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Re:	This is a response to a Call for Comments on IEEE P802.16e-D7
Abstract	Clarified usage of FAST-FEEDBACK channel in OFDMA
Purpose	This document is submitted for review by 802.16e Working Group members
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Clarification of Fast-feedback channel in OFDMA

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1. Introduction

Clarification and correction for Enhanced FAST-FEEDBACK channel and Primary/Secondary FAST-FEEDBACK channel in OFDMA are proposed.

2. Proposed text changes

[Note to editor: instruction for text changes is yellow]

[Modify the section 8.4.5.4.15 as following]

CQICH_Enhanced_Alloc_IE(), is introduced to dynamically allocate or de-allocate a CQICH to a SS. This IE shall only be used with enhanced FAST FEEDBACK channel in 8.4.5.4.10.4 and primary/secondary FAST FEEDBACK channel in 8.4.5.4.10.12. Once allocated, the SS transmit feedback information of the specified type on the assigned CQICH with the determined period, until the SS receives a CQICH_Enhanced_Alloc_IE() to de-allocate the assigned CQICH.

Table 302a—CQICH Enhanced allocation IE format

Syntax	Size (bits)	Notes
CQICH_Enhanced_Alloc_IE(){		
…	…	...
CQICH_Num	4	Number of CQICHs assigned to this CQICH_ID is (CQICH_Num+1)
for (i=0;i<CQICH_Num;i++) {		
CQICH type	3	0b000 = 6 bit CQI 0b001 = DIUC CQI 0b010 = 3 bit CQI (even) 0b011 = 3 bit CQI (odd) 0b100 = 6 bit CQI (primary) 0b101 = 4 bit CQI (secondary) 0b110-0b111 = reserved A DIUC-CQI is a CQI channel that uses a modulation and coding level derived from the DIUC.
Feedback type	3	~~0b000 = Fast DL measurement/Default Feedback with antenna grouping~~ ~~0b001 = Fast DL measurement/Default Feedback with antenna selection~~ ~~0b010 = Fast DL measurement/Default Feedback with reduced code book~~ 0b000-0b010 = Fast DL measurement/Default Feedback depending on CQICH types 0b011 = Quantized precoding weight feedback 0b100 = Index to precoding matrix in codebook 0b101 = Channel Matrix Information 0b~~101~~110 = Per stream power control ~~0b110 ~~ 0b111 = Reserved
Allocation index	6	Index to the fast feedback channel region marked by

		UIUC=0
…	…	…
}		
…	…	…
}		

Feedback Type

~~For feedback types 0b000-0b010 it instructs the SS to transmit the feedback of the specified type using the 5 LSBs on its assigned CQICH as in Table 296d. In this case the MSB is set to 0. In addition, for feedback types 0b000-0b010, the SS may transmit, on its assigned CQICH, the feedback information specified in 8.4.5.4.10.7.~~

For CQICH type=0b000, 0b001 or 0b100,

0b000 = Fast DL measurement/Default Feedback with antenna grouping

0b001 = Fast DL measurement/Default Feedback with antenna selection

0b010 = Fast DL measurement/Default Feedback with reduced code book

When the MS transmits the feedback of S/N using 5 LSBs of 6 bits on it assigned CQICH, the MSB is set to 0 (see 8.4.5.4.10.5). MS may transmit, on its assigned CQICH, the feedback information specified in 8.4.5.4.10.7.

For CQICH type= 0b010 or 0b011,

0b000 = Antenna grouping (see Table 298d of 8.4.5.4.10.7)

0b001 = Antenna selection (see Table 298e of 8.4.5.4.10.7)

0b010 = Reduced codebook (see Table 298f of 8.4.5.4.10.7)

For CQICH type= 0b101,

0b000 = Fast DL measurement (see 8.4.5.4.10.1 and 8.4.5.4.10.5)

0b001 = Default Feedback with antenna grouping (see Table 298 of 8.4.5.4.10.3)

0b010 = Antenna selection and reduced codebook (see Table xxx of 8.4.5.4.10.3)

0b011 = Quantized precoding weight feedback (see Figure 231 of 8.4.5.4.10.2)

[Modify the Table 298 in 8.4.5.4.10.3 as following]

Table 298—Encoding of payload bits for Fast-feedback slot and secondary Fast-feedback slot

Value (binary)	Description
0000	STTD and PUSC/FUSC permutation
0001	STTD and adjacent-subcarrier permutation
0010	SM and PUSC/FUSC permutation
0011	SM and adjacent-subcarrier permutation
0100	Closed-loop SM and PUSC/FUSC permutation
0101	Closed-loop SM and adjacent-subcarrier permutation
0110	Closed-loop SM + Beamforming and adjacent-subcarrier permutation
~~0111–1111~~	~~Reserved~~
0111	Antenna Group A1 for rate 1 For 3-antenna BS, See 8.4.8.3.4.1 For 4-antenna BS, See 8.4.8.3.5.1
1000	Antenna Group A2 for rate 1
1001	Antenna Group A3 for rate 1
1010	Antenna Group B1 for rate 2 For 3-antenna BS, See 8.4.8.3.4.2 For 4-antenna BS, See 8.4.8.3.5.2
1011	Antenna Group B2 for rate 2
1100	Antenna Group B3 for rate 2
1101	Antenna Group B4 for rate 2 (only for 4-antenna BS)
1110	Antenna Group B5 for rate 2 (only for 4-antenna BS)
1111	Antenna Group B6 for rate 2 (only for 4-antenna BS)

[Add Table xxx at the end of 8.4.5.4.10.3]

Table xxx—Encoding of payload bits for secondary Fast-feedback slot

Value (binary)	Description
0000	Antenna selection option 0
0001	Antenna selection option 1
0010	Antenna selection option 2
0011	Antenna selection option 3
0100	Antenna selection option 4
0101	Antenna selection option 5
0110	Antenna selection option 6
0111	Antenna selection option 7
1000	Reduced Precoding matrix code book entry 0
1001	Reduced Precoding matrix code book entry 1
1010	Reduced Precoding matrix code book entry 2
1011	Reduced Precoding matrix code book entry 3
1100	Reduced Precoding matrix code book entry 4
1101	Reduced Precoding matrix code book entry 5
1110	Reduced Precoding matrix code book entry 6
1111	Reduced Precoding matrix code book entry 7

[Modify the text between line 5~32 page 296 in 8.4.5.4.10.5 as following]

When the FAST_FEEDBACK allocation subheader Feedback Type field is '00' or at a specific frame indicated in the CQICH_Alloc_IE() (see section 8.4.5.4.12), or the Feedback_type field in CQICH_Enhanced_Alloc_IE() is ~~'00'~~ 0b000-0b010 with CQICH type 0b000 or 0b100 (see 8.4.5.4.15), the SS shall report the S/N it measures on the DL. The following formula shall be used:

$$Payload\ bits = \begin{cases} 0, & S/N \le -3\ \text{dB} \\ n, & (n-4) < (S/N) \le (n-3),\ 0 < n < 31 \\ 31, & S/N > 27\ \text{dB} \end{cases}$$

MIMO capable MS shall measure post processing S/N for each individual layers as shown in Figure ~~229b~~yyy. When the FAST_FEEDBACK allocation subheader Feedback Type field is 0b00, the MS shall report the post processing S/N~~R~~ averaged over layers. When BS requests MS feedback through CQICH_Alloc_IE() or CQICH_Enhanced_Alloc_IE() with Feedback type 0b000-0b010 and CQICH type 0b101, MS shall report average S/N or individual layer S/N as described in 8.4.5.4.12 and 8.4.5.4.15

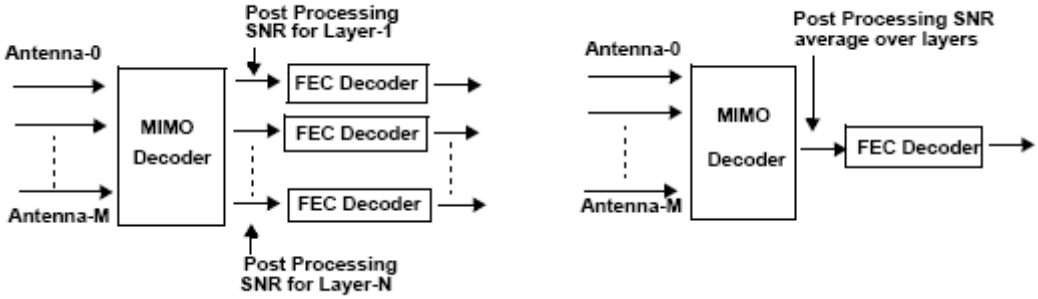

Figure yyy- Post processed S/N for MIMO

For MS with more than one receive antennas, the following formula shall be used

$$Payload\ bits\ Nibble = \begin{cases} 0, & S/N < -2 - \Delta\ \text{dB} \\ n, & 2n-2-\Delta < S/N < 2n-2-\Delta\ \text{dB},\ 0 < n < 15 \\ 15, & S/N > 26 - \Delta\ \text{dB} \end{cases}$$

[Modify the text between line 37~41 page 296 in 8.4.5.4.10.5 as following]

When the FAST_FEEFBACK allocation subheader Feedback Type field is 0b00 or at a specific frame indicated in the CQICH_Alloc_IE() (see 8.4.5.4.12), or the Feedback_type field in CQICH_Enhanced_Alloc_IE() is 0b000-0b010 with CQICH type 0b000 or 0b100 (see 8.4.5.4.15), the SS shall report the S/N it measures on the DL. The following formula shall be used

For MS with more than one receive antennas, the following formula shall be used

$$Payload\ bits\ Nibble = \begin{cases} 0, & S/N < -3 - \Delta\ \text{dB} \\ n, & n-4-\Delta < S/N < n-3-\Delta\ \text{dB},\ 0 < n < 31 \\ 31, & S/N > (27 - \Delta)\text{dB} \end{cases}$$

[Add the following text at the end of 8.4.5.4.10.2]

When CQI Feedback Type field in CQICH_Enhanced_Alloc_IE() (see 8.4.5.4.15) is 0b011 and CQICH type is 0b101, the MS shall report the MIMO coefficient the BS should use for best DL reception. The mapping for the complex weights is shown in Figure 231. For this type of feedback, if N is the number of BS transmit antennas, then (N-1) CQICH shall be allocated to the SS and SS shall report the desired antenna weights of antenna 1 through N-1 based on antenna 0.

[Modify the text between line 4~14 page 297 in 8.4.5.4.10.6 as following]

When the FAST_FEEDBACK Fast-feedback allocation subheader Feedback Type field is 0b01 or 0b10 or the CQI Type field in the MIMO Compact DL-MAP IE() (see 6.3.2.3.43.6.7) is 0b01, or the ~~CQI~~ Feedback Type field in CQICH_Enhanced_Alloc_IE() (see 8.4.5.4.15) is 0b011 with CQICH type 0b000 or 0b100, the MS shall report the MIMO coefficient the BS should use for best DL reception. The mapping for the complex weights is shown in Figure 229b.~~, and the SS shall construct the 6 CQI bits with 0 as the MSB and the mapped code as the remaining LSBs.~~ For this type of feedback, if N is the number of BS transmit antennas, then (N-1) CQICH shall be allocated to the SS and SS shall report the desired antenna weights of antenna 1 through N-1 based on antenna 0.

[Modify the text between line 57~63 page 298 in 8.4.5.4.10.7 as following]

When the enhanced FAST FEEDBACK channel is employed, the SS may report the MIMO mode feedback on the assigned CQICH when the FAST_FEEDBACK allocation subheader Feedback Type field is 0b00, or the ~~CQI~~ Feedback Type field in the MIMO Compact DL-MAP IE() (see 6.3.2.3.43.6.7) is 0b000, 0b001, or 0b010, or the ~~CQI~~ Feedback Type field in CQICH_Enhanced_Alloc_IE() (see 8.4.5.4.15) is 0b000, 0b001, or 0b010 with CQICH type 0b000 or 0b100. The encoding of payload bits is shown in Table 298c.

[Modify the Table 298c, 298d, Table 298e and Table 298f in 8.4.5.4.10.7 as following]

Table 298c—Encoding of payload bits for MIMO Mode Feedback with Enhanced FAST FEEDBACK Channel

Value (binary)	Description
101000	STTD and PUSC/FUSC permutation
101001	STTD and adjacent-subcarrier permutation
101010	SM and PUSC/FUSC permutation
101011	SM and adjacent-subcarrier permutation
101100	Hybrid and PUSC/FUSC permutation
101101	Hybrid and adjacent-subcarrier permutation
101110-110110	Interpretation according to table ~~296c, 296f or 296g~~298d, 298e or 298f, depending on if antenna grouping, antenna selection or a reduced precoding matrix code book is used.
110111	Closed loop precoding with 1 stream.
111000	Closed loop precoding with 2 stream.
111001	Closed loop precoding with 3 stream.
111010	Closed loop precoding with 4 stream.
111011 - 111111	Reserved

Table 298d—Interpretation of code words 0b101110-0b110110 in Table ~~296d~~298c in the case of using antenna grouping

Value (binary) 6-bit/3-bit	Description
101110/000	Antenna Group A1 for rate 1 For 3-antenna BS, See 8.4.8.3.4.1 For 4-antenna BS, See 8.4.8.3.5.1
101111/001	Antenna Group A2 for rate 1
110000/010	Antenna Group A3 for rate 1
110001/000	Antenna Group B1 for rate 2 For 3-antenna BS, See 8.4.8.3.4.2 For 4-antenna BS, See 8.4.8.3.5.2
110010/001	Antenna Group B2 for rate 2
110011/010	Antenna Group B3 for rate 2
110100/011	Antenna Group B4 for rate 2 (only for 4-antenna BS)
110101/100	Antenna Group B5 for rate 2 (only for 4-antenna BS)
110110/101	Antenna Group B6 for rate 2 (only for 4-antenna BS)

Table 298e—Interpretation of code words 0b101110-0b110110 in Table ~~296d~~298c in the case of using antenna selection

Value (binary) 6-bit/3-bit	Description
101110/000	Antenna selection option 0
101111/001	Antenna selection option 1
110000/010	Antenna selection option 2
110001/011	Antenna selection option 3
110010/100	Antenna selection option 4
110011/101	Antenna selection option 5
110100/110	Antenna selection option 6
110101/111	Antenna selection option 7
110110	Reserved

Table 298f—Interpretation of code words 0b101110-0b110110 in Table ~~296d~~298c in the case of Using reduced precoding matrix code book

Value (binary) 6-bit/3-bit	Description
101110/000	Reduced Precoding matrix code book entry 0
101111/001	Reduced Precoding matrix code book entry 1
110000/010	Reduced Precoding matrix code book entry 2
110001/011	Reduced Precoding matrix code book entry 3
110010/100	Reduced Precoding matrix code book entry 4
110011/101	Reduced Precoding matrix code book entry 5
110100/110	Reduced Precoding matrix code book entry 6
110101/111	Reduced Precoding matrix code book entry 7
110110	Reserved

[Modify the text between line 48~51 page 303 in 8.4.5.4.10.10 as following]

When the Band AMC operation is triggered, the SS shall report the differential of CINR for five selected bands (increment: 1 and decrement: 0 with a step of 1 dB) on its enhanced or primary Fast-feedback channel. The first 32 codewords with MSB of 0 are used.

[Modify the text between line 57 page 303 and line 9 page 304 in 8.4.5.4.10.11 as following]

For an MS which supports the feedback method using the Feedback header, the MS can send an indication flag on the Fast-feedback channel or the enhanced Fast-feedback channel. The indication flag is a specific encoding of the payload bits on the Fast-feedback channel, ~~or~~ the enhanced Fast-feedback channel or the primary/secondary Fast-feedback channel. The indication flag is used by the MS to indicate to the BS its intention to transmit a Feedback header or a Bandwidth Request header without the need to perform bandwidth request ranging. After receiving the indication flag from the MS, the BS may allocate the required UL resource to the MS. For the case of Fast-feedback channel or secondary Fast-feedback channel, if the Indication Flag feedback operation is enabled, the specific encoding of the payload bits is defined in the Use CQICH indication flag TLV. This specific encoding is reserved for the purpose of indication flag and shall not be used to send other feedback information (see section 8.4.5.4.10.1).

For the case of enhanced Fast-feedback channel or primary Fast-feedback channel, the encoding of 0b111100 shall be used as the indication flag.