Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Preamble design to enhance MIMO support**
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Re:	IEEE 802.16e D3 Draft
Abstract	Preamble design to improve MIMO support
Purpose	To incorporate the changes here proposed into the 802.16e D4 draft.
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Preamble design to improve MIMO support

1 Background

The current preamble design does not take the advantage of multiple transmit and receive. If signal from one transmit antenna experiences a deep fading, then MSS may look for multiple preambles in order to get a successful initial access. With multiple transmit antennas; we can explore the spatial diversity to shorten the initial access time. The second problem is that the preamble can not be used for channel estimation in case of multiple transmit antennas. This is very useful feature for fast decoding of DL_MAP and select AMC band if AMC channel is to be used. The third problem is that it is very time consuming for MSS to identify BS from preamble.

The fourth problem is that for smaller FFT size, the initial access performance is degraded considerably comparing with 2k FFT, therefore, the longer access time. In this contribution, we propose a new preamble design to overcome the above problems for FFT size other than 2K.

With multiple transmit antennas, it is preferred that the transmissions from different antennas are orthogonal. In this way, initial system access, synchronizations, base station identification and selection and channel estimations from each antenna can be performed on each antenna. We proposed to use two OFDM symbols; one OFDM symbol is used for a common sync channel for fast initial access, the second OFDM symbol is used for cell identification and channel estimation. The new design can be used for single or multiple antennas.

2 Specific text changes

[Add the following text into section 8.4.9.4.3.2]

`---------Start text proposal-------`

In this section, we describe the principle using 1k FFT as an example. The preamble is transmitted at the beginning of the DL transmission in each frame. It consists of two header OFDM symbols. The time domain structure of the preamble is as below:

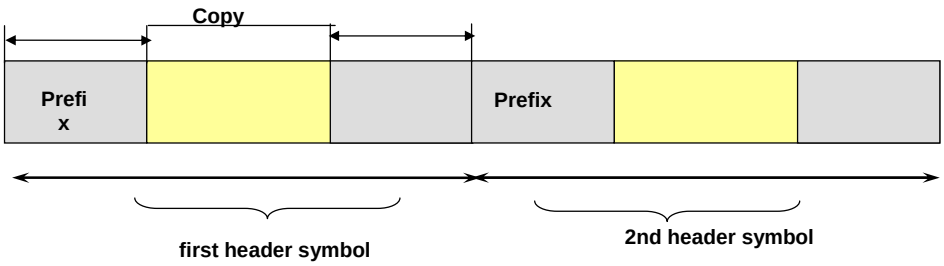

Figure 1 MIMO permeable time domain structure

The first header OFDM symbol serves as the common SYNC channel, a common PN sequence consisting of two sub-sequences is used by all cells to modulate the subcarriers with even-numbered frequency offset Indices.

- For single antenna, the whole sequence is transmitted by one antenna.
- For 2 or 4 antennas, antenna 1 modulates sub-carriers with frequency offset indices of 4m (m=0,1,2,…..N_carrier/4-1) with sub-sequence 1, antenna 2 modulates sub-carriers with frequency offset indices of 4m+2 with sub-sequence 2.

The second half of the time domain waveform is a replica of the first half one, frame sync and coarse timing can be extracted based on this repetition structure.

The second header symbol serves as the cell specific pilot channel. A cell specific PN sequence consisting of four sub-sequences is used by a cell to modulate all the used subcarriers (except DC subcarrier). The total used subcarriers are partitioned into 4 types of preamble carrier-sets

$PreambleCarrierSet_n = n+4k$

where n = 0,1,2,3 is the number of the preamble carrier-set, k is the running index 0, 1, ……, N-carrier/4.

- For the cells with one antenna, all four sub-sequences are used by the antenna to modulate all carrier-sets
- For the cells with two antennas,
  - Sub-sequences 1&3 are used by the antenna 1 to modulate carrier-sets 1&3
  - Sub-sequences 2&4 are used by the antenna 2 to modulate carrier-sets 2&4
- For the cells with four antennas,
  - Sub-sequences 1 is used by the antenna 1 to modulate carrier-sets 1
  - Sub-sequences 2 is used by the antenna 2 to modulate carrier-sets 2
  - Sub-sequences 3 is used by the antenna 3 to modulate carrier-sets 3
  - Sub-sequences 4 is used by the antenna 4 to modulate carrier-sets 4

The following diagram illustrates the subcarriers allocation.

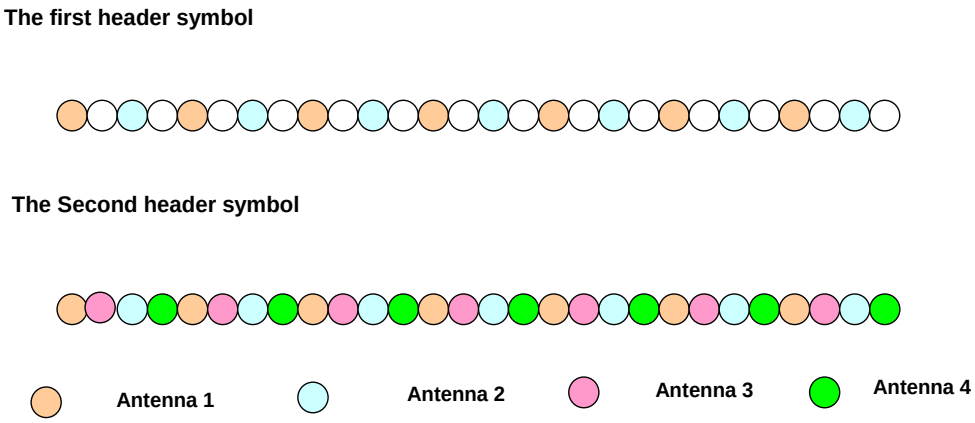

Figure 2 MIMO permeable frequency domain structure

---------End text proposal-------