

Project	<b>IEEE 802.16 Broadband Wireless Access Working Group</b> < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	<b>Corrections to fast DL S/N measurements</b>	
Date Submitted	<b>2005-06-08</b>	
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Re:	IEEE P802.16e/D8	
Abstract	This contribution corrects some problems with fast DL S/N measurements on enhanced fast-feedback channels.	
Purpose	Discuss and approve.	
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## Introduction

802.16-2004 defines mechanisms for the MS to feedback measurements of the DL S/N on a fast-feedback channel. This type of fast feedback is termed “CQICH” (channel quality indication). The MS can be requested to send a S/N measurement via several means, including: sending a Fast Feedback subheader, and sending a CQICH Allocation IE in the UL-MAP.

In an 802.16-2004 fast-feedback channel, 4 bits of information are encoded into a single slot; consequently only 16 different S/N values can be sent on a CQICH. In 802.16-2004, the range of S/N that can be reported is -2 to +26 dB in 2 dB steps.

In P802.16e/D8, an enhanced fast-feedback channel is defined that encodes 6 bits into a slot. The draft also defines new mechanisms for requesting the MS to report DL S/N on this enhanced fast-feedback channel (including an “Enhanced CQICH Allocation IE”), and indicates how the S/N value is to be encoded. However there are a number of problems with the draft:

- 1) It is not clearly stated if requesting a report via the (old) CQICH Allocation IE should result in 6-bit S/N feedback, although this seems to be intent.
- 2) The section that specifies the S/N coding (8.4.5.4.10.5) contains a number of errors and ambiguities, in particular,
  - a. It is not clearly stated which encoding formula is supposed to be used in which cases;
  - b. The encoding formulas make use of  $N_r$  (number of MS receive antennas) which is not always known by the BS (for example, if the MS has 2 antennas, but does not support receiving either STC matrix A or B, then there is no way for the MS to indicate the number of its antennas in the “OFDMA SS Demodulator for MIMO Support” IE in SBC).
  - c. Several minor errors, e.g. incorrect cross-references.

These problems could result in the BS mis-interpreting the S/N value reported by an MS, which would have a negative impact on system operation.

In the proposed changes, we clarify the text in 8.4.5.4.10.5. To eliminate the dependency on  $N_r$  in the coding formulas, we introduce an explicit “S/N base” value, which is sent to the MS in the REG-RSP, and used by the MS in the encoding formulas. This allows the BS to insure that the MS’s S/N reports cover the numerical range of interest regardless of the antenna configurations. This is a robust approach that will future-proof this important function.

**Proposed text changes:**

**[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 0b000-0b011 with CQICH type 0b000, 0b001 or 0b100 (see 8.4.5.4.15), the MS shall report the S/N it measures on the DL. The following formula shall be used:

$$\text{payload\_bits} = \begin{cases} 0, & S/N < B \\ n, & (n - 1) \leq S/N < B \\ 31, & S/N \geq 30 \cdot B \end{cases}$$

When the Feedback\_type field in CQICH\_Enhanced\_Alloc\_IE() is 0b000 with CQICH type 0b101 the following formula shall be used:

$$\text{payload\_bits} = \begin{cases} 0, & S/N < B \\ n, & (2n - 1) \leq S/N < B \\ 15, & S/N \geq 29 \cdot B \end{cases}$$

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.

The BS may allocate one or multiple CQICH channels to the MS in UL\_MAP for the purposes of Fast DL Measurement. If a single CQICH is allocated, MS shall report the average post processing S/N. If more than one CQICH is allocated, the MS shall report post processing S/N of individual layers in 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