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Title	A Method To Increase Number Of Extended DIUC/UIUC	
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Re:	IEEE P802.16e/D5a-2004	
Abstract	This contribution provides a method to expand the number of extended DIUC/UIUC. It also includes correction for the current extended DL/UL IEs.	
Purpose	Review and adopt suggested change into P802.16e/D5a-2004	
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A Method To Increase Number Of Extended DIUC/UIUC

Phil Barber et al

1. Problem Statement

In IEEE P802.16e-D5a-2004, there are several problems related to Extended DIUC/UIUC usage for the OFDMA PHY mode:

- All 16 Extended DIUCs codes have been used (counting Feedback Polling IE using 0x??). There are also more Extended DIUC IEs being defined in new contributions.
- The use of extended DL-MAPs is efficient for a number of uses and continued addition of extended DL-MAPs should not be curtailed simply because the current method suffers code constraints. Extension of the method to permit new contributions is warranted.
- Extended DIUC/UIUC usage needs to be clarified and corrected. There are a few Extended DL/UL IEs using the same DIUC/UIUC.

2. Proposed Solutions

This contribution proposes an expanded format to increase the number of types of Extended IE for OFDMA PHY mode. This new expanded format is defined for both DL MAP and UL MAP. The Extended DIUC 15 and Extended UIUC 15 are used to identify this new format. The expanded format contains an Expanded Type field immediately after Length field in Extended IE. This Expanded Type field is 6 bits long and is used to identify types of Extended IEs defined in 802.16e. All Extended IEs defined in 802.16d remain unchanged and are identified by Extended DIUC/UIUC (0x00... 0x0E). This contribution redefines all Extended IE defined in 802.16e with the new expanded format.

This contribution also adds allocation tables for Extended DIUC/Extended UIUC and Expanded Types. By adding these tables, duplicating usage can be avoided.

3. Specific Text Changes

[Append the following to the end of section 8.4.5.3.2:]

[Table 275a defines the encoding for Extended DIUC that shall be used by DL-MAP Extended IEs.](#)

Table 275a—Extended DIUC Allocation

<u>Extended DIUC</u>	<u>Usage</u>
<u>0x00</u>	<u>Channel Measurement</u>
<u>0x01</u>	<u>Space Time Code(STC)/Zone Switch</u>
<u>0x02</u>	<u>AAS</u>
<u>0x03</u>	<u>Data location in another BS</u>
<u>0x04</u>	<u>CID Switch</u>
<u>0x05</u>	<u>MIMO DL Basic</u>
<u>0x06</u>	<u>MIMO DL Enhanced</u>
<u>0x07</u>	<u>H_ARQ Map Pointer</u>
<u>0x08</u>	<u>DL Physical Modifier</u>
<u>0x09 ... 0x0E</u>	<u>Reserved</u>
<u>0x0F</u>	<u>Expanded Format</u>

Extended DIUC 0x0F shall be used to identify an Expanded format for Extended IEs. All Extended IEs for systems supporting mobility shall use Expanded format.

[Renumber sections 8.4.5.3.3 through 8.4.5.3.11 to become 8.4.5.3.2.1 through 8.4.5.3.2.9, resequencing in ascending order by Code; i.e. in the same order as in Table 275a]

[Insert the following section; re-sequence sections and modify tables as indicated:]

8.4.5.3.3 DL-MAP Extended IE Expanded Format format

A DL-MAP Extended IE with Extended DIUC=0x0F indicates that this is an Extended IE with expanded format which conforms to the structure shown in Table 283c. A DL-MAP Extended IE with expanded format shall conform to section 8.4.5.3.3. Expanded Format DL-MAP Extended IE is differentiated from other DL-MAP Extended IE through inclusion of an Expanded Type field, immediately following Length, to identify the different types of Extended IE introduced in 8.4.5.3.3. Systems supporting mobility shall support the DL-MAP Extended IE Expanded Format. An MSS shall ignore an extended IE entry with an expanded type value for which the station has no knowledge or does not support. In the case of a known expanded type value but with a length field longer than expected, the station shall process information up to the known length and ignore the remainder of the IE.

Table 283c—DL-MAP Extended IE Expanded Format format

<u>Syntax</u>	<u>Size</u>	<u>Note</u>
<u>DL_Expanded_IE() {</u>		
<u>Extended DIUC</u>	<u>4 bits</u>	<u>Expanded Format = 0x0F</u>
<u>Length</u>	<u>4 bits</u>	
<u>Expanded Type</u>	<u>6 bits</u>	<u>0x00...0x3F</u>
<u>Unspecific Data</u>	<u>Variable</u>	
<u>}</u>		

Table 283a defines the encoding for Expanded Type that shall be used by DL-MAP Extended IEs with Expanded format.

Table 283d—Expanded Type Allocation

<u>Extended DIUC</u>	<u>Usage</u>
<u>0x00</u>	<u>Multicast and Broadcast Service MAP</u>
<u>0x01</u>	<u>DL PUSC Burst Allocation in Other Segment</u>
<u>0x02</u>	<u>HO Anchor Active DL MAP</u>
<u>0x03</u>	<u>HO Active Anchor DL MAP</u>
<u>0x04</u>	<u>HO CID Translation MAP</u>
<u>0x05</u>	<u>MIMO in another BS</u>
<u>0x06</u>	<u>Macro-MIMO DL Basic</u>
<u>0x07</u>	<u>UL noise and interference level</u>
<u>0x08</u>	<u>Feedback polling</u>
<u>0x09 ... 0x3F</u>	<u>Reserved</u>

[Modify the following sections:]

8.4.5.3. ~~143.1~~ Multicast and Broadcast Service MAP IE (MBS_MAP_IE)

.....

Table 283b—Multicast and Broadcast Service MAP IE

Syntax	Size	Note
MBS_MAP_IE {		
Extended DIUC	4 bits	MBS_MAP = 0x05-Expanded Format = 0x0F
Length	4 bits	Length = 0x034
Expanded Type	6 bits	MBS_MAP = 0x00
.....		
}		

.....

8.4.5.3. ~~123.2~~ DL PUSC Burst Allocation in Other Segment IE

.....

Table 284c—DL PUSC Burst Allocation in Other Segment IE

Syntax	Size	Note
DL PUSC Burst Allocation in Other Segment IE() {		
Extended DIUC	4 bits	DL PUSC Burst Allocation in Other Segment IE () = 0x0B-Expanded Format = 0x0F
Length	4 bits	Length = 0x09
Expanded Type	6 bits	DL PUSC Burst Allocation in Other Segment = 0x01
.....		
reserved	6 bits	Shall be set to zero
}		

.....

8.4.5.3. ~~133.3~~ HO Anchor Active DL MAP IE

.....

Table 284d—HO Anchor Active DL MAP IE

Syntax	Size	Note
HO Anchor Active DL MAP IE() {		
Extended DIUC	4 bits	HO Anchor Active MAP IE = 0x0C Expanded Format = 0x0F
Length	4 bits	Length = Variable
Expanded Type	6 bits	HO Anchor Active MAP IE = 0x02
.....		
}		

.....

8.4.5.3. [143.4](#) HO Active Anchor DL MAP IE

.....

Table 284e—HO Active Anchor MAP IE

Syntax	Size	Note
HO Active_Anchor DL MAP IE () {		
Extended DIUC	4 bits	HO Active_Anchor MAP IE = 0x0D Expanded Format =0x0F
Length	4 bits	
Expanded Type	6 bits	HO Active_Anchor MAP IE = 0x03
.....		
}		

.....

8.4.5.3. [153.5](#) HO CID Translation MAP IE

.....

Table 284f—HO CID Translation MAP IE

Syntax	Size	Note
HO Anchor Active DL MAP HO CID Translation MAP IE() {		
Extended DIUC	4 bits	CID Translation MAP IE = 0x0E Expanded Format =0x0F
Length	4 bits	
Expanded Type	6 bits	CID Translation MAP IE = 0x04
.....		
}		

.....

8.4.5.3. [163.6](#) MIMO in another BS IE

.....

Table 284g—MIMO in another BS IE

Syntax	Size	Note
MIMO_in_another_BS_IE () {		
Extended DIUC	4 bits	0x09 Expanded Format =0x0F
Length	4 bits	Length in bytes
Expanded Type	6 bits	MIMO in another BS IE = 0x05
.....		
}		

.....

8.4.5.3. [173.7](#) Macro-MIMO DL Basic IE format

.....

Table 284h—Macro MIMO DL Basic IE()

Syntax	Size	Note
Macro_MIMO_DL_Basic_IE()		

{		
Extended DIUC	4 bits	0x0b Expanded Format =0x0F
Length	4 bits	
Expanded Type	6 bits	Macro MIMO DL Basic IE = 0x06
.....		
}		

.....

8.4.5.3. [183.8](#) UL noise and interference level IE

.....

Table 284i—UL interference and noise level extended IE

Syntax	Size	Note
UL interference and noise level IE{		
Extended DIUC	4 bits	UL_NI=0x0F Expanded Format =0x0F
Length	4 bits	Length = 0x03~64 7
Expanded Type	6 bits	UL interference and noise level IE = 0x07
Reserved	2 bits	Shall be set to zero
....		
}		

.....

8.4.5.3. [193.9](#) Feedback polling IE

.....

[Table 284j—Feedback Polling IE](#)

Syntax	Size	Note
Feedback polling IE () {		
Extended UIUC	4 bits	0x?? Expanded Format =0x0F
Length	4 bits	Length in bytes of following fields
Expanded Type	6 bits	Feedback Polling IE = 0x08
....		
}		

.....

[Append the following to the end of section 8.4.5.4.4:]

[Table 289a](#) defined the encoding for Extended UIUC that shall be used by UL-MAP Extended IEs.

[Table 289a—Extended UIUC Allocation](#)

Extended UIUC	Usage
0x00	Power control
0x01	Mini-subchannel allocation
0x02	AAS/ MIMO UL Basic
0x03	CQICH Allocation
0x04	UL Zone switch
0x05	UL-MAP Physical Modifier

0x08 ... 0x0E	Reserved
0x0F	Expanded Format

[Extended UIUC 0x0F shall be used to identify an Expanded format for Extended IEs. All Extended IEs for systems supporting mobility shall use Expanded format.](#)

[Renumber sections 8.4.5.4.5 through 8.4.5.4.14 to become 8.4.5.4.4.1 through 8.4.5.4.4.11, resequencing in ascending order by Code; i.e. in the same order as in Table 289a]

[Insert the following sections before current section 8.4.5.4.15 and all subsequent sections should be renumbered:]

[8.4.5.4.5 UL-MAP Extended IE Expanded Format](#)

[A UL-MAP Extended IE with Extended UIUC 0x0F indicates that this is an Extended IE with expanded format which conforms to the structure shown in Table 298aa. A UL-MAP Extended IE with expanded format shall conform to specification defined in section 8.4.5.4.5. Expanded Format DL-MAP Extended IE is differentiated from other DL-MAP Extended IE through inclusion of an Expanded Type field, immediately following Length, to identify the different types of Extended IE introduced in 8.4.5.4.5. Systems supporting mobility shall support the DL-MAP Extended IE Expanded Format. A station shall ignore an extended IE entry with an expanded type value for which the station has no knowledge. In the case of a known expanded type value but with a length field longer than expected, the station shall process information up to the known length and ignore the remainder of the IE.](#)

[Table 298aa—UL-MAP Extended IE Expanded Format](#)

Syntax	Size	Note
UL_Expanded_IE() {		
Extended UIUC	4 bits	Expanded Format = 0xF
Length	4 bits	
Expanded Type	6 bits	0x00...0x3F
Unspecific Data	Variable	
}		

[Table 298ab defined the encoding for Expanded Type that shall be used by UL-MAP Extended IEs with Expanded format.](#)

[Table 298ab—Expanded Type Allocation](#)

Expanded Type	Usage
0x00	CQICH Enhanced Allocation
0x01	UL PUSC Burst Allocation in Other Segment
0x02	HO Anchor Active UL MAP
0x03	HO Active Anchor UL MAP
0x04	OFDMA Fast Ranging
0x05	UL MAP Fast Tracking
0x06	Anchor BS Switch
0x07 ... 0x3F	Reserved

[Modify the following sections:]

8.4.5.4.155.1 CQICH Enhanced Allocation IE format

Table 298a—CQICH Enhanced allocation IE format

Syntax	Size	Note
CQICH_Enhanced_Alloc_IE() {		
Extended D UIUC	4 bits	0x09-Expanded Format =0x0F
Length	4 bits	Length in bytes of following fields
<u>Expanded Type</u>	<u>6 bits</u>	<u>CQICH Enhance Allocation = 0x00</u>
.....		
}		

.....

8.4.5.4.165.2 UL PUSC Burst Allocation in Other Segment IE

.....

Table 298b—UL PUSC Burst Allocation in Other Segment IE

Syntax	Size	Note
UL PUSC Burst Allocation in Other Segment IE () {		
Extended UIUC	4 bits	UL PUSC Burst Allocation in Other Segment IE () == 0x08-Expanded Format =0x0F
Length	4 bits	Length=0x08
<u>Expanded Type</u>	<u>6 bits</u>	<u>UL PUSC Burst Allocation in Other Segment = 0x01</u>
.....		
reserved	<u>13</u> bits	shall be set to zero
}		

.....

8.4.5.4.175.3 Optional Enhanced UL ACK channels

.....

8.4.5.4.185.4 HO Anchor Active UL MAP IE

.....

Table 298e—HO Anchor Active UL MAP IE

Syntax	Size	Note
HO Anchor Active UL MAP IE () {		
Extended UIUC	4 bits	HO Anchor Active MAP IE = 0x09 Expanded Format =0x0F
Length	4 bits	
<u>Expanded Type</u>	<u>6 bits</u>	<u>HO Anchor Active MAP = 0x02</u>
.....		
padding nibble	<u>0 or 4 bits-2 or 6 bits</u>	Shall be set to zero.
}		

.....

8.4.5.4.195.5 HO Active Anchor UL MAP IE

.....

Table 298f—HO Active Anchor UL MAP IE

Syntax	Size	Note
HO Active_Anchor UL MAP IE () {		
Extended UIUC	4 bits	HO Active_Anchor MAP IE = 0x09 Expanded Format = 0x0F
Length	4 bits	
Expanded Type	6 bits	HO Active_Anchor MAP = 0x03
.....		
padding nibble	0 or 4 bits-2 or 6 bits	Shall be set to zero.
}		

.....

8.4.5.4.205.6 OFDMA Fast_Ranging_IE format IE

.....

Table 298g—OFDMA Fast_Ranging_IE format IE

Syntax	Size	Note
Fast_Ranging_IE{		
Extended UIUC	4 bits	0x06-Expanded Format = 0x0F
Length	4 bits	Length = variable
Expanded Type	6 bits	Fast_Ranging_IE = 0x04
.....		
}		

.....

8.4.5.4.215.7 UL_MAP_Fast_Tracking_IE

.....

Table 298h—UL_MAP_Fast_Tracking_IE

Syntax	Size	Note
UL_MAP_Fast_Tracking_IE() {		
Length 4 bits Variable		
Extended UIUC	4 bits	Fast Indication = 0x03-Expanded Format = 0x0F
Number of Length	4 bits	Variable
Expanded Type	6 bits	Fast Tracking IE = 0x05
Reserved	2 bits	shall be set to zero
.....		
}		

.....

8.4.5.4.225.8 Anchor BS Switch IE

.....

Table 298i—Anchor_BS_switch_IE format

Syntax	Size	Note
Anchor_BS_switch_IE() {		
Extended <u>DUIUC</u>	4 bits	<u>AS = 0x07-Expanded Format = 0xF</u>
Length	4 bits	Length of the message in bytes
<u>Expanded Type</u>	<u>6 bits</u>	<u>AS = 0x06</u>
.....		
}		

.....

4. References

- [1] IEEE 802.16- 2004 IEEE Standards for local and metropolitan area networks part 16: Air interface for fixed broadband wireless access systems
- [2] IEEE P802.16e-D5a-2004