Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Band AMC Operation using 6 CQICH bit encoding**
Date Submitted	**2004-11-05**
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Re:	IEEE P802.16e/D5-2004
Abstract	In this contribution, the transition between band AMC and normal subchannels and the band AMC operation using 6 bit encoded CQICH are proposed.
Purpose	Review and Adopt the suggested changes into P802.16e/D5
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Band AMC Operation using 6 CQICH bit encoding

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I. Introduction

The IEEE 802.16d standard describes the operation of CQICH in 6.3.17.4. While the two new CQICH encoding schemes with more numbers of information bits (5 and 6 information bits can be encoded in the current 16e standard) were introduced, the operation of Band AMC can be described more clearly using an extra codeword. In this contribution, I propose the CQICH operation in the transition mechanism between normal subchannels (PUSC, optional PUSC, FUSC, and optional FUSC ones) and Band AMC subchannels.

II. Band AMC Operations using 6 bit CQICH encoding

1. Call Flows for mode transitions between normal subchannel and Band AMC

i. Assumption

There are three allocated CQICH codewords for indicating the transitions. Let the first codeword be C1(the 62 th codeword in Table 296b : 0b111101), the second one C2 (the 63 th codeword : 0b111110), and the third one C3 (the 64th codeword : 0b111111).

ii. Normal -> Band AMC

The MSS transmits C1, and the BS that receives the codeword transmits REP-REQ. The MSS replies with REP-RSP having the CINR measurements of the 5 best bands with transmitting C2 at the same frame or after transmitting C2 (this is required since the CQICH may be allocated with period higher than 1). From the next frame after transmitting REP-RSP, the MSS reports the Band AMC differential CQI of the selected bands.

iii. Band AMC -> Normal

The MSS transmits C3. The MSS reports the regular CQI of the whole bandwidth. Until the BS allocates normal subchannels, the MSS repeats this process. In other words, the MSS transmits the C3 and the regular CQI alternately until the normal subchannel is allocated to it.

iv. Band change

The MSS and its BS follows the same procedure of the transition from normal subchannel to Band AMC.

v. Refreshing the CINR of the 5 best bands without band changes

The MSS transmits an unsolicited REP-RSP with transmitting C2 at the same frame or after transmitting C2.

2. Conditions of transition triggering

i. Normal subchannel → AMC transition

If the maximum of the standard deviations of the individual band's CINR measurements is lower than 'Band AMC Allocation Threshold' and the average CINR of the whole bandwidth is larger than 'Band AMC Entry Average CINR' for at least 'Band AMC Allocation Timer' frames, SS using normal subchannels sends an unsolicited REP_RSP to request mode transition and transmits a special codeword on its CQICH to inform its BS of its request of mode transition. REP_RSP message contains band bitmap indicating the best five bands and their CINR measurements.

ii. AMC → Normal subchannel transition

If the maximum of the standard deviations of the individual band's CINR measurements for at least 'Band AMC Release Timer' frames is higher than 'Band AMC Release Threshold', SS in Band AMC mode may trigger mode transition from Band AMC to normal subchannel.

iii. Band Change

If the CINR of any one band excluding the best five bands previously selected for band AMC allocations is greater than the average CINR of the AMC reporting bands for at least Band AMC Allocation Timer, the AMC allocation bands should be changed by following the procedure given above.

III. Recommended Text Changes

Add a section 6.3.17.5

6.3.17.5 Band AMC Operations using 6 bit CQICH encoding

For band AMC subchannel operations, the number of bands should be less than or equal to 12.
As described in 6.3.17.4, if the number of bands is 48 (2048 FFT in 20 MHz), the two contiguous bands are paired and renumbered the same as a 24 band system. Then, if the LSB of an SS MAC address is 1, it only uses the odd-numbered bands. If not, it only uses the even-numbered bands. Hence, for example, the LSB of an SS MAC address is 1, (4m+2, 4m+3) bands are paired and the paired band is the m-th band of the SS. Similarly, for an even-numbered SS, (4m, 4m+1) bands are paired and the paired band is the m-th band of the SS. If the number of bands is 24, the two contiguous bands are just paired and renumbered the same as a 12 band system. If the original number of band is equal to or less than 12, the logical definition is not necessary.

6.3.17.5.1 Call Flows for mode transitions between normal subchannel and Band AMC

Three allocated CQICH codewords are allocated for indicating the transitions. Let the first codeword be C1(the 62 th codeword in Table 296b : 0b111101), the second one C2 (the 63 th codeword : 0b111110), and the third one C3 (the 64th codeword : 0b111111).

i. Normal -> Band AMC
   The MSS transmits C1, and the BS that receives the codeword transmits REP-REQ. The MSS replies with REP-RSP having the CINR measurements of the 5 best bands at the same frame or after transmitting C2. From the next frame after transmitting REP-RSP, the MSS reports the Band AMC differential CQI of the selected bands.
ii. Band AMC -> Normal
   The MSS transmits C3. The MSS reports the regular CQI of the whole bandwidth. Until the BS allocates normal subchannels, the MSS repeats this process. In other words, the MSS transmits the C3 and the regular CQI alternately until the normal subchannel is allocated to it.
iii. Band change
   The MSS and its BS follows the same procedure of the transition from normal subchannel to Band AMC.
iv. Refreshing the CINR of the 5 best bands without band changes
   The MSS transmits an unsolicited REP-RSP at the same frame or after transmitting C2.

6.3.17.5.2 Conditions of transition triggering

i. Normal subchannel ➔ AMC transition
   If the maximum of the standard deviations of the individual band's CINR measurements is lower than 'Band AMC Allocation Threshold' and the average CINR of the whole bandwidth is larger than 'Band AMC Entry Average CINR' for at least 'Band AMC Allocation Timer' frames, SS using normal subchannels sends an unsolicited REP_RSP to request mode transition and transmits a special codeword on its CQICH to inform its BS of its request of mode transition. REP_RSP message contains band bitmap indicating the best five bands and their CINR measurements.

ii. AMC ➔ Normal subchannel transition
   If the maximum of the standard deviations of the individual band's CINR measurements for at least 'Band AMC Release Timer' frames is higher than 'Band AMC Release Threshold', SS in Band AMC mode may trigger mode transition from Band AMC to normal subchannel.

iii. Band Change
   If the CINR of any one band excluding the best five bands previously selected for band AMC allocations is greater than the average CINR of the AMC reporting bands for at least Band AMC Allocation Timer, the AMC allocation bands should be changed by following the procedure given above.

In Table 351, add the following descriptions and rows

Name	Type (1 byte)	Length	Value

Band AMC Allocation Threshold	159	1	dB unit threshold of the maximum of the standard deviations of the individual band's CINR measurements over time to trigger mode transition from normal subchannel to Band AMC
Band AMC Release Threshold	160	1	dB unit threshold of the maximum of the standard deviations of the individual band's CINR measurements over time to trigger mode transition from Band AMC to normal subchannel
Band AMC Allocation Timer	161	1	Frame unit Minimum required number of frames to measure the average and standard deviation for the event of Band AMC triggering
Band AMC Release Timer	162	1	Frame unit Minimum required number of frames to measure the average and standard deviation for the event triggering from Band AMC to normal subcannel
Band Status Reporting MAX Period	163	1	Frame unit Maximum period between refreshing the Band CINR measurements by the unsolicited REP-RSP
Band AMC Retry Timer	164	1	Frame unit Backoff timer between consecutive mode transitions from normal subchannel to Band AMC when the previous request is failed
Band AMC Entry Average CINR	173	1	dB unit Threshold of the average CINR of the whole bandwidth to trigger mode transition from normal subchannel to AMC