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Title	Clarifications for MIMO data mapping in PUSC
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Abstract	Clarifies ambiguities in the data mapping for MIMO in PUSC for 2 TX antennas (matrix A,B)
Purpose	Adopt changes
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Clarifications for MIMO data mapping

Yuval Lomnitz

1. Motivation

The mapping of data to subcarriers in MIMO modes is not clear in the standard, especially for PUSC and FUSC. Two main things are not clear:

1. The meaning of the matrices (what $s_{0,}s_1$ appearing in the matrix format mean, or where in the encoded data stream they come from)
2. How data subcarriers are mapped to physical slots

We focus on the PUSC permutation, 2 transmit antennas and matrix A,B, and propose a solution based on the concepts of 802.16d.

2. Text changes

8.4.3 OFDMA basic terms definition

[Add a new subsections at the end of the section 8.4.8.1.2.1]

8.4.8.1.2.1.3 STC data mapping

In the STC zone, for spatial multiplexing, the mapping of modulated data after channel encoding to MIMO streams depends on the type of encoding (horizontal or vertical encoding).

For vertical encoding (num_layer=1), the number of data slots used by the FEC encoder equals R times the number of physical slots allocated in the map, where R is the space time coding rate and equals the number of streams in case of spatial multiplexing. Denote the number of allocated physical slots by D (duration). The D·R data slots shall be encoded, including splitting the data into FEC blocks according to the concatenation rule, randomization, encoding, interleaving, and repetition, as specified in 8.4.9, and shall be mapped to QAM symbols. Then, the resulting QAM symbols shall be mapped in stream-first order into R streams as described in 8.4.8.

For example, if the rate is R=2, and no precoding is used, then the 48 QAM symbols of the first data slot are mapped to the first 24 subcarriers of the first physical slot (in antenna first order, so that the even QAM symbols are mapped to antenna 0 and the odd QAM symbols to antenna 1), the next 48 symbols are mapped to subcarriers 25..47 of the first physical slot. The mapping continues to the second physical slot, and so on.

For horizontal encoding with rate T, (num_layer=T), the number of data slots used by the FEC encoder equals the number of physical slots allocated in the map, and T different bursts are encoded. Each burst is allocated to a stream.

8.4.4.2 PMP frame structure

[Add the following text at the end of the section]

The number of symbols in an STC zone (not including the midamble) shall divide by the number of symbols in any MIMO matrix used in the zone. In addition, the STC zone shall include at least one full period of the pilot pattern defined for the relevant permutation and the number of antennas.

8.4.8.1 STC using two antennas

[at the end of section8.4.8.1.2.1.1]

The following tables shows an STC data mapping example for the DL PUSC using vertical encoding as the result of mapping of QAM symbols (see 8.4.3.5) followed by MIMO encoding. Each row is subcarrier-in-subchannel, and each column is a symbol. s0..s47 denote first slot out of the FEC, s48..s95 denote second slot. The figure is in logical subcarriers (subcarrier in subchannel) over symbols (before DL PUSC permutation).

STTD (Matrix A), 2 antennas

	Antenna 0		Antenna 1	
	Even symbol	Odd symbol	Even symbol	Odd symbol
Sub carrier 0	s0	$-s24^*$	s24	$s0^*$
Sub carrier 1	s1	$-s25^*$	s25	$s1^*$
.	s2	$-s26^*$	s26	$s2^*$
.	s3	$-s27^*$	s27	$s3^*$
.	s4	$-s28^*$	s28	$s4^*$
.	s5	$-s29^*$	s29	$s5^*$
	s6	$-s30^*$	s30	$s6^*$
	s7	$-s31^*$	s31	$s7^*$
	s8	$-s32^*$	s32	$s8^*$
	s9	$-s33^*$	s33	$s9^*$
	s10	$-s34^*$	s34	$s10^*$
	s11	$-s35^*$	s35	$s11^*$
	s12	$-s36^*$	s36	$s12^*$
	s13	$-s37^*$	s37	$s13^*$
	s14	$-s38^*$	s38	$s14^*$
	s15	$-s39^*$	s39	$s15^*$
	s16	$-s40^*$	s40	$s16^*$
	s17	$-s41^*$	s41	$s17^*$
.	s18	$-s42^*$	s42	$s18^*$
.	s19	$-s43^*$	s43	$s19^*$
.	s20	$-s44^*$	s44	$s20^*$
.	s21	$-s45^*$	s45	$s21^*$
Subcarrier 22	s22	$-s46^*$	s46	$s22^*$
Subcarrier 23	s23	$-s47^*$	s47	$s23^*$

SM (Matrix B), 2 antennas

	Antenna 0		Antenna 1	
	Even symbol	Odd symbol	Even symbol	Odd symbol
Sub carrier 0	s0	s48	s1	s49
Sub carrier 1	s2	s50	s3	s51
.	s4	s52	s5	s53
.	s6	s54	s7	s55
.	s8	s56	s9	s57
.	s10	s58	s11	s59
	s12	s60	s13	s61
	s14	s62	s15	s63
	s16	s64	s17	s65
	s18	s66	s19	s67
	s20	s68	s21	s69
	s22	s70	s23	s71
	s24	s72	s25	s73
	s26	s74	s27	s75
	s28	s76	s29	s77
	s30	s78	s31	s79
	s32	s80	s33	s81
	s34	s82	s35	s83
.	s36	s84	s37	s85
.	s38	s86	s39	s87
.	s40	s88	s41	s89
.	s42	s90	s43	s91
Subcarrier 22	s44	s92	s45	s93
Subcarrier 23	s46	s94	s47	s95