Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Mini-subchannel support for OFDMA PHY mode**
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Re:	Sponsor re-circulation Ballot
Abstract	Reintroduce the concept of UL mini-suchannels, to provide UL margin enhancement
Purpose	Adoption of proposed enhancement into P802.16-REVd/D4-2004
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Mini-subchannel support for OFDMA mode in IEEE 802.16d

1 Motivation and explanation of changes

The motivation of reintroducing the mini-subchannel concept it the ability to get a UL margin boost of up to almost 8dB per SS by further narrowing down the number of subcarriers that a SS uses for an UL transmission. This enhancement is particularly beneficial to narrow band SS supporting voice services.

2 Proposed changes

Add the text below as a new section:

8.4.6.2.4 Partition a subchannel to mini-subchannels

An uplink subchannel is composed of six tiles. Mini-subchannels are created by concatenating multiples of two, three or six subchannels, and allocating traffic for more than one SS on this concatenation by a subdivision of the tiles. Table aaa show the three possibilities for subchannel partitioning into mini-subchannel. The tile indices are those referred to in equation (101) for the mandatory uplink permutation, or in equation (103) for the optional uplink permutation.

Ctype	Number of concatenated subchannels	Number of mini-subchannels	Mini-subchannel index	Tile allocation as a function subchannel index in the concatenation					
				0	1	2	3	4	5
00	2	2	0	0,1,2	3,4,5				
			1	3,4,5	0,1,2				
01	2	2	0	0,2,4	0,2,4				
			1	1,3,5	1,3,5				
10	3	3	0	0,1	2,3	4,5			
			1	4,5	0,1	2,3			
			2	2,3	4,5	0,1			
11	6	6	0	0	1	2	3	4	5
			1	5	0	1	2	3	4
			2	4	5	0	1	2	3
			3	3	4	5	0	1	2
			4	2	3	4	5	0	1
			5	1	2	3	4	5	0

Table aaa: subchannel partitioning into mini-subchannels

For example, when partitioning to 3 mini-subchannels, an allocation of n x 3 subchannels is required, where n is an integer. Each group of 3 subchannels in this allocation is partitioned such that the tiles indexed 0,1 on the first subchannel, the tiles indexed 2,3 on the second subcahnnel and the tiles indexed 4,5 on the third subchannel belong to the mini-subchannel whose index is 0. The tiles indexed 4,5 on the first subchannel, the tiles indexed 0,1 on the second subcahnnel and the tiles indexed 2,3 on the third subchannel belong to the mini-subchannel whose index is 1, etc.

The mini-subchannels are mapped by the UL map like normal subchannels, only the mapping is done by the mini-subchannel allocation IE (see 8.4.5.4.9).

Add the text below as a new section:

8.4.5.4.9 Mini-subchannel allocation IE

The mini-subchannel allocation IE is used for subdividing subchannels into mini-subchannels. This IE uses the extended UIUC = 15 with the subcode 0x01 with the structure shown in Table bbb. The CID in the UL-MAP when using the mini-subchannel allocation IE shall be set to the broadcast CID.

Syntax	Size	Notes
Mini-subchannel allocation IE {		
Extended UIUC	4 bits	Mini-subchannel allocation = 0x01
Length	4 bits	Length(M) = 0x03 if M==2 0x04 if M==3 0x06 if M==6
CType	2 bits	00 – 2 mini-subchannels (defines M=2) 01 – 2 mini-subchannels (defines M=2) 10 – 3 mini-subchannels (defines M=3) 11 – 6 mini-subchannels (defines M=6)
Duration	10 bits	In OFDMA slots
For (j=0; j<M; j++) {		
CID(j)		
UIUC(j)	4 bits	Allowed values are 1-10
Repetition(j)	2 bits	Indicates the repetition code used inside the allocated burst for mini-subchannel with index j 00 - No repetition coding 01 - Repetition coding of 2 used 10 - Repetition coding of 4 used 11 - Repetition coding of 6 used
}		
Padding	n bits	Padding bits shall be set to 0 n = 0 if M==2 2 if M==3 0 if M==6
}		

Ctype
Defines M, the number of mini-subchannels allocated by this IE

Duration
Defines the allocation duration in OFDMA slots. Should be an integer multiple of M.

CID(j)
CID to use for mini-subchannel with index j

UIUC(j)
UIUC to use for mini-subchannel with index j. Allowed values are 1-10

Repetition(j)
Indicates the repetition code used inside the allocated burst for mini-subchannel with index j