Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Reply Comment on sub-packet combing for 4 Transmit antenna MIMO-HARQ**
Date Submitted	**2005-01-23**
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Re:	IEEE 802.16-REVe/D5a, BRC recirc
Abstract	Clarify the sub-packet re-transmission format for 4 Transmit MIMO case. The update is in blue fonts
Purpose	To incorporate the changes here proposed into the 802.16e D5a draft.
Notice	
Release	
Patent Policy and Procedures	

Reply comment on sub-packet combing for 4 transmit antenna MIMO-HARQ

1 Introduction

In comment 2284 and comment 2285, it was proposed to modify the current 4 Tx sub-packet retransmission format. Namely in contribution C80216e-04_509r3 the 1st re-transmission format is modified and in contribution C80216e-05_053 the 2nd and 3rd re-transmission formats are changed as shown in Table 1.

Table 1 Sub-packet combing for 4 Transmit MIMO-HARQ (C80216e-05_053)

	( )=0 transmission	( )=1 transmission	( )=2 transmission	( )=3 transmission
Space time code incremental redundancy for matrix A			$S^{(2)}=\begin{bmatrix}S_3\\S_4\\S_1\\S_2\end{bmatrix}$	$S^{(3)}=\begin{bmatrix}-S_4^*\\S_3^*\\-S_2^*\\S_1^*\end{bmatrix}$

In this contribution, we provide the performance simulation results and compare against current scheme in the 802.16e/5a draft.

In current standard the first re-transmission sub-packet combining with the initial transmission constitutes a double STTD, the receiver can combined sub-packets with MMSE receiver, the 2nd and 3rd re-transmissions follows the same structure as the previous two, and it can be further combined in energy with the result of first MMSE result of the first pair of double STTD. However, we can further exploit the diversity gain from the 2nd and 3rd re-transmissions, in this case, *the mapping of the* S_1, S_2 *between* S_3, S_4 *needs to be swapped to* achieve the full diversity for 4 transmit antennas, namely, each symbol is transmitted through all the antennas after the 3rd re-transmission. The proposed the solution is listed in Table 2.

Table 2 Full diversity sub-packet combing for 4 Transmit MIMO-HARQ

	( )=0 transmission	( )=1 transmission	( )=2 transmission	( )=3 transmission
Space time code incremental redundancy for matrix A			$S^{(2)}=\begin{bmatrix}S_3\\S_4\\S_1\\S_2\end{bmatrix}$	$S^{(3)}=\begin{bmatrix}-S_4^*\\S_3^*\\-S_2^*\\S_1^*\end{bmatrix}$

2 Simulation Results

In order to evaluate the benefit of the proposed solution, we present the post MMSE combiner SNR CDF distribution; in this the statistic of the 4 sub-packet re-transmissions for the current IEEE802.16e, the contribution C80216e-05_053 and the proposed full diversity combining are shown in Figure 1. As we can see the full diversity sub-packet combing allows significant reduce the SNR variation and reduce the low post SNR output at MMSE combiner.

Post Sub -packet Combining SNR

(at 3rd re-transmission)

802.16e C80216e -05_053 Full Diversity

Figure 1 Post SNR distribution for sub-packet re-transmissions

3 Text proposal

[Replace Table 315n in section 8.4.8.9]

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Table 315n—STC subpacket combining (4-transmit antenna case)

	( )=0 transmission	( )=1 transmission	( )=2 transmission	( )=3 transmission
Space time code incremental redundancy for matrix A			$S^{(2)} = \begin{bmatrix} S_3 \\ S_4 \\ S_1 \\ S_2 \end{bmatrix}$	$S^{(3)} = \begin{bmatrix} -S_4^* \\ S_3^* \\ -S_2^* \\ S_1^* \end{bmatrix}$

-------------------------*End Text* --