Modification of Open loop STC

Abstract
Modification of the open loop STC for 3, 4 Tx

Purpose
Adoption of proposed changes into P802.16e

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Modification of Open loop STC

1. Introduction
We propose a modification to the space-time codes for 3 and 4 transmit antennas in the OFDMA PHY.

2. Proposed Clarification to the Space-Time Codes
Since, there are space-time-frequency codes (over two OFDMA symbols and two sub-carriers) in [1], we propose a modification of the 3 Tx antenna STC for rate 1 and 2, i.e., Matrix A, Matrix B, should be changed to:

\[ k = \text{mod} \left( \text{floor} \left( \frac{(\text{logical} \_ \text{data}_{-}\text{sub} - \text{carrier} \_\text{number} \_\text{for}\_\text{first} \_\text{tone} \_\text{of} \_\text{code} - 1)}{2} \right) \right) + 1 \]

In addition, the above equation can be applied to the 4Tx antenna rate 1 (Matrix A).

where, \( \text{logical} \_\text{data}_{-}\text{sub} - \text{carrier} \_\text{number} \_\text{for}\_\text{first} \_\text{tone} \_\text{of} \_\text{code} = 1, 2, 3, \ldots, \) total number of data subcarriers.

Fig 1. An example of the choice of subscript \( k \) to determine the Matrix A.
For 4Tx rate 2 case, since there are 6 different B Matrices, therefore, expression for \( k \) is changed to

\[
k = \text{mod}(\text{floor}((\text{logical_data_sub-carrier_number_for_first_tone_of_code}-1)/2),6)+1.
\]

3. Specific Text Changes

[Modify the section 8.4.8.3.4(line 17, page 416 of [1]) as follows]

8.4.8.3.4 Transmission schemes for 3 antenna BS

In optional FUSC zones, the index \( k \), of permuted version of Matrix A and B to use for a particular deployment is given by:

\[
k = \text{mod}(\text{floor}((\text{logical_data_sub-carrier_number_for_first_tone_of_code}-1)/2),3)+1, \quad k = \text{mod}((\text{logical_data_sub-carrier_number_for_first_tone_of_code}-1)/2,3) + 1\]

where logical_data_sub-carrier_number_for_first_tone_of_code=1,2,3,…, Total # of data sub-carriers.

End text proposal

[Modify the section 8.4.8.3.5(line 58, page 418 of [1]) as follows]

8.4.8.3.5 Transmission schemes for 4-antenna BS

The choice of subscript \( k \) to determine the matrix \( A_k \) is given by the following formula:

\[
k = \text{mod}(\text{logical_data_sub-carrier_number_for_first_tone_of_code},3) + 1, \quad k = \text{mod}(\text{floor}((\text{logical_data_sub-carrier_number_for_first_tone_of_code}-1)/2),3) + 1
\]

where logical_data_sub-carrier_number_for_first_tone_of_code=1,2,3,…, total # of data sub-carriers.

Note: The following subsection is a part of contribution 05/009r1 (comment # 1534), which was accepted in Sanya meeting, Jan 2005. However, it did not appear in the latest D6 version of 802.16e spec.

The proposed Space-Time-Frequency code (over two OFDMA symbols and two sub-carriers) for 4Tx-Rate 2 configuration is given in six permuted versions:

\[
B_1 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_2 & S_1^* & S_6 & S_5^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix}, \quad B_2 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_2 & S_1^* & S_6 & S_5^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix}, \quad B_3 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_2 & S_1^* & S_6 & S_5^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix},
\]

\[
B_4 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix}, \quad B_5 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix}, \quad B_6 = \begin{bmatrix}
S_1 - S_2^* & S_5 - S_6^* \\
S_3 - S_4^* & S_7 - S_8^* \\
S_4 & S_3^* & S_8 & S_7^*
\end{bmatrix}
\]
The choice of subscript $k$ to determine the matrix $B_k$ is given by the following formula: $k = \text{mod} (\text{floor} (\text{logical_data_sub_carrier_number_for_first_tone_of_code} - 1/2), 6) + 1$, where logical_data_sub_carrier_number_for_first_tone_of_code = 1, 2, 3, ..., Total # of data sub-carriers.

Note: End of excerpt from accepted 05/009, Comment # 1534

References: