Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Enhanced Feedback Method for Enhanced FAST_FEEDBACK channels**
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Re:	IEEE P802.16e/D5-2004
Abstract	This contribution proposes to enhance the feedback content on CQICH
Purpose	Review and Adopt the suggested changes into P802.16e/D5
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1 Introduction

To enable advanced physical layer operations, such as MIMO, FBSS, band AMC and etc, a MSS is required to provide feedback to the BS. In some cases, the amount of feedback contents is large, like multiple band CQI feedback. Based on current standard, the feedback header (section 6.3.2.1.4) and fast feedback channel (CQICH) can be used for this purpose. However, how to mapping the feedback content to multiple CQICH(s) is missing in current standard (p802.16e/D5).

In this contribution, we propose a method to enable a MSS provide variety of feedback information by using fast feedback channel (CQICH).

The solution includes the following components:

- Define feedback content formats (e.g., for per-band CQI feedback, the format is defined as “band index (6bits) + CQI of this band (5 bits)”)
- BS polling feedback from a MSS
  - Define a Feedback request IE sent from BS to a MSS, the IE mainly includes the followings:
    - CQICH assignments
    - The format index and the number of repetition of the contents (the number of content transmission forms feedback cycle)
    - The MSS flag insertation indication. If the indication is set, the MSS shall insert a flag field between every one or multiple feedback cycle(s)
  - MSS maps the feedback content bits to CQICH payload regardless of the CQICH payload boundary
- MSS autonomously provides feedback type change
  - If a MSS has CQICH(s) allocated by the above feedback request IE, the MSS can use the flag field to indicate a feedback format change
  - The feedback mapping method is the same as that of BS polling feedback

2 Proposed Text Changes

[Insert Section 8.4.5.4.5.x Feedback request IE]

This IE is used by BS to assign one or more fast feedback channel (CQICH) to a MSS for the MSS to provide variety of feedback.

Table x – Feedback_request IE

Syntax	Size	Notes
Feedback_request_IE () {		
Extended UIUC	4 bits	0x??
Length	4 bits	Length in bytes of following fields
Num_Assignments	5 bits	Number of assignments in this IE
For (i = 0; i <Num_Assignments; i++)		
{		
CID	16 bits	MSS basic CID
Duration(d)	3 bits	The CQICH is assigned to a MSS for $10x2^d$ frames; If d =0b000, the CQICH is deallocated; If d = 0b111, the MSS shall repor feedback information using the assigned resource until the BS commands for the MSS to stop
Frame offset	3 bits	The MSS starts to provide MIMO feedback at the

		frame which the number has the same 3LSB as the specified frame offset. If the current frame is specified, the MSS shall start transmit feedback in 8 frames
If (d !=0b000)		
{		
Num_CQICH_Allocation	4 bits	Number of CQICHs allocated to the MSS identified by the MSS basic CID
Num_feedback	3 its	Number of feedbacks formatted based on the Format index defined below
Length of band_index	3 bits	Indication of the length of AMC band index
Length of CQI value index	2 bits	Indication of the length of CQI value index 0b00: 4 bits 0b01: 5 bits 0b10: 6bits 0b11: reserved
Format_Index	3 bits	See Table Z
Flag_insertation_indication	1 bit	0: a Flag field of 4 bits is inserted after each feedback cycle 1: no Flag field is inserted after each feedback cycle
If (Flag_insertation_indication ==1)		
(		
Flag_insertaion_period(p)	3	Flag field is inserted every 2^p feedback cycle.
}		
}		
}		
}		

After a MSS receive such a IE, the MSS shall continuously transmit the following information defined in Table XXX during the assignment duration or until the CQICH(s) is deallocated. The information bits are mapped to the assigned CQICH(s) in the following way:
For the first frame where CQICH(s) is allocated, the payload of first CQICH is first filled and the payload of second CQICH is filled up and so on until the all assigned CQICH(s) in the frame is filled up; for the following frames, the above is repeated

Table Y. MIMO feedback.

Syntax	Size	Notes
for (i=0; I < Num_feedback; i++)		If the Num_MIMO_feedback > 1, the feedback, either layer based or AMC band based, shall be in the order so that the layer or AMC band who has the maximum CQI appears first.
{		
Feedback content formatted as indicated by format index	variable	See Table xx. Feedback format.
}		
If (Flag_insertaion_indication == 1)		
Flag	4 bits	0b0000: Falg nothing 0b0001-000110: see Table Z 0b0010-1110: reserved

		0b1111: a MSS requesting resource for sending a MAC header (BW request header or feedback header)
}		

Table Z MIMO feedback formats

Format index	Feedback contents
1 (STTD/BLAST diversity permutation)	STTD/BLAST selection (1 bit) + Average CQI (the number of bits = length of CQI value index indicated in the corresponding MIMO_CHICH_Alloc_IE, e.g., 4/5/6 bits)
2 (STTD/BLAST antenna grouping for both diversity and AMC band permutations)	STTD/BLAST selection (1 bit) + Antenna group index (2 bits) + average CQI (the number of bits = length of CQI value index indicated in the corresponding MIMO_CHICH_Alloc_IE, e.g., 4/5/6 bits)
3 (STTD/BLAST for AMC band permutation)	Layer index (2 bits) + AMC band index (number of bits = Length of band index indicated in the corresponding MIMO_CHICH_Alloc_IE) + CQI (the number of bits = length of CQI value index indicated in the corresponding MIMO_CHICH_Alloc_IE, e.g., 4/5/6 bits)
4 (feedback Channel H for AMC band permutation)	layer index(2 bits)+H (xx bits-depending on antenna configuration)
5 (feedback transmission weights for AMC band permutation)	layer index(2 bits)+W (xx bits-depending on antenna configuration) + CQI (the number of bits = length of CQI value index indicated in the corresponding MIMO_CHICH_Alloc_IE, e.g., 4/5/6 bits)
6 (feedback V matrix for AMC band permutation)	layer index(2 bits)+V (xx bits-depending on antenna configuration) + CQI (the number of bits = length of CQI value index indicated in the corresponding MIMO_CHICH_Alloc_IE, e.g., 4/5/6 bits)