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Title	Changes to subchannel group in DL PUSC zone to Support Scalable FFT in OFDMA PHY
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Re:	Response to IEEE 802.16-04/23 (Recirculation Ballot #14b Announcement)
Abstract	This document suggests changes in TGe Draft Document IEEE 802.16e-D3 to define subchannel group for different FFT size in OFDMA PHY. Subchannel group is defined in DL-Frame-Prefix and Data-Location-in-Another-BS-IE under the DL PUSC mode to specify the range of used subchannels.
Purpose	Adopt into the current TGe working draft
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# Changes to subchannel group in DL PUSC zone to Support Scalable FFT in OFDMA PHY

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## 1. Motivation

The OFDMA PHY enhancement defined in 802.16e-D3 employs scalable FFT to support a wide range of system bandwidth. The number of subchannels varies with different FFT sizes. The following table gives an example of the number of total subchannels for 2048/1024/512 FFT under DL PUSC mode.

FFT size	# of subchannels
2048	60
1024	30
512	15

As specified in 8.4.4.3 and 8.4.5.3.6 of TGD Draft Document IEEE 802.16d-D5, there are 6 bits each in DL-Frame-Prefix and Data-Location-in-Another-BS-IE to indicate which groups of subchannels are used in the PUSC zone. However the start index and end index of subchannel groups are only defined for 2048 FFT. This contribution will define the subchannel groups for 1024 and 512 FFT to support FFT scalability. The proposed changes are backward compatible with REVd PHY.

## 2. Specific Changes Suggested to TGe Draft Document IEEE P802.16e-D3

[Insert the following under 8.4.4 before 8.4.4.6 in the baseline document]

### 8.4.4.3 DL-FRAME-PREFIX

Apply the following changes to Tables 266 in section 8.4.3

**Table 266—OFDMA downlink Frame Prefix format**

Syntax	Size	Notes
DL_Frame_Prefix_Format() {		
<b>Used subchannel bitmap</b>	6 bits	Bit #0: <del>Subchannels 0-11 are used</del> Subchannel group 0 Bit #1: <del>Subchannels 12-19 are used</del> Subchannel group 1 Bit #2: <del>Subchannels 20-31 are used</del> Subchannel group 2 Bit #3: <del>Subchannels 32-39 are used</del> Subchannel group 3 Bit #4: <del>Subchannels 40-51 are used</del> Subchannel group 4 Bit #5: <del>Subchannels 52-59 are used</del> Subchannel group 5
<b>Ranging_Change_Indication</b>	1 bit	
<b>Repetition_Coding_Indication</b>	2 bits	00 - No repetition coding on DL-MAP 01 - Repetition coding of 2 used on DL-MAP 10 - Repetition coding of 4 used on DL-MAP 11 - Repetition coding of 6 used on DL-MAP
<b>Coding_Indication</b>	3 bits	0b000 - CC encoding used on DL-MAP 0b001 - BTC encoding used on DL-MAP 0b010 - CTC encoding used on DL-MAP 0b011 = ZT CC used on DL-MAP 0b100 to 0b111 -Reserved

<b>DL-Map_Length</b>	8 bits	
<b>reserved</b>	4 bits	Shall be set to zero
}		

Add the following table in section 8.4.3 after Table 266

**Table 266a – Subchannel index of the six subchannel groups**

FFT size	Subchannel group #	Subchannel Range
2048	0	0-11
	1	12-19
	2	20-31
	3	32-39
	4	40-51
	5	52-59
1024	0	0-5
	1	6-9
	2	10-15
	3	16-19
	4	20-25
	5	26-29
512	0	0-3
	1	4
	2	5-8
	3	9
	4	10-13
	5	14

[Insert the following under 8.4.4 before 8.4.4.6 in the baseline document]

#### **8.4.4.3 Allocation of subchannels for FCH, and logical subchannel numbering**

Replace the 1<sup>st</sup> paragraph under 8.4.4.4, line 41~44, with the following text

In PUSC, any segment used shall be allocated at least the same amount of subchannels in subchannel group #0. The first 4 slots in the downlink part of the segment contain the FCH as defined in 8.4.4.2. These slots contain 48 bits modulated by QPSK with coding rate 1/2 and repetition coding of 4. The basic allocated subchannel sets for Segments 0, 1, and 2 are Subchannel Group #0, #2, #4 respectively. Figure 220 depicts this structure.

[Insert the following after 8.4.5.3.4]

#### **8.4.5.3.6 Data location in another BS IE**

Apply the following changes to Tables 279 in section 8.4.5.3.6

**Table 279—OFDMA Data location in another BS IE**

Syntax	Size	Notes
Data_location_in_another_BS_IE() {		
<b>Extended DIUC</b>	4 bits	Data_location_in_another_BS = 0x3
<b>Length</b>	4 bits	Length = 0x0A
<b>reserved</b>	6 bits	Shall be set to zero
<b>Segment</b>	2 bits	Segment number
<b>Used subchannels</b>	6 bits	Bit #0: <b>Subchannels 0-11 are used</b> Subchannel group 0 Bit #1: <b>Subchannels 12-19 are used</b> Subchannel group 1 Bit #2: <b>Subchannels 20-31 are used</b> Subchannel group 2 Bit #3: <b>Subchannels 32-39 are used</b> Subchannel group 3 Bit #4: <b>Subchannels 40-51 are used</b> Subchannel group 4 Bit #5: <b>Subchannels 52-59 are used</b> Subchannel group 5
<b>IDcell</b>	5 bits	Cell ID of other BS

<b>Frame Advance</b>	3 bits	The number of frames offset from the current frame where the data will be transmitted (0 = Next frame)
<b>OFDMA Symbol offset</b>	8 bits	
<b>Subchannel offset</b>	6 bits	
<b>Boosting</b>	3 bits	000: normal (not boosted); 001: +6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
<b>No. OFDM Symbols</b>	8 bits	
<b>No. Subchannels</b>	6 bits	
<b>Repetition Coding Indication</b>	2 bits	00 - No repetition coding 01 - Repetition coding of 2 used 10 - Repetition coding of 4 used 11 - Repetition coding of 6 used
}		