Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Beamforming MIMO mode**
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Re:	
Abstract	Beamforming MIMO mode
Purpose	Adoption of proposed changes into P802.16e D5. ~~Crossed-out indicates deleted text,~~ underlined blue indicates new text change to the Standard
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Beam-forming MIMO mode

Intel Corporation

Abstract

Transmit beam-forming enables performance gains with multiple antennas at the BS and even a single antenna at the MS. These performance gains are derived from the array gain plus the diversity gain, which can be as much as 10 dB for a system with four antennas at the BS and a single antenna at the MS.

Currently, the IEEE 802.16-2004 standard enables transmit beam-forming through AAS mechanisms. In addition, the standard enables pre-coding for MIMO systems. AAS can be treated as a special case of MIMO pre-coding, thereby enabling a vendor to more easily design a system with beam-forming benefits as well as MIMO benefits.

We propose some simple text changes to clarify this option in the standard.

All of the basic mechanisms for beam-forming are already in the standard. Payload bits can be encoded in the enhanced FAST_FEEDBACK channel (Table 297) as 0b110000 to represent beam-forming, and the beam-forming weights can be computed by the MS receiver, quantized with 5-bit or 6-bit APSK “wheels”, as shown in Figure 231c, and fed-back to the BS to be used as BS transmitter weights.

1 Existing mechanisms for beam-forming MIMO mode

All of the basic mechanisms for beam-forming are already in the standard. Payload bits can be encoded in the enhanced FAST_FEEDBACK channel (Table 297) as 0b110000 to represent beam-forming, and the beam-forming weights can be computed by the MS receiver, quantized with 5-bit or 6-bit APSK “wheels”, as shown in Figure 231c, and fed-back to the BS to be used as BS transmitter weights.

2 Specific Text Changes

[Add the following text to section 8.4.8.3.6, 802.16e D5.]

The space time coding output or the OFDM symbol can be weighted

Mt is the number of antennas at the output of the space-time coding scheme, or the OFDM symbols for pure beam-forming mode.