Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**New H-ARQ Related IEs for DL/UL-MAP Message**	
Date Submitted	**2004-11-04**	
Source(s)	Hang Zhang, Mo-Han Fong, Peiying Zhu, Wen Tong Nortel Networks 3500 Carling Avenue, Ottawa Ontario, Canada K2H 8E9	mhfong@nortelnetworks.com Voice: +1-613-765-8983 Fax: +1-613-765-6717
Re:	IEEE P802.16e/D5-2004	
Abstract	This contribution introduces new H-ARQ related IEs to DL/UL-MAP message	
Purpose	Review and Adopt the suggested changes into P802.16e/D5	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.	

1 Introduction

In current DL/UL MAP IE, there is no IE designed for H-ARQ operation. In this contribution, some new types of DL/UL IEs are introduced to enable various H-ARQ operation.

This contribution includes the following components:

- For DL, the following IEs are introduced:
  - IR based H-ARQ for non-MIMO capable MSS – IR_H-ARQ MAP IE
  - Chased based H-ARQ for non-MIMO capable MSS – Chase_H-ARQ IE
  - IR based H-ARQ for MIMO-capable MSS – MIMO_IR_H-ARQ IE
  - Chase based H-ARQ for MIMO-capable MSS – MIMO_Chase_H-ARQ IE
  - STC based H-ARQ – STC_H-ARQ IE
- For UL, the following IEs are introduced:
  - IR based H-ARQ for non_MIMO capable MSS – IR_H-ARQ MAP IE
  - Chased based H-ARQ for non-MIMO MSS – Chase_H-ARQ IE
  - IR based H-ARQ for MIMO-capable MSS – MIMO_IR_H-ARQ IE
  - Chase based H-ARQ for MIMO-capable MSS – MIMO_Chase_H-ARQ IE
  - STC based H-ARQ – STC_H-ARQ IE

To provide the acknowledgment function of H-ARQ, two extra IEs shall be also introduced. The H-ARQ Region allocation IE and H-ARQ BITMAP IE introduced for H-ARQ MAP message can be reused for this purpose.

2 Proposed Text Changes

[Add section 8.4.5.3.x IR_HARQ MAP IE]

8.4.5.3.x IR_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MSSes that are running H-ARQ enabled connections and the using IR mode.

Table xx. IR_H-ARQ MAP IE.

Syntax	Size (bits)	Note
IR_H-ARQ_IE()		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
DIUC	4	
CID	16	
OFDMA Symbol offset	8	
Subchannel offset	6	
Boosting	3	

No. OFDMA offset	8	
No. subchannel offset	6	
Repetition coding indication	2	
ACID	3	H-ARQ channel ID
Packet SN	1	Packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.3.x Cahse_HARQ MAP IE]

8.4.5.3.x Chase_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MSSes that are running H-ARQ enabled connections and using Chase mode.

Table xx. Chase_H-ARQ MAP IE.

Syntax	Size (bits)	Note
Chase_H-ARQ_IE()		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
DIUC	4	
CID	16	
OFDMA Symbol offset	8	
Subchannel offset	6	
Boosting	3	
No. OFDMA offset	8	
No. subchannel offset	6	
Repetition coding indication	2	
ACID	3	H-ARQ channel ID
Tx_Count	2	Transmission count: 00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.3.x MIMO_IR_HARQ MAP IE]

8.4.5.3.x MIMO_IR_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MIMO-capable MSSes that are running H-ARQ enabled connections and using IR mode.

Table xx. MIMO_IR_H-ARQ MAP IE.

Syntax	Size (bits)	Note
IMIMO_IR_H-ARQ_IE()		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignment	2	
For (i=0;i<Num_Assignment;i++)		
{		
OFDMA Symbol offset	8	
Subchannel offset	6	
Boosting	3	
No. OFDMA offset	8	
No. subchannel offset	6	
Repetition coding indication	2	
Matrix_indicator	2	
Num_Layer	2	
For i=0;i<Num_Layers;i++)		
{		
CID	16	
DIUC	4	
Layer_index	2	
ACID	3	H-ARQ channel ID
Packet_SN	1	Packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
}		
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.3.x MIMO_Cahse_ HARQ MAP IE]

8.4.5.3.x MIMO_Chase_ HARQ MAP IE

This IE is transmitted by a BS to one or multiple MIMO-capable MSSes that are running H-ARQ enabled connections and using Chase_ mode.

Table xx. MIMO_Chase_ H-ARQ MAP IE.

Syntax	Size (bits)	Note
MIMO_Chase_H-ARQ_IE()_		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignment	2	
For (I =0;i<Num_Assignment;i++)		
{		
_OFDMA Symbol offset	8	
_Subchannel offset	6	
_Boosting	3	
_No. OFDMA_offset	8	
_No. subchannel offset	6	
_Repetition coding indication	2	
_Matrix_indicator	2	
_Num_Layer	2	
_For i=0;i<Num_Layers;i++)		
_{		
__CID	16	
__DIUC	4	
__Layer_index	2	
__ACID	3	H-ARQ channel ID
__Tx_count	2	Transmission count_ 00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
__}		
_}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.3.x STC_HARQ MAP IE]

8.4.5.3.x STC_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MIMO-capable MSSes that are running H-ARQ enabled connections and using STC mode. The retransmission matrix used depends on the number of BS transmission antenna. (Matrix A (2-transmission antenna, see 8.4.8.9, Matrix B 4-transmission antenna, see 8.4.8.9)

Table xx. STC_H-ARQ MAP IE.

Syntax	Size (bits)	Note
STC_H-ARQ_IE()		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
DIUC	4	
CID	16	
Tx_count	2	00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
If (Tx_count == 00)		
{		
OFDMA Symbol offset	8	
Subchannel offset	6	
Boosting	3	
No. OFDMA_offset	8	
No. subchannel offset	6	
Repetition coding indication	2	
}		
ACID	3	H-ARQ channel ID
}		

Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.4.x IR_HARQ MAP IE]

8.4.5.4.x IR_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MSSes that are running H-ARQ enabled connections and the using IR mode.

Table xx. IR_H-ARQ MAP IE.

Syntax	Size (bits)	Note
IR_H-ARQ_IE()		
Extended UIUC	4	IR_H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
UIUC	4	
CID	16	
Duration	10	
Repetition coding indication	2	
ACID	3	H-ARQ channel ID
Packet_SN	1	Packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.4.x Cahse_HARQ MAP IE]

8.4.5.4.x Chase_HARQ MAP IE

This IE is transmitted by a BS to one or multiple MSSes that are running H-ARQ enabled connections and using Chase mode.

Table xx. Chase_H-ARQ MAP IE.

Syntax	Size (bits)	Note

Chase_H-ARQ_IE()		
Extended UIUC	4	Chase_H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
UIUC	4	
CID	16	
Duration	6	
Repetition coding indication	2	
ACID	3	H-ARQ channel ID
Tx_Count	2	Transmission count: 00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.4.x MIMO_IR_ HARQ MAP IE]

8.4.5.4.x MIMO_IR_ HARQ MAP IE

This IE is transmitted by a BS to one or multiple MIMO-capable MSSes that are running H-ARQ enabled connections and using IR mode.

Table xx. MIMO_IR_ H-ARQ MAP IE.

Syntax	Size (bits)	Note
MIMO_IR_ H-ARQ_IE()		
Extended UIUC	4	H-ARQ = 0x09
Length	4	
Num_assign	2	
For i=0;i<Num_assign;i++)		
{		
Duration	10	
Collaborative SM_Indication	1	0: Non_collaborative_SM (assignment to a dual transmission capable MSS) 1: Collaborative SM (assignment to 2 collaborative SM capable MSSes)

If (Collaborative SM Indication == 0)		
{		
MIMO_Control	1	0: STTD 1: SM
CID	16	Connection ID
UIUC	4	
ACID	3	H-ARQ channel ID
Packet_SN	1	Packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
}		
else		
{		
CID	16	Connection ID. This MSS shall use pilot pattern A
UIUC	4	
ACID	3	H-ARQ channel ID
Packet_SN	1	Packet ID-packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
CID	16	Connection ID. This MSS shall use pilot pattern B
UIUC	4	
ACID	3	H-ARQ channel ID
Packet_SN	1	Packet sequence number. When changed, it means a new packet is been transmitted
SPID	2	Sub-packet ID
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.4.x MIMO_Cahse_ HARQ MAP IE]

8.4.5.4.x MIMO_IR_ HARQ MAP IE

This IE is transmitted by a BS to one or multiple MIMO-capable MSSes that are running H-ARQ enabled connections and using Chase mode.

Table xx. MIMO_Chase_ H-ARQ MAP IE.

Syntax	Size (bits)	Note
MIMO_Chase_H-ARQ_IE()		
Extended UIUC	4	H-ARQ = 0x09
Length	4	
Num_assign	2	
For i=0;i<Num_assign;i++)		
{		
Duration	10	
Collaborative SM_Indication	1	0: Non collaborative SM (assignment to a dual transmission capable MSS) 1: Collaborative SM (assignment to 2 collaborative SM capable MSSes)
If (Collaborative SM_Indication == 0)		
{		
MIMO_Control	1	0: STTD 1: SM
CID	16	Connection ID
UIUC	4	
ACID	3	H-ARQ channel ID
Tx_Count	2	Transmission count
}		
else		
{		
CID	16	Connection ID. This MSS shall use pilot pattern A
UIUC	4	
ACID	3	H-ARQ channel ID

Tx_Count	2	Transmission count: 00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
CID	16	Connection ID. This MSS shall use pilot pattern B
UIUC	4	
ACID	3	H-ARQ channel ID
Tx_Count	2	Transmission count: 00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

[Add section 8.4.5.4.x STC_HARQ MAP IE]

8.4.5.4.x STC_HARQ MAP IE

This IE is transmitted by a BS to one or multiple dual-transmission capable MSSes that are running H-ARQ enabled connections and using STC mode. The retransmission matrix used is Matrix A (2-transmission antenna, see 8.4.8.9)

Table xx. STC_H-ARQ MAP IE.

Syntax	Size (bits)	Note
STC_H-ARQ_IE()		
Extended DIUC	4	H-ARQ = 0x09
Length	4	
Num_Assignments	2	
For (i=0;i<Num_Assignments;i++)		
{		
DIUC	4	
CID	16	
Tx_xount	2	00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
If (Tx_count == 00)		
{		
OFDMA Symbol offset	8	
Subchannel offset	6	
Boosting	3	
No. OFDMA offset	8	
No. subchannel offset	6	
Repetition coding indication	2	
}		
ACID	3	H-ARQ channel ID
}		
Padding bits	Variable	Padding bits to align boundary of byte
}		

8.4.5.4.x. ACKCH Region IE

This IE is used by BS to define a DL region to include one or more ACK channel(s). The IE format is shown in Table xx.

The subchannels in the ACKCH region are divided into two half-subchannels. The first half-subchannel is composed of first, third and fifth tiles and the second half-subchannel is composed of second, fourth and sixth tiles. In the ACKCH Region, the 2n-th half-subchannel is the first half-subchannel and the (*2n+1*)-th half-subchannel is the second half-subchannel of the n-th subchannel.
The H-ARQ enabled MSS that receives H-ARQ DL burst at i-th frame should transmit ACK signal through the half-subchannel in the ACKCH region at (*i+j*)-th frame. The frame offset '*j*' is defined by the "H-ARQ ACK Delay for DL Burst" field in the UCD message. The half-subchannel offset in the ACKCH Region is determined by the order of H-ARQ enabled DL burst in the DL MAP. For example, when a MSS receives a H-ARQ enabled burst at i-th frame and the burst is n-th H-ARQ enabled burst amoung the H-ARQ related IEs, the MSS should transmit H-ARQ ACK at *n*-th half-subchannel in ACKCH Region that is allocated by the BS at the (*i+j*)-th frame.

Table xx. ACKCH_region MAP IE format.

Syntax	Size (bits)	Note
ACKCH_Region_IE()		
Extended DIUC	4	
Length	4	
ACKCH_region_Change_indication	1	0: no region changed 1: region changed
OFDMA Symbol offset	8	
Subchannel offset	6	
No. OFDMA offset	8	
No. subchannel offset	6	
Padding bits	Variable	Pading bits to align byte boundary
}		

H-ARQ Region Change Indication
Indicates whether the region for H-ARQ ACK is changed or not.
OFDMA Symbol offset
Subchannel offset
No. OFDMA Symbols
No. Subchannels
Specify the start symbol offset, the start subchannel offset, the number of allocated symbols and the number of subchannels for the H-ARQ acknowledgement region respectively.

8.4.5.4.x. H-ARQ_ACK IE

This IE is used by BS to send H-ARQ acknowledgment to UL H-ARQ enabled traffic.The bit position in the bitmap is determined by the order of the H-ARQ enabled UL bursts in the UL-MAP. The frame offset between the UL burst and the H-ARQACK-BITMAP is specified by "H-ARQ_ACK_Delay_for_UL_Burst" field in the DCD message.
For example, when a MSS transmits a H-ARQ enabled burst at *i*-th frame and the burst is *j*-th H-ARQ enabled burst in the MAP, the MSS should receive H-ARQ ACK at *j*-th bit of the BITMAP which is sent by the BS at *i*+(frame offset)-th frame.

Table xx. H-ARQ_ACK IE format.

Syntax	Size (bits)	Note

H-ARQ_ACK_IE() _		
Extended DIUC	4	
Length	4	
Bitmap Length	6	
Btmap	Variable	
Padding bits	Variable	Padding bits to align byte boundary
} _		

BITMAP Length

Specifies the length of the following BITMAP field.

BITMAP

Includes H-ARQ ACK information for H-ARQ enabled UL bursts. The size of BITMAP should be equal or larger than the number of H-ARQ enabled UL-bursts.