Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Enhance MIMO features for TDD specific mode**
Date Submitted	**2004-05-17**
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Re:	IEEE 802.16e D2 Draft
Abstract	Enhance MIMO features for TDD specific mode
Purpose	To incorporate the changes here proposed into the 802.16e D2 draft.
Notice	
Release	
Patent Policy and Procedures	

Enhance MIMO features for TDD specific mode

1 Background

In general, close-loop transmission performs better than open loop transmission, which does not use the channel state information. With knowledge of channel state information, beam forming increases SNR through coherent signal transmission, hence, extended range and coverage. For the case of multiple receive antennas, beam forming can be combined with MIMO to future increase data rate, especially in the case where the number of transmit antenna is larger than the number of receive antenna. In general, channel state information feedback can cause higher overhead for the close loop transmission schemes. However, for a TDD operation, BS can estimate DL channel information based on UL transmission, therefore, feedback overhead is not a major issue. In the current standard, MIMO scheme does not take advantage of the TDD system. In this contribution, we propose to further enhance MIMO features, specifically for AMC sub-channel.

2 AMC sub-channel sub-MIMO configuration for single SS

For a DL AMC sub-channel 4x2 sub-MIMO system

$$H = \begin{bmatrix} h_{11} & h_{12} & h_{13} & h_{14} \\ h_{21} & h_{22} & h_{23} & h_{24} \end{bmatrix}$$

Denoting

$$H_{12} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} H_{13} = \begin{bmatrix} h_{11} & h_{13} \\ h_{21} & h_{23} \end{bmatrix} H_{23} = \begin{bmatrix} h_{12} & h_{13} \\ h_{22} & h_{23} \end{bmatrix} H_{14} = \begin{bmatrix} h_{11} & h_{14} \\ h_{21} & h_{24} \end{bmatrix} H_{24} = \begin{bmatrix} h_{12} & h_{14} \\ h_{22} & h_{24} \end{bmatrix} H_{34} = \begin{bmatrix} h_{13} & h_{14} \\ h_{23} & h_{24} \end{bmatrix}$$

And selecting the sub-system H_{ij} that satisfies

$$\left|\det(H_{ij})\right| = \max\left\{\left|\det(H_{12})\right|, \left|\det(H_{13})\right|, \left|\det(H_{23})\right|, \left|\det(H_{14})\right|, \left|\det(H_{24})\right|, \left|\det(H_{34})\right|\right\}$$

The best mode of the 2×2 sub-MIMO system can be determined. The null sub-carriers are fed into the non-selected antennas.

3 AMC sub-channel sub-MIMO SM for single SS

For a DL 4x2 MIMO system, consider six sub-MIMO systems H_{12}, H_{13}, H_{23}, H_{14} and H_{34}. Assuming that H_{ij}, H_{ik} and H_{il} are the sub-MIMO systems that satisfy

$$\left|\det(H_{ij})\right| + \left|\det(H_{ik})\right| + \left|\det(H_{il})\right| = \max\left\{\left|\det(H_{ij})\right| + \left|\det(H_{ik})\right| + \left|\det(H_{il})\right|, \left|\det(H_{ij})\right| + \left|\det(H_{jk})\right| + \left|\det(H_{jl})\right|\right\},$$

then by beam-forming with the j th and k th columns of H, and setting the weights to

$$w_j = \frac{\det^*(H_{ij})}{\sqrt{\left|\det^*(H_{ij})\right|^2 + \left|\det^*(H_{ik})\right|^2 + \left|\det^*(H_{il})\right|^2}}$$

$$w_k = \frac{\det^*(H_{ik})}{\sqrt{\left|\det^*(H_{ij})\right|^2 + \left|\det^*(H_{ik})\right|^2 + \left|\det^*(H_{il})\right|^2}}$$

$$w_l = \frac{\det^*(H_{il})}{\sqrt{\left|\det^*(H_{ij})\right|^2 + \left|\det^*(H_{ik})\right|^2 + \left|\det^*(H_{il})\right|^2}}$$

Respectively, we have

$$\det(H_{ij}^{(jkl)}) = \sqrt{\left|\det{}^{*}(H_{ij})\right|^{2} + \left|\det{}^{*}(H_{ik})\right|^{2} + \left|\det{}^{*}(H_{il})\right|^{2}}$$

The 4x2 sub-MIMO BLAST is shown in Figure 1.

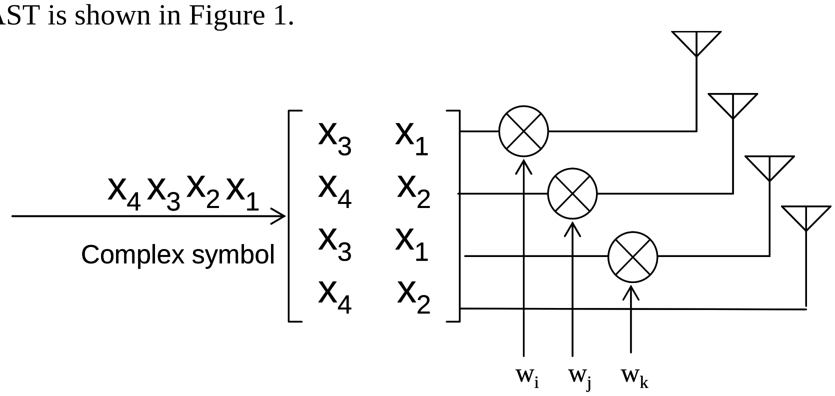

Figure 1 4x2 Sub-MIMO SM transmission

4 AMC sub-channel sub-MIMO transmission for multiple SS

For the closed loop implementation of MISO transmission, pre-coding matrix weighting in frequency-domain can be applied for 4x2x2 (N_T=4 for 2 MSS each with N_R=4) or 4x1x4 (N_T=4 for 4 MSS each with N_R=1) transmission as shown in Figure 2.

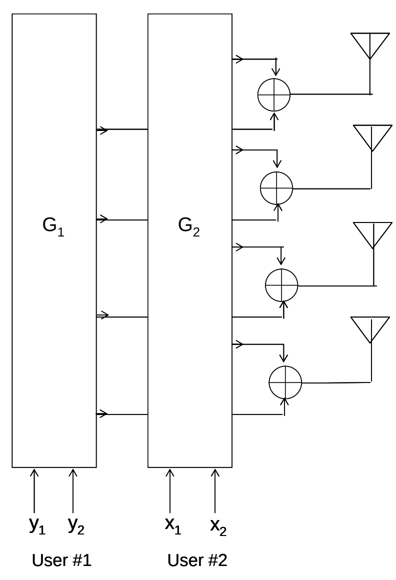

Figure 2 Multi-user MIMO AMC sub-channel

By applying the dirty-paper encoding principle, and inter-user interference is pre-cancelled by transmit weighting matrixes G_1 and G_2.

5 Text proposal

[Add a new section 8.4.8.3.4.2]

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8.4.8.3.4.2 Closed-loop encoding format for 4-transmit antennas BS

The closed-loop encoding consists of hybrid antenna selection and antenna weighing transmission. For TDD operation, the weights and antenna selection can be determined at the transmitter. For FDD operation, the antenna selection and antenna weight should be feedback to the transmitter.

For the allocation of single user with 2-antenna to the AMC permutation zone, we have:

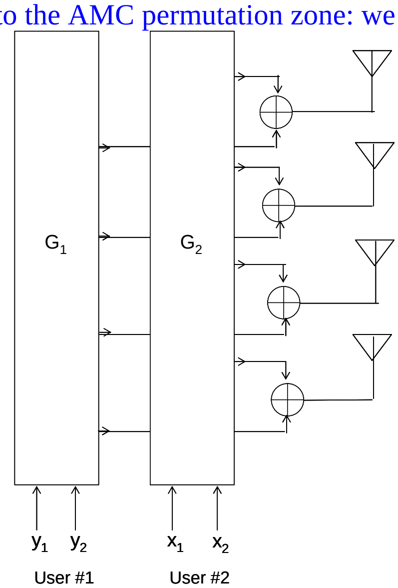
The encoding matrix and configuration table (Table yyy) are defined as follows:

$$D = \begin{bmatrix} w_1 S_1 \\ w_2 S_2 \\ w_3 S_1 \\ w_4 S_2 \end{bmatrix}$$

Table 1 yyy

$b_0b_1b_2$	W_1	W_2	W_3	W_4
000	w_1	1	w_3	1
001	w_1	w_2	w_3	1
010	w_1	w_2	0	0
011	w_1	0	w_3	0
100	w_1	0	0	w_4
101	0	w_2	w_3	0
110	0	w_2	0	w_4
111	0	0	w_3	w_4

For the allocation of 2-user with 2-antenna to the AMC permutation zone: we have



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