Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**Proposed Symbol Structure for HR-Network OFDMA PHY**	
Date Submitted	**1 April 2011**	
Source(s)	Liru Lu (Alina), Xin Zhang, Masayuki Oodo, Ming-Tuo Zhou, Vinh Dien Hoang, Hiroshi Harada(NICT)	Voice: [Telephone Number (optional)]] E-mail: [liru@nict.com.sg; zhangxin@nict.com.sg; moodo@nict.go.jp; mingtuo@nict.com.sg; hvdien@nict.com.sg; harada@nict.go.jp] *<http://standards.ieee.org/faqs/affiliationFAQ.html>
Re:	[Call for contributions for the 802.16n Amendment Working Draft Base Contribution: IEEE 802.16n-10/0048.]	
Abstract	[This document proposes symbol structure to be used in HR-Network OFDMA PHY.]	
Purpose	[To be discussed in 802.16n Task Group.]	
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Proposed Symbol Structure for HR-Network OFDMA PHY

Liru Lu (Alina), Xin Zhang, Masayuki Oodo, Ming-Tuo Zhou, Hoang Vinh Dien, Hiroshi Harada
NICT

Introduction

In Doc. IEEE 802.16n-10/0048, section 6.2.4 specifies the requirement on Uplink Heavy Data Service. The following symbol structure is proposed for HR-Network OFDMA PHY in achieving this function requirement.

Proposed Symbol Structure in OFDMA PHY

An OFDMA system requires the information of wireless channel for recovering of data based on estimated channel parameters. The subcarriers in each OFDMA symbol are allocated for data and pilot signals. The pilot signals received are used to estimate channel delay profiles by comparing with original pilot messages sent at the transmitter of the system. The obtained channel profile is used for channel equalization and to combat multipath frequency selective fading. For a large communication range, the maximum channel delay spread is 10ms. A typical OFDMA system, such as IEEE 802.16e OFDMA system, is unable to combat long delay profile when it is operating at 1.25 and 5 MHz bandwidths due to its short cyclic prefix length. The data rate offered by OFDMA system is also not enough for supporting high data rate applications such video streaming.

For the downlink and uplink OFDMA symbol structures defined in wireless standards IEEE 802.16e, the allocation of symbols for uplink transmission follows a tile structure which is defined as (4 subcarriers) * (3 OFDM symbols). The pilot pattern of downlink system follows cluster structure. 4 pilot symbols are included for each cluster which is form by (14 subcarriers) * (2 OFDM symbols). The ratio of data and pilots is 2:1 and 6:1 for uplink and downlink respectively. The overhead is high and the system is unable to support high data rate applications such as high definition TV which requires not less than 7Mbps uplink transmission rate.

In this document, an optimized OFDMA symbol structure is proposed to reduce the overhead and combat the long propagation delay profile in particularly for the channel band 170 to 205 MHz Public Broadband Network Systems and other OFDMA based wireless communications system. The symbol structure is defined by positioning the data and pilot subcarriers in each OFDMA symbol by adopting the tile structure in Figures 247a and 249a for downlink and uplink systems, respectively. By means of provided OFDMA symbol structure, the system data rate can be increased by nearly 30% for the same level of SNR and the packet overhead is reduced to 1/7.

Proposed Text

Adopt the following Remedies.

---------- Start of Proposed Text ----------

8. Physical layer (PHY)

8.4 WirelessMAN-OFDMA PHY

8.4.1 Introduction

Insert the following contents to section 8.4.1 on Page 694 at the end of 2nd paragraph

For WirelessMAN-OFDMA PHY specified for public broadband with operating frequency from 170 to 205MHz, channel bandwidth is limited to 5MHz. The corresponding OFDMA PHY mode is named PBB mode. The FFT size of 1024 and 512 shall be supported in PBB mode of OFDMA PHY.

8.4.3 OFDMA basic terms definition

8.4.3.1 Slot and data region

Insert the following contents in blue for the 2nd and 3rd bullet points in Section 8.4.3.1

— For DL PUSC (defined in 8.4.6.1.2.1), one slot is one subchannel by two OFDMA symbols. For PBB mode DL PUSC, one slot is one subchannel by four OFDMA symbols.
— For UL PUSC (defined in 8.4.6.2.1 and 8.4.6.2.5) and for DL TUSC1 and TUSC2 (defined in 8.4.6.1.2.4 and 8.4.6.1.2.5), one slot is one subchannel by three OFDMA symbols. For PBB mode UL PUSC, one slot is one subchannel by seven OFDMA symbols.

8.4.4.3 OFDMA Frame Parameters and Operations

At the end of Section 8.4.4.3 on Page 709 insert the following texts

In PBB mode, subcarrier allocation scheme of PUSC (defined in 8.4.6.1.2.1.1 and 8.4.6.2.2) is used for both UL and DL and duplex method is TDD, and MIMO, STC scheme are not used.

8.4.4.4 DL frame prefix

At the end of Section 8.4.4.4 on Page 711 inserts the following texts

For PBB mode, CC encoding used on DL-MAP or CTC encoding used on DL-MAP are selected as “Coding_Indication” from DL frame prefix format shown in Table 314. The FFT size of 512 or 1024 is selected from Table 315.

8.4.6 OFDMA subcarrier allocations

At the end of Section 8.4.6 on Page 916 inserts the following texts

In PBB mode, sampling factor n is 8/7 for the channel bandwidth of 5 MHz and also subcarrier allocation scheme of PUSC (defined in 8.4.6.1.2.1 and 8.4.6.2.5) is used for both UL and DL

8.4.6.1.1 Preamble

Before the last paragraph on Page 918 inserts the following texts

512 or 1024 is used as FFT size for PBB mode.

8.4.6.1.2.1 Symbol structure for PUSC

Insert the following on Page 941

For PBB mode, the symbol is first divided into basic tiles (as defined in Figure 247a) and zero carriers are allocated. Pilots and data carriers are allocated within each tile. Table 442a summaries the parameters of the symbol structure under this PHY mode.

A slot in the DL of PBB Mode is composed of **four (4)** OFDMA symbols and one subchannel. Within each slot, there are **72** data subcarriers and **24** fixed-location pilots as shown in Table xx. The subchannel is constructed from six DL tiles. Each tile has four successive active subcarriers, and its configuration is illustrated in Figure 247a.

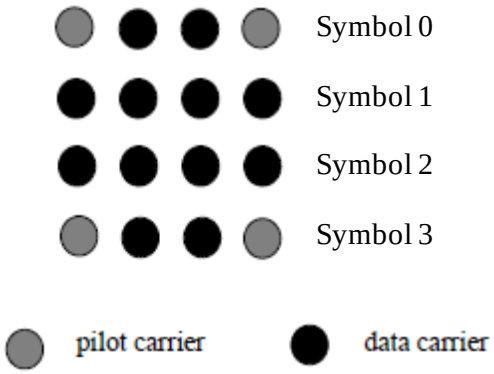

Figure 247a—Description of a DL tile in Mode 2

8.4.6.2.1 Symbol structure for subchannel (PUSC)

Insert the following contents on Page 953 after Figure 249

For PBB mode, a slot in the UL of Mode 2 is composed of **seven (7)** OFDMA symbols and one subchannel. Within each slot, there are **144** data subcarriers and 24 fixed-location pilots as shown in Table xx. The subchannel is constructed from six UL tiles. Each tile has four successive active subcarriers, and its configuration is illustrated in Figure 249a.

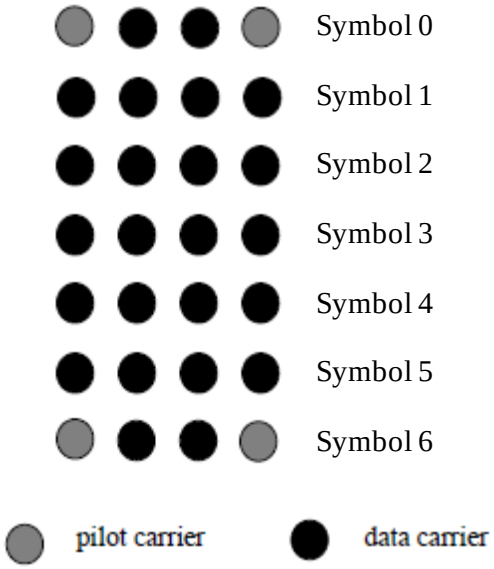

Figure 249a—Description of an UL tile in PHY Mode specified for HR-Network

8.4.9.2.1 Convolutional coding (CC)

At the end of Section 8.4.9.2.1 on Page 1032 inserts the following texts

For PBB mode, the basic size of useful data payloads is defined in Table 495a ”Useful data payload for an FEC Block in PBB mode”.

Table 495a: Useful data payload for an FEC Block in PBB mode

	QPSK		**16 QAM**		**64 QAM**		
Encoding rate	R=1/2	R=3/4	R=1/2	R=3/4	R=1/2	R=2/3	R=3/4
Data payload (bytes)	18						
		27					
	36		36				
	54	54		54	54		
	72		72			72	
		81					81
	90						
	108	108	108	108			

8.4.9.3 Interleaving

At Section 8.4.9.3 on Page 1061 before the last 2nd paragraph inserts the following texts

For PBB mode, the first and second permutation follows the equations (121) and (122), respectively with d=18.

---------- End of Proposed Text ----------