Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Power control of uplink AAS preamble for SDMA operation**
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Re:	Recirculation of P802.16 REVe/D5
Abstract	There is no specific description of power level of AAS preamble in P802.16REVd/D5 and it is assumed to be equal to that of following data sub-carriers. This contribution presents an efficient and flexible solution for adjusting the uplink AAS preamble power tailored to TDD SDMA operation.
Purpose	Adoption of suggested changes into P802.16e/D6
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(For readers: The changes made during revision process are underlined and written in pink. The text changes proposed in the original contribution remain in blue)

Problem Definition

The current text has no specific description of power level of AAS preamble both in uplink and downlink. Presumably, the level of AAS preamble power is assumed to be equal to that of the following data sub-carriers. Thus, the uplink SDMA users experience power unbalance of uplink AAS preamble and therefore there happens large error in user's spatial signature estimation.

To investigate the effects of received power unbalance of SDMA users, system level simulation was carried out using 3GPP Urban Macro spatial channel model, wherein angular spread and Doppler frequency are $\sigma_{AS}^2 = 8^o$, $f_d = 30\,\mathrm{Hz}$, respectively. The carrier frequency is 2.3 GHz and 4 ULA (Uniform Linear Array) antennas with adjacent antenna spacing of 4λ are assumed herein. Also, the user locations were randomly selected and 2-user SDMA cases with/without power unbalance were considered. The MCS levels of SDMA users were QPSK 1/2 with 480 bit packet length. The uplink packet error rate (PER) was obtained by computer simulation with MMSE receiver beam-forming applied to ULA. The spatial channels were estimated by cyclic time shifted preambles with one symbol span and the level of preamble power was assumed to be 2.5 dB larger than data sub-carrier. The figures below summarize the MSE of spatial channel estimation and PER of the weaker power user with 0 dB and 7.8 dB (6) power unbalance in comparison with the stronger user. The horizontal axis represents the signal to thermal noise and inter-cell interference ratio. These results illustrate that the power unbalance between SDMA users causes the deterioration of PERs, which amounts to CNR loss of 0.7 dB at PER of 1 % in case of 7.8 dB power unbalance. Specifically, with implemented channel estimation, the CNR for 1% PER increased by 1.3 dB (0.6 dB) under power unbalance of 7.8 dB (0 dB).

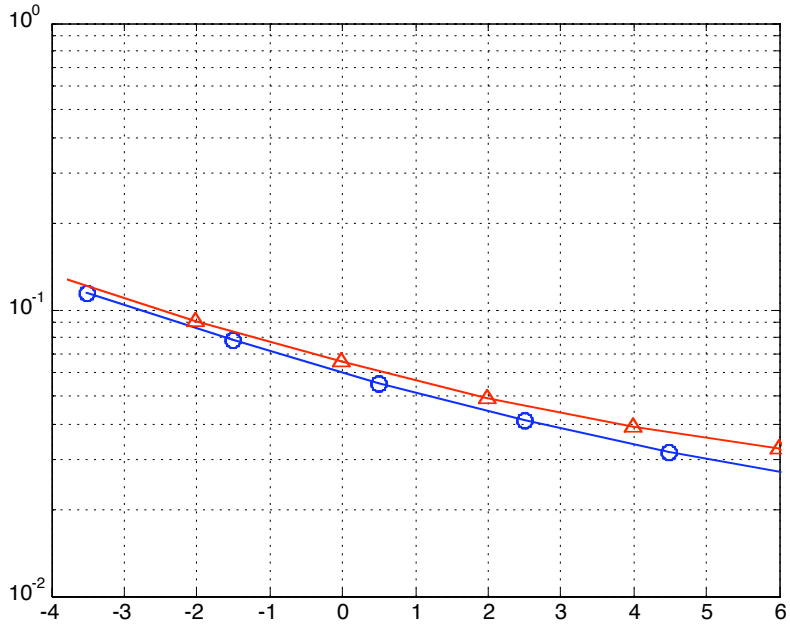

Fig. 1, MSE performance with and without power unbalance

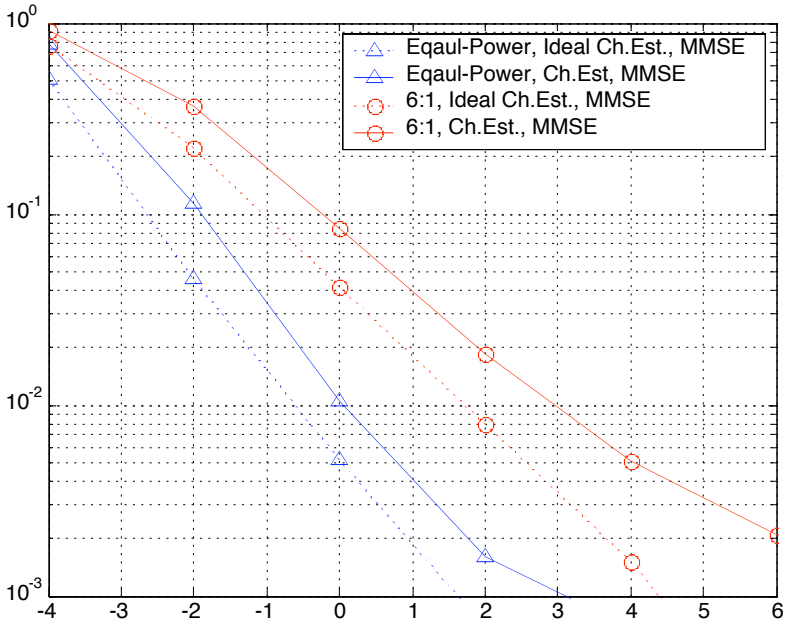

Fig. 2, PER performance with and without power unbalance

Proposed Solution

To reduce the power unbalance between SDMA users, the transmit power level of uplink AAS preamble is equal to that of data sub-carriers if the reference normalized C/N per modulation in Table 333 is between the predefined upper bound and lower bound. Otherwise, the transmit power level of uplink AAS preamble is set to one of the thresholds which are broadcasted in UCD TLV. Note that there is no problem in power outage cases cased by boosted preamble power. In this case, the QPSK modulation is used and phase reference is sufficient for data demodulation. Also, the proposed solution gives much flexibility by changing the thresholds.

Suggested text changes to 16.e standard

[Add the text as follows somewhere in 8.4.4.6.4 "AAS Uplink Preamble"]

8.4.4.6.4 AAS Uplink Preamble

The transmit power level of uplink AAS preamble is equal to that of data sub-carriers when the reference normalized C/N per modulation in Table 333 is between the predefined upper bound and lower bound, which are broadcasted in UCD TLV. Otherwise, the transmit power level of uplink AAS preamble is equal to one of the thresholds according to the Eq. (aaa). The relative power level difference between AAS uplink preamble and data sub-carriers should be maintained as specified in Table 333 when data burst are power controlled either by open-loop or closed-loop mechanism. The resolution and range of the threshold are equal to those of normalized C/N values in Table 333.

$$\begin{cases} C/N_{AAS\_UL\_Preamble} = C/N_{AAS\_UL\_Lower\_Bound} & if\ C/N_{AAS\_UL\_Data} < C/N_{AAS\_UL\_Lower\_Bound} \\ C/N_{AAS\_UL\_Preamble} = C/N_{AAS\_UL\_Upper\_Bound} & if\ C/N_{AAS\_UL\_Data} > C/N_{AAS\_UL\_Upper\_Bound} \\ C/N_{AAS\_UL\_Preamble} = C/N_{AAS\_UL\_Data} & else\ where \end{cases} \quad \text{(aaa)}$$

[Add the text as follows somewhere in 8.4.4.6.3 "AAS Downlink Preamble"]

8.4.4.6.3 AAS Downlink Preamble

The transmit power level of downlink AAS preamble is equal to that of data sub-carriers.