Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Operating mode identification using preamble**
Date Submitted	**2004-06-25**

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Re:	
Abstract	Method to identify the operating mode using preamble
Purpose	Adopting of proposed method into P802.16e
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Operating mode identification using preamble

Problem Definition and Proposed Solutions

For flexible usage of the symbol structure in IEEE 802.16e/D3, we propose a method of operating mode identification using preamble. PUSC symbol structure is useful for sectored cell deployment to lower inter-cell interference. For frequency reuse one deployment, FUSC and optional FUSC symbol structures are beneficial in order to increase spectral efficiency. Moreover, AAS supporting BS may prefer the AMC subchannel structure. Consequently, it is crucial that the FCH is flexibly configured according to the preferred system deployment and system capability to support advanced technology.

We propose a method of operating mode identification using preamble which requires minor modifications of existing standard. The proposed method of operating mode identification does not have any impacts on the existing preamble structure. The PAPR and frame synchronization performances can be retained when comparing with the default mode (PUSC) operation.

Suggested change to the standard

[ADD new section '8.4.6.1.1.1 Operating mode identification using preamble' before section 8.4.6.1.2]

8.4.4.2.1 Operating mode identification using preamble

For FFT size other than 2048-FFT, the FCH shall be transmitted using QPSK rate 1/2 with four repetitions using the symbol structure (e.g. PUSC, FUSC, optional FUSC or AMC) designated in the preamble, and the mandatory coding scheme (e.g. the FCH information will be sent on four adjacent subchannels). Table aaa defines the structure of DL_Frame_Prefix for FFT size other than 2048-FFT.

Table aaa–OFDMA downlink Frame Prefix format for FFT size other than 2048-FFT

Syntax	Size	Notes
DL_Frame_Prefix_Format() {		
Used subchannel bitmap	6 bits	xxxxx1: Subchannels 0-11 used xxxx1x: Subchannels 12-19 used xxx1xx: Subchannels 20-31 used xx1xxx: Subchannels 32-39 used x1xxxx: Subchannels 40-51 used 1xxxxx: Subchannels 52-59 used When FUSC, optional FUSC or AMC symbol structure is used for FCH, all subchannels shall be used with all 1's for the 'used subchannel bitmap'
Ranging_Change_Indication	1 bit	
Repetition_Coding_Indication	2 bits	00 – No repetition coding on DL-MAP 01 – Repetition coding of 2 used on DL-MAP 10 – Repetition coding of 4 used on DL-MAP 11 – Repetition coding of 6 used on DL-MAP

Coding_Indication	3 bits	000 – CC encoding used on DL-MAP 001 – BTC encoding used on DL-MAP 010 – CTC encoding used on DL-MAP 011 to 111 – reserved
DL-MAP Length	8 bits	
Reserved	4 bits	Reserved; Shall be set to 0
}		

The information about symbol structure for FCH is transmitted using preamble by the following method.

In case when the preamble is cyclically shifted in time domain by n/4 of OFDMA symbol for n=0,1,2,3 (see Table bbb), 4 types of symbol structure can be differentiated. When the preamble is cyclically delayed in time by N samples, the transmitted waveform s(t) becomes as following:

$$s(t) = \mathrm{Re}\left\{ e^{j2\pi f_c t} \cdot \left(\sum_{\substack{k=-(N_{used}-1)/2 \\ k\neq 0}}^{k=(N_{used}-1)/2} c_k \cdot e^{j2\pi Nk/N_{FFT}} \cdot e^{j2\pi k\Delta f (t-T_g)} \right) \right\} \quad \text{(xxx)}$$

where c_k are the preamble tone values, and t is the time elapsed since the beginning of the OFDMA symbol with $0 < t < T_s$. Four types of operating modes each of which defines symbol structure for FCH are listed in Table bbb.

Table bbb – Operating mode configuration

n (index for delay in time)	Operating mode
0 (default)	PUSC
1	FUSC
2	Optional FUSC
3	AMC

References

[1] 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.

[2] IEEE P802.16-REVe/D3-2004 Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Band.