Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Clarification of SNR definition for MIMO**
Date Submitted	**2005-01-13**
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Re:	Call for Reply Comments regarding the Maintenance Task Group Comment Report 80216maint-04_09.zip
Abstract	In this contribution, we propose to feedback CQI based on SNR measured after MIMO decoder and before FEC encoder, so called post processing SNR to provide a unified approach for MIMO CQI measurement. In the proposal, we also clarify the multiple layer feedback using CQICH_Alloc_IE() or Enhanced_CQICH_Alloc_IE().
Purpose	The contribution should be considered by Maintenance group within comment resolution procedure
Notice	
Release	
Patent Policy and Procedures	

Clarification of SNR Definition for MIMO

1 Introduction

In the current standard, the BS assigns burst profile based on CQI feedback from MSS. For the SISO case, CQI is based on the SNR measured at the receive antenna port. However, for MIMO case, SNR measured at per-receive antenna does not provide enough information for this purpose. The channel burst profile selection depends on the type of MIMO decoder and channel matrix condition. In this contribution, we propose to feedback CQI based on SNR measured after MIMO decoder and before FEC encoder, so called post processing SNR as shown in Figure 1, therefore, provide a unified approach to CQI measurement with all the factors being taken into account. MSS may feedback either average post processing SNR or post processing SNR for individual layer as instructed by BS.

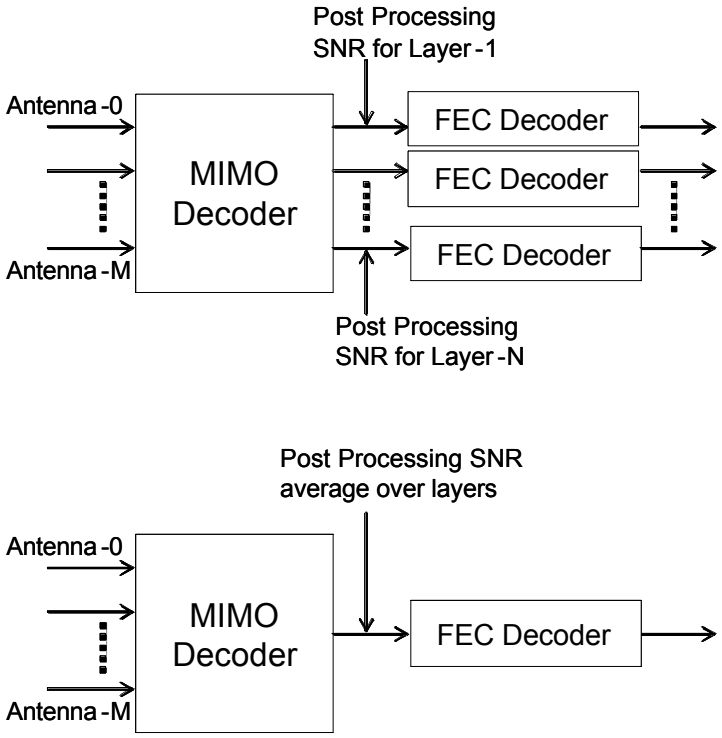

Figure 1 Post processing SNR

The current standard enables the spatial multiplexing MIMO transmission, it provides the feedback mechanism. However, when multiple layer feedback is enabled, the layer index is implied, not clearly specified. In the proposal, we add some text to clarify the multiple layer feedback using CQICH_IE() or Enhanced CQICH_IE().

2 Proposed text change

Modify the text in section 8.4.5.4.10.5

---------- begin----------

When the FAST_FEEDBACK 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' (see 8.4.5.4.15), the SS shall report the S/N it measures on the DL. The following formula shall be used:
---------- *end*----------

Insert the following text in section 8.4.5.4.10.5 after line 65

----------*Begin*----------

MIMO capable MSS shall measure post processing S/N for each individual layers as shown in Figure xxx. When the FAST_FEEDBACK subheader Feedback Type field is "00", the MSS shall report the post processing S/R averaged over layers. When BS requests MSS feedback through CQICH_Alloc_IE() or CQICH_Enhanced_Alloc_IE() with '00' Feedback_type field, MSS shall report average S/N or individual layer S/N as desribed in sections 8.4.5.4.12 and 8.4.5.4.15

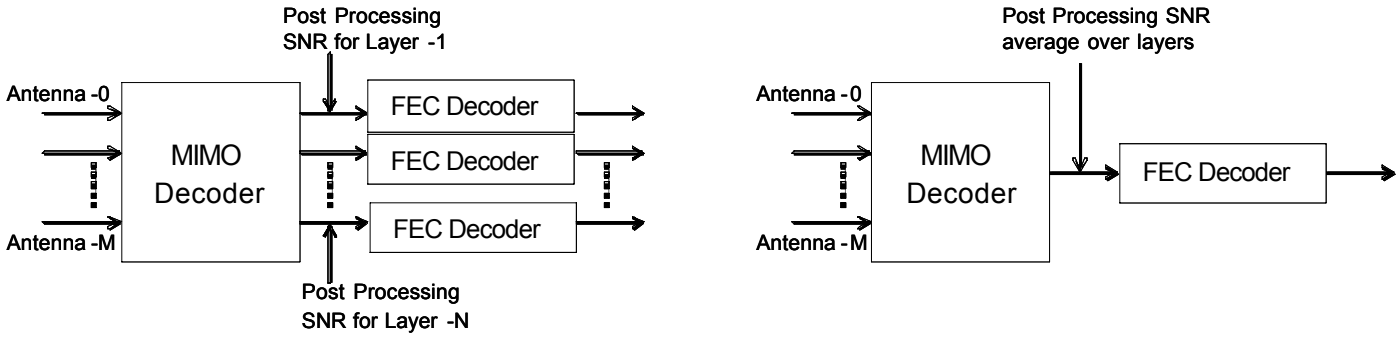

Figure XXX Post processed S/N for MIMO

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

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

where _ = 10 log (Nr) for the cases of single transmit antenna BS or 2 and 4 transmit antenna BS using matrix A transmission format and _ = 10 log (Nr/2) for the case of 2 and 4 transmit antennas BS using matrix B transmission format. Nr is the number of receive antennas.

----------*end*----------

Modify the text in section 8.4.5.4.10.5 Fast DL measurement feedback for enhanced FAST_FEEDBACK channel

---------- *begin*----------

When the FAST_FEEDBACK 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' (see 8.4.5.4.15), the SS shall report the S/N it measures on the DL. The following formula shall be used:

---------- *end*----------

Insert the following text at the end of the section

---------- *begin*----------

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

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

where _ = 10 log (Nr) for the cases of single transmit antenna BS or 2 and 4 transmit antenna BS using matrix A transmission format and _ = 10 log (Nr/2) for the case of 2 and 4 transmit antennas BS using matrix B transmission format. Nr is the number of receive antennas. S/N is post processing S/N averaged over layers as defined in section 8.4.5.4.10.5.

----------*end*----------

Insert the following text in the end of section 8.4.5.4.12 CQICH Allocation IE Format to clarify the multi-layer CQI feedback for MIMO case

---------- *begin* ----------

For MIMO capable MSSs, BS may allocate one or multiple CQICH channels to the MSS in UL_MAP. If one CQICH channel is allocated, MSS shall report the average post processing S/R. If multiple CQICH channels are allocated, MSS shall report post processing SNR of individual layers, the order of CQICH channel allocation shall match the order of layer index.

----------*end* ----------

Insert the following text in the section 8.4.5.4.12.1 CQICH Enhanced Allocation IE Format

---------- *begin* ----------

For MIMO capable MSSs, BS may allocate one or multiple CQICH channels to the MSS in UL_MAP. If CQICH_Num=0 and feedback type is '00', MSS shall report the average post processing S/R. For CQICH_Num>0 and and feedback type is '00', MSS shall report post processing SNR of individual layers, the order of CQICH channel allocation shall match the order of layer index..

----------*end* ----------