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Source(s)	Ran Yaniv, Tal Kaitz, Naftali Chayat, Vladimir Yanover, Danny Stopler **Alvarion Ltd.**

danny.stopler@alvarion.com
ran.yaniv@alvarion.com
tal.kaitz@alvarion.com

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

Ran Yaniv, Tal Kaitz, Naftali Chayat, Vladimir Yanover, Danny Stopler
Alvarion Ltd.

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 layers, 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	
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.)
		Transmit_diversity = transmit diversity mode indicated in the latest TD_Zone_IE().
		if (Transmit_Diversity == 0b01)
		{
		00 = Matrix A
		01 = Matrix B
		10 – 11 = Reserved
		}
		elseif (Transmit_Diversity == 0b10)
		{
		00 = Matrix A
		01 = Matrix B
		10 = Matrix C
		11 = Reserved
		}

Num_layer	2 bits	
Reserved	1 bit	Shall be set to zero
for (Layer_Index = 0; Layer_Index < Num_layer; Layer_Index ++) {		
if (INC_CID == 1) {		
CID	16 bits	

}		
~~**Layer_index**~~	~~2 bits~~	
DIUC	4 bits	
Boosting	3 bits	000: normal (not boosted); 001: +6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
Reserved	1 bit	Shall be set to zero
}		
If (! Byte boundary) {		
Padding	4 bit	Shall be set to zero
}		
}		

[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 layers, the number of different CIDs stated in the Num_layer "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 users 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 layer ordering.

Table XXX – DL MIMO operation modes

Number of Antennas	Matrix indicator	Num_Layer	Number of different CIDs	Coding Type	Rate	Remark
2	A	1	1	Alamouti	1	
2	B	1	1	Vertical coding	2	
2	B	2	1	Horizontal coding for a single user	2	Two overlapping bursts
2	B	2	2	Horizontal coding for two different users	2	Two overlapping bursts
4	A	1	1	Alamouti	1	
4	B	1	1	Vertical coding	2	
4	C	1	1	Vertical coding	4	
4	C	4	1	Horizontal coding for a single user	4	Four overlapping bursts
4	C	4	> 1	Horizontal coding for two or more different users	4	Four overlappingbursts

Vertical coding – Indicates transmitting the coded stream of a single burst over multiple antennas.
Horizontal coding – Indicates transmitting a separate burst per antenna.
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 layers, 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 ~~10~~ bits	
If (Permutation = 0b11 and (AMC type is 2x3 or 1x6)) {		
Subchannel offset	8 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.)
		Transmit_diversity = transmit diversity mode indicated in the latest TD_Zone_IE().
		if (Transmit_Diversity == 0b01)
		{
		00 = Matrix A
		01 = Matrix B
		10 – 11 = Reserved
		}
		elseif (Transmit_Diversity == 0b10)
		{
		00 = Matrix A
		01 = Matrix B
		10 = Matrix C
		11 = Reserved
		}

Num_layer	2 bits	
Reserved	1 bit	Shall be set to zero
For (~~j~~ Layer_Index = 0; ~~j~~ Layer_Index < Num_layer; ~~j~~ Layer_Index ++) {		
if (INC_CID == 1) {		
CQICID	*variable*	Index to uniquely identify the CQICH resource assigned to the SS. The size of this field is dependent on system parameter defined in DCD.
}		
~~**Layer_index**~~	~~2 bits~~	
DIUC	4 bits	
Boosting	3 bits	000: normal (not boosted); 001: +6dB; 010: -

		6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
Reserved	1 bit	Shall be set to zero
}		
If (! Byte boundary) {		
Padding	4 bit	Shall be set to zero
}		
}		

-------- 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 MIMO downlink 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."

Type	Length	Value	Scope
155	2	Bit #0: 2-antenna STC matrix A. Bit #1: 2-antenna STC matrix B, vertical coding Bit #2: 2-antenna STC matrix B, horizontal coding with both bursts for the same user. Bit #3: 2-antenna STC matrix B, horizontal coding with each burst for a different user. Bit #4: 4-antenna STC matrix A Bit #5: 4-antenna STC matrix B Bit #6: 4-antenna STC matrix C, vertical coding Bit #7: 4-antenna STC matrix C, horizontal coding with all bursts for the same user. Bit #8: 4-antenna STC matrix C, horizontal coding with bursts for more than one user. Bit #9-15: *reserved*	SBC-REQ (see 6.3.2.3.23) SBC-RSP (see 6.3.2.3.24)

The combinations of horizontal decoding for single user and horizontal decoding of multiple users imply that an SS may accept a multiple layer transmission with more than one overlayed burst intended for him, but some overlaid bursts for other SS. E.g. if bits 7 and 8 are set to 1, the SS may handle a 4 layer transmission with two layers intended for him and two others for another SS.

-------- END --------