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Re:	
Abstract	
Purpose	Adoption of proposed changes into P802.16e ~~Crossed-out indicates deleted text,~~ underlined blue indicates new text change to the Standard
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Clarification on Transmitter Structure for MIMO Precoding

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1 Introduction

The combination of space-time code (STC) and transmit beamforming (MIMO precoding) is commonly desired by the harmonization group for closed-loop MIMO. This means a beamforming matrix is applied to the output of STC matrix. There are three numbers involved in this process, namely, N_d the number of streams input to the STC matrix, N_s the number of output streams at the output of STC matrix, and N_t the number of base station transmit antennas. In the current D5a standard, the combination of STC and MIMO precoding is allowed. However, a strong limitation exists. Following the D5a standard, the BS first determines the options STC matrixes by the number of base station antennas. Once the matrix (i.e., one of Matrix A, B, and C) is selected, the rate number associated with the selected matrix determines the number data streams input to the STC matrix. The major limitation is that the number of input to the beamforming matrix is always equal to the number of transmit antennas, because the number of STC output streams is determined by the number of antennas. This sets a limitation. For example, for a 4x2 downlink with 4 BS antennas and 2 SS antennas, we can't only send signals over the two strongest spatial channels because the input to the beamforming matrix is always four while we need it to be two. For another example, we can't send three data stream with 4 BS antennas since there is no rate 3 STC matrix for 4 BS antenna case.

The simple solution to these problems is to allow the number of STC output not equal to the number of transmit antennas. A MIMO structure for the combination of STC and MIMO precoding is proposed to add in section 8.4.8.3.6. Corresponding to the open loop structures for STC Matrix C in figure 251c and 251d, page 336, 16e D5a, a modulation coding scheme (MCS) table is proposed to enable bit loading for closed-loop MIMO (or MIMO precoding). Since the number of entries in the table for up to 4 data streams is less than 64, the MCS can be uniquely specified by a 6 bit index. This enables the feeback of MIMO MCS using 6 bit CQICH, which is supported by contribution 552r3.

2 Specific Text Changes

Added at the end (i.e., line 27) in section 8.4.8.3.6 on page 344 of [1] as follows

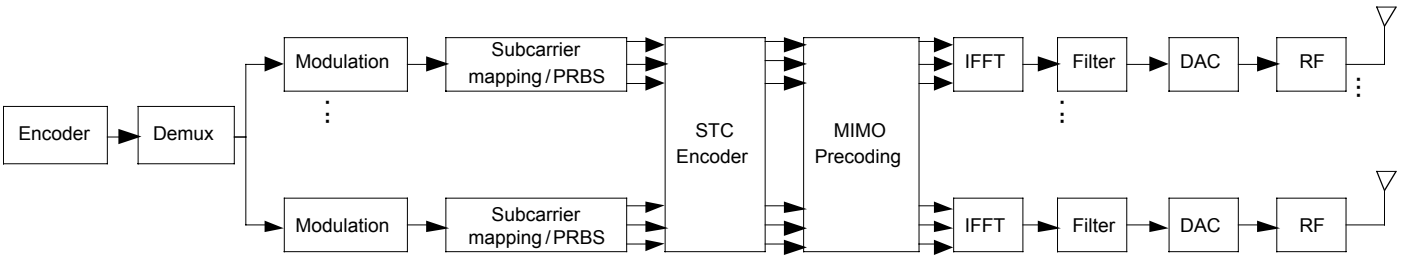

Figure 251h Illustration of Matrix C with vertically encoding for optional zones in DL.

In Figure 251h, the STC encoder can employ any matrixes defined in sections 8.4.8.3.3, 8.4.8.3.4, and 8.4.8.3.5 whose number of output (i.e. rows) is equal or less than the number of the BS antennas. The demux assigns bits to multiple data streams according to the modulation employed by the stream.
The MCSs at the input of the STC encoder with Matrix C are specified in Table 315.

Table 115 Modulation coding schemes for STC encoder with Matrix C for MIMO precoding.

ID#	Stream Count	Code Rate	Stream ID vs. Modulation			
			stream 1	stream 2	Stream 3	stream 4
1	1	1/2	QPSK			
2	1	3/4	QPSK			
3	1	1/2	16QAM			
4	1	3/4	16QAM			
5	1	1/2	64QAM			
6	1	2/3	64QAM			
7	1	3/4	64QAM			
8	2	1/2	QPSK	QPSK		
9	2	3/4	QPSK	QPSK		
10	2	1/2	16QAM	16QAM		
11	2	3/4	16QAM	16QAM		
12	2	1/2	64QAM	64QAM		
13	2	2/3	64QAM	64QAM		
14	2	3/4	64QAM	64QAM		
15	3	1/2	QPSK	QPSK	QPSK	
16	3	3/4	QPSK	QPSK	QPSK	
17	3	1/2	16QAM	16QAM	16QAM	
18	3	3/4	16QAM	16QAM	16QAM	
19	3	1/2	64QAM	64QAM	64QAM	
20	3	2/3	64QAM	64QAM	64QAM	
21	3	3/4	64QAM	64QAM	64QAM	
22	4	1/2	QPSK	QPSK	QPSK	QPSK
23	4	3/4	QPSK	QPSK	QPSK	QPSK
24	4	1/2	16QAM	16QAM	16QAM	16QAM
25	4	3/4	16QAM	16QAM	16QAM	16QAM
26	4	1/2	64QAM	64QAM	64QAM	64QAM
27	4	2/3	64QAM	64QAM	64QAM	64QAM
28	4	3/4	64QAM	64QAM	64QAM	64QAM
29	2	1/2	16QAM	QPSK		
30	2	3/4	16QAM	QPSK		
31	2	3/4	64QAM	QPSK		
32	2	3/4	64QAM	16QAM		
33	3	1/2	16QAM	16QAM	QPSK	
34	3	3/4	64QAM	16QAM	16QAM	
35	3	3/4	64QAM	64QAM	16QAM	
36	4	1/2	16QAM	16QAM	QPSK	QPSK
37	4	1/2	16QAM	16QAM	16QAM	QPSK
38	4	3/4	64QAM	64QAM	16QAM	QPSK

References:

[1] IEEE P802.16e/D5a 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] Q. Li, *et al*., "Per-Stream Bit Loading for MIMO Precoding," IEEE C80616e-04/529r5, 2004.