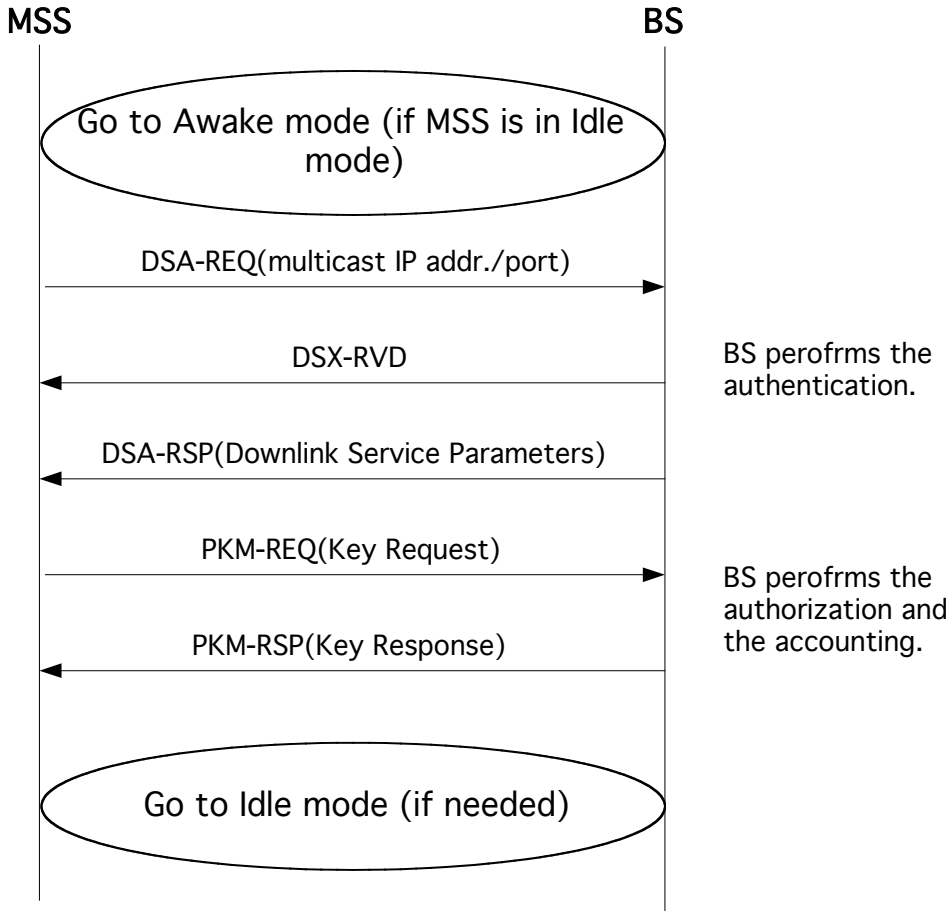
(4) MSS either enter into Idle Mode or stays in Normal Operation.



← **MBS Authentication and Security Key Acquisition**

(5) After acquiring the MBS Channel information, MSS sends DSA-REQ message with the specific MBS content's multicast IP address and port number to the BS. (Note: this is only one example of operation, the initiation of the DSA-REQ can be done from the BS side as well).

(6) BS sends the DSX-RVD message to acknowledge DSA-REQ message and perform the authentication procedure for authorize the MBS content receipt.



(7) After the successful authentication and authorization, the BS sends DSA-RSP message to the MS with the information of downlink service parameters(e.g, MBS SA-ID, etc)

(8) MSS sends PKM-REQ message to the BS for obtaining the MBS key to decrypt the encrypted MBS MAC PDU transmitted from the BS.
(9) BS sends PKM-RSP message to the MSS with the MBS key.
(10) MSS decrypts the encrypted MAC PDUs for corresponding MBS content.

2. Issues and Remedies

(1) Same Connection information for MBS over multiple BSs

Originally, Samsung proposes the virtual connection concept to support the MBS in Idle Mode. To receive MBS traffic, a MSS must be able to store the connection information as well as SFID after entering the Idle Mode. If a MSS establishes a virtual connection, the MSS should store the connection information, the security association, SFID, and etc. until the security information becomes invalid. So, the MSS can receive MBS traffic without reestablishing a connection although the MSS is in Idle Mode.

Some companies give their opinion on this issue as follows:

- **[Alvarion]** : Alvarion agrees to introduce Multicast CID and proposes the Multicast CID shall corresponds to a MBS SFID. Alvarion thinks that the provisioned SFID can be maintained over multiple BSs regardless of the MSS's mode(e.g., awake, sleep and idle). That is, "For mobile networks Service Flows are globally provisioned as services to be supplied to MSSs. Service Flows may be multicast or broadcast. Parameters of Service Flows are known to all BSs but the way they become known is out of the scope of the standard." The mapping rule between Multicast CID and MBS SFID is that the Multicast CID can be derived from MBS SFID. That is, "For multicast SFs, SFIDs must be taken from range 0xFF00-0xFFFD [or 0x0000FF00-0x0000FFFD]. Multicast CID value is equal to SFID value. For example SF with SFID = 0x0000FF01 must be instantiated as connection with CID = 0xFF01. After that CID appears in DL-MAP IE to mark destination of certain bursts."
- **[Runcom]** : Runcom agrees with the requirement such that "MBS connection information being maintained with the same value over multiple BSs". However, they think that this issue is out of scope of 802.16e. They don't think we need any provision for CIDs beyond the one that currently exists in the MAC, as the MAC supports broadcast and multicast service as it currently stands. The only provision required is to ensure that the same CID is used for the same content across multiple BS.

(2) MBS Zone concept

Originally, Samsung proposes the MBS Zone Concept in the C80216e-04_201r1.
MBS related parameters (e.g. security key, multicast CID, or etc.) may be different in some region. And the MBS content may be broadcast only in a restricted region. Therefore, when a MSS monitoring a MBS content moves and performs a handoff, the MSS should determine whether the stored MBS information is valid, and whether the MSS can continuously monitor the MBS content.

If the MSS knows the MBS content is not monitored in a cell owing to the using the different parameters or not transmitting the MBS content, the MSS should access to a new BS to update its parameters for the MBS content, especially if the MSS is in Idle state. If MBS Zone concept is introduced, a MSS can immediately know the validness of its stored MBS parameters by checking MBS_zone identifier. MBS zone is associated with a MBS service (or multicast CID). Also a same MBS zone identifier can be assigned for multiple MBS services. Furthermore, within the MBS Zone the MSS can have the Macro Diversity Effects

Some companies give their opinion on this issue as follows:

- **[Runcom]** : Runcom thinks the MBS Zone should be reserved for true broadcast service, while for regional broadcast service there is a possibility to handle this without the MBS (i.e. the physical macro-diversity) zone.

(3) MBS_MAP Information Element

Originally, Samsung proposes the MBS MAP IE in the C80216e-04_201r1.
The MSS regardless of its current mode (e.g., awake mode, idle mode) shall save its power consumption during the period that the MSS is receiving MBS. There may be a mechanism for saving MSS's power during the period that the MSS is receiving the multicast and broadcast content from the BS.
The reason of using special IE is to indicate scheduling information of a burst which is transmitted by the BS within serveral frames. The IEs currently defined in the specification only indicates a burst which is sent only in the current frame. A MSS may receive a broadcast burst with IEs currently defined in the specification. However, the MSS should decode every MAP message in every frame not to miss any broadcast burst. Hence no power saving is possible. But, the MBS_MAP IE can provide that a MSS does know exactly how many frames after a burst of broadcast service will arrive. Hence, an Idle mode MSS can sleep between the frames for broadcast services without receiving MAP messages. Consequently, the main reason of the secial MBS IE is to enable power saving for idle mode MSS.

Some companies give their opinion on this issue as follows:

- **[Alvarion]** : Alvarion has a doubt whether or not this MBS_MAP IE is needed.
- **[Runcom]** : Runcom seems to agree to the general concept of MBS_MAP IE. They are not against a DL-MAP IE, but if the MBS is indeed defined as an independent entity, it can have its own DL MAP, which would share the advantages of macro-diversity, and will not have to be repeated in each cell. It would also make it much simpler for MSS in SLEEP or IDLE mode to track the MBS.

(4) Group Paging/Awakening Mechanism

Originally, Alvarion raises this issue.
If the BS may awake all MSS to receive the specific MBS content, the BS need a group paging or group traffic indication mechanism for awakening all MSS at the same time to receive the same MBS content.

Some companies give their opinion on this issue as follows:

- **[Runcom]** : Runcom doesn't think a waking mechanism is required. At most, we need is a definition of the cycle of each broadcast connection, which could be given several frames in advance.
- **[Samsung]** : The scenario that Alvarion is having is somewhat different from Samsung's original scenario, Samsung thinks that the BS does not need to know in what mode the MSS currently is when the BS is transmitting the MBS content. The group paging/waking mechanism is not required at this time.

(5) Pre-Advertisement of MBS

Originally, LGE raises this issue.
MSS involved in an MBS service may consider Neighbor BS's MBS Zone ID before it decides Target BS and sends a MOB-MSSHO-REQ message. Neighbor BS that does not support MBS or has a different MBS Zone ID may be excluded from being selected as Target BS. After determining Target BS, MSS may perform the general procedures for handover. Additionally, the REG-REQ/RSP procedure can negotiate whether or not the BS/MSS can support the MBS.

Some companies give their opinion on this issue as follows:

- **[Samsung]** : Since Macro-Diversity is supported, the MSS has already received the same MBS content transmitted by neighboring BSs. Accordingly, MSS does not need to know whether or not the target BS can support the MBS Zone and its MBS contents.

(6) Network Reference Model for MBS

Originally, Runcom proposes the MBS operation reference model in Contribution C80216e-04_275.doc with the following reasons.

- BS must perform synchronized transmissions of the multimedia traffic to achieve the macro-diversity effect at the MSS
  - ← This requires all BS in the same multimedia broadcast (MBS) to transmit a synchronized PDU stream. Some means for synchronizing SDU distribution, conversion to PDUs, and any process that changes the PDU transmission over the air must be the same for all the BS in the same MBS zone
  - ← The 802.16e reference model and standard must be accordingly updated to support a centralized data transmitter that performs data scheduling for simultaneous, identical, transmissions over multiple Base Stations

Runcom's proposal for text changes are summarized as follows:

Reference Model
We add an MBS Distribution Server entity to the reference model. An MBS Distribution Server is a generic entity responsible for scheduling of data across multiple Base Stations and distributing the MBS stream. An MBS SAP resides above the security sublayer – as classification and scheduling services are not performed for the MBS-controlled flows.

MBS Service Operation
Each BS participating in the MBS zone "outsources" the scheduling and PDU building functions for the MBS zone data interval to the MBS distribution server. The MBS Server supplies the transmittable data and timing information to each BS to transmit directly over the PHY.

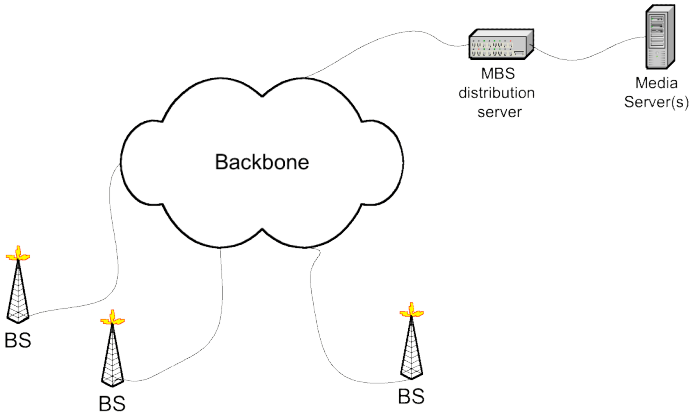


Figure 1: Example of MBS service scenario

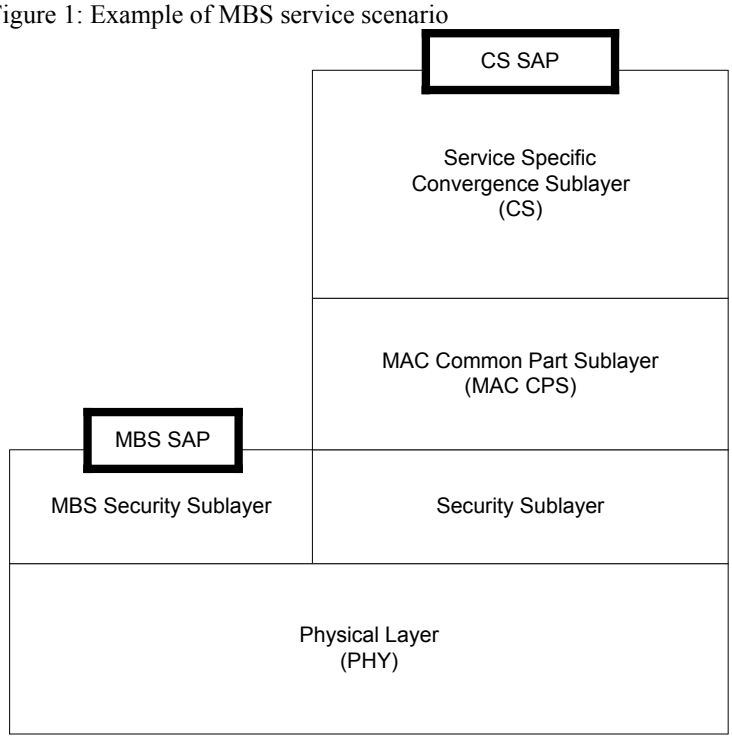


Figure 2: MBS operation reference model

3. Proposed Text Changes to 802.16e/D4

6.3.13 Establishment of multicast connections

The BS may establish a downlink multicast service by creating a connection with each SS to be associated with the service. Any available traffic CID value may be used for the service (i.e. there are no dedicated CIDs for multicast transport connections). For networks of BS employing synchronized transmissions of common multicast data, some traffic CID values may be assigned for the service (.i.e. there may be some dedicated CIDs for multicast transport connections). To ensure proper multicast operation, the CID used for the service is the same for all SSs on the same channel that participate in the connection. To ensure proper multicast operation on networks of BS employing synchronized transmissions of common multicast data, the CID used for the service may be the same for all BS and SSs on the same channel that participate in the connection. ~~The SSs need not be aware that the connection is a multicast connection.~~ The data transmitted on the connection with the given CID shall be received and processed by the MAC of each involved SS. Thus each multicast SDU is transmitted only once per BS channel. Since a multicast connection is associated with a service flow, it is associated with the QoS and traffic parameters for that service flow.

ARQ is not applicable to multicast connections.

If a downlink multicast connection is to be encrypted, each SS participating in the connection shall have an additional security

association (SA), allowing that connection to be encrypted using keys that are independent of those used for other encrypted transmissions between the SSs and the BS.

6.3.14 Seamless Multicast and broadcast service across multiple BS(MBS)

Multicast and broadcast service is defined as a kind of service that all MSSs successfully registered to the specific multicast and broadcast content on the network level can receive on the cell the encrypted MAC PDUs of the multicast and broadcast content that multiple BSs transmit anywhere under the given time period.

Multicast service synchronized across multiple BS enables an MSS to receive the multicast or broadcast transmission from multiple BS, and thereby improve the reliability of reception. In contrast to normal multicast and broadcast connections, MBS does not require that the MSS be registered to the BS from which it receives the transmission, or to any other BS. To provide seamless multicast and broadcast service over multiple BS, a MBS connection shall use the same CID, and transport the same data in a synchronized manner across the group of BS. A multicast and broadcast zone identifier (MBS_ZONE) is used to indicate the group of BS through which a CID and SA for a broadcast and multicast service flow are valid.
MBS connections are established like normal multicast connections (i.e. when the MSS is registered to a specific BS), but unlike normal multicast connection, they may be maintained by the MSS during IDLE and Sleep mode, or when transitioning to another BS.

Multicast and broadcast service may provide access control against theft of service by enforcing data encryption based on AES-CTR defined in NIST Special Publication 800-38A, FIPS 197. Detail of MBS Security is defined in section 7.x.x.x PKMv2 MBS Security Support.

6.3.14.1 Establishment and Maintenance of multicast and broadcast services

Since the MSS in the Idle Mode can receive the multicast and broadcast service on the cell, the connection establishment of multicast and broadcast service between the BS and the MSS should be maintained regardless of the MSS's current mode. That is the connection for the MBS is not dedicated to the specific MSS and is maintained even though the MSS is either in awake/Sleep Mode or in the Idle Mode. If the MSS receiving MBS enters into the Idle Mode, the MSS continuously maintains the information of MBS connection such as the session context and the security context for the specific MBS and receives the current MBS without any interruption.

Multicast and Broadcast services are associated with Multicast and Broadcast Service Flows. Multicast and Broadcast Service Flows are not dedicated to the specific MSS and are maintained even though the MSS is either in awake/sleep mode or in the idle mode. When an MSS is registered at a BS for receiving Multicast and Broadcast service, Multicast and Broadcast Service Flows shall be instantiated as multicast connections. Data of Multicast and Broadcast Service Flows may be transmitted from BS and received at MSS also regardless of what mode the MSS is currently in. The BS may establish a downlink multicast and broadcast service by creating a Multicast and Broadcast Service Flows when the service commences.
Mapping of Multicast and Broadcast Service Flow IDs to CIDs may be known to all BSs belong to the same Multicast and Broadcast Service Zone.

When the MSS is being registered at BS for receiving Multicast and Broadcast services, it may initiate DSA procedure with respect to Multicast and Broadcast connections to inform the BS that the MSS is a consumer of certain Multicast / Broadcast services. Such knowledge may be used to initiate bi-directional upper layers communication between the MSS and the network for the purpose of configuration of Multicast / Broadcast service. After the successful configuration, the MSS may reuse the same configuration when it moves to another BS without re-configuration.

ARQ is not applicable to multicast and broadcast connection associated with Multicast and Broadcast Service Flows..

Multicast and Broadcast Service Flows are encrypted at either application layer or MAC layer. Upper layer encryption may be employed to prevent non-authorized access to multicast and broadcast content.

6.3.14.2 Performance enhancement with macro diversity

To increase the receiving performance, MBS transmission in a group of BS may be synchronized. In such case, each BS shall transmit the same PDUs, using the same transmission mechanism (symbol, subchannel, modulation, and etc.) at the same time. The way that multiple BSs accomplish the synchronized transmission (which implies performing functions like classification, fragmentation, scheduling at a centralized point called the MBS Server) is outside the scope of the standard.

6.3.14.3 Power saving operation

Power efficient reception of MBS connections is particularly important to MSS in Sleep and IDLE mode. To facilitate that, an MBS MAP IE may be placed in the DL-MAP to points to the location of a dedicated MBS zone in the DL sub-frame (see 8.4.5.3.9). The purpose of this IE is to do the initial direction of the MSS to the MBS zone, and to redirect MSS that lost synchronization with MBS zone back to the MBS zone. Inside the MBS zone a MBS_MAP message is transmitted and functions like a DL-MAP in the sense that it provides the physical attributes for the connection allocated to the MBS zone. In addition to this functionality, the MBS_MAP provides per each connection the location of the next frame where data will be sent on it.

The BS may notify the number of the frame, which will contain the data for a multicast and broadcast service flow. If MSS knows the frame number that the BS transmits the information in, MSS may not monitor frames except the frame containing the data for the service flow. However, if MSS does not know the frame number, MSS shall continuously monitor frames until it can know the number of the frame containing the data for the service flow.

MSS in idle or sleep mode may only wake up at frames indicated as carrying the MBS connection(s) they are interested in. Since connections on the MBS zone point to future relevant MBS zones, there is no need for an MSS in IDLE or Sleep mode to decode the DL-MAP message unless it losses synchronization with the MBS zone, and has to re-acquire via the MBS MAP_IE.

6.3.14.4 Multicast and broadcast zone (MBS_Zone)

A multicast and broadcast service flow may be transmitted in only a certain region. Also, a different CID or a different SA(Security Association) may be used in a different region for the same multicast and broadcast service flow. A multicast and broadcast zone identifier (MBS_ZONE) is used to indicate a region through which a CID and SA for a broadcast and multicast service flow are valid. If a MSS moves into BSs in the same MBS zone, the MSS does not have to re-establish a connection or a virtual connection to monitor the multicast and broadcast service flow. However, if a MSS moves into a different zone, the MSS may need to re-establish a connection or a virtual connection for the multicast and broadcast service flow.

MBS zone may be associated with a CID for a multicast and broadcast service. Therefore, one BS may have multiple MBS zone identifiers. (see 8.4.5.3.10)

[…]

[Add the text at the end of section 6.3.2.3.11 as follows:]

Whether successful or unsuccessful, the message shall include the following:

HMAC Tuple (see 11.1.2)
The HMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC Tuple attribute shall be the final attribute in the DSx message's attribute list.

When the connection requested in the DSA-REQ is a MBS connection, the BS may include in the DSA-RSP the following parameter:

MBS Zone identifier
The MBS Zone identifier is used by the MSS to identify the DL-MAP element which points to the MBS zone where the connection will be mapped

6.3.2.3.57 MBS MAP

The BS may send an MBS-MAP message on an MBS zone to describe the MBS connections serviced by the MBS zone. When a MBS-MAP is sent, the connections need be described in the DL-MAP, but a MBS-MAP_IE() shall be substituted instead.

Table xxx—MBS- MAP

Syntax	Size	Notes
MBS-MAP_Message_Format() {		
Management Message Type = ?	8 bits	
Frame number	24 bits	The frame number is identical to the frame number in the DL-MAP
for (*i* = 0; *i* < *n*; *i*++) {		
Multicast CID	12 bits	12 LSB of CID for multicast
DIUC	4 bits	
OFDMA Symbol offset	8 bits	OFDMA symbol offset with respect to start of the MBS zone
Subchannel offset	6 bits	
Boosting	3 bits	000: normal (not boosted); 001: +6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
No. OFDMA Symbols	7 bits	
No. Subchannels	6 bits	
Repetition Coding Indication	2 bits	0b00 - No repetition coding 0b01 - Repetition coding of 2 used 0b10 - Repetition coding of 4 used 0b11 - Repetition coding of 6 used
Next MBS frame offset	8 bits	The Next MBS frame offset value is lower 8 bits of the frame number in which the BS shall transmit the next MBS frame.

Next MBS OFDMA Symbol offset	8 bits	The offset of the OFDMA symbol in which the next MBS zone starts, measured in OFDMA symbols from the beginning of the downlink frame in which the MBS-MAP is transmitted.
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}		

[Add the text after the section 6.3.2.3.43.6 as follows:]

6.3.2.3.43.7 H-ARQ Compact MBS MAP IE

Table 99—H-ARQ Compact_MBS -MAP IE format for extension

Syntax	Size	Notes
Compact MBS-MAP Message Format() {		
Management Message Type = ?	8 bits	
Frame number	24 bits	The frame number is identical to the frame number in the DL-MAP
for (*i* = 0; *i* < *n*; *i*++) {		
Multicast CID	12 bits	12 LSB of CID for multicast
Nep	4 bits	Code of encoder packet bits (see 8.4.9.2.3.5)
Nsch	4 bits	Code of allocated subchannels (see 8.4.9.2.3.5)
H ARQ Control IE	variable	
Next MBS frame offset	8 bits	The Next MBS frame offset value is lower 8 bits of the frame number in which the BS shall transmit the next MBS frame.
Next MBS burst start offset	8 bits	The start offset of the MBS burst, measured in slots from the beginning of the next MBS zone in which the MBS-MAP is transmitted.
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}		

8.4.5.3.9 Multicast and Broadcast Service MAP IE (MBS_MAP_IE)

In the DL-MAP, a BS may transmit DIUC=15 with the MBS_MAP_IE() to indicate when the next data for a multicast and broadcast service flow will be transmitted. The offset value is associated with a CID value, and indicates the frame that the next data will be transmitted in by using the CID value.

Table 256—Multicast and Broadcast Service MAP IE

Syntax	Size	Notes
MBS_MAP_IE {		
Extended DIUC	4 bits	MBS_MAP = 0x05
Length	4 bits	Length = 0x03
Multicast CID	162 bits	12 LSB of CID for multicast
MBS zone identifier	7 bits	MBS Zone identifier corresponds to the identifier provided by the BS at connection initiation
OFDMA Symbol offset	8 bits	The offset of the OFDMA symbol in which the MBS zone starts, measured in OFDMA symbols from the beginning of the downlink frame in which the DL-MAP is transmitted.
Macro diversity enhanced	1 bits	0 = Non Macro-Diversity enhanced zone 1 = Macro-Diversity enhanced zone
If (Macro diversity enhanced == 1){		

Permutation	2 bits	0b00 = PUSC permutation 0b01 = FUSC permutation 0b10 = Optional FUSC permutation 0b11 = Adjcent subcarrier permutation
IDcell	6 bits	
}		
else {		
Reserved	8 bits	
}		
}		

[…]

[*Insert a row in Table 343 at the section 10.4*]

Table 343 - CIDs

CID	Value	Description
Initial ranging	0x0000	Used by SS and BS during initial ranging process.
Basic CID	0x0001 – m	The same value is assigned to both the DL and UL connection.
Primary management	m+1 – 2m	The same value is assigned to both the DL and UL connection.
Transport CIDs and secondary Mgt CIDs	2m+1 – 0xFE9F	For the secondary management connection, the same value is assigned to both the DL and UL connection.
Multicast CIDs	0xFEA0 – 0xFEFE	For the downlink multicast service, the same value is assigned to all MSSs on the same channel that participate in the connection.
AAS initial ranging CID	0xFEFF	A BS supporting AAS shall use this CID when allocating a Initial Ranging period for AAS devices
Multicast polling CIDs	0xFF00 – 0xFFFD	An SS may be included in one or more multicast polling groups for the purposes of obtaining bandwidth via polling. These connections have no associated service flow.
Padding CID	0xFFFE	Used for transmission of padding information by SS and BS.
Broadcast CID	0xFFFF	Used for broadcast information that is transmitted on a downlink to all SS.

It is noted that the multicast CID may have a format with Reduced CID on H-ARQ region.

[Insert the following after section 11.12]

11.13.x MBS zone identifier assignment

The DSA-RSP message may contain the value of this parameter to specify a MBS Zone identifier. This parameter indicates a MBS zone through which the connection or virtual connection for the associated service flow is valid.

Type	Length	Value	Scope
[145/146].29	8	MBS zone identifier	DSA-REQ/RSP