Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Traffic Channel Definition for HARQ Burst Allocation in OFDMA PHY
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Re:	IEEE P802.16e/D6-2005
Abstract	This contribution proposes to apply the semi-static traffic channel (or region) definition on the DL for HARQ burst allocation, similar to the way it is currently done for non-HARQ burst allocation. The objective is to reduce the overhead in DL HARQ burst allocation. This contribution also proposes to support multiple modes of HARQ within a data region.
Purpose	Review and Adopt the suggested changes into P802.16e/D6
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1 Introduction

As currently defined in the p802.16e/D6 draft, semi-static DL channel definition in DCD (DL Channel Definition TLV) is used to reduce the overhead in DL burst allocation for non-HARQ traffic. As explained in details in the contribution IEEE C802.16e-04/542r2 which was adopted in session #35, the use of semi-static DL channel definition eliminate the need to explicitly specify the 28-bit OFDMA symbol offset, subchannels offset, number of OFDMA symbols and number of subchannels for each DL burst allocation. Instead, a 6-bit channel ID (CHID) is used to identify a semi-static channel (or region) defined in the DCD. The reduction in overhead is non-negligible in particular for cases where non-bulk traffic (e.g. VoIP, HTTP) is supported.

In this contribution, we propose to apply the same channel definition concept to the HARQ burst allocation schemes adopted in session #35, i.e contributions IEEE C802.16e-05/23r5 and IEEE C802.16e-05/38r1. Similar benefit can be realized for the case of HARQ burst allocation, as in the case of non-HARQ burst allocation.

In addition, we also propose to define multiple HARQ modes within a data region. This will allow greater scheduling flexibility and optimization in actual deployment scenario where MSs may have different coding capabilities.

2 Proposed Text Change

Remedy 1: Add the support of semi-static channel definition (identified by CHID) to the non-MIMO HARQ burst allocation IEs.

[Modify Table 285m in p802.16e/D6 to include CHID. Add the MIMO support in HARQ_DL_MAP_IE as in IEEE C802.16e-05/38r1 which was adopted in session #35 but was not included in D6 text. Enhance the HARQ_DL_MAP_IE to enable the support of multiple HARQ modes within a data region]

Table 285m—HARQ DL MAP IE format

Syntax	Size	Notes
HARQ DL MAP IE {		
Extended DIUC 2	4	Set to 0x1
Length	8	Length of the IE in bytes
RCID_Type	2 bits	00 = Normal CID 01 = RCID11 10 = RCID7 11 = RCID3
While (data remains) {		
CHID use indicator	1 bit	0: not use CHID 1: use CHID
If (CHID use indicator == 0) {		
OFDMA symbol offset	8 bits	Offset from the start of DL sub-frame
Subchannel offset	6 bits	
~~Boosting~~	~~3 bits~~	~~000: normal (not boosted); 001: +6 dB; 010: -6 dB; 011: +9 dB; 100: +3 dB; 101: -3 dB; 110: -9 dB; 111: -12 dB~~
Number of OFDMA symbols	7 bits	
Number of subchannels	6 bits	

}else {		
CHID	6 bits	Index to the DL region defined in DL channel definition TLV in DCD
}		
Boosting	3 bits	000: normal (not boosted); 001: +6 dB; 010: -6 dB; 011: +9 dB; 100: +3 dB; 101: -3 dB; 110: -9 dB; 111: -12 dB
N_sub_burst	5 bits	Number of sub-bursts in the 2D region
For (j=0; j< N sub burst; j++) {		
Mode	4 bits	Indicates the mode of this IE 0 = Chase HARQ 1 = Inremental redundancy HARQ for CTC 2 = Inremental redundancy HARQ for convolutional code 3 = MIMO Chase H-ARQ 4 = MIMO IR H-ARQ 5 = MIMO IR H-ARQ for convolution code 6 = MIMO STC H-ARQ ~~7~~3-15 *Reserved*
If (Mode == 0) {		
DL HARQ Chase sub-burst IE()	*Variable*	
} else if (Mode == 1) {		
DL HARQ IR CTC sub-burst IE()	*Variable*	
} else if (Mode == 2) {		
DL HARQ IR CC sub-burst IE()	*Variable*	
} else if (Mode == 3) {		
MIMO_DL_Chase_H-HARQ_Sub-Burst_IE()	*Variable*	
} else if (Mode == 4) {		
MIMO_DL_IR_H-ARQ_Sub-Burst_IE ()	*Variable*	
} else if (Mode == 5) {		
MIMO_DL_IR_H-ARQ_for_CC_Sub-Burst-IE()	*Variable*	
} else if (Mode == 6) {		
MIMO_DL_STC_H-ARQ_Sub-Burst_IE()	*Variable*	
}		
}		
}		
Padding	*Variable*	Padding to byte; shall be set to 0

}		

[Modify Table 285n in p802.16e/D6 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 285n—DL HARQ Chase sub-burst IE format

Syntax	Size	Notes
DL HARQ Chase sub-burst IE() {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
}		
Same DIUC indication	**1 bit**	**0 = the DIUC and repetition coding indication are the same as the previous sub_burst 1: = the DIUC and repetition coding indication are different from the previous sub_burst (for the first sub-burst in each H-ARQ DL IE, this bit is set to 1)**
If (Same DIUC indication == 1) {		
DIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 -- No repetition coding 0b01 -- Repetition coding of 2 used 0b10 -- Repetition coding of 4 used 0b11 -- Repetition coding of 6 used
}		
~~**N sub-burst[ISI]**~~	~~5 bits~~	~~Number of sub-bursts in the 2D region~~
~~For (j=0; j< N sub-burst; j++){~~		
RCID_IE()	*Variable*	
Duration	10 bits	Duration in slots
ACID	4 bits	
AI_SN	1 bit	
CQICH Control Indicator	1 bit	
If(CQICH Control Indicator == 1){		
Allocation Index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS

Period (p)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2p frames.
Frame offset	3 bits	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for 2(d-1) frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop.
}		
Dedicated DL Control Indicator	1 bit	
If (Dedicated DL Control Indicator ==1) {		
Dedicated DL Control IE ()	*Variable*	
}		
~~}~~		
}		

[Modify Table 285o in p802.16e/D6 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 285o—DL HARQ IR CTC sub-burst IE format

Syntax	Size	Notes
DL HARQ IR CTC sub-burst IE() {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
}		
~~**N sub-burst**~~	~~5 bits~~	
~~For (j=0; j< N sub-burst; j++){~~		
RCID_IE()	*Variable*	
Nep	4 bits	
Nsch	4 bits	
SPID	2 bits	
ACID	4 bits	

AI_SN	1 bit	
ACK disable	1 bit	When this bit is "1" no ACK channel is allocated and the SS shall not reply with an ACK.
CQICH Control Indicator	1 bit	
If(CQICH Control Indicator == 1){		
Allocation index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS
Period(p)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2p frames.
Frame offset	3 bits	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for 2(d-1) frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop
}		
Dedicated DL Control Indicator	1 bit	
If (Dedicated DL Control Indicator ==1) {		
Dedicated DL Control IE ()	*Variable*	
}		
}		
}		

[Modify Table 285p in p802.16e/D6 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 285p—DL HARQ IR CC sub-burst IE format

Syntax	Size	Notes
DL HARQ IR CTC sub-burst IE() {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
}		

Same DIUC indication	1 bit	0 = the DIUC and repetition coding indication are the same as the previous sub_burst 1: = the DIUC and repetition coding indication are different from the previous sub_burst (for the first sub-burst in each H-ARQ DL IE, this bit is set to 1)
If (Same DIUC indication == 1) {		
DIUC	4 bits	
Repetition coding indication	2 bits	0b00 - No repetition coding 0b01 - Repetition coding of 2 used 0b10 - Repetition coding of 4 used 0b11 - Repetition coding of 6 used
}		
~~N sub-burst~~	~~5 bits~~	
~~For (j=0; j< N sub-burst; j++){~~		
RCID_IE()	*Variable*	
Duration	10 bits	
ACID	4 bits	
AI_SN	1 bit	
SPID	2 bits	
CQICH Control Indicator	1 bit	
If(CQICH Control Indicator == 1){		
Allocation index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS
Period(p)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2p frames.
Frame offset	3 bits	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for 2(d-1) frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop
}		
Dedicated DL Control Indicator	1 bit	
If (Dedicated DL Control Indicator ==1) {		
Dedicated DL Control IE ()	*Variable*	
}		
~~}~~		

}		

Remedy 2: Add the support of semi-static channel definition (identified by CHID) to MIMO HARQ burst allocation IEs. Note that we also show here the modification on top of the proposed text change in IEEE C802.16e-05/38r1 which was adopted in session #35 but did not get included into D6

[Modify Table 306i in IEEE C802.16e-05/38r1 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 306i MIMO DL Chase H-ARQ Sub-Burst IE Format

MIMO DL Chase H-ARQ Sub-Burst IE {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
~~For (j=0; j< N_sub_burst; j++){~~		
MU Indicator	1 bit	Indicates whether this UL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Length	10 bits	
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
DIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
ACID	4 bits	
AI_SN	1 bit	

}		
~~}~~		
}		

[Modify Table 306j in IEEE C802.16e-05/38r1 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 306j MIMO DL IR H-ARQ Sub-Burst IE Format

MIMO DL IR H-ARQ Sub-Burst IE {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
|		
~~For (j=0; j< N sub burst; j++){~~		
MU Indicator	1 bit	Indicates whether this UL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
ACK Disable	1 bit	When this bit is "1" no ACK channel is allocated and the SS shall not reply with an ACK
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Nsch	4 bits	
If (ACK Disable == 0) {		
SPID	2 bits	
ACID	4 bits	
AI_SN	1 bit	
}		
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
Nep	4 bits	
}		
~~}~~		

}		

[Modify Table 306k in IEEE C802.16e-05/38r1 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region]

Table 306k MIMO DL IR H-ARQ for CC Sub-Burst IE Format

MIMO DL IR H-ARQ for CC Sub-Burst IE {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
~~For (j=0; j< N_sub_burst; j++){~~		
MU Indicator	1 bit	Indicates whether this UL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Length	10 bits	
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
DIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
ACID	4 bits	
AI_SN	1 bit	
SPID	2 bits	
}		
~~}~~		
}		

[Modify Table 306l in IEEE C802.16e-05/38r1 to enable the support of multiple HARQ modes within a data region Introduce sub-burst offset to allow flexibility in the placement of the sub-burst within the data region. Correct the definition error in Table 306l for the STC HARQ operation]

Table 306l MIMO DL STC H-ARQ Sub-Burst IE Format

MIMO DL STC H-ARQ Sub-Burst IE {		
Sub-burst offset indication	1 bit	
If (Sub-burst offset indication == 1) {		
Sub-burst offset	10 bits	Offset in slots with respect to the previous sub-burst defined in this data region. If this is the first sub-burst within the data region, this offset is with respect to slot 0 of the data region.
]		
Dedicated MIMO DL Control Indicator	1 bit	
RCID_IE()	*Variable*	
~~For (j=0; j< N sub burst; j++){~~		
TX count	2 bit	00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
Length	10 bits	
If (Tx count == 00) {		
~~MU Indicator~~	~~1 bit~~	~~Indicates whether this DL burst is intended for multiple SS~~
~~If (MU indicator == 0) {~~		
~~RCID IE()~~	~~Variable~~	
~~}~~		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
~~For (i=0;i<N_layer;i++) {~~		
~~if (MU indicator == 1) {~~		
~~RCID IE()~~	~~Variable~~	
~~}~~		
DIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
}		

ACID	4 bits	
}		
}		
}		