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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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UL Codebook-based Collaborative SM for the IEEE 802.16m

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Introduction

In this contribution, we propose the closed-loop collaborative spatial multiplexing (Collaborative SM, CSM) as an extension of legacy Collaborative SM.

Collaborative SM in the legacy system

The collaborative SM has been adopted for UL data transmission in IEEE802.16e as a kind of multi-user MIMO scheme [1]. It is a representative candidate of UL MIMO scheme of IEEE802.16e. Figure 1 shows the legacy collaborative SM scheme for two single antenna mounted MSs.

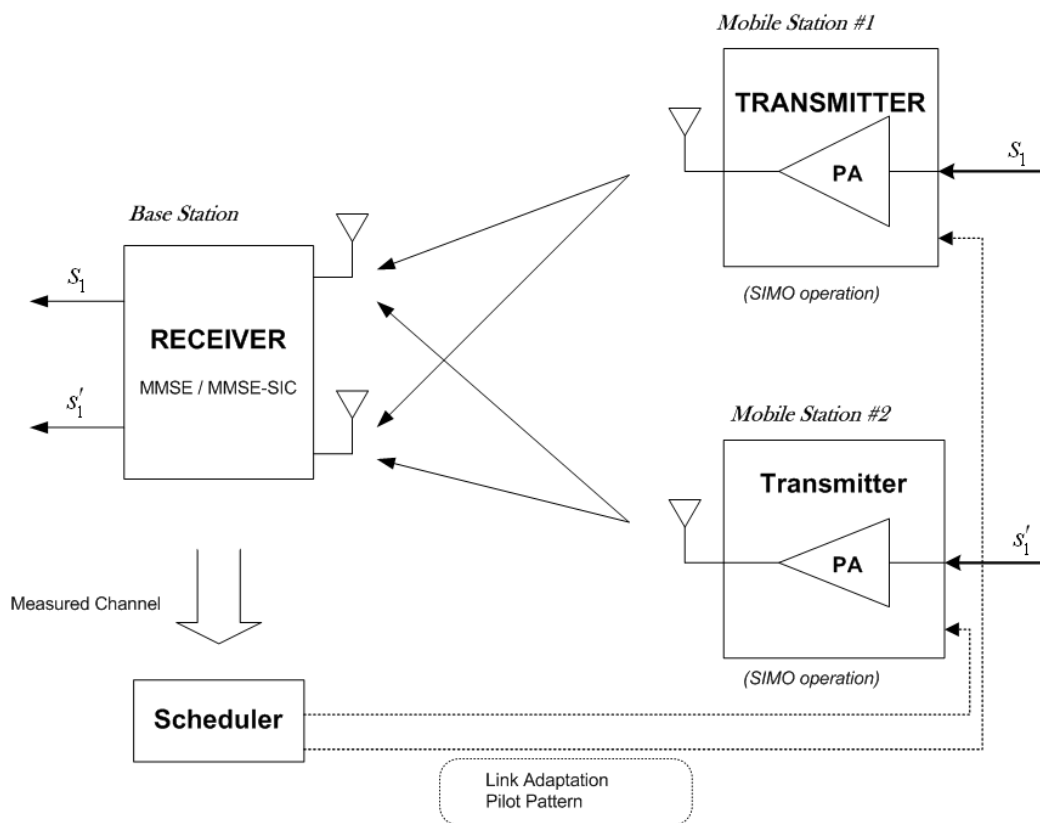


Figure 1 Collaborative SM for two single antenna MSs in the legacy system

In this scheme, although the collaborative MSs can share the same frequency/time resource, no additional operation for MU-MIMO is required for each MS. Most operations for MU-MIMO support are done by BS.

Proposed Codebook-based Collaborative SM

In this section, we propose a closed-loop collaborative SM scheme. We further propose a codebook-based precoding scheme, which is expected to have very low implementation cost on MS. Figure 2 describes a brief process of codebook-based collaborative SM.

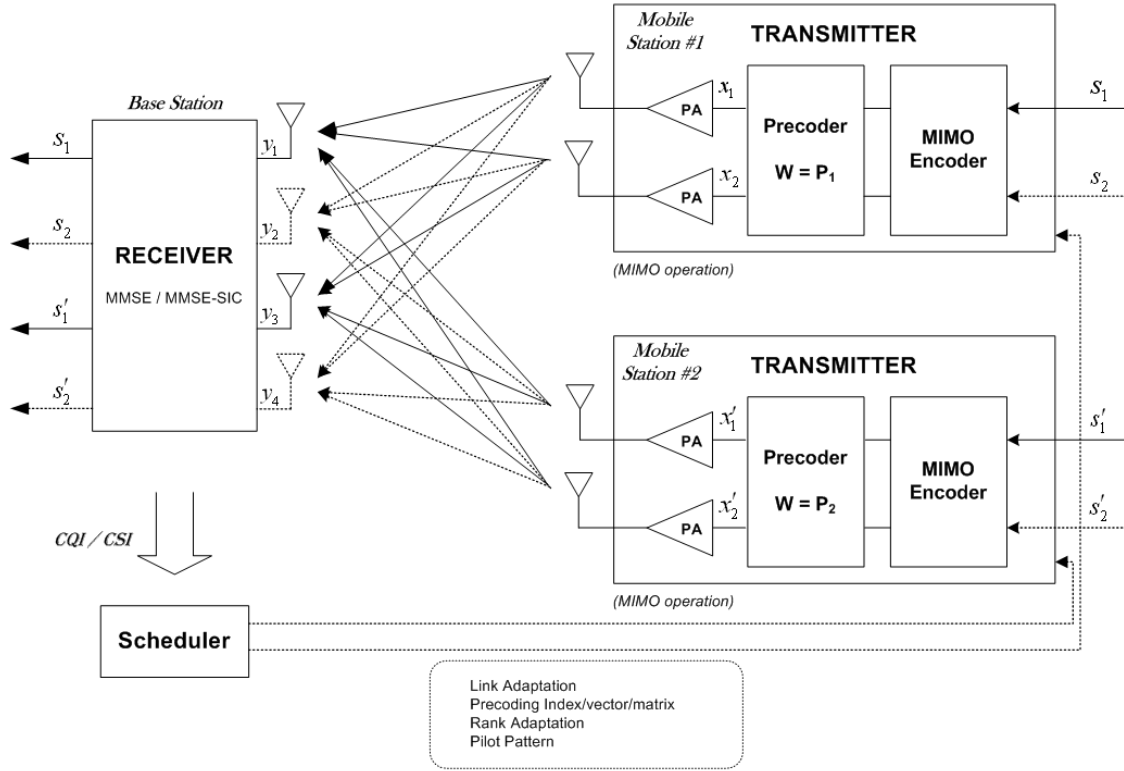


Figure 2 block-diagram of codebook-based collaborative SM.

As a general concept, we assume that the K collaborative MSs ($K \leq N_r$) can share the time/frequency resource, where N_r represents the number of receiver antennas at the BS.

The received signal can be written as

$$Y = \sum_{i=0}^K H^{(i)} x^{(i)} + N, \quad x = \mathbf{w}s$$

where s is the transmit data, w is precoding vector, $H^{(i)}$ is the channel response between the i -th MS and BS, and N is noise. The codebook-based collaborative SM is very similar to codebook-based precoding in single-user MIMO case.

However, the operations in BS are very different with SU-MIMO. Actually, most operations for MU-MIMO is performed in BS, which are MU/SU-MIMO switching, link-adaptation for MU-MIMO, user selection & pairing, preferred precoding vector/matrix selection, etc.

In the proposed scheme, the precoding may bring significant performance gain due to resulting in lower correlation between collaborative MSs. Furthermore, it can also help improving link performance by precoding gain.

Conclusions

Codebook based closed-loop collaborative spatial multiplexing shall be adopted as one of IEEE 802.16m uplink MIMO scheme.

Reference

[1] IEEE P802.16Rev2/D5, DRAFT Standard for Local and metropolitan area networks, “Part 16: Air Interface for Broadband Wireless Access Systems”