

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Fast Link Adaptation Feedback	
Date Submitted	2004-08-27	
Source:	<p>Erik Lindskog, Kamlesh Rath, Mai Vu, Djordje Tujkovic, David Garrett, K. Giridhar, Shashidhar, B. Sundar Rajan, Bob Lorenz, Babu Mandava, A. Paulraj, Taiwen Tang, Tareq Al-Naffouri, Erik Stauffer, V. Trevor Pearman, Aditya Agrawal</p> <p>Beceem Communications, Inc. 3930 Freedom Circle, Suite 101 Santa Clara, CA 95054 U.S.A.</p>	<p>Voice: +1-408-387-5014 elindskog@beceem.com</p>
Re:	IEEE 802.16e D5 Draft	
Abstract	To improve the closed loop MIMO	
Purpose	To incorporate the changes here proposed into the 802.16e D5 draft.	
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 >.	

Fast Link Adaptation Feedback

Erik Lindskog, Kamlesh Rath, Mai Vu, Djordje Tujkovic, David Garrett, K. Giridhar, Shashidhar, B. Sundar Rajan, Bob Lorenz, Babu Mandava, A. Paulraj, Taiwen Tang, Tareq Al-Naffouri, Erik Stauffer, V. Trevor Pearman, Aditya Agrawal

Beceem Communications, Inc.

1 Background

We are proposing fast feedback of desired FEC rate and QAM order. The intent is to facilitate effective MIMO link adaptation. With this change both desired STC mode (as well as subcarrier allocation/zone choice) as well as the desired FEC rate and QAM order can be fed back from the SS to the BS. The subscriber station that typically has a very complete set of information of the link quality can then make an appropriate recommendation of the STC mode, FEC rate and QAM. If multiple layers are used then one FEC rate and QAM order recommendation can be fed back per layer.

Specific text changes

-----Start text proposal-----

[Modify the following Table 298a in section 8.4.5.4.12.1]

Table 298a. CQICH Enhanced allocation IE format

Syntax	Size (bits)	Notes
CQICH_Enhanced_Alloc_IE() {		
Extended DIUC	4	0x09
Length	4	Length in bytes of following fields
CQICH_ID	variable	Index to uniquely identify the CQICH resource assigned to the MSS
Period (=p)	2	A CQI feedback is transmitted on the CQICH every 2^p frames
Frame offset	3	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)	3	A CQI feedback is transmitted on the CQI channels indexed by the CQICH_ID for 10×2^d frames. If $d=0$, the CQICH is de-allocated. If $d=111$, the MSS should report until the BS command for the MSS to stop.
N_T actual BS antennas	3	001 = Reserved 010 = 2 actual antennas 011 = 3 actual antennas

		<p>100 = 4 actual antennas</p> <p>101 = 5 actual antennas</p> <p>110 = 6 actual antennas</p> <p>111 = 7 actual antennas</p> <p>000 = 8 actual antennas</p>
Feedback_type	4	<p>0000 = Open loop precoding. Pilots in burst to be precoded with W. SS to rely only on pilots in burst for channel estimation.</p> <p>0001 = Complex weight of specific element of W</p> <p>0010 = Fast DL measurement</p> <p>0011 = Layer specific channel strengths</p> <p>0100 = MIMO mode and permutation zone feedback</p> <p>0101 = Feedback of subset of antennas to use.</p> <p>0110 = <Used in other proposal for 802.16e D5 Draft></p> <p>0111 = Fast Link Adaptation Feedback. Feedback recommended FEC rate and QAM. Feedback binary number indicates which FEC rate and QAM combination in increasing combined bit rate order. Combinations with the same rate are ordered in increasing QAM order. The lowest bit rate FEC rate and QAM combination has binary representation 00000.</p> <p>0110 ~ 1111 reserved</p>
CQICH_Num	4	Number of CQICHs assigned to this CQICH_ID is (CQICH_Num +1)
for (i=0;i<CQICH_Num;i++) {		
Allocation index	6	Index to the fast feedback channel region marked by UIUC=0
}		
if (Feedback_type != 0100) { MIMO_permutation_feedback cycle }	2	<p>00 = No MIMO and permutation mode feedback</p> <p>01 = the MIMO and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 4 frames. The first indication is sent on the 8th CQICH frame.</p> <p>10 = the MIMO mode and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 8 frames. The first indication is sent on the 8th CQICH frame.</p> <p>11 = the MIMO mode and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 16 frames. The first indication is sent on the 16th CQICH frame.</p>
if (Feedback_type != 0111) { Number layers to feedback recommended FEC rate and QAM for, one CQICH for each }	2	<p>00 = 1 layer</p> <p>01 = 2 layers</p> <p>10 = 3 layers</p> <p>11 = 4 layers</p>
Padding	<i>variable</i>	The padding bits are used to ensure the IE size is integer number of bytes.

-----End text proposal-----