Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Comments on Per-tone SINR Computation for PHY Abstraction in P802.16m Evaluation Methodology Document**
Date Submitted	**2007-11-13**
Source(s)	Pei-Kai Liao, I-Kang Fu, Paul Cheng pk.liao@mediatek.com paul.cheng@mediatek.com MediaTek Inc. No.1, Dusing Road 1, Science-Based Industrial Park, Hsinchu, Taiwan 300, R.O.C. Yuan Pin Lin, Chun Fang Lee, Chieh Yuan Ho, Fan-Shuo Tseng, Chung-Hsien Hsu, Ta-Sung Lee, Yu-Ted Su, Wen-Rong Wu, Kai-Ten Feng, Ching Yao Huang fred.lin@mediatek.com cf.lee@mediatek.com fs.tseng@mediatek.com thorpe.ho@mediatek.com stanley.hsu@mediatek.com NCTU/MediaTek Inc. ED905A, 1001 Ta Hsueh Road, Hsinchu, Taiwan 300, ROC
Re:	IEEE 802.16m-07/039r1, "Call for Comments on Draft 802.16m Evaluation Methodology Document."
Abstract	This contribution lists several obscure and erroneous places in Section 4.5 "Per-tone SINR Computation" and Appendix O of current draft EVM, and proposes the revised texts or equations to it.
Purpose	Propose to revise listed places with proposed texts or equations in current draft EVM.
Notice	*This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups.* It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.

Comments on Per-tone SINR Computation for PHY Abstraction in P802.16m Evaluation Methodology Document

Pei-Kai Liao, I-Kang Fu, Paul Cheng
MediaTek Inc.

Yuan Pin Lin, Chun Fang Lee, Fan-Shuo Tseng, Chieh Yuan Ho, Chung-Hsien Hsu, Ta-Sung Lee, Yu-Ted Su, Wen-Rong Wu, Kai-Ten Feng, Ching Yao Huang
NCTU/MediaTek Inc.

I. Introduction

In Section 4.5, it computes per-tone SINR values for different transmission schemes to enable system-level simulation without the knowledge of detailed PHY layer parameters. In order to provide system-level simulation results with better accuracy, precise PHY-layer abstraction for upper layer calculation is required. SINR computation is one of important parameters in PHY-layer abstraction. Inaccurate SINR value may result in large difference from true results. In the ensuing section, we list the erroneous places and propose the corresponding remedies. Besides, in addition to MMSE receiver, MMSE-VBLAST is also a widely used receiver structure to suppress the co-channel interferences for spatial multiplexing so it is suggested to insert one more subsection or an informative appendix to include this receiver structure for PHY abstraction.

II. Text Proposal

Part 1:

----------Start of the Text----------

[*Adopt the following modification to the P802.16m Evaluation Methodology Document from line#26, page#78*]

Here, the MMSE weights $W(n)$ ($N_R \times N_T$ matrix) are specified as

$$W(n) = \left(\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)} \underline{H}^{(0)}(n) \underline{H}^{(0)^*}(n) + \tilde{\sigma}^2 I \right)^{-1} \sigma_0^2 \sqrt{P_{tx}^{(0)} P_{loss}^{(0)}} \underline{H}^{(0)}(n), \quad (81)$$

where (.)* is the Hermitian operator and $\tilde{\sigma}^2 = \sigma^2 I + \sum_{j=1}^{N_I} \sigma_j^2 P_{tx}^{(j)} P_{loss}^{(j)} \underline{H}^{(j)}(n) \underline{H}^{(j)^*}(n)$

----------End of the Text----------

Part 2:

----------Start of the Text----------

[*Insert the following texts to the P802.16m Evaluation Methodology Document from line#23, page#78*]

4.5.4.1 MIMO Linear MMSE receiver

A linear MMSE receiver is used to demodulate the transmitted signal vector, thus……

4.5.4.2 MIMO MMSE-VBLAST receiver

Regarding per-tone post SINR for MIMO MMSE-VBLAST receiver, the nulling vector for *i*th layer at *n*th subcarrier is

$$w_i(n)=\left(\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)} \sum_{j=1}^{i} \underline{H}_j^{(0)}(n)\underline{H}_j^{(0)^*}(n)+\tilde{\sigma}^2 I\right)^{-1} \sigma_0^2 \sqrt{P_{tx}^{(0)} P_{loss}^{(0)}}\,\underline{H}_i^{(0)}(n), \quad i=1,\cdots,M_t, \qquad (83)$$

where $\underline{H}_i^{(j)}(n)$ is the *i*th column vector of $\underline{H}^{(j)}(n)$.

$\tilde{\sigma}^2=\sigma^2 I+\sum_{j=1}^{N_I}\sigma_j^2 P_{tx}^{(j)} P_{loss}^{(j)} \underline{H}^{(j)}(n)\underline{H}^{(j)^*}(n)$.

As a result, the poster processing SINR of desired MS for *i*th layer and *n*th subcarrier using $\mathbf{w}_i(n)$ is

$$SINR_i^{(0)}(n)=\frac{\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)}\left|w_i^*(n)\underline{H}_i^{(0)}(n)\right|^2}{w_i^*(n)\left(\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)}\sum_{j=1}^{i-1}\underline{H}_j^{(0)}\underline{H}_j^{(0)*}+\tilde{\sigma}\right)w_i(n)}. \qquad (84)$$

----------End of the Text----------

Part 3:

----------Start of the Text----------

[*Adopt the following text modification to the P802.16m Evaluation Methodology Document from line#32, page#81*]

Taking into account the effect of EVM, per-tone SINR for the SISO case as an example becomes

$$SINR^0(n)=\frac{\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)}\left|H^{(0)}(n)\right|^2}{\sigma^2+\sum_{j=1}^{N_i}\sigma_j^2 P_{tx}^{(j)} P_{loss}^{(j)}\left|H^{(j)}(n)\right|^2+10^{-EVM/10}\cdot\sigma_0^2\cdot P_{tx}^{(0)} P_{loss}^{(0)}\left|H^{(0)}(n)\right|^2} \qquad (87)$$

----------End of the Text----------

Part 4:

----------Start of the Text----------

[*Adopt the following modification to the P802.16m Evaluation Methodology Document from line#16, page#155*]

$$SINR^{(0)}(n)=\frac{\sigma_0^2 P_{tx}^{(0)} P_{loss}^{(0)}\left|\tilde{H}^{(0)}(n)\right|^2}{\sigma^2+\sum_{j=1}^{N_I}\sigma_j^2 P_{tx}^{(j)} P_{loss}^{(j)}\left|H^{(j)}(n)\right|^2}$$

----------End of the Text----------