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| Project | IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 > | |
| Title | Uplink MIMO Overview for the IEEE 802.16m | |
| Date Submitted | 2008-07-07 | |
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| Re: | IEEE 802.16m-08/024: Call for Comments and Contributions on Project 802.16m System Description Document (SDD) Target Topic: "Uplink MIMO schemes" | |
| Abstract | This contribution provides the text proposal of UL MIMO Scheme. | |
| Purpose | Discussion and adoption in TGM | |
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Uplink MIMO Overview for the IEEE 802.16m

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General UL MIMO Structure

Figure 1 shows a general UL MIMO structure.

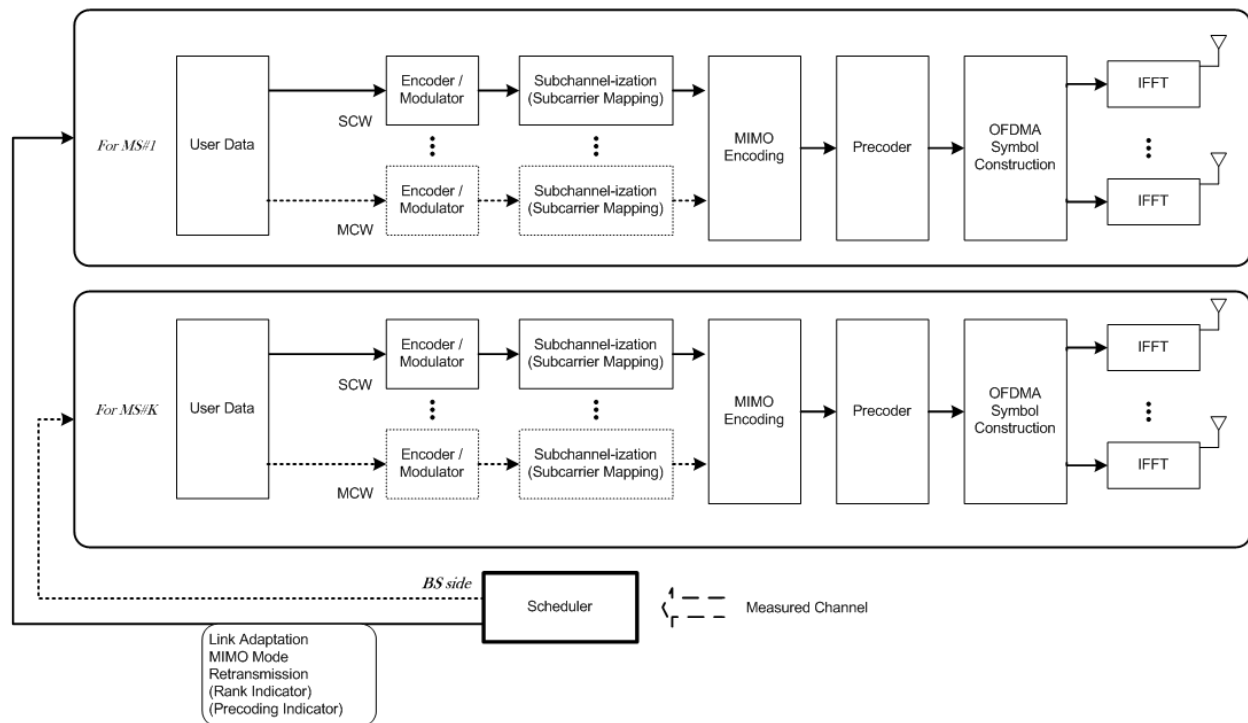


Figure 1 General UL MIMO Structure

Single-codeword vs. Multi-codeword

There are two types of basic MIMO transmission structure regarding codeword in IEEE802.16e: horizontal encoding (i.e. MCW – multiple codeword) and vertical encoding (i.e. SCW – single codeword). Their usages are shown in figure 2 and 3, respectively.

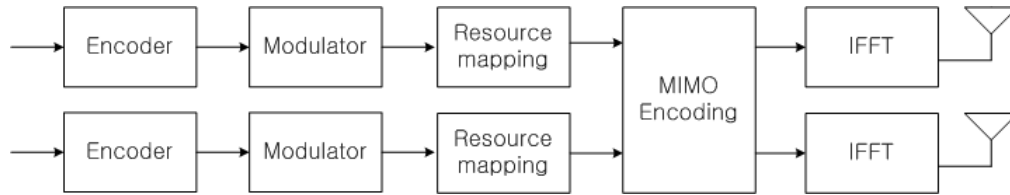


Figure 2 horizontal encoding

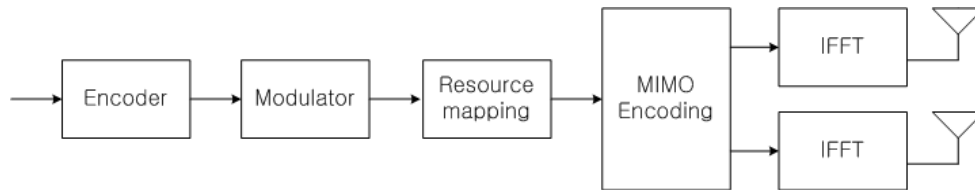


Figure 3 vertical encoding

For horizontal encoding, each burst per layer is encoded and modulated. Therefore, it requires multiple MCS level indication and ACK/NACK, AMC per stream and codeword level SIC receiver can be implemented.

In the vertical encoding, single burst is encoded and modulated and then transmitted. It requires only one MCS level indication and ACK/NACK, and spatial diversity can be obtained.

Number of transmit antenna

The legacy system only supports single transmit antenna per MS, even with support of two virtual antennas in case of collaborative SM. The number of transmit antennas depends on how many transmit power amplifiers are employed in MS. Assuming support of MIMO techniques for MS in IEEE802.16m system, we propose that two transmit antennas and two power amplifiers per MS should be supported. In other words, we propose the use of maximum of four virtual transmit antennas for uplink system.

Open-loop vs. Closed-loop

The IEEE 802.16e system supports open-loop system such as Matrix A and B. Matrix A is a type of space-time coding (STC), which can be used to achieve space-time diversity gain. Matrix B (SM – Spatial Multiplexing) can improve peak data rate or cell-throughput by spatial multiplexing gain.

It is well known that closed-loop technique can achieve higher throughput for low mobility MSs than open-loop technique. We propose that the closed-loop should be adopted in IEEE802.16m system. Furthermore, we propose codebook-based precoding, which can be easily implemented by multiplication of BS chosen precoding matrix/vector.

Additionally, to support band selection and closed-loop technique, we should support measuring the channel of entire band per MS.

Single-user vs. Multi-user

Single user MIMO schemes are used to improve per-link performance, while multi-user MIMO scheme can be used to improve cell-capacity.

The legacy system supports open loop MU-MIMO transmission such as collaborative spatial multiplexing (collaborative SM). With closed-loop MU-MIMO scheme, we can achieve higher cell throughput by beamforming gain as well as pairing gain.

We propose SU and MU MIMO should be adopted in IEEE 802.16m system with both open-loop and closed-loop scheme. Additionally, we propose that the pilot allocation should support MU-MIMO effectively regarding pilot overhead, channel estimation performance, and throughput.

Text Proposal for 802.16m SDD

===== Start of Proposed Text =====

Figure yyy shows a general data processing in UL MIMO structure.

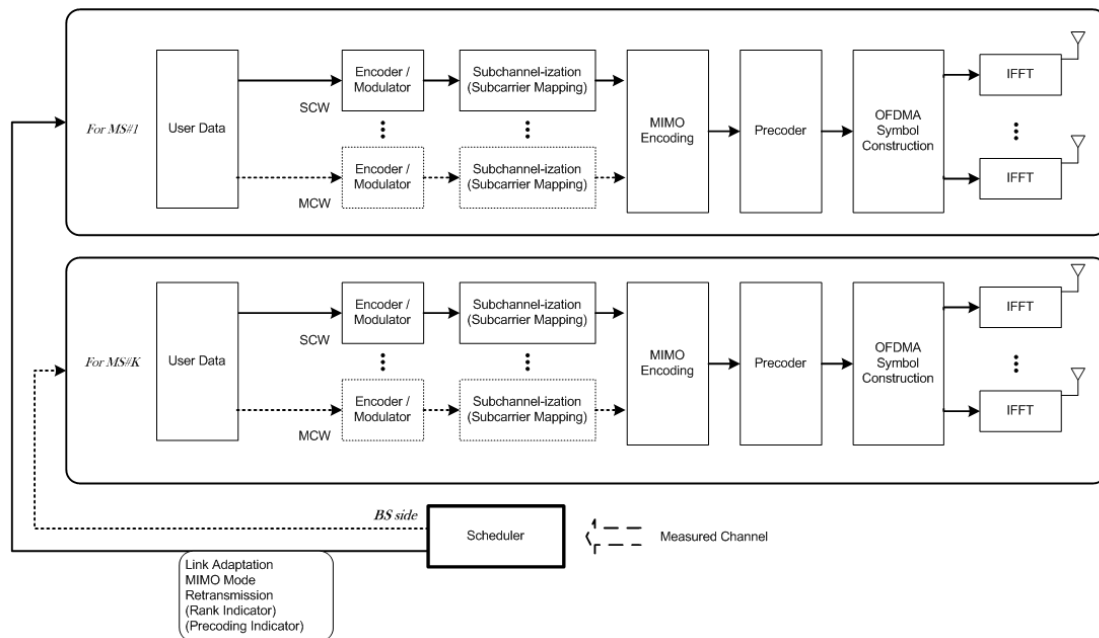


Figure yyy. General UL MIMO Structure

Up to four transmit antennas is supported in IEEE 802.16m UL MIMO. Both open-loop and closed-loop techniques shall be supported in SU and MU-MIMO as shown table xxx.

| | | |
|--|---------|---------|
| | SU-MIMO | MU-MIMO |
|--|---------|---------|

| | | | | |
|-------------|----------------------|---|--------|---|
| Open-loop | Transmit Diversity | 2Tx : SFBC 4Tx : SFBC with precoder (With dedicated 2Tx pilot pattern) | OL-CSM | - One stream for each MS (up to 2 MSs multiplexing) |
| | Spatial Multiplexing | 2Tx : SM 4Tx : up to Rank 2, SM with precoder (With dedicated 2Tx pilot pattern) | | |
| Closed-loop | Precoding | 2Tx : Codebook-based precoding 4Tx : codebook-based precoding (up to Rank 2) | CL-CSM | Codebook-based CSM - One stream for each MS (up to 4 MSs multiplexing) |

Table xxx. Proposed uplink MIMO scheme

Note : transmit power should be balanced for every UL MIMO scheme.

=====*End of Text Proposal*=====