Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Integration of comments #5482, #5484, #5487, their reply comments, contribution 289, 305 and 118r4 on fast DL S/N measurements
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Re:	IEEE P802.16e/D8
Abstract	This contribution integrates comments #5482, #5484, #5487, their reply comments, contribution 289, 305 and 118r4 on fast DL S/N measurements, and changes some portions based on the D8 draft.
Purpose	Discuss and approve.
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Integration of Comments 5482, 5484, 5487 and all their reply comments, contributions 289, 118r4, 305

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Introduction

The contribution 118r3, which was based on draft IEEE P802.16e/D8 was approved in Atlanta meeting. However, comments 5482 and 5484 suggested some changes to section 8.4.5.4.10, which was approved in BRC in Schumburg IL. Comment 5484 was based on contribution 289 from Motorola, which was replied by contribution 305 from Nortel. In BRC contribution 305 was approved and it superceded comment #5482. However, comment #5487 suggest correct implementation of the approved contribution 118r3 that was modified based on draft D8. There are several inconsistencies and conflicts between these comments. This contribution tries to incorporate the modifications suggested by 118r4, and 305, all reply comments for comments 5482, 5484, and 5487, and at the same time fix some bugs in those documents. The contribution suggests changes based upon baseline document IEEE802.16-2004.

Proposed text changes:

[Add the following text before the first paragraph of 8.4.5.4.10.1 (page 321, line 51. It should replace the contents of 8.4.5.4.10.1 in the baseline document]:

When the Feedback_type field in CQICH_Enhanced_Alloc_IE() is 0b000 with CQICH type 0b101 the following formula shall be used*:*

$$payload\_bits = \begin{cases} 0, & S/N \quad 1 \quad B \\ n, & (2n \quad 1 \quad B) \quad S/N \quad (2n \quad 1 \quad B), \quad 0 \quad n \quad 15 \\ 15, & S/N \quad 29 \quad B \end{cases}$$ [Add proper equation number here](say xx)

[It should be payload bits Nibble rather than payload_bits, as it corresponds to 4 bit CQICH]

where B is the positive integer value indicated in the SN Reporting Base IE (see 11.7.27). B shall default to "3" if the SN Reporting Base IE was not included in the REG-RSP.

[Insert following text at the end of section 8.4.5.4.10.]:

MIMO capable MS shall measure post processing S/N for each individual layers as shown in Figure 230a.When the FAST_FEEDBACK subheader Feedback Type field is "00", the MS shall report the post processing Effective SNR (Eff_SNR) for S/N in (xx) [please use appropriate eq#], as defined below. When BS requests MS feedback through CQICH_Alloc_IE () or CQICH_Enhanced_Alloc_IE() with '00' Feedback_type field, MS shall report ~~average S/N~~ Eff_SNR or individual layer S/N as described in 8.4.5.4.12 and 8.4.5.4.15

Note that the effective SNR (Eff_SNR) is defined as

$$Eff\_SNR = e^{C(d,y|H)} - 1$$ [Add proper equation number here](a)

where C(d,y|H) is the receiver-constrained mutual information conditioned on knowing the channel knowledge. Note that d is the transmitted signal, y is the post-processing receive signal and H is the channel matrix between transmit and receive antennas. For example, LMMSE-type of MIMO detectors where individual post-detector-processing signal to noise ratios are given as SNR_1, …. SNR_N, then the average receiver-constrained mutual information is given by

$$C(d,y|H)=\frac{1}{N}\sum_{n=1}^{N}\log(1+SNR_n)$$; [Add proper equation number here](b)

considering (a),(b) [Replace with proper equation number from above] together we get $Eff\_SNR=\left(\prod_{n=1}^{N}(1+SNR_n)\right)^{1/N}$, [add –1 at the end of this equation] which is well approximated by average SNR, i.e. $Eff\_SNR \approx \frac{1}{N}\sum_{n=1}^{N} SNR_n$ (in dB) , when the individual SNRs are reasonably high. On the other hand, for ML MIMO detectors the receiver-constrained mutual information is simply the MIMO channel mutual information:

$$C(d,y|H)=\frac{1}{N}\log\det(I_N+H^H R^{-1} H)$$ [Add proper equation number here] (c)

where I_N is an N by N identity matrix and R is the correlation matrix of interference plus noise measured at SS.
Once receiver-constrained mutual information is obtained from (b) or (c), equation (a) [Replace with proper equation number from above] is used to calculate the Eff_SNR for a vertically encoded system.

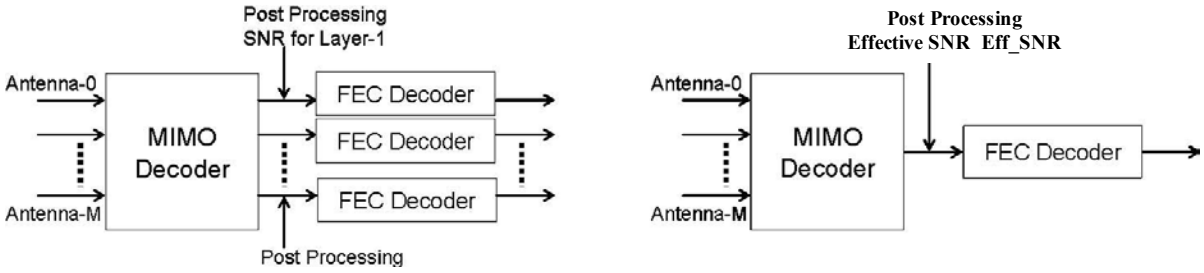

Figure 230a – Post Processing S/N for MIMO Region

[Replace the first half of the figure 230a with the one from contribution 305]

[Replace the contents of 8.4.5.4.10.5 (page 328, line 33 thru page 329, line 19) with the following text]:

When the FAST_FEEDBACK allocation subheader Feedback Type field is 0b00 ~~or the MIMO_Permutation_Feedback_Cycle field in the CQICH_Alloc_IE() is 0b00 (see section 8.4.5.4.12)~~, or the Feedback_type field in CQICH_Enhanced_Alloc_IE() is 0b000-0b010 with CQICH type 0b000, 0b001 or (see 8.4.5.4.15), the MS shall report the S/N it measures on the DL. The following formula shall be used:

$$payload\_bits = \begin{cases} 0, & S/N \le B \\ n, & (n-1-B) < S/N \le (n-B),\ 0 < n < 31 \\ 31, & S/N > 30 + B \end{cases} \quad (107a)$$

where B is the positive integer value indicated in the SN Reporting Base IE (see 11.7.27). B shall default to "3" if the SN Reporting Base IE was not included in the REG-RSP

For MIMO capable MSs, if BS allocates a single CQICH to the MS in UL_MAP for the purposes of Fast DL Measurement, MS shall report the effective post processing S/R Eff_SNR as defined in 8.4.5.4.10.1. Otherwise, if BS allocate multiple CQICHs to the MS in UL_MAP for the purposes of Fast DL Measurement, the MS shall report post processing S/N of individual layers in order of layer indices.

[Modify the text in section 8.4.5.4.11.1 after line 4 in page 347]

For MIMO capable MSs, BS may allocate one or multiple CQICH channels to the MS in UL_MAP. IF CQICH_Num=0 and feedback type is '00', MS shall report the effective post processing S/R Eff_SNR as

defined in 8.4.5.4.10.1 ***[It was 8.4.5.4.10.5 in 305 but I changed it based on this which comes from 305].*** For CQICH_Num>0 and feedback type is '00', MS shall report post processing SNR of individual layers, the order of CQICH channel allocation shall match the order of layer index.

***[On page 527, line 21, insert new subclause 11.7.27]*:**

11.7.27 SN Reporting Base

SN Reporting Base indicates the (negative of the) base value that the MS shall use in sending fast DL measurement feedback on an enhanced fast-feedback channel.

Type	Length	Value	Scope
-	1	A positive integer in the range 0-255; the base value used in reporting shall be the negative of this value.	REG-RSP