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Title	**Enable closed-loop MIMO channel estimation using partially beamformed midamble**
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Re:	
Abstract	Enable closed-loop MIMO channel estimation using partially beamformed midamble
Purpose	Adoption of proposed changes into P802.16e ~~Crossed-out indicates deleted text,~~ underlined blue indicates new text change to the Standard
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Enable Closed-Loop MIMO Channel Estimation Using Partially Beamformed Midamble

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Abstract

For closed-loop MIMO (i.e. MIMO precoding), there is no training mechanism in the current standard for the composite channel, which consists of the beamforming matrix, the transmit chain response at the transmitter, the, wireless medium response, and the receive chain response at the receiver. This is because all the pilots and midamble are sent without beamforming. The receiver has to rely on the assumption that the receiver knows the beamforming matrix employed in the transmitter. However, the assumption doesn't hold for two cases. First, it fails when channel sounding and channel reciprocity is employed TDD modes. Secondly, it fails when there is a feedback error in FDD modes. For both cases, the MIMO precoding doesn't work. This can be solved by sending part the midable in beamformed mode, which is employed for the data portion.

1 Beamformed Midamble

Subcarriers are sequentially and periodically assigned to transmit antennas in midamble as shown in 8.4.8.5 in [1], where the period is the number of antennas N_t. We may select the mod(k,N_t)-th subcarrier in the *k-th* period to send training signal through the mod(k,N_t)-th beamformed spatial channel, where k starts from 0. The signal sent in the beamformed channel is the same as the original specified in 8.4.8.5.1 and 8.4.8.5.2.

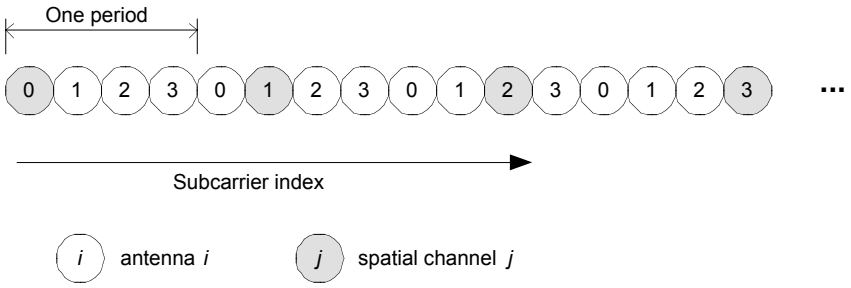


Figure 1 Midamble structure and beamforming pattern

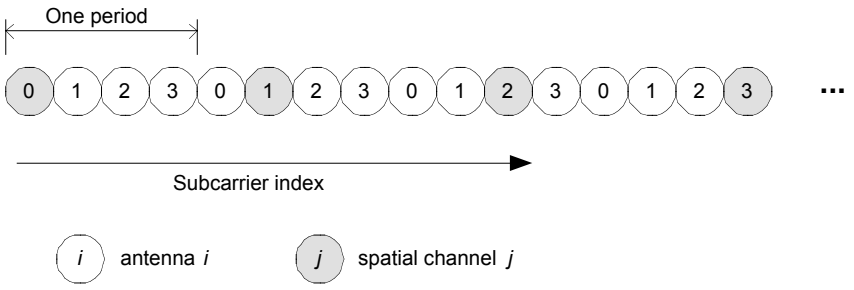
2 Specific Text Changes

Modified line 6 and 7 in section 8.4.8.5 on page 245 of [1] as follows

~~The MIMO midamble consists of one OFDM symbols which is mapped onto multiple antennas. Non-overlapping subcarriers are allocated to the transmit antennas.~~

The MIMO midamble consists of one OFDM symbols which is mapped onto multiple antennas. Non-overlapping subcarriers are allocated to the transmit antennas and spatial channels. The (mN_t+j)-th subcarrier is allocated to the j-th beamformed spatial channel, where j is spatial channel index (0, 1, …, N_t) and m is an integer starting from 0. The rest of the subcarriers are allocated to transmit antennas as follows. The (mN_t+n)-th subcarrier is allocated to the n-th antenna.

Substitude Figure 252c with



References:

[1] IEEE P802.16e/D5 Air Interface for Fixed and Mobile Broadband Wireless Access Systems – Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, 2004.

[2] IEEE P802.16-REVd/D5-2004 Draft IEEE Standards for local and metropolitan area networks, Part 16: Air interface for fixed broadband wireless access systems, 2004.