Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Proposed modifications to Subband Partioning to improve frequency diversity**
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Re:	Category: AWD comments / Area: Chapter 15.3.5 (DL-PHY) "Comments on AWD 15.3.5 (DL-PHY)
Abstract	The current DL PHY subband partitioning scheme has a problem where for high Subband Allocation Counts (SAC) the remaining subbands allocated to the miniband permutation have little to no frequency diversity. This is a problem as those remaining subband will be used for A-MAP whose performance would suffer. This contribution provides an alternate subband partitioning scheme that guarantees 4th order frequency diversity for any value of SAC.
Purpose	To be discussed and adopted by TGm for the 802.16m AWD
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Proposed Text of DL PHY Structure for the IEEE 802.16m Amendment

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1. Introduction

The current DL PHY subband partitioning scheme has a problem where for high Subband Allocation Counts (SAC) the remaining subbands allocated to the miniband permutation have little to no frequency diversity. This is a problem as those remaining subband will be used for A-MAP whose performance would suffer. This contribution provides an alternate subband partitioning scheme that guarantees 4th order frequency diversity for any value of SAC.

2. Problems with current subband partitioning

The current subband partitioning scheme has been evaluated in scenarios where half the subband are allocated for localized use (frequency selective) and the other half are allocated to minibands for distributed (frequency diverse) use. However, for large allocations of subbands there are few PRUs left for miniband use. In this latter scenario, little to no frequency disversity is achieved for miniband PRUs allocated suggesting a significant performance degradation for the A-MAP. While it may be argued that 50/50 PRU distribution between subbands and minibands is more typical, there exist some compelling cases where the subband allocation will be large > 85%. Particularly, the ITU scenarios for micro-urban and indoor are examples of these cases where localized allocations will be employed to achieve the maximum spectral efficiency.

In the current subband partitioning scheme, PRUs assigned to miniband are always grouped in contiguous blocks of 4 PRUs. For small miniband allocations of 8 or 12 PRUs, less than 4th order frequency diversity is achieved. For allocations of only 4 miniband PRUs, no frequency diversity is achieved. Figure A illustrates the current subband allocation scheme. The white space shows where the miniband PRUs would be assigned. Notice for SAC=9 or greater the miniband PRUs have little frequency diversity

The proposed remedy allocates mini-band PRUs in 4 uniformly distributed points withn the band such that a 4th order frequency diversity is guaranteed. Figure B illustrates the proposed subband partitioning scheme. Notice that, even for SAC=11, 4th order diversity always maintained.
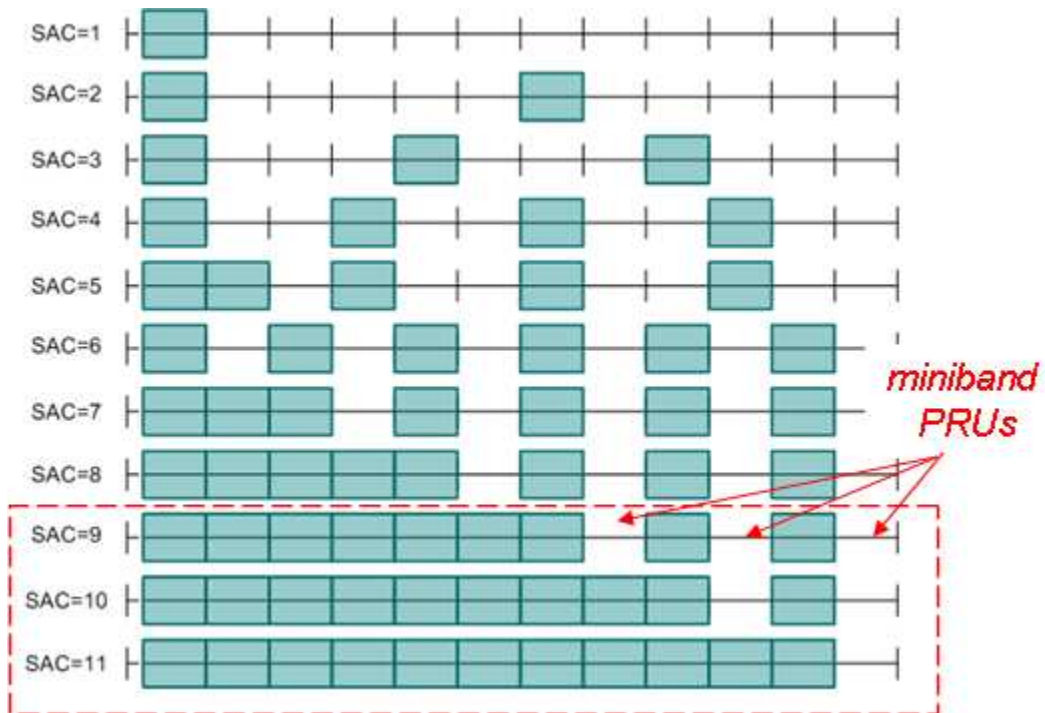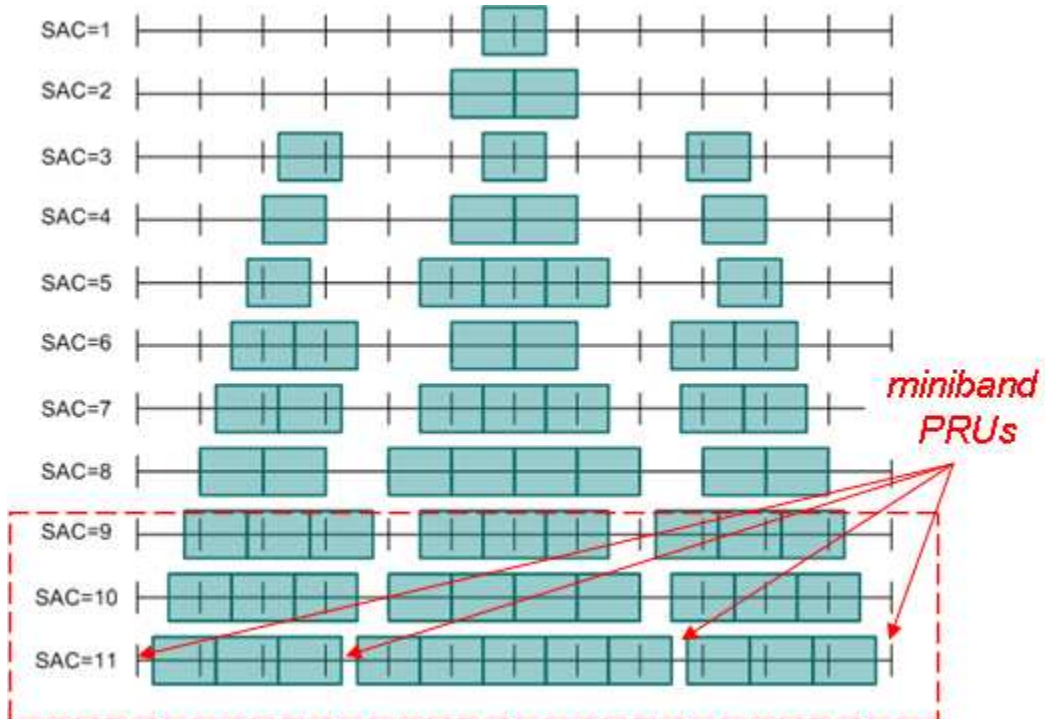
Figure A Current Subband Partitioning Scheme in 10r1

Figure B Proposed subband partitioning scheme

Text proposal for inclusion in the 802.16m amendment

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Make the following modifications to subclause 15.3.5.2.1 Subband partitioning:

Replace equation (175) on page 33 with the following:

$$
i = \begin{cases}
j + \left\lceil \dfrac{L_{MB}}{4} \right\rceil & \text{for} & j < 4\left\lfloor \dfrac{K_{SB}}{3} \right\rfloor \\[2ex]
j + \dfrac{L_{MB}}{2} & \text{for} & 4\left\lfloor \dfrac{K_{SB}}{3} \right\rfloor \le j < 4\left(K_{SB} - \left\lfloor \dfrac{K_{SB}}{3} \right\rfloor \right) \\[2ex]
j + \left(L_{MB} - \left\lceil \dfrac{L_{MB}}{4} \right\rceil \right) & \text{for} & j \ge 4\left(K_{SB} - \left\lfloor \dfrac{K_{SB}}{3} \right\rfloor \right)
\end{cases}
\qquad (175)
$$

Replace equation (177) on page 33 with the following:

$$
i = \begin{cases}
k & \text{for} & k < \left\lceil \dfrac{L_{MB}}{4} \right\rceil \\[2ex]
k + 4\left\lfloor \dfrac{K_{SB}}{3} \right\rfloor & \text{for} & \left\lceil \dfrac{L_{MB}}{4} \right\rceil \le k < \dfrac{L_{MB}}{2} \\[2ex]
k + 4\left(K_{SB} - \left\lfloor \dfrac{K_{SB}}{3} \right\rfloor \right) & \text{for} & \dfrac{L_{MB}}{2} \le k < L_{MB} - \left\lceil \dfrac{L_{MB}}{4} \right\rceil \\[2ex]
k + 4K_{SB} & \text{for} & k \ge L_{MB} - \left\lceil \dfrac{L_{MB}}{4} \right\rceil
\end{cases}
\qquad (177)
$$

Delete line 47 to 48 on page 33.
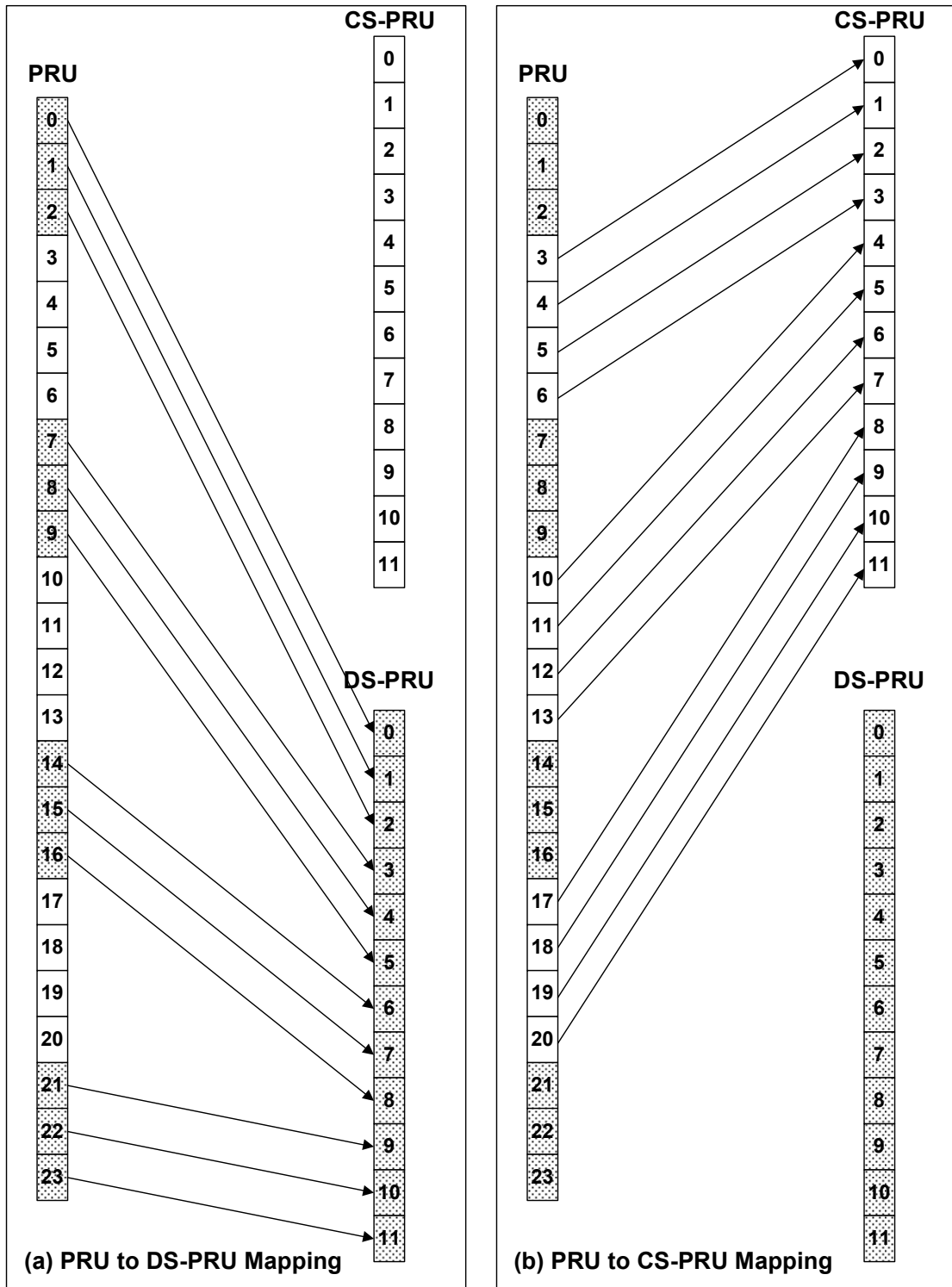
Replace Figure 408 with the following:

Figure 408 PRU to DS-PRU and CS-PRU mapping for BW=5 MHz, SAC=3

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