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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>** |
| Title | **Corrections in OFDMA Subcarrier Allocations** |
| Date Submitted | **2004-11-04** |
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| Re: | IEEE P802.16e/D5-2004 |
| Abstract | Editorial Correction in OFDMA Subcarrier Allocations |
| Purpose | Adopting of proposed method into P802.16e |
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# Corrections in OFDMA Subcarrier Allocations

# 1. Introduction

Some of the comments and the contributions accepted in the previous IEEE meeting are not reflected correctly in P802.16e/D5 standard.

In this contribution, the non-reflected parts are proposed again for the purpose of clarification.

# 2. Suggested Text Changes

***(1) Replace text from page 217, line 43 to page 218, line 65 with the following text:***

---------- Start Text ----------

**8.4.6.1.2.3 Additional optional Symbol Structure for FUSC**

***[Add the following Tables to section 8.4.6.1.2.3:]***

**Table 310a—1024-FFT OFDMA downlink carrier allocations – Optional FUSC**

| Parameters | Value | Comments |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 80 | |
| Number of Guard Subcarriers, Right | 79 | |
| Number of Used Subcarriers($N_{used}$) (Including all possible allocated pilots and the DC subcarrier) | 865 | |
| Number of Pilot Subcarriers | 96 | |
| Pilot Subcarrier Index | 9k+3m+1 for k=0,1…95 and m=[symbol index] mod 3 | Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame. |
| Number of Data Subcarriers | 768 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 310b—512-FFT OFDMA downlink carrier allocations – Optional FUSC**

| Parameters | Value | Comments |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 40 | |
| Number of Guard Subcarriers, Right | 39 | |
| Number of Used Subcarriers($N_{used}$) (Including all possible allocated pilots and the DC subcarrier) | 433 | |
| Number of Pilot Subcarriers | 48 | |
| Pilot Subcarrier Index | 9k+3m+1 for k=0,1…47 and m=[symbol index] mod 3 | Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame. |
| Number of Data Subcarriers | 384 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 310c—128-FFT OFDMA FUSC downlink carrier allocations – Optional FUSC**

| Parameters | Value | Comments |
|---|---|---|

| | | |
|---|---|---|
| **Number of DC Subcarriers** | **1** | |
| **Number of Guard Subcarriers, Left** | **10** | |
| **Number of Guard Subcarriers, Right** | **9** | |
| **Number of Used Subcarriers($N_{used}$) (Including all possible allocated pilots and the DC subcarrier)** | **109** | |
| **Number of Pilot Subcarriers** | **12** | |
| **Pilot Subcarrier Index** | **9k+3m+1 for k=0,1…11 and m=[symbol index] mod 3** | **Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame.** |
| **Number of Data Subcarriers** | **96** | |
| **Number of Data Subcarriers per Subchannel** | **48** | |

#### 8.4.6.1.2.3.1 Downlink subchannels subcarrier allocation

***[Replace section 8.4.6.1.2.3.1 'Downlink subchannels subcarrier allocation' with the following text:]***

To allocate the subchannels, the whole data tones in a symbol are partitioned into groups of contiguous data subcarriers. Each subchannel consists of one subcarrier from each of these groups. The number of groups is therefore equal to number of data subcarriers per subchannel, and its value is 48. The number of the subcarriers in a group is equal to the number of subchannels, say Ns. As shown in Table 310e, Ns is determined by FFT size. The exact partitioning into subchannels is according to Equation (108a), called DL permutation formula.

$$Carrier(s,m) = \begin{cases} N_s \times k + [s + P_{1,c_1}(k') + P_{2,c_2}(k')], \ 0 < c_1, c_2 < N_s \\ N_s \times k + [s + P_{1,c_1}(k')], \ c_1 \neq 0, c_2 = 0 \\ N_s \times k + [s + P_{2,c_2}(k')], \ c_1 = 0, c_2 \neq 0 \\ N_s \times k + s, \ c_1 = 0, c_2 = 0 \end{cases} \quad (108a)$$

where

Carriers(s, m) = subcarrier index of m-th subcarrier in subchannel s

k=(m+s*23)mod 48, k'=k mod(Ns-1)

m = subcarrier-in-subchannel index from the set [0~47]

s = index number of a subchannel from the set [0~Ns-1]

$P_{1,c1}(j)$ = $j^{th}$ element of the sequence obtained by rotating basic permutation sequence $P_1$ cyclically to the left c1 times. See Table 310e.

$P_{2,c2}(j)$ = $j^{th}$ element of the sequence obtained by rotating basic permutation sequence $P_2$ cyclically to the left c2 times. See Table 310e.

$c_1 = ID_{cell} \bmod N_s$ , $c_2 = \lfloor ID_{cell} / N_s \rfloor$, $0 \le c_1, c_2 < N_s$

In Equation (108a), the operation in [ ] is done over GF(Ns). In GF($2^n$), addition is binary XOR operation.
For example, 13 + 4 in GF($2^n$) is [$(1101)_2$ XOR $(0100)_2$]= $(1001)_2$ = 9, where $(x)_2$ represents binary expansion of x.

**Table 310e—Basic permutation sequences for subcarrier allocations**

| FFT size | Ns | Basic permutation sequences | | |
|---|---|---|---|---|
| **128** | **2** | **GF(2)** | **$P_1$** | **1** |

| | | | | |
|---|---|---|---|---|
| | | | $P_2$ | 1 |
| 512 | 8 | GF(8) | $P_1$ | 1,2,4,3,6,7,5 |
| | | | $P_2$ | 1,4,6,5,2,3,7 |
| 1024 | 16 | GF(16) | $P_1$ | 1, 2, 4, 8, 3, 6, 12, 11, 5, 10, 7, 14, 15, 13, 9 |
| | | | $P_2$ | 1, 4, 3, 12, 5, 7, 15, 9, 2, 8, 6, 11, 10, 14, 13 |

---------- End Text ----------

*(2) Replace text from page 220, line 13 to page 225, line 28 with the following text:*

---------- Start Text ----------

### 8.4.6.2.5 Additional optional Symbol Structure for PUSC

*[ADD tables to section '8.4.6.2.5 Additional optional symbol structure for PUSC']*

**Table 313a—Optional 1024-FFT OFDMA uplink subcarrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 80 | |
| Number of Guard Subcarriers, Right | 79 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 865 | |
| Number of Subchannels | 48 | |
| Number of Tiles | 288 | |
| Number of Subcarriers per Tile | 3 | |
| Tiles per Subchannel | 6 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 313b—Optional 512-FFT OFDMA uplink subcarrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 40 | |
| Number of Guard Subcarriers, Right | 39 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 433 | |
| Number of Subchannels | 24 | |
| Number of Tiles | 144 | |
| Number of Subcarriers per Tile | 3 | |
| Tiles per Subchannel | 6 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 313c—Optional 128-FFT OFDMA uplink carrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 10 | |
| Number of Guard Subcarriers, Right | 9 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 109 | |
| Number of Subchannels | 6 | |
| Number of Tiles | 36 | |

| | | |
|---|---|---|
| **Number of Subcarriers per Tile** | **3** | |
| **Tiles per Subchannel** | **6** | |
| **Number of Data Subcarriers per Subchannel** | **48** | |

**8.4.6.2.5.2 Partitioning of subcarriers into subchannels in the uplink**

***[Change section "8.4.6.2.5.2 Partitioning of subcarriers into subchannels in the uplink" as follows:]***

To allocate the subchannels, $N_{used}$ subcarriers are partitioned into tiles which is 3x3 frequency-time block containing 9 tones(1 pilot tones and 8 data tones). The whole frequency band is partitioned into groups of contiguous tiles. Each subchannel consists of 6 tiles each of which is chosen from different groups. Let us denote the number of tiles in a group by Ns. Ns is different according to FFT size.

***[Remove formula 111 and the variable descriptions below it. Replace with the following:]***

There are 18 groups in the whole frequency band and the number of tiles in a group is Ns. In order to make a subchannel, 6 groups at equal distance (3 groups away from each) are chosen and each of 6 tiles is selected from each group.

The exact partitioning into subchannels is according to Equation (111a), called UL permutation formula.

$$Tile(s,m) = \begin{cases} 3N_s \cdot m + N_s \cdot S + \left\lfloor s' + P_{1,c_1}(m') + P_{2,c_2}(m') \right\rfloor, & 0 < c_1, c_2 < N_s \\ 3N_s \cdot m + N_s \cdot S + \left\lfloor s' + P_{1,c_1}(m') \right\rfloor, & c_1 \neq 0, c_2 = 0 \\ 3N_s \cdot m + N_s \cdot S + \left\lfloor s' + P_{2,c_2}(m') \right\rfloor, & c_1 = 0, c_2 \neq 0 \\ 3N_s \cdot m + N_s \cdot S + s', & c_1 = 0, c_2 = 0 \end{cases} \quad (111a)$$

where

*Tile(s, m)* = tile index of the *m*th tile in subchannel *s*.

$$S = \lfloor s / N_s \rfloor, \quad s' = s \cdot \mathrm{mod}(N_s)$$

m = tile-in-subchannel index from the set [0~5], *m*' = *m* mod(*Ns-1)*

s = index number of a subchannel from the set [0~3Ns-1]

$P_{1,c1}(j)$ = $j^{th}$ element of the sequence obtained by rotating basic permutation sequence $P_1$ cyclically to the left $c_1$ times. See Table 310e.

$P_{2,c2}(j)$ = $j^{th}$ element of the sequence obtained by rotating basic permutation sequence $P_2$ cyclically to the left $c_2$ times. See Table 310e.

$$c_1 = ID_{cell} \cdot \mathrm{mod}(N_s), \quad c_2 = \lfloor ID_{cell} / N_s \rfloor$$

In Equation (6), the operation in [ ] is over GF($2^n$). In GF($2^n$), addition is binary XOR operation. For example, 13 + 4 in GF($2^n$) is [$(1101)_2$ XOR $(0100)_2$]= $(1001)_2$ = 9, where $(x)_2$ represents binary expansion of x.

---------- End Text ----------

***(3) Replace text from page 232, line 26 to page 234, line 9 with the following text:***

---------- Start Text ----------

**8.4.6.3 Optional permutations for AAS and AMC subchannels**

***[Add the following Tables and text to "Section 8.4.6.3 Optional permutations for AAS and AMC subchannels"]***

**Table 314a—1024-FFT OFDMA AMC subcarrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 80 | |
| Number of Guard Subcarriers, Right | 79 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 865 | |
| Number of Pilot Subcarriers | 96 | |
| Pilot Subcarrier Index | 9k+3m+1 for k=0,1…95 and m=[symbol index] mod 3 | Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame. |
| Number of Data Subcarriers | 768 | |
| Number of Bands | 24 | |
| Number of Bins per Band | 4 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 314b—512-FFT OFDMA AMC subcarrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 40 | |
| Number of Guard Subcarriers, Right | 39 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 433 | |
| Number of Pilot Subcarriers | 48 | |
| Pilot Subcarrier Index | 9k+3m+1 for k=0,1…47 and m=[symbol index] mod 3 | Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame. |
| Number of Data Subcarriers | 384 | |
| Number of Bands | 12 | |
| Number of Bins per Band | 4 | |
| Number of Data Subcarriers per Subchannel | 48 | |

**Table 314c—128-FFT OFDMA AMC subcarrier allocations**

| Parameter | Value | Notes |
|---|---|---|
| Number of DC Subcarriers | 1 | |
| Number of Guard Subcarriers, Left | 10 | |
| Number of Guard Subcarriers, Right | 9 | |
| Number of Used Subcarriers ($N_{used}$) (including all possible allocated pilots and the DC sibcarrier) | 109 | |
| Number of Pilot Subcarriers | 12 | |
| Pilot Subcarrier Index | 9k+3m+1 for k=0,1…11 and m=[symbol index] mod 3 | Symbol of index 0 in pilot subcarrier index should be the first symbol of the frame. |
| Number of Data Subcarriers | 96 | |

| | | |
|---|---|---|
| **Number of Bands** | **3** | |
| **Number of Bins per Band** | **4** | |
| **Number of Data Subcarriers per Subchannel** | **48** | |

There are four types of AMC subchannels which are different in the collection of 6 bins in a band. In the first type(default type), the available bins in a band are enumerated by starting from the lowest bin in the first symbol to the last bin in the symbol and then going to the lowest bin in the next symbol and so on. A subchannel consists of 6 consecutive bins in this enumeration. The second type is 2 bins by 3 symbols, the third type is 3 bins by 2 symbols and the last type is 1 bin by 6 symbols. In the last three types, enumeration of bins in a subchannel is the same as in the first type. In all the types, the index of the subchannels in a band is increased along bins and then symbols.

---------- End Text ----------