

Proposal for IEEE 802.16m Enhanced MBS

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*<http://standards.ieee.org/faqs/affiliationFAQ.html>>

Re: "PHY and MAC aspects of enhanced MBS"; in response to the Call for Contributions and Comments on Project 802.16m System Description Document (SDD) 802.16m-08/033 for Session 57

Purpose: Adopt the proposal into the IEEE 802.16m System Description Document

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Scope

- This contribution proposes an enhanced MBS scheme.
- Both PHY and MAC aspects are covered in this contribution.

IEEE 802.16m System Requirements

- The TGm SRD (IEEE 802.16m-07/002r4) specifies the following requirements:
 - Provide support for MBS (Section 6.7)
- The proposed enhanced MBS design targets the above requirements.

Numerology

- A larger CP size is defined to accommodate MBS traffic transmitted over a large network.
- The new CP size is obtained by removing one OFDM symbol from the sub-frame containing the MBS zone.
- The CPs for the remaining OFDM symbols are increased to fill the original sub-frame duration.

Channelization

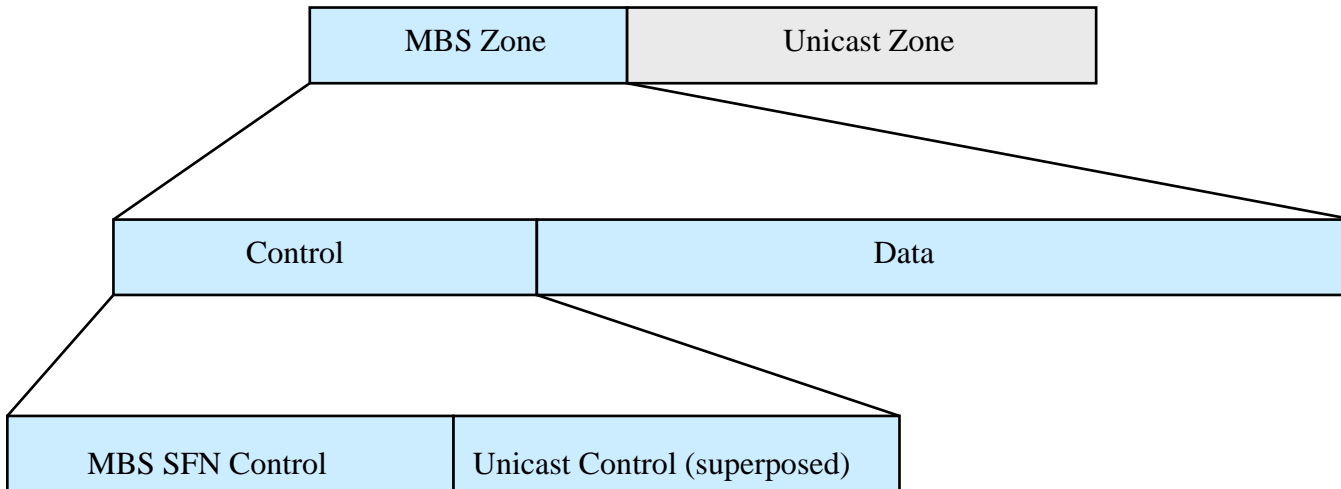
- MBS traffic can be transmitted in either a localized or a distributed zone.
- A distributed zone may provide more frequency diversity when the number of sectors participating in SFN transmission is small.
- The channelization and pilot pattern for the MBS zone is the same across all sectors participating in the SFN transmission.
- The MBS zone can be an entire DL sub-frame or a part of a sub-frame.
 - If the MBS zone shares a sub-frame with other DL traffic then it is multiplexed using FDM.

MBS Pilot Design

- The MBS pilot is a common pilot.
- The pilot is transmitted on the same tones in each sector in the SFN network.
- The pilot design for MBS traffic is similar to the unicast pilot pattern, but with a higher pilot density.
- The number of transmit antennas to be supported and the corresponding pilot patterns are FFS.

MBS Control (1/2)

- The control signaling for MBS traffic is contained within the MBS zone.
- If unicast data is superposed onto MBS traffic in the MBS zone then the unicast control information is contained within the MBS zone.
 - The unicast control is superposed onto the MBS control
 - The unicast control signaling and message format that is used in the unicast zone can be used to signal the superposed unicast traffic in the MBS zone.
- Common MBS control is sent by all sectors on the same resources using SFN transmission. Control information specific to a sector is broadcast to the mobiles in the sector on resources outside the MBS zone.



MBS Control (2/2)

- MBS control information can contain information on the next occurrence of the MBS zone or data or periodicity of occurrence of the MBS zone or data
- The configuration of MBS zone and its location in time/frequency is signaled by the BS through broadcast control or multicast control or unicast control to MS who subscribed to the MBS service

Transmission Formats (1/2)

- MBS traffic can be transmitted as a
 - Single layer
 - Multiple MIMO layers using spatial multiplexing
 - Multiple hierarchical layers
- In the case of SM transmission, the data can be transmitted using either SCW or MCW.
 - Each sector in the SFN network must transmit all the MIMO layers using the same transmission format.
 - In sectors at the edge of the MBS zone, additional information can be transmitted on separate resources as either chase combining or incremental redundancy. This is similar to HARQ for unicast transmission.
- In the case of hierarchical transmission, two layers are transmitted. The first layer (base layer) carries lower quality data. The second layer (enhanced layer) carries additional information to enhance the quality.
 - The sectors in the centre of the MBS zone can transmit both the base layer and the enhanced layer.
 - Sectors near or at the edge of the MBS zone can transmit only the base layer.

Transmission Formats (2/2)

- The transmission format for the MBS traffic is indicated by an index into an MBS MCS table.
 - The MCS index indicates the MCS of each layer and whether or not the transmission is SM or hierarchical.
- When hierarchical transmission is used by the SFN network, each BS can decide how many hierarchical layers to send based on feedback from the mobiles.

MCS Table for MBS

MCS Level	Modulation Level 1	Code rate Level 1	Modulation Level 2	Code rate Level 2	SM / H ¹	Field
1	QPSK	1/3, 2 reps				000
2	QPSK	1/3				001
3	16QAM	1/3				010
4	64 QAM	1/3				011
5	QPSK	1/3	QPSK	1/3	H	100
6	QPSK	1/3	16 QAM	1/3	H	101
7	QPSK	1/3	QPSK	1/3	SM	110
8	16QAM	1/3	16 QAM	1/3	SM	111

1. SM / H : Spatial multiplexing or hierarchical modulation

MBS Feedback

- In order to achieve the desired coverage for MBS traffic, the MCS for the SFN transmission is adapted based on feedback from the mobiles.
- The MBS feedback from the MS is a low rate feedback that indicates the quality of service of the MBS data.
 - The feedback can be the requested MCS for the MBS traffic or it can be ACK/NACK type of feedback where a NACK indicates that the MBS PER exceeds a threshold.
- The BS can respond to the MBS feedback by choosing to send only a subset of the hierarchical layers.
- In some cases, the MCS for MBS indicated by the control signaling sent by the BS may not be consistent with actual MCS transmitted by the BS.
 - For example, a BS can indicate that hierarchical transmission is used by the SFN network, but the BS may only send the first layer.

Summary

- The proposed MBS design satisfies the requirements of the TGm SRD.

Proposed Text for SDD

- Section 11.x Enhanced MBS
 - [*Add content of slides 5-7 to this section*]
- Section 11.x.1 MBS Control
 - [*Add content on slide 8-9 to this section*]
- Section 11.x.1 Transmission Formats
 - [*Add content on slides 10-12 to this section*]
- Section 11.x.2 MBS Feedback
 - [*Add content on slide 13 to this section*]