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Re:	Call for comments, maintenance task group	
Abstract		
Purpose		
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Corrections to definitions of Downlink MIMO in OFDMA PHY

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1 Problem Statement

Several ambiguities exist in the definitions of downlink MIMO in 802.16REVd/D5, specifically:

1. Since not all different combinations of MIMO DL IE parameters are allowed, a table of the allowed combinations should be added. Otherwise there is no basis to discuss the SS requirements and the capability bits.
2. MIMO_DL_Basic_IE() and MIMO_DL_Enhanced_IE() both describe DL allocations. This is similar in concept to the regular DL-MAP_IE. The first paragraph in the section is therefore not correct as it refers to a subsequent allocation and mentions ongoing relevance until the end of the frame.
3. The number of bits used in the MIMO DL IEs for 'No. of subchannels', 'Subchannel offset', etc., is not correct and does not support AMC 1x6 and 2x3 subchannels.
4. 'Boosting' is a burst-specific field, and as such should be specified per each burst in the MIMO DL IEs.
5. Padding and alignment bits are missing from the two MIMO DL IEs.
6. Definition of downlink MIMO capability negotiation is missing.

2 Detailed Text Changes

1. Section 8.4.5.3.8:

[Modify text from page 528 line 49 to page 529 line 3 as follows]

----- BEGIN -----

In the DL-MAP, a MIMO-enabled BS may transmit DIUC=15 with the MIMO_DL_Basic_IE() to ~~indicate the MIMO configuration of the subsequent downlink allocation to a specific MIMO-enabled SS CID~~ describe downlink allocations assigned to MIMO-enabled SSS. The MIMO mode indicated in the MIMO_DL_Basic_IE() shall only apply to the ~~subsequent downlink~~ allocations described in the IE until the end of frame. The allowed combinations of number of antennas, matrices, number of encoded streams, and CIDs are listed in Table XXX.

----- END -----

[Modify table 281 as follows]

----- BEGIN -----

Syntax	Size	Notes
Extended DIUC	4 bits	MIMO = 0x05
Length	4 bits	Length of the message in bytes (variable)
Num_Region	4 bits	
for (i = 0; i < Num_Region; i++) {		
OFDMA Symbol offset	8 10 bits	
If (Permutation = 0b11 and (AMC type is 2x3 or 1x6)) {		
Subchannel offset	8 bits	
Boosting	3 bits	
No. OFDMA triple symbol	5 bits	
No. subchannels	6 bits	
Else {		
Subchannel offset	6 5 bits	
Boosting	3 bits	
No. OFDMA Symbols	7 9 bits	
No. subchannels	6 5 bits	
}		
Matrix_indicator	2 bits	STC matrix (see 8.4.8. 1.4) STCTransmit_diversity = STCTransmit_diversity -mode indicated in the latest STC TD_Zone_IE(). if (STCTransmit_diversity == 0b01) { 00 = Matrix A 01 = Matrix B 10 - 11 = Reserved } elseif (STC Transmit_diversity == 0b10) { 00 = Matrix A 01 = Matrix B 10 = Matrix C 11 = Reserved }
Num_Streams	2 bits	
Reserved	1 bit	Shall be set to zero

for (j= 0; j< Num_Streams; j ++){		
if (INC_CID == 1) {		
CID	16 bits	
}		
DIUC	4 bits	
}		
<u>If (! Byte boundary) {</u>		
Padding	4 bit	<u>Shall be set to zero</u>
<u>}</u>		
}		

[Add the following text before the end of section 8.4.5.3.8]

----- BEGIN -----

The following table defines the modes of operation specified by MIMO DL Basic IE() and MIMO DL Enhanced IE(). For each it details: the number of antennas (as indicated by the latest TD_ZONE IE()), the type of matrix, the number of encoded streams, the number of different CIDs stated in the Num_Streams “for” loop; the implicit type and rate of coding. The cases of either broadcast CID or (INC_CID == 0), correspond to “Single CID” rows, but should be decoded by all SSs on a best effort basis. An SS that does not support decoding of multiple overlapping bursts shall attempt to decode the first burst relevant to it, according to the stream ordering.

Table XXX – DL MIMO operation modes

<u>Number of Transmit Antennas</u>	<u>Matrix indicator</u>	<u>Num Streams</u>	<u>Number of different SSs</u>	<u>Encoding Type</u>	<u>Rate</u>	<u>Mapping of Stream to matrix entries</u>	<u>Remark</u>
<u>2</u>	<u>A</u>	<u>1</u>	<u>1</u>	<u>Alamouti</u>	<u>1</u>	<u>Stream #0: S1, S2</u>	
<u>2</u>	<u>B</u>	<u>1</u>	<u>1</u>	<u>Vertical encoding</u>	<u>2</u>	<u>Stream #0: S1, S2</u>	
<u>2</u>	<u>B</u>	<u>2</u>	<u>1</u>	<u>Horizontal encoding for a single SS</u>	<u>2</u>	<u>Stream #0: S1 Stream #1: S2</u>	<u>Two overlapping bursts</u>
<u>2</u>	<u>B</u>	<u>2</u>	<u>2</u>	<u>Horizontal encoding for two different SSs</u>	<u>2</u>	<u>Stream #0: S1, S2 Stream #1: S3, S4</u>	<u>Two overlapping bursts</u>
<u>4</u>	<u>A</u>	<u>1</u>	<u>1</u>	<u>Alamouti</u>	<u>1</u>	<u>Stream #0: S1, S2, S3, S4</u>	
<u>4</u>	<u>B</u>	<u>1</u>	<u>1</u>	<u>Vertical encoding</u>	<u>2</u>	<u>Stream #0: S1, S2, S3, S4</u>	
<u>4</u>	<u>B</u>	<u>2</u>	<u>1</u>	<u>Horizontal encoding for a single SS</u>	<u>2</u>	<u>Stream #0: S1, S2, S5, S7 Stream #1: S3, S4, S6, S8</u>	<u>Two overlapping bursts</u>
<u>4</u>	<u>B</u>	<u>2</u>	<u>2</u>	<u>Horizontal encoding for two different SSs</u>	<u>2</u>	<u>Stream #0: S1, S2, S5, S7 Stream #1: S3, S4, S6, S8</u>	<u>Two overlapping bursts</u>
<u>4</u>	<u>C</u>	<u>1</u>	<u>1</u>	<u>Vertical encoding</u>	<u>4</u>	<u>Stream #0: S1, S2, S3, S4</u>	
<u>4</u>	<u>C</u>	<u>4</u>	<u>1</u>	<u>Horizontal encoding for a</u>	<u>4</u>	<u>Stream #0: S1</u>	<u>Four</u>

				single_SS		Stream #1: S2 Stream #2: S3 Stream #3: S4	overlapping bursts
4	C	4	>1	Horizontal encoding for two or more different SSs	4	Stream #0: S1 Stream #1: S2 Stream #2: S3 Stream #3: S4	Four overlapping bursts

[Vertical encoding](#) – Indicates transmitting a single FEC encoded stream over multiple antennas. The number of encoded streams is always 1.

[Horizontal encoding](#) – Indicates transmitting multiple separately FEC encoded streams over multiple antennas. The number of encoded streams is more than 1.

[Rate](#) – The number of QAM symbols signaled per array channel use.

----- END -----

2. Section 8.4.5.3.9:

[Modify text on page 530 lines 15-20 as follows]

----- BEGIN -----

In the DL-MAP, a MIMO-enabled BS may transmit DIUC=15 with the MIMO_DL_Enhanced_IE() to ~~indicate the MIMO mode of the subsequent downlink allocation to a specific MIMO-enabled SS~~ [describe downlink allocations assigned to MIMO-enabled SSs, each](#) identified by the CQICH_ID previously assigned to ~~it~~ [the SS](#). The MIMO mode indicated in the MIMO_DL_Enhanced_IE() shall only apply to the ~~subsequent downlink allocations described in the IE until the end of frame~~. [The allowed combinations of number of antennas, matrices, number of encoded streams, and CID's are listed in Table XXX, section 8.4.5.3.8.](#)

----- END -----

[Modify table 282 as follows]

----- BEGIN -----

Syntax	Size	Notes
Extended DIUC	4 bits	EN_MIMO = 0x06
Length	4 bits	Length of the message in bytes (variable)
Num_Region	4 bits	
for (i = 0; i < Num_Region; i++) {		
OFDMA Symbol offset	8 4 bits	
If (Permutation = 0b11 and (AMC type is 2x3 or 1x6)) {		
Subchannel offset	8 bits	
Boosting	3 bits	
No. OFDMA triple symbol	5 bits	
No. subchannels	6 bits	
Else {		
Subchannel offset	6 5 bits	
Boosting	3 bits	
No. OFDMA Symbols	7 9 bits	
No. subchannels	6 5 bits	
}		
Matrix_indicator	2 bits	STC matrix (see 8.4.8. 1.4) STC Transmit_diversity = STC Transmit_diversity mode

		indicated in the latest STC Zone_IE(). if (STC Transmit_diversity == 0b01) { 00 = Matrix A 01 = Matrix B 10 – 11 = Reserved } elseif (STC Transmit_diversity == 0b10) { 00 = Matrix A 01 = Matrix B 10 = Matrix C 11 = Reserved }
Num_Streams	2 bits	
<u>Reserved</u>	<u>1 bit</u>	<u>Shall be set to zero</u>
For (j = 0; j < Num_Streams; j++) {		
if (INC_CID == 1) {		
CQICID	<i>variable</i>	Index to uniquely identify the CQICH resource assigned to the SS. The size of this field is dependent on system parameter defined in DCD.
}		
DIUC	4 bits	
}		
<u>If (! Byte boundary) {</u>		
Padding	<u>4 bit</u>	<u>Shall be set to zero</u>
<u>}</u>		
}		

----- END -----

3. Add section 11.8.3.7.6: define downlink MIMO capability negotiation.

[Add new section 11.8.3.7.6]

----- BEGIN -----

11.8.3.7.6 OFDMA SS Demodulator for MIMO support

This field indicates the different MIMO options supported by a WirelessMAN-OFDMA PHY SS in the downlink. This field is not used for other PHY specifications. A bit value of 0 indicates “not supported” while 1 indicates “supported.”

<u>Type</u>	<u>Length</u>	<u>Value</u>	<u>Scope</u>
<u>155</u>	<u>2</u>	<u>Bit #0: 2-antenna STC matrix A.</u> <u>Bit #1: 2-antenna STC matrix B, vertical coding</u> <u>Bit #2: 2-antenna STC matrix B, horizontal coding</u> <u>Bit #3: 4-antenna STC matrix A</u> <u>Bit #4: 4-antenna STC matrix B vertical coding</u> <u>Bit #5: 4-antenna STC matrix B, horizontal coding</u>	<u>SBC-REQ (see 6.3.2.3.23)</u> <u>SBC-RSP (see 6.3.2.3.24)</u>

		<u>Bit #6: 4-antenna STC matrix C, vertical coding</u> <u>Bit #7: 4-antenna STC matrix C, horizontal coding</u> <i>Bit #8-16: reserved</i>	
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----- END -----