Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>	
Title	**HARQ Through RS UL Dedicated Channel**	
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Re:	IEEE P802.16j/D1: IEEE 802.16j working group letter ballot #28.	
Abstract	The current baseline does not specify how to support HARQ for the RS UL_DCH. The RS UL_DCH supports signaling and data traffic associated with service flows, and hence HARQ needs to be supported. The sub-burst IE used for HARQ is not applicable to the RS UL_DCH. This contribution supplies text to support HARQ for the RS UL_DCH.	
Purpose	To incorporate the proposed text into the P802.16j Baseline Document IEEE P802.16j/D1 (August 2007).	
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HARQ Through RS UL Dedicated Channel

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Nortel

Introduction

The RS UL_DCH supports signaling and data traffic associated with service flows, and hence HARQ on UL_DCH needs to be supported. As the UL_DCH is a persistence allocation and the resources are available periodically without any further signaling until it needs to be updated, such as, to a different size. As such, it is not possible to follow the current HARQ process of using embedded sub-burst IE inside HARQ UL MAP IE during HARQ BW allocation. The sub-burst IE contains the HARQ control signaling (i.e. ACID and AI_SN).

The current ACK/NACK for the UL HARQ transmission bursts from the MSs/RSs are sent using DL HARQ ACK IE. It contains an ACK/NACK bitmap and the order of bits follows the same order of the HARQ sub-burst allocations in the broadcasted HARQ UL MAP IE. As such, it also cannot be used for HARQ in UL_DCH.

This contribution supplies text to enable HARQ control signaling and ACK/NACK exchange for HARQ through RS UL_DCH.

Proposal

The UL HARQ controls signaling (i.e. ACID and AI_SN) are sent using an Extended MAC signaling header type II in the same frame together with all UL_DCH HARQ bursts.

For HARQ on the UL_DCH, each RS cannot determine how many HARQ bursts are being transmitted by all the other RSs through their UL_DCH and their order of transmission. Hence, the ACK/NACK for different RSs cannot be combined into a broadcasted bitmap to acknowledge HARQ bursts from all subordinate RSs on their dedicated channels. A unicast ACK/NACK bitmap is used for each RS and it is sent using a DL MAC control header.

For multihop centralized scheduling, it is not possible to dynamically allocated ACK/NACK resource for RSs that are two or more hops away from the MR-BS as the minimum round trip delay will be larger than the maximum of 3 frames delay for the ACK/NACK signaling. To effectively enable ACK/NACK signaling for the UL HARQ transmission on the dedicated channel, the MR-BS needs to allocate dedicated signaling channel in the downlink for the RS.

For distributed scheduling, in place of frequent/periodic ACK/NACK allocations, the superordinate station may allocate dedicated signaling channel in the downlink for its RSs when significant number of HARQ enabled service flows have been established.

Text Proposal

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[Add the following subclause]

6.3.17.6 Uplink HARQ on Dedicated Channel

HARQ sub-bursts from multiple MSs/RSs are multiplexed and transmitted through the UL DCH. Each DCH region can transmit a single HARQ burst at a time. The corresponding HARQ control signaling is sent in the same frame together with all HARQ bursts in the frame. The signaling is sent using the UL DCH HARQ control header. The control header may be sent using the most robust DCH region amongst all the allocated DCH regions managed by the RS. The DCH region used to send the control header cannot be used to send HARQ burst. A non HARQ burst can be sent together with the control header in the same DCH region.

Under centralized control, the MR-BS may choose to support UL HARQ transmission from the MS on the RS dedicated channel by allocating DL DCH resource to each RS along the path using the RS_DL_DCH assignment IE for HARQ ACK/NACK bitmap signaling.

Under distributed control, in place of frequent/periodic allocations for ACK/NACK signaling, the superordinate station may allocate dedicated signaling channel in the downlink for its RSs using the RS_DL_DCH assignment IE when significant number of HARQ enabled service flows have been established.

The ACK/NACK bitmap is sent by the MR-BS or the parent RS using the DL DCH HARQ ACK header. The MR-BS or parent RS that receives HARQ UL burst at i-th frame should transmit ACK signal at (i+j)-th frame. The frame offset “j” is defined by the “HARQ ACK Delay for UL Burst” field in the DCD message.

[Change Table 19a in Subclause 6.3.2.1.2.2.2 as indicated]

Table 19a—Extended Type field encodings for Extended MAC signaling header type II

Extended Type field	MAC header Type	Reference figure	Reference table
0	RS BR header	Figure 35b	Table 19b
1	RS UL_DCH request header	Figure 35c	Table 19c
2	Acknowledgement header	Figure 35d	Table 19d
3	HARQ RS error report header	Figure 35e	Table 19e
4	MR_Code-REP header	-	Table 19f
5	RS UL size request header	Figure 35f	Table 19g
6	UL DCH control header		
~~6~~ 7	Reserved		

[Add the following subclause]

6.3.2.1.2.2.2.7 UL DCH control header

The UL DCH control header is used by the RS to send control signaling to MR-BS or parent RS. The header format is as follows:

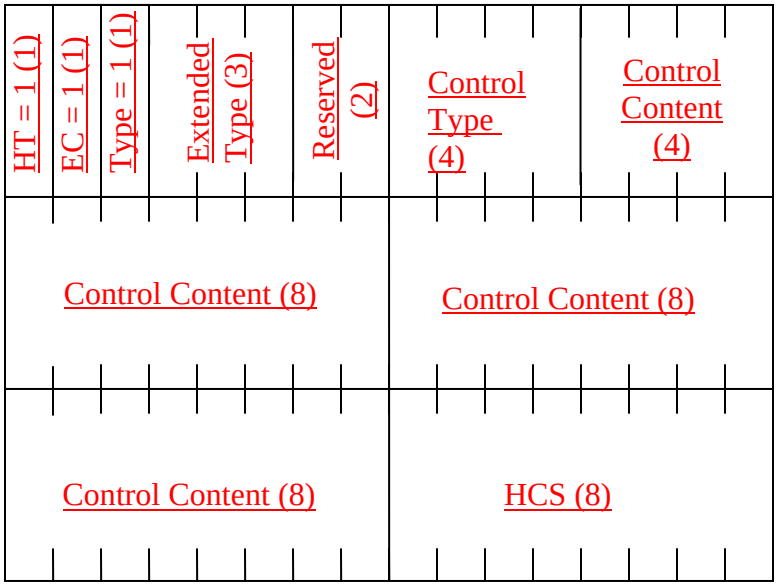

Figure XXX – UL DCH control header

Table XXX - UL DCH control header format

Syntax	Size	Notes
MAC Header(){		
_HT	1 bit	Shall be set to 1
_EC	1 bit	Shall be set to 1
_Type	1 bit	Shall be set to 1
_Extended TYPE	3 bits	Shall be set to 110 for UL DCH control header
_Reserved	2 bits	
_Control Type	4 bits	0000 = UL DCH HARQ control 0001-1111 = Reserved
_Control Content	28 bits	
_HCS	8 bits	Header check sequence
}		

[Add the following subclause]

6.3.2.1.2.2.2.7.1 UL DCH HARQ control header

The UL DCH HARQ control header is used by the RS to send HARQ control signaling to MR-BS or parent RS. The control content is sub-divided into 7 groups of 4 bits which allow up to seven UL DCH regions for HARQ burst transmission. The first group of 4 bits corresponding to the first allocated DCH region and so on. The first bit, when set to 1, indicates HARQ enabled. The next 2 bits indicate ACID (up to 4 HARQ channels per DCH region). The last bit indicates AI_SN. The header format is as follows:

Table XXX - UL DCH HARQ control header format

Syntax	Size	Notes
MAC Header(){		
_HT	1 bit	Shall be set to 1

EC	1 bit	Shall be set to 1
Type	1 bit	Shall be set to 1
Extended TYPE	3 bits	Shall be set to 110 for UL DCH control header
Reserved	2 bits	
Control Type	4 bits	Shall be set to 0000 for UL DCH HARQ control
For (i=0; i<7; i++) {		
HARQ Enable	1 bit	Set to 1 to enable HARQ
ACID	2 bits	HARQ CH ID
AI_SN	1 bit	HARQ ID Seq. No
}		
HCS	8 bits	Header check sequence
}		

[Add the following table to the end of Subclause 6.3.2.1.3]

Table XXX—Type field encodings for DL MAC control header

Type field	MAC control header Type	Reference figure	Reference table
0	DL DCH HARQ ACK header		
1-15	Reserved		

[Add the following subclause]

6.3.2.1.3.1 DL DCH HARQ ACK header

The DL DCH HARQ ACK header is used by the MR-BS or parent RS to send the HARQ ACK/NACK bitmap to acknowledge the corresponding RS UL DCH HARQ bursts. The MR-BS or parent RS that receives HARQ UL burst at i-th frame should transmit ACK signal at (i+j)-th frame. The frame offset "j" is defined by the "HARQ ACK Delay for UL Burst" field in the DCD message. The format of the header is shown in Figure XXX.

Table XXX - DL DCH HARQ ACK header format

Name	**Length (bits)**	**Description**
HT	1	Header type. Shall be set to 1
EC	1	Encryption control. Shall be set to 0
Type	4	Shall be set to 0000 for DL DCH HARQ ACK signaling
ACK/NACK bitmap	7	HARQ ACK/NACK bitmap for the corresponding UL DCH HARQ bursts specified by the UL DCH HARQ control header (maximum 7 bursts)
Reserved	27	
HCS	8	Header check sequence

[Change Table 496c in Subclause 8.4.5.9.1 as indicated]

Table 496c—R-link specific IE types

Type (hexadecimal)	Usage
00	RS_UL_DCH assignment IE
01	RS_BW-ALLOC IE
02	RS_DL_DCH assignment IE
~~02~~03-1F	Reserved

[Add the following subclause]

8.4.5.9.3 RS DL DCH assignment IE

This IE is used for the initial allocation and subsequent updates of the downlink dedicated channel for the RS.

Table XXX. RS_DL_DCH assignment IE format.

Syntax	Size	Notes
RS_DL_DCH assignment IE {		
Type	5 bits	RS_DL_DCH assignment IE = 0x02
Length	4 bits	
RSCID	8 bits	Reduced basic CID of the RS
Update type	2 bits	00 = Control signaling 01-11 = Reserved
Assignment type	2 bits	00 = Incremental (Add the specified resource to DL DCH) 01 = Aggregate (An aggregate assignment with no resource indicates all DL DCH removal) 10 = Removal (Remove the specified resource from DL DCH) 11 = Reserved
DIUC	4 bits	
Boosting	3 bits	
Repetition coding indication	2 bits	
OFDMA Symbol offset	8 bits	
Subchannel offset	8 bits	
No. OFDMA Symbols	7 bits	
No. Subchannels	6 bits	
Frequency (N)	4 bits	Allocation repeats once every N frames
}		

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