

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Pilot allocations for 5,6,7,and 8 BS antennas	
Date Submitted	2004-11-12	
Source(s)	Qinghua Li, Xintian Eddie Lin, Shilpa Talwar, Nageen Himayat Intel Corporation	qinghua.li@intel.com Voice: +1-408-765-9698
Re:		
Abstract	Pilot allocations for 5-8 transmit antennas in optional FUSC and Band AMC	
Purpose	Adoption of proposed changes into P802.16e Crossed out indicates deleted text, <u>underlined blue indicates new text change to the Standard</u>	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
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 and Procedures	<p>The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures (Version 1.0) <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing the standard."</p> <p>Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:r.b.marks@ieee.org> as early as possible, in written or electronic form, of any patents (granted or under application) that may cover technology that is under consideration by or has been approved by IEEE 802.16. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.</p>	

Pilot Allocations for 5-8 Transmit Antennas in optional FUSC and Band AMC

Qinghua Li, Xintian Eddie Lin, Shilpa Talwar, and Nageen Himayat

Intel Corporation

Abstract

Closed-loop MIMO can benefit from a large number of transmit antennas by conducting transmit beamforming. The current feedback channel CQICH assigns three bits to the number of transmit antennas and allows it to be 2,3,...,7,8 as shown in Table 289a , page 189. Using less than 5 antennas would waste one bit. Furthermore, the text in section 8.4.8.3.6, page 242 doesn't restrict the number of transmit antennas to less than 4, and it is open to more than 4 antennas. Pilot allocations for up to 4 transmit antennas are already defined in section 8.4.8.3.

In this contribution, pilot allocations for 5, 6, 7, and 8 transmit antennas are derived. The pilots are at the same locations as those for 4 transmit antennas. The pilots for each antenna are evenly spread across frequency and time as much as possible, which tracks the channel variations on the two dimensions and minimizes the channel estimation/interpolation complexity.

1 Pilot allocations for 5, 6, 7, and 8 transmit antennas

For 5-antenna base station (BS), pilot pattern is shown in Figure 1. The pilot in gray is periodic with a frequency period of 9 subcarriers and a time period of 4 OFDM symbol durations. The pilot in light blue has a frequency period of 9 subcarriers and a time period of 8 OFDM symbol durations. The pilot density of each antenna except antenna 0 is 1/24 and the pilot density of antenna 0 is 1/18. Antenna 0 is desired to be the antenna also employed in the adjacent zones.

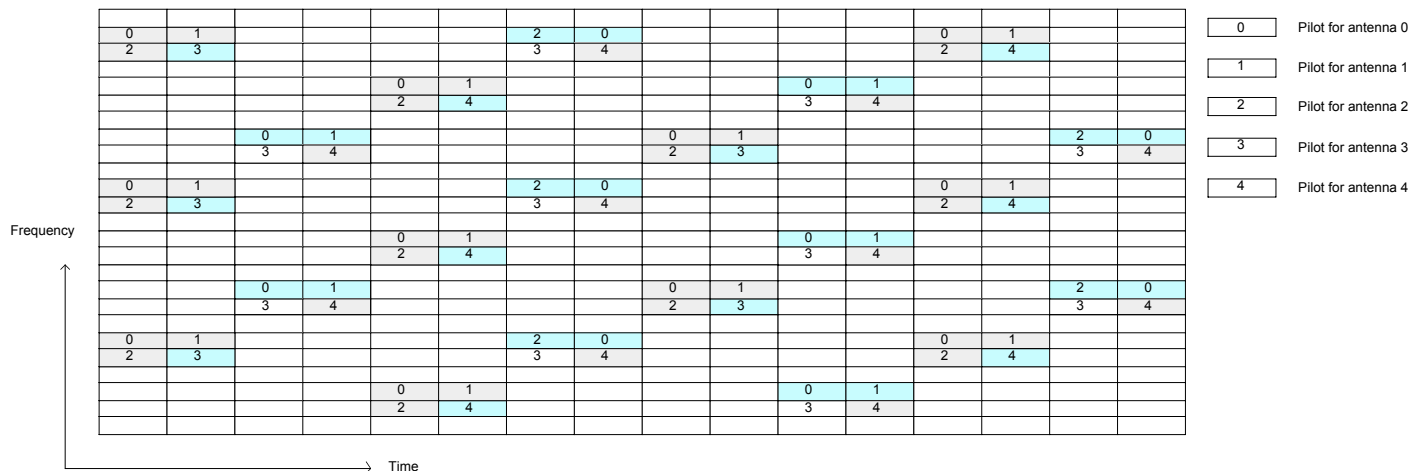


Figure 1 Pilot allocation for 5-antenna BS for the optional FUSC and the optional AMC zones.

For 6-antenna BS, pilot pattern is shown in Figure 2. The pilot in gray is periodic with a frequency period of 9 subcarriers and a time period of 4 OFDM symbol durations. The pilot in light blue has a frequency period of 9 subcarriers and a time period of 8 OFDM symbol durations. The pilot density of each antenna is 1/24.

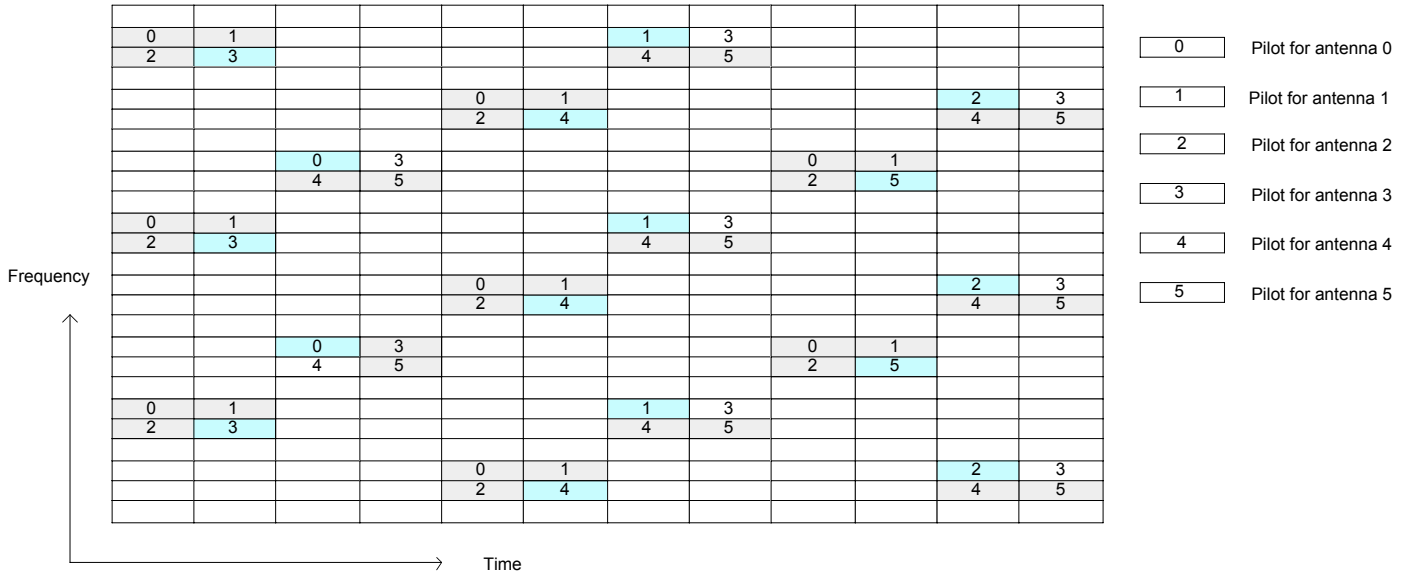


Figure 2 Pilot allocation for 6-antenna BS for the optional FUSC and the optional AMC zones.

For 7-antenna BS, pilot pattern is shown in Figure 3. The pilot in gray is periodic with a frequency period of 9 subcarriers and a time period of 4 OFDM symbol durations. The pilot in light blue has a frequency period of 9 subcarriers and a time period of 28 OFDM symbol durations. The pilot density of each antenna is 2/63.

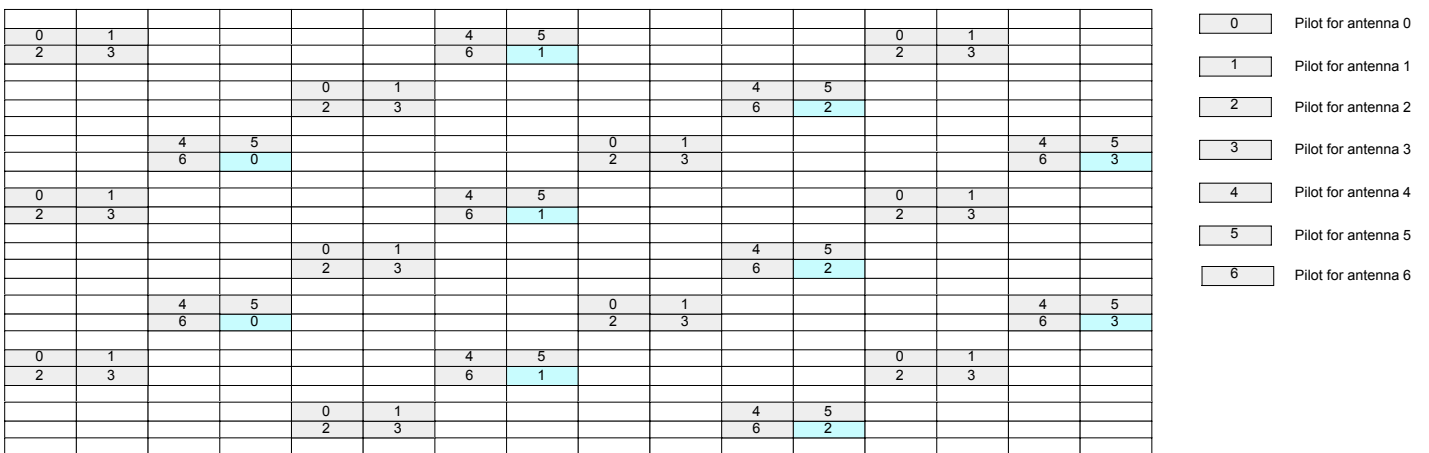


Figure 3 Pilot allocation for 7-antenna BS for the optional FUSC and the optional AMC zones.

For 7-antenna BS, pilot pattern is shown in Figure 3. The pilot in gray is periodic with a frequency period of 9 subcarriers and a time period of 4 OFDM symbol durations. The pilot in light blue has a frequency period of 9 subcarriers and a time period of 8 OFDM symbol durations. The pilot density of each antenna is 1/36.

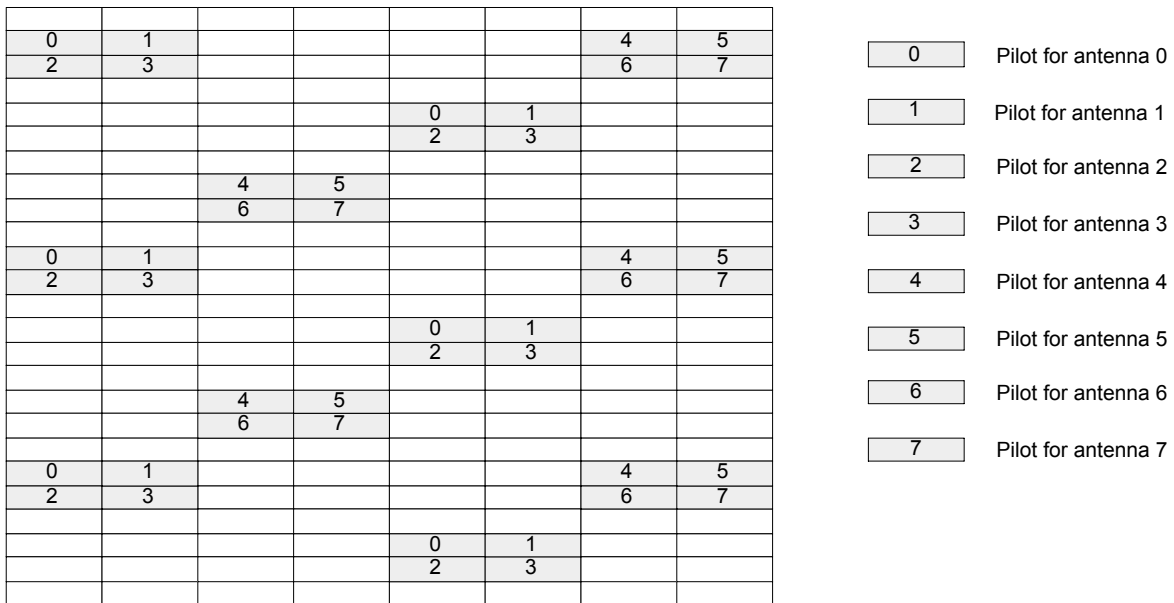


Figure 4 Pilot allocation for 8-antenna BS for the optional FUSC and the optional AMC zones.

2 Specific Text Changes

[Add the following text to section 8.4.8.3.1, 802.16e D5.]

[For 5-antenna BS, pilot pattern is shown in Figure 1.](#)

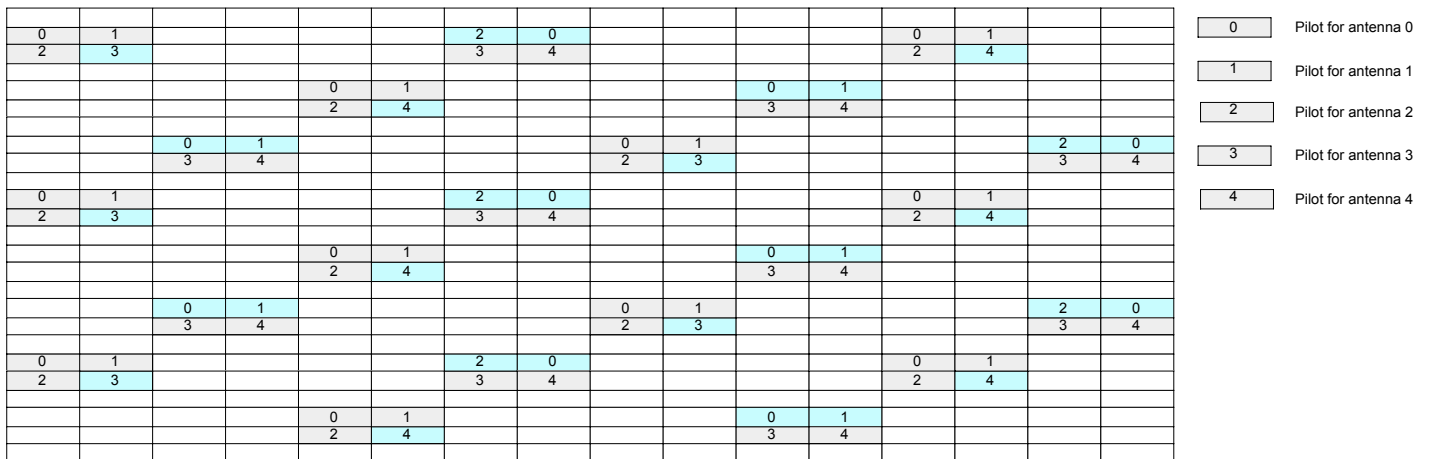


Figure 251d—Pilot allocation for 5-antenna BS for the optional FUSC and the optional AMC zones.

[For 6-antenna BS, pilot pattern is shown in Figure 2.](#)

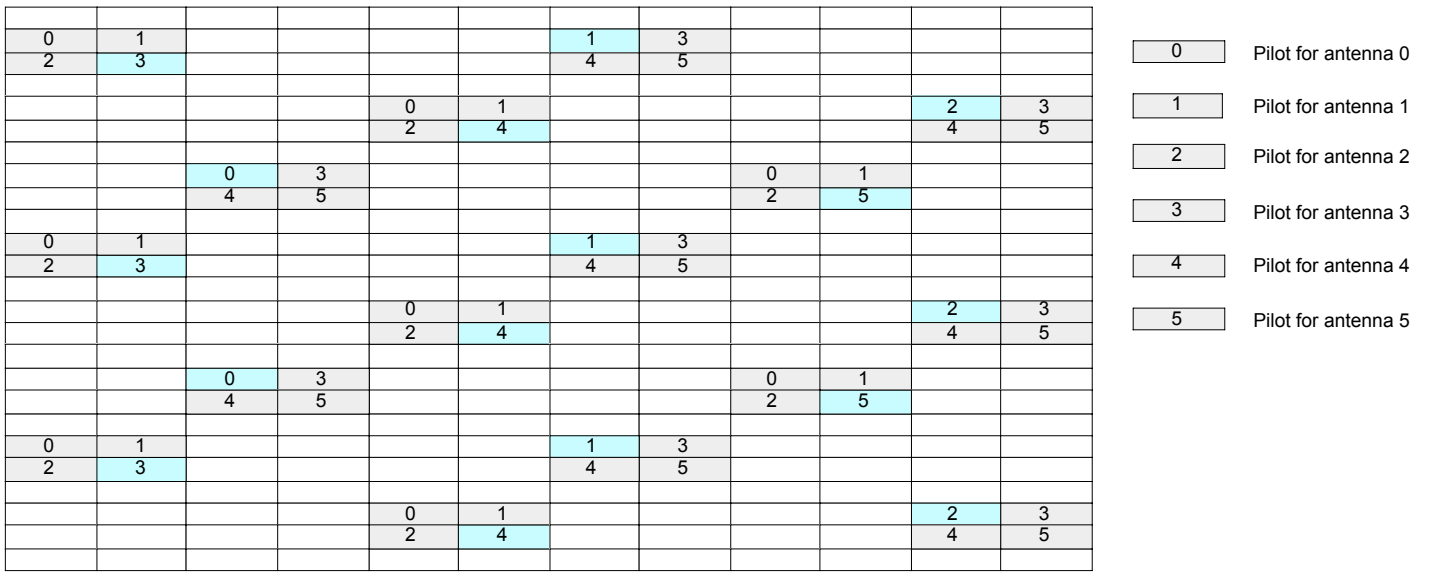


Figure 251e—Pilot allocation for 6-antenna BS for the optional FUSC and the optional AMC zones.

For 7-antenna BS, pilot pattern is shown in Figure 3.

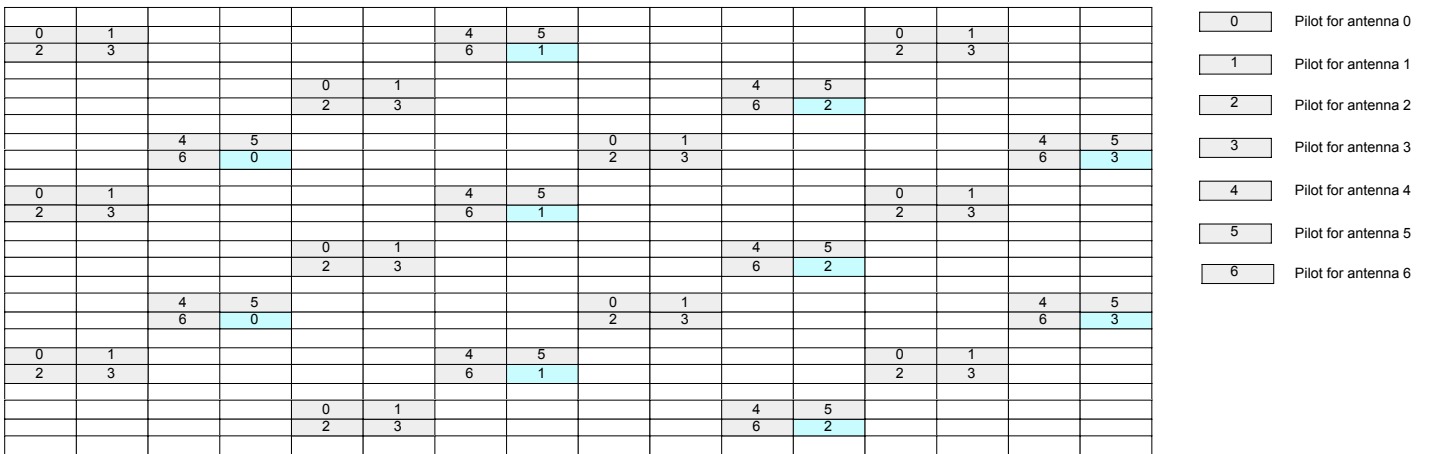
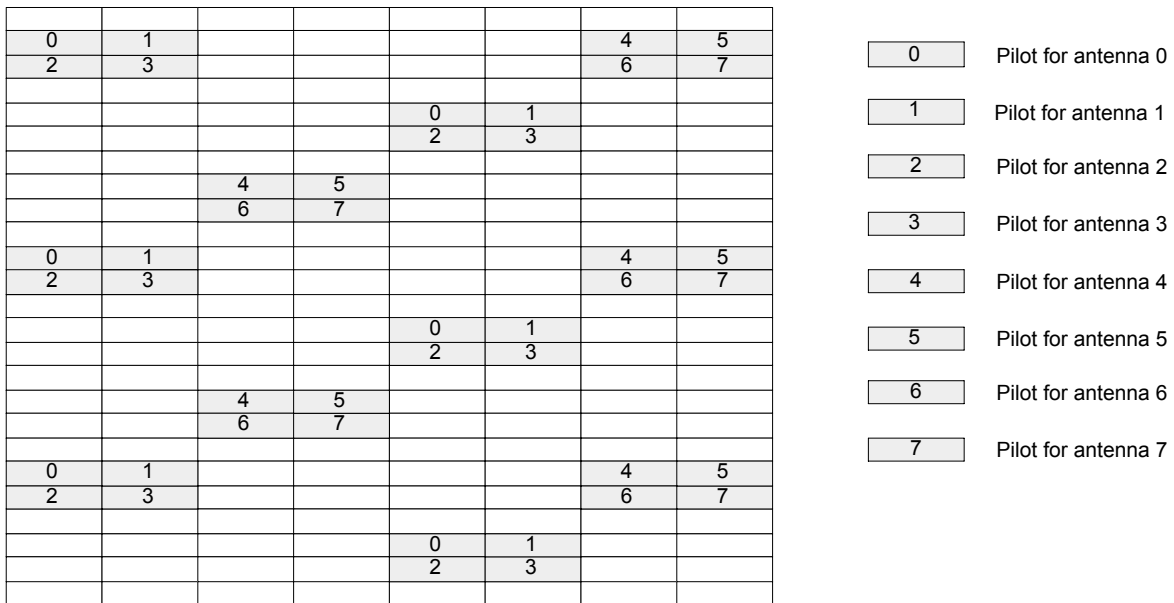


Figure 251f—Pilot allocation for 7-antenna BS for the optional FUSC and the optional AMC zones.

For 8-antenna BS, pilot pattern is shown in Figure 3.



[Figure 251g—Pilot allocation for 8-antenna BS for the optional FUSC and the optional AMC zones.](#)

References:

[1] IEEE P802.16e/D5 Air Interface for Fixed and Mobile Broadband Wireless Access Systems – Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, 2004.

[2] 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, 2004.

[3] Recommendation ITU-R M.1225, Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000, 1997.