

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >
Title	Supporting MIMO and Advanced Antenna Array Technology in IEEE 802.16m
Date Submitted	2007-11-07
Source(s)	Fred Vook, Kevin Baum, Jeff Zhuang, Mark Cudak, Marc De Courville, Fan Wang, Tim Thomas E-mail: fred.vook@motorola.com Motorola
Re:	TGm Call for comments on SDD, IEEE 802.16m-07/040
Abstract	Discuss the functional implications of MIMO and Advanced Antenna Array Technology for IEEE 802.16m. Propose table of contents outline for the MIMO section of the System Description Document.
Purpose	Adoption of recommendations into Table of Contents / Outline for 802.16m System Description Document
Notice	<i>This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.</i>
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	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: < http://standards.ieee.org/guides/bylaws/sect6-7.html#6 > and < http://standards.ieee.org/guides/opman/sect6.html#6.3 >. Further information is located at < http://standards.ieee.org/board/pat/pat-material.html > and < http://standards.ieee.org/board/pat >.

Introduction

Advanced antenna array techniques such as those based on Beamforming and Multiple Input Multiple Output (MIMO) methodologies represent key technologies for meeting the performance requirements contained in the 802.16m System Requirements Document. This contribution proposes a table of contents for the MIMO portion of the SDD document along with an outline of the functionality to be described in the various subsections.

Table of Contents for “MIMO Structure” sub-clause

13.5	MIMO Structure	3
13.5.1	Downlink	3
13.5.1.1	Open-Loop Transmission Methods	3
13.5.1.2	Closed-Loop Transmission Methods	3
13.5.1.3	Link Adaptation for MIMO	3
13.5.1.4	Subchannels and Pilot Formats	3
13.5.1.5	MIMO on DL Control Channels	3
13.5.1.5.1	Open-Loop Transmission for Broadcast Control	3
13.5.1.5.2	Closed-Loop Transmission for Dedicated Control	4
13.5.2	Uplink	4
13.5.2.1	Single-User Transmission	4
13.5.2.2	Multi-User Transmission	4
13.5.2.3	Link Adaptation for MIMO	4
13.5.2.4	Subchannels and Pilot Formats	4

Table of Contents for “MIMO Structure” sub-clause - Topics

The following “MIMO Structure” sub-clause outline is proposed as a sub-section of the physical layer specification. Included in this outline are functions and topics that should be addressed in the various sub-sections

13.5 MIMO Structure

13.5.1 Downlink

13.5.1.1 Open-Loop Transmission Methods

- STBC and SU-MIMO
- Antenna virtualization / aggregation

13.5.1.2 Closed-Loop Transmission Methods

- Beamforming
- SU-MIMO
- MU-MIMO
- Feedback and Transmission Enablers
 - MIMO Midamble
 - UL Channel Sounding (TDD and FDD)
 - Precoding Matrix Index (PMI) Feedback
 - Direct / Analog Feedback
 - Quantized Feedback
 - Channel State Feedback
- Antenna virtualization / aggregation

13.5.1.3 Link Adaptation for MIMO

Decisions needing to be made as part of the link adaptation process:

- Open-Loop vs Closed-Loop Array Transmission
- Frequency-selective (narrowband) transmission versus Diversity (broadband) transmission
- Single user transmission (BF & SU-MIMO) versus multiple user (MU-MIMO)
 - User selection/grouping
 - Codebook index/user matching
- Spatial rank / transmission mode per user
- Single Codeword vs Multi Codeword
- MCS selection per codeword

Feedback methodologies for enabling link adaptation decisions

- Channel related feedback (e.g., Doppler)

13.5.1.4 Subchannels and Pilot Formats

- Resource Blocks (RB) – basic building block
 - Define for 1Tx, 2Tx, 4Tx BS antennas / virtual antennas
- Narrowband Subchannel Format
- Diversity Subchannel Format
- Dedicated Pilots
- Broadcast Pilots
- Cell/Sector synchronization of RBs

13.5.1.5 MIMO on DL Control Channels

13.5.1.5.1 Open-Loop Transmission for Broadcast Control

- Transmission methods
- Antenna virtualization/aggregation

13.5.1.5.2 Closed-Loop Transmission for Dedicated Control

- Transmission methods
- Antenna virtualization/aggregation

13.5.2 Uplink**13.5.2.1 Single-User Transmission**

- SIMO
- Diversity transmission modes / STC / MIMO
- Support for MS Beamforming / CL MIMO

13.5.2.2 Multi-User Transmission

- Collaborative MIMO/ RX-SDMA

13.5.2.3 Link Adaptation for MIMO

- User grouping for collaborative MIMO
- UL Channel Sounding for supporting UL Frequency Selective Scheduling

13.5.2.4 Subchannels and Pilot Formats

- Resource Blocks (RB) – basic building block
- Narrowband Subchannel Format
- Diversity Subchannel Format
- Cell/Sector synchronization of RBs