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Title	<b>Pilot allocations for 5,6,7,and 8 BS antennas</b>	
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Re:		
Abstract	Pilot allocations for 5-8 transmit antennas in optional FUSC and Band AMC	
Purpose	Adoption of proposed changes into P802.16e <del>Crossed out indicates deleted text,</del> <u><a href="#">underlined blue indicates new text change to the Standard</a></u>	
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# Pilot Allocations for 5-8 Transmit Antennas in optional FUSC and Band AMC

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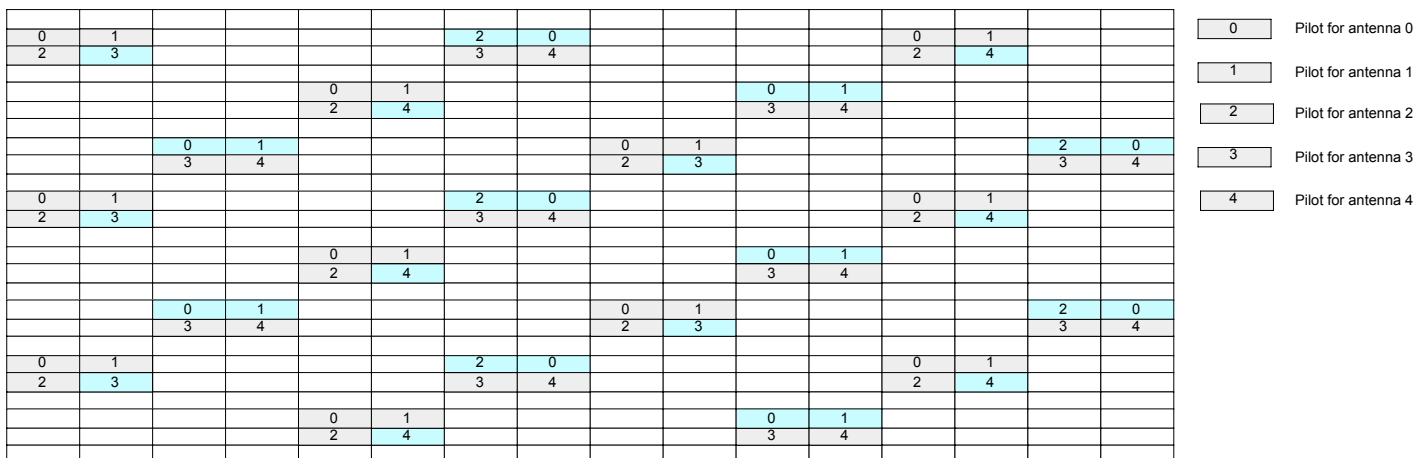
## Abstract

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.

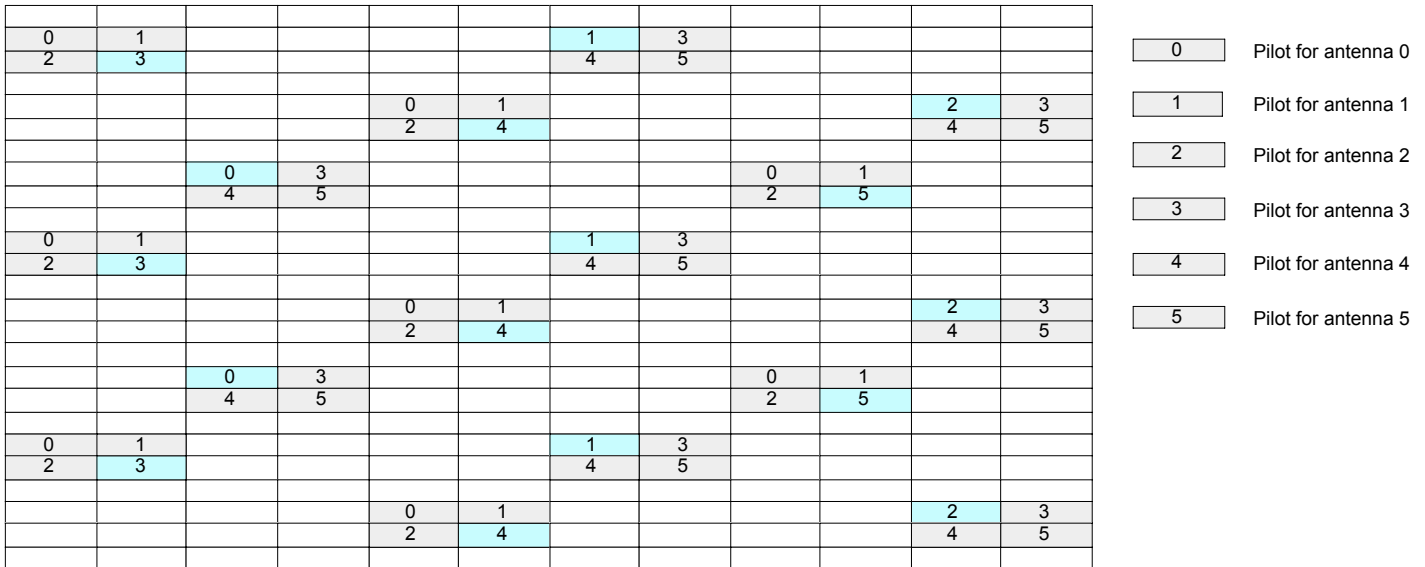
## 1 Pilot allocations for 5, 6, 7, and 8 transmit antennas

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.



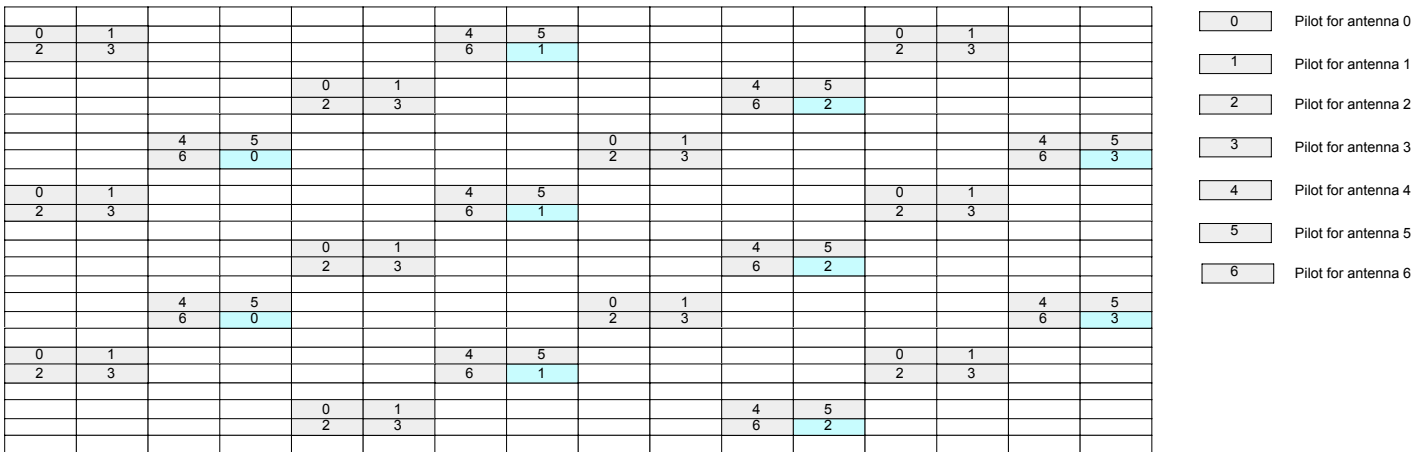
**Figure 1 Pilot allocation for 5-antenna BS for the optional FUSC and the optional AMC zones.**

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.

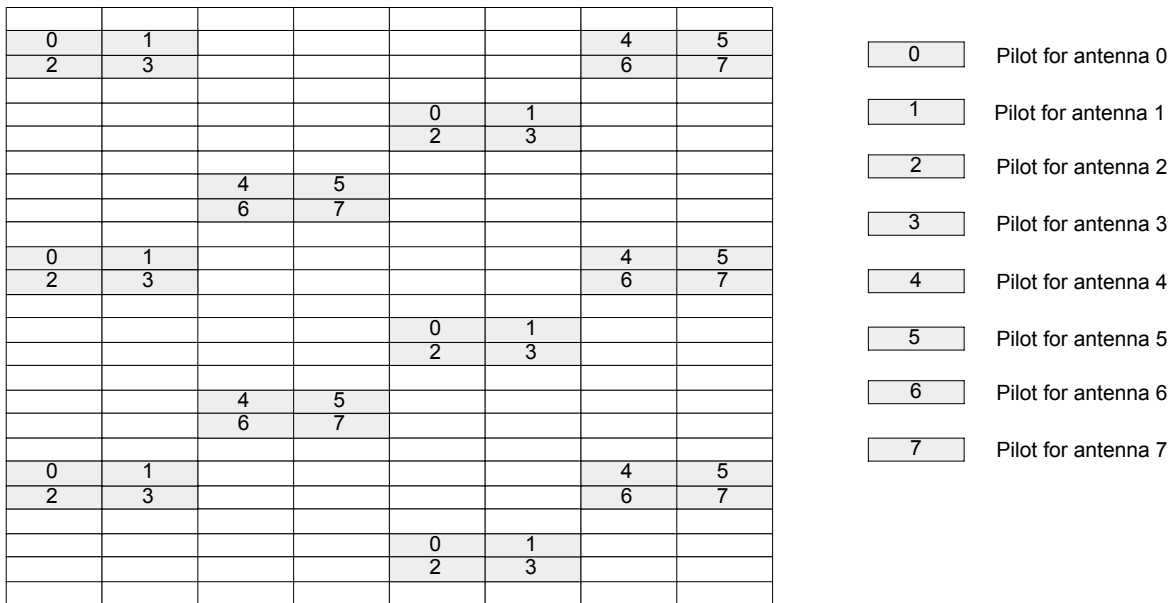


Figure 4 Pilot allocation for 8-antenna BS for the optional FUSC and the optional AMC zones.

## 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. 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.

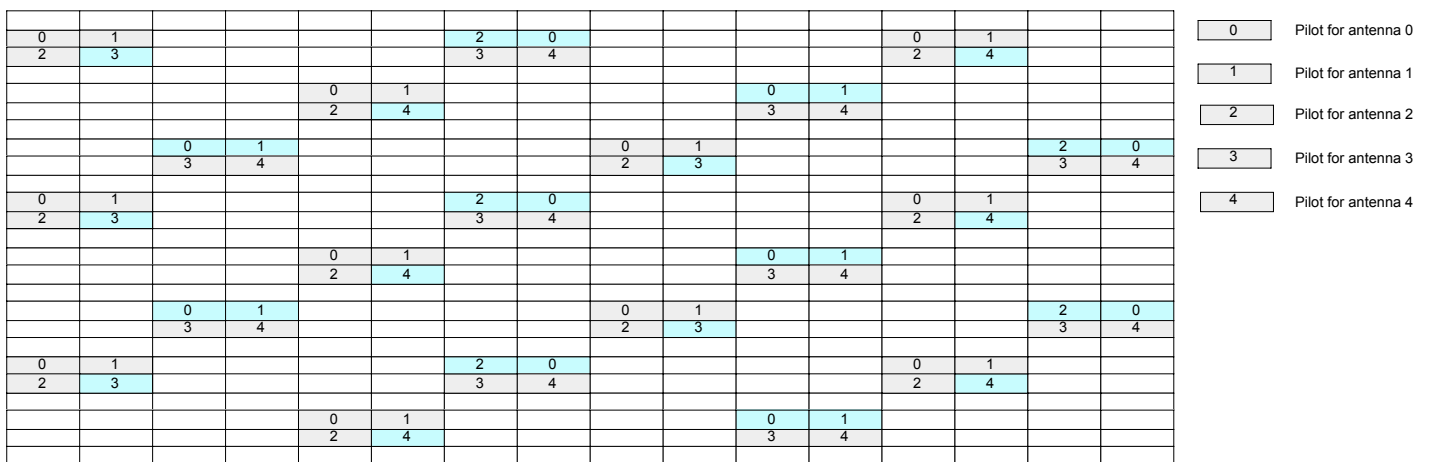


Figure 251d—Pilot allocation for 5-antenna BS for the optional FUSC and the optional AMC zones.

For 6-antenna BS, pilot pattern is shown in Figure 2. 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.

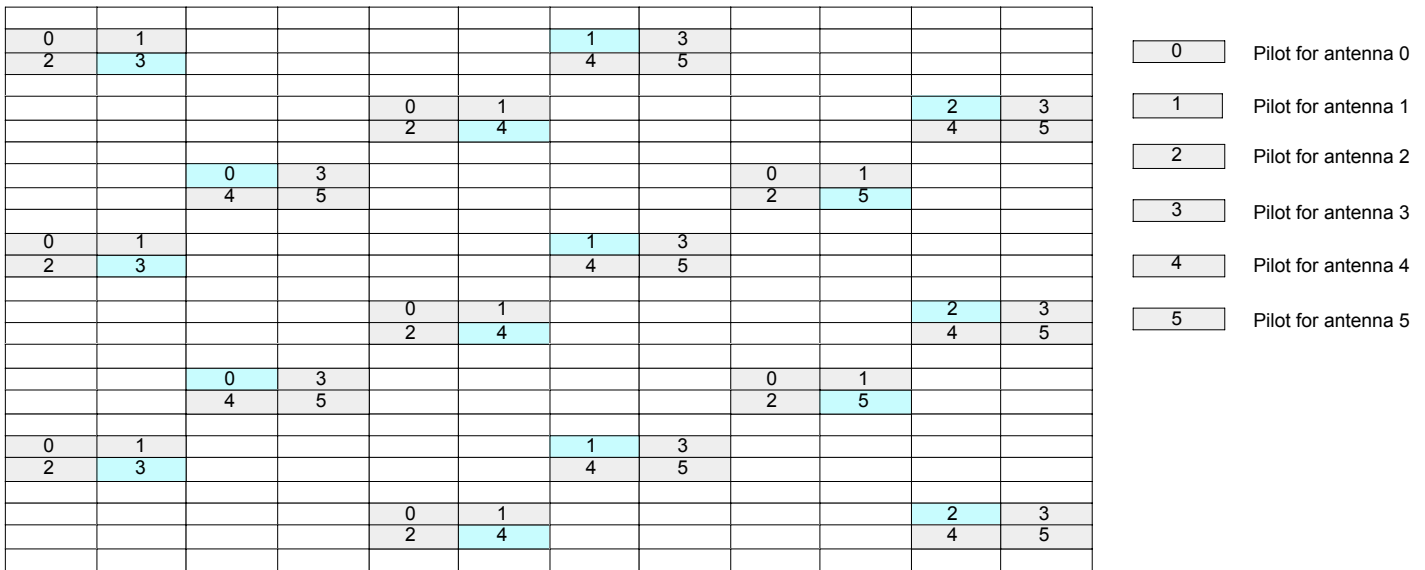


Figure 251e—Pilot allocation for 6-antenna BS for the optional FUSC and the optional AMC zones.

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

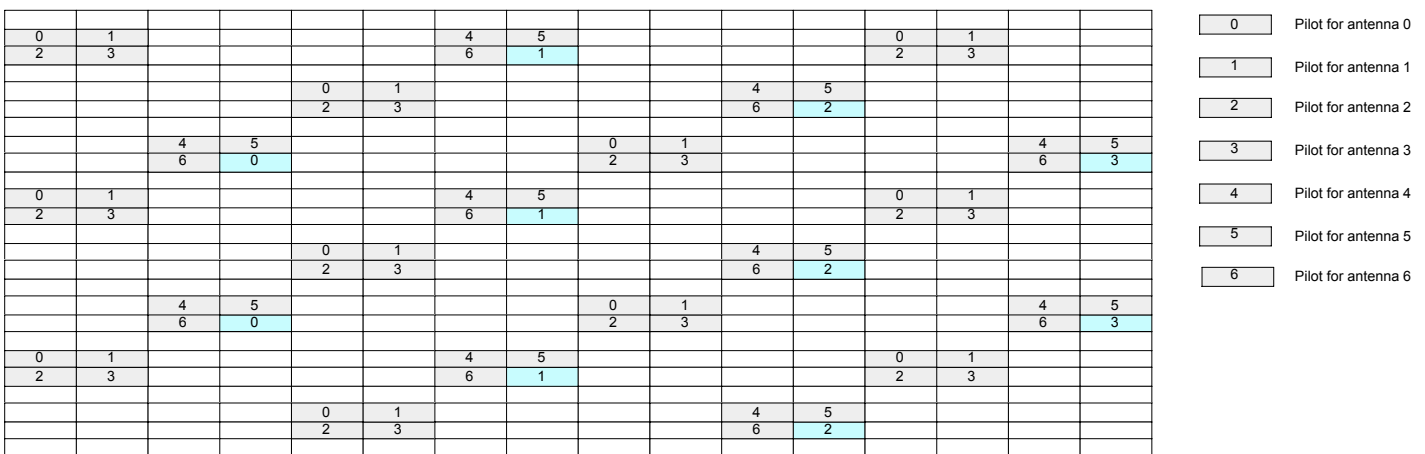
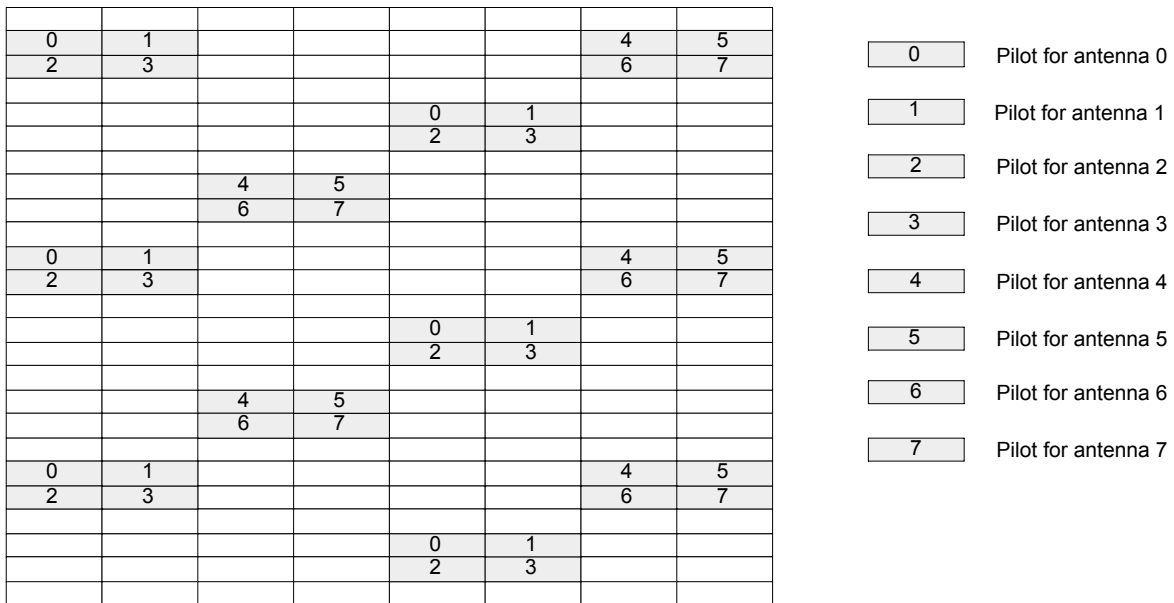


Figure 251f—Pilot allocation for 7-antenna BS for the optional FUSC and the optional AMC zones.

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