

Project	<b>IEEE 802.16 Broadband Wireless Access Working Group</b> < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	<b>Uplink pilot structure for 802.16m</b>	
Date Submitted	<b>2008-05-05</b>	
Source(s)	Tian tao, Wei hui, Lv kaiying, Wang wenhuan, Liu min, ZTE Corporation	Voice: [Telephone Number (optional)] E-mail: <a href="mailto:tian.tao@zte.com.cn">mailto:tian.tao@zte.com.cn</a> * <a href="http://standards.ieee.org/faqs/affiliationFAQ.html">http://standards.ieee.org/faqs/affiliationFAQ.html</a> >
Re:	IEEE 802.16m-08/016r1 –Call for Contributions on Project 802.16m System Description Document (SDD); Uplink Pilot Structures	
Abstract	This contribution covers the considerations about the uplink Pilot design for IEEE 802.16m	
Purpose	To be discussed and adopted by TGM for use in the IEEE 802.16m SDD	
Notice	<i>This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the “Source(s)” field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.</i>	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE’s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE’s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: < <a href="http://standards.ieee.org/guides/bylaws/sect6-7.html#6">http://standards.ieee.org/guides/bylaws/sect6-7.html#6</a> > and < <a href="http://standards.ieee.org/guides/opman/sect6.html#6.3">http://standards.ieee.org/guides/opman/sect6.html#6.3</a> >. Further information is located at < <a href="http://standards.ieee.org/board/pat/pat-material.html">http://standards.ieee.org/board/pat/pat-material.html</a> > and < <a href="http://standards.ieee.org/board/pat">http://standards.ieee.org/board/pat</a> >.	

# Uplink pilot structure for 802.16m

Tian Tao, Wei Hui, Lv Kaiying Wang wenhuan, Liu min  
ZTE Corporation

## 1. Introduction

This contribution proposes an uplink pilot structure for IEEE 802.16m SDD.

- The pilot structure presented in this proposal is based on uplink resource unit size 18subcarriers by 6 OFDMA symbols(For convenience, in the following, resource unit size will be represented as 18×6). The 18×6 resource unit is the basic resource unit which is called BRU in the following.
- The BRU is flexible to be divided into several sub-blocks with size 9×6, 6×6 or 18×3. These sub-blocks have the same pilot density as BRU, and they can be used for frequency diversity.
- The pilot overhead is 5.56% for 1 Transmit antenna case and 11.12% for 2 Transmit antenna case.
- Simulation parameter is based on IEEE 80216m-08-004r1.

## 2. Proposed pilot structure

### 2.1 Proposed pilot structure for 1 Transmit antenna

The pilot structure for 1 Transmit antenna is shown in Figure 1, it has the following features:

- Low pilot density(1/18) with respect to 16e(PUSC-1/3 Optional 1/9).
- The pilot structure is suitable for isolated RU demodulation without the adjacent resource units' aids.
- In this figure and the following figures, horizontal direction is OFDM symbol, vertical direction is subcarrier.

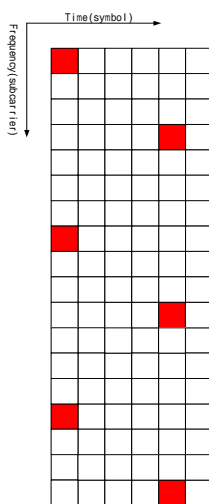


Figure 1

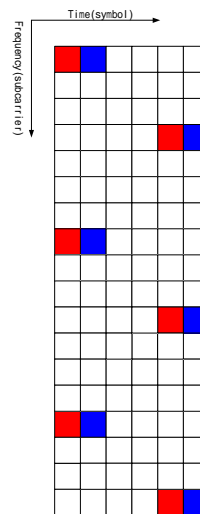


Figure 2

### 2.2 Proposed pilot structure for 2 Transmit antennas

The pilot structure for 1 Transmit antenna is shown in Figure 1, it has the following features:

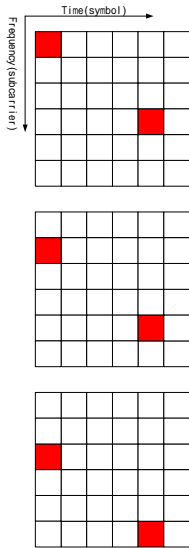
- Total pilot density is 1/9 with similar structure for two antennas.
- The red square is for the first antenna, the blue square is for the second antenna.
- The pilot structure is suitable for isolated RU demodulation without the adjacent resource units' aids.
- Easy to be used for STBC.
- 

### 2.3 Pilot structure for sub-block

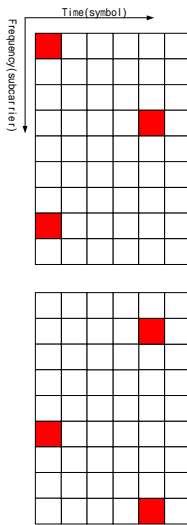
- The BRU is flexible to be divided into several sub-blocks with size 9×6, 6×6 or 18×3.

- The pilot structure for sub-block is just the part of the pilot structure in BRU. These sub-blocks have the same pilot density as BRU.

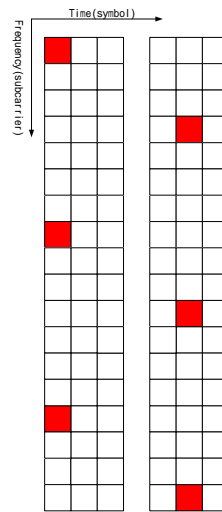
Figure 3-a, 3-b, 3-c are respectively pilot structures for  $9 \times 6$ ,  $6 \times 6$  and  $18 \times 3$  sub-block for one transmit antenna case. They are just division of the pilot structure in Figure 1. With the same method, the sub-block pilot structures for 2 transmit antenna case are just division of the pilot structure in Figure 2.



**Figure 3-a**



**Figure 3-b**

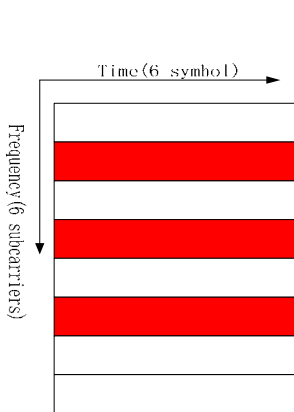


**Figure 3-c**

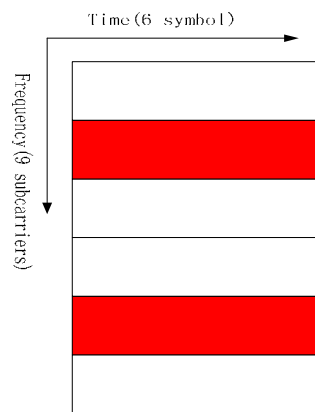
**2.4 Sub-block for diversity**

- One BRU can be equally divided into two  $9 \times 6$ , two  $18 \times 3$  or three  $6 \times 6$  sub-blocks with the same pilot density as BRU. The  $6 \times 6$ ,  $9 \times 6$  or  $18 \times 3$  sub-blocks can be used for diversity.

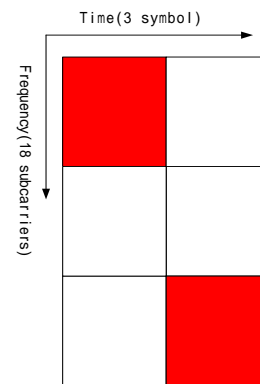
Figure 4-a is a diversity example for three  $6 \times 6$  sub-blocks, Figure 4-b is a diversity example for two  $9 \times 6$  sub-blocks, Figure 4-c is a diversity example for two  $18 \times 3$  sub-blocks.



**Figure 4-a**



**Figure 4-b**



**Figure 4-c**

**2.5 sub-block for sub-frame aggregation**

- One sub-frame is constituted with 6 adjacent OFDMA symbols as shown in BRU.
- The  $6 \times 6$  ( $9 \times 6$ ) blocks in adjacent 3(2) sub-frames could be aggregated for time domain spread and flexible resource allocation.
- Figure 5-a is the aggregation of  $6 \times 6$  mini blocks in 3 adjacent sub-frames.
- Figure 5-b is the aggregation of  $9 \times 6$  mini blocks in 2 adjacent sub-frames.

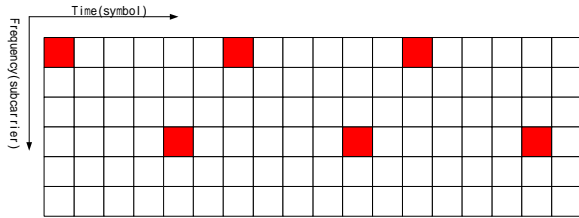


Figure 5-a

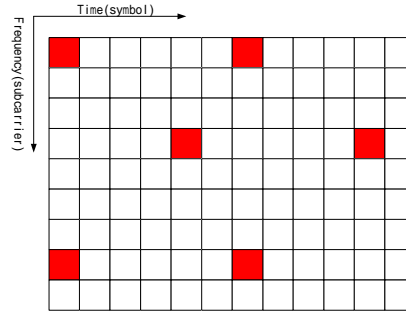


Figure 5-b

3.

Text Proposal for the 802.16m SDD

===== Start of Proposed Text =====

Section x.x: Uplink Resource Block

Section x.x.1 UL pilot structure for STC/MIMO

Basic resource unit (BRU) is 18 subcarriers by 6 symbols.

- The UL pilot structure of BRU for 1 antenna is shown in Figure xxx.1.
- The UL pilot structure of BRU for 2 antennas is shown in Figure xxx.2.
- These pilot structures can be equally divided into two 9x6, two 18x3 or three 6x6 sub-blocks, which have the same pilot density as BRU.

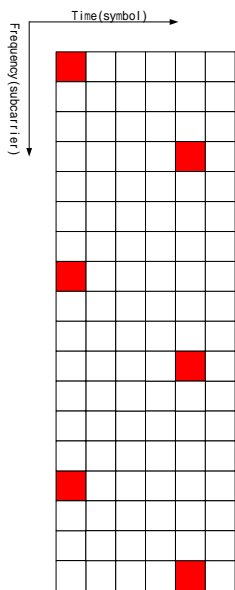


Figure xxx.1

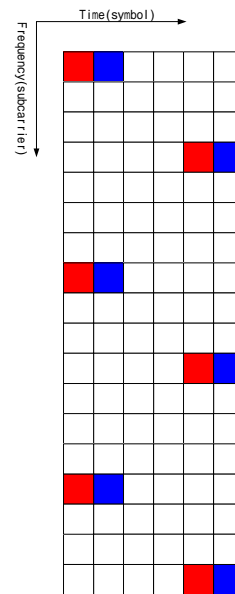


Figure xxx.2