Project	**IEEE 802.16 Broadband Wireless Access Working Group** **<http://ieee802.org/16>**
Title	**A More Flexible Dedicated Control for the Harmonized Map**
Date Submitted	**2005-03-09**
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Re:	Proposes a more efficient and flexible structure for Dedicated DL Control
Abstract	The normal map extension for HARQ has incorporated optional Dedicated DL Control into the HARQ sub burst IE formats for all types of HARQ—Chase, CTC IR and CC IR. The Dedicated Control IE as defined has several short comings with respect to efficiency, future expansion and flexibility that need to be resolved.
Purpose	Adoption
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Introduction

The normal map extension for HARQ has incorporated two types of optional dedicated control fields into the HARQ sub burst IE formats for all types of HARQ—Chase, CTC IR and CC IR. The control fields are the CQICH Control and the Dedicated DL Control. These control fields are very similar in that they both add low-overhead when not used (a single bit indicates that the optional control fields are not present); are assigned on a per HARQ sub burst basis; are directed to the SS represented by the RCID and allocate specific fields when enabled. The Dedicated DL Control IE can contain several different types of dedicated control within it (e.g., SDMA); the very similar CQICH Control is specified by itself outside of the rest of the Dedicated DL Control.

The Dedicated DL Control IE as defined has several short comings. First, the Dedicated Control IE is not as efficient as it should be. When enabled each Dedicated Control IE consumes at least 12 bits. This is true even if only 1 additional bit needs to be communicated. This can be a significant burden if the Dedicated Control IE is used by all sub bursts within the allocated region. In addition, the Dedicated Control IE has limited capability for future enhancement. The Dedicated DL Control IE enables only four additional control fields; one of these fields has already been assigned. Finally, it is unusual that the CQICH Control fields have not been incorporated as part of the Dedicated DL Control IE. One might speculate that this was done to avoid the aforementioned inefficiencies of the Dedicated Control IE. In light of all these issues, it seems appropriate to restructure the Dedicated Control IEs to make them more efficient, allow for future expansion and eliminate any unnecessary special cases (e.g. CQICH control).

This contribution proposes a method to allow for the flexible assignment of dedicated control by leveraging the Downlink Channel Descriptor (DCD).

Requirements

The following are requirements that the newly proposed Dedicated DL Control IE must satisfy.

1) ***Future Expansion*** – Future features may require additional types of dedicated DL control fields. These control fields will have to be backwards compatible and therefore parsable by older generations of 802.16e equipment. Therefore, a mechanism must exist within the current specification that will allow for the definition of new dedicated DL control fields having arbitrary length.
2) ***Efficiency*** – The dedicated DL control fields may be contained as part of every HARQ sub-burst allocation within a H-ARQ DL MAP IE, and therefore they must consume very little overhead. TLV encoding is an impractical solution for this particular case.
3) ***Flexibility*** – Not all dedicated control options will be appropriate for all deployments and all base station implementations. Therefore, the overhead associated with unused

Dedicated DL Control Fields will be inappropriate for systems that do not employ the desired feature. Moreover, features that are appropriate for first generation systems may not be effective or desirable in later generations. Static dedicated control assignment will burden future system to support legacy overhead.

Concept

In order to facilitate future proofing, efficiency and flexibility, it is proposed that the structure of the dedicated control be configured as part of the DCD. This approach is very similar to how the burst profiles are configured per DIUC. Four parameters would completely specify the dedicated control, one global parameter and three per indicator parameters:

Number of Dedicated DL Control Indicators – A base station can enable one or more dedicated control indicators to be included in the HARQ sub-burst. Typically only one or two might be included. However, many more types of dedicated control indicators may exist.

Position of Dedicated DL Control Indicator – The position of the current dedicated control indicator within the enabled list of dedicated control IEs.

Type of Dedicated DL Control Indication – The type of the dedicated control being indicated. Possible types might include CQICH, SDMA or some future capability.

Length of the Dedicated DL Control IE – The length in bits of the dedicated control IE. This field provides the necessary future expansion capability. SS which belong to an older generation who are unaware of the particular type of dedicated control will be able to parse sub bursts intended for SS of a newer generation with this knowledge.

The configuration of the dedicated control within the DCD allows for a very efficient implementation within the HARQ sub-burst. A simple loop which iterated by the "Number of Dedicated DL Control Indicators" specified can be used to cycle through the potential dedicated control indications. If no dedicated control indications are configured, then absolutely no overheard is incurred within the HARQ sub-burst. If a single dedicated control is configured, the overhead would be equivalent to the overhead as currently specified for the CQICH control.

Editorial Instructions

On page 260, section 8.4.5.3.22 HARQ DL MAP IE make the following edits to Tables 285n, 285o, and 285p

Table 285n DL H-ARQ Chase Sub-Burst IE Format

DL H-ARQ Chase Sub-Burst IE {			
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		Number of sub-bursts in 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		

For (k=0;
    k< Number Dedicated DL
        Control Indicators;
    k++){
			Number Dedicated DL Control Indicators as specified in the DCD

If (Dedicated DL Control Indicator k ==1) {	1		k-th dedicated DL control indicator as configured in the DCD
Dedicated DL Control IE k ()	Length as specified in DCD		k-th dedicated DL control IE as configured in the DCD
}			
CQICH Control Indicator	1 bits		
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 2^p 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		

†				
}				
}				

On page 258, line 1 replace section 8.4.5.3.21.1 Dedicated DL Control with the following

8.4.5.3.21.1 Dedicated DL Control

Multiple optional types of downlink dedicated control may be configured as part of the HARQ sub-burst allocations. The particular downlink dedicated control types enabled for a system are defined within the DCD.

8.4.5.3.21.1.1 Dedicated DL Control Configuration

Table 285KA defines the format for the dedicated control configuration which is used in the DCD message. The configuration defines the number dedicated control types enabled and the respective size of each dedicated control IE. The order of the dedicated control indications within the HARQ sub-burst is identical to the order in which they are defined in the dedicated control configuration. If the Dedicate DL Control Configuration is not present in the DCD, then there are no dedicated control indicators in the HARQ sub-burst IEs.

Table 285KA Dedicated DL Control Configuration

Syntax	Size	Notes
Dedicated DL Control Configuration {		
Type	8 bits	Type value within the DCD message
Length	8 bits	
Number Dedicated DL Control Indicators	4 bits	Number of dedicated control indicators enabled within the HARQ sub-burst
For (k=0; k< Number Dedicated DL Control Indicators; k++){		
Dedicated DL Control Type	8 bits	Type of the dedicated control enabled
Dedicated DL Control Length	4 bits	Length of the dedicated control IE in bits
}		
Padding	Variable	Used to match octet boundary
}		

8.4.5.3.21.1.2 Dedicated Control IE Types

Table 285KB lists the current types of dedicated control defined in this standard.

Table 285KB Dedicated DL Control Configuration

Type			Value	IE Length	Notes	
CQICH Control			0	16 bits	Parameters for allocating and deallocation CQICH feedback.	
SDMA Control			1	2 bits	Indicates the activation of SDMA	
Reserved			2-255			

8.4.5.3.21.1.2.1 CQICH Dedicated Control

Table 285KC defines the content of the CQICH Dedicated Control IE

Table 285KC CQICH Dedicated Control IE

Syntax		Size		Notes	
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 2^p 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	

8.4.5.3.21.1.2.2 SDMA Dedicated Control

Table 285KD defines the content of the CQICH Dedicated Control IE

Table 285KD SDMA Dedicated Control IE

Syntax		Size		Notes	
Num SDMA Layers		2 bits		Number of SDMA layers minus 1	

This field shall appear for the first sub burst in each layer of an SDMA allocation, and indicates activation of SDMA. Each SDMA layer has a different pilot pattern (layer n uses pilot pattern n). The appearance of another burst with Num SDMA layers indicates a new SDMA layer. The number of SDMA layer is incremented and the symbol and subchannel offsets are reset to the beginning of the allocation. The Num SDMA layers appearing in first burst of each layer must be equal.

On page 476, line 47, Section 11.4 add the following line to the table 358a

Table 358a DCD Channel Encoding

Name	Type (1 byte)	Length	Value (variable length)		PHY Scope
Dedicated DL Control Configuration	51	Variable	See 8.4.5.3.21.1.1		OFDMA