

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	[Proposal of DL Preamble for OFDMA]	
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Re:		
Abstract	This document contains a proposal for the DL preamble of a OFDMA system.	
Purpose	This proposal provide the DL preamble of the OFDMA system.	
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Proposal of Preamble for OFDMA

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1. References

[1] P802.16a-2003

[1] 80216d-03_01 TGD working document

2. Introduction

In the IEEE 802.16a-2003, the Preambles pilot modulation (section 8.5.9.4.3.1 line 51) is defined as: "The initialization vector of the pilot modulation PRBS (defined in 8.5.9.4.3) for the symbol in which the DL-MAP message starts, and two consecutive symbols thereafter, is [01010101010]. These three symbols serve as the OFDMA DL preamble, in the sense that they indicate where the OFDMA frame starts. The pilots shall be boosted and shall be modulated according to the following formula:"

$$\begin{aligned} \operatorname{Re}\{c_k\} &= \frac{8}{3} \left(\frac{1}{2} - w_k \right) \\ \operatorname{Im}\{c_k\} &= 0 \end{aligned} \quad (79)$$

The Pilot Modulation is defined in the section 8.5.9.4.3 line 3 of the 802.16aD7 document as: "Pilot carriers shall be inserted into each data burst in order to constitute the Symbol and they shall be modulated according to their carrier location within the OFDMA symbol. The PRBS generator depicted hereafter shall be used to produce a sequence, w_k . The polynomial for the PRBS generator shall be $X^{11} + X^9 + 1$."

The Peak-to-Average Power Ratio (**PAPR**) of this preamble is **5.2992 dB**

3. Technical discussion

This document recommends to change the DL preamble of the OFDMA mode in the TG d document [2]. A enhanced DL preamble with significantly reduced PAPR is proposed here.

4. Proposed Preamble for OFDM

In this contribution we propose to use the following binary sequence for the DL preamble:

```

D(-852:852)={
+1 -1 +1 -1 +1 -1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 -1 +1 +1 -1 [-852:-833]
-1 +1 -1 +1 -1 -1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 +1 -1 -1 +1 +1 -1 [-832:-801]
+1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 +1 -1 +1 [-800:-769]
-1 +1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 +1 +1 -1 +1 [-768:-737]
-1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 -1 +1 -1 -1 -1 +1 +1 -1 +1 +1 +1 +1 [-736:-705]
-1 -1 +1 -1 -1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [-704:-673]
+1 +1 -1 -1 +1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 +1 [-672:-641]
+1 +1 +1 +1 -1 -1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 +1 +1 +1 +1 +1 +1 [-640:-609]
+1 +1 +1 +1 -1 -1 -1 -1 -1 -1 +1 +1 +1 -1 -1 +1 +1 -1 +1 -1 +1 +1 -1 +1 [-608:-577]
+1 -1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 [-576:-545]
+1 -1 +1 -1 -1 +1 -1 +1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 +1 -1 +1 [-544:-513]
-1 -1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [-512:-481]
+1 +1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1 +1 +1 [-480:-449]
+1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 -1 -1 -1 -1 [-448:-417]
+1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1 -1 -1 +1 -1 +1 -1 +1 -1 [-416:-385]
+1 +1 +1 +1 +1 +1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 +1 +1 +1 -1 -1 -1 -1 +1 +1 -1 -1 [-384:-353]
+1 +1 -1 -1 +1 +1 +1 -1 -1 -1 -1 -1 +1 +1 +1 -1 -1 +1 +1 -1 -1 -1 -1 -1 -1 [-352:-321]
-1 +1 -1 +1 -1 -1 -1 -1 +1 -1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 +1 +1 [-320:-289]
+1 +1 +1 +1 -1 -1 -1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 -1 +1 [-288:-257]
+1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [-256:-225]
-1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 +1 -1 +1 -1 +1 [-224:-193]
-1 -1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1 -1 -1 +1 -1 -1 -1 +1 +1 +1 +1 [-192:-161]
-1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 +1 -1 -1 +1 -1 -1 -1 +1 +1 +1 +1 +1 [-160:-129]
+1 +1 +1 -1 -1 -1 -1 -1 +1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 -1 +1 [-128:- 97]
-1 -1 +1 +1 -1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 [- 96:- 65]
-1 +1 -1 +1 -1 +1 -1 +1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 [- 64:- 33]
+1 -1 +1 -1 +1 -1 +1 -1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [- 32:- 1]
+0
[DC]
+1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 [ 1: 31]
-1 -1 +1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 -1 -1 +1 +1 -1 +1 -1 -1 +1 +1 -1 +1 [ 32: 63]
-1 -1 +1 -1 -1 +1 -1 +1 -1 -1 +1 -1 -1 +1 -1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 +1 [ 64: 95]
+1 -1 -1 -1 +1 +1 -1 +1 -1 -1 +1 +1 -1 +1 -1 -1 +1 -1 -1 -1 +1 +1 -1 -1 +1 +1 -1 [ 96:127]
-1 +1 +1 -1 -1 +1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 [128:159]
+1 +1 +1 +1 -1 -1 +1 +1 +1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 [160:191]
+1 +1 +1 +1 -1 -1 -1 -1 -1 +1 -1 +1 -1 -1 +1 -1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 [192:223]
-1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 +1 [224:255]
-1 -1 +1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 -1 -1 -1 +1 -1 +1 [256:287]
-1 +1 +1 -1 -1 +1 +1 +1 -1 -1 -1 -1 -1 +1 -1 +1 -1 -1 +1 -1 -1 +1 -1 +1 -1 +1 [288:319]
+1 -1 -1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 +1 +1 -1 -1 [320:351]
-1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1 -1 -1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 +1 +1 +1 [352:383]
+1 -1 -1 +1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 +1 +1 +1 -1 -1 +1 -1 -1 +1 -1 -1 [384:415]
-1 +1 +1 +1 +1 +1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 -1 -1 -1 +1 +1 +1 -1 -1 [416:447]
-1 +1 +1 -1 -1 +1 +1 +1 -1 -1 -1 -1 +1 +1 +1 +1 +1 +1 +1 +1 +1 -1 -1 -1 -1 -1 [448:479]
-1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 +1 +1 -1 +1 +1 -1 +1 +1 +1 +1 +1 +1 -1 +1 +1 [480:511]
+1 +1 +1 +1 +1 -1 -1 -1 -1 -1 +1 -1 +1 +1 -1 -1 +1 +1 -1 +1 -1 -1 +1 -1 +1 -1 +1 [512:543]
+1 +1 -1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [544:575]
-1 -1 +1 -1 +1 +1 -1 +1 -1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [576:607]
-1 +1 +1 -1 -1 +1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 -1 -1 +1 +1 -1 [608:639]
-1 +1 +1 +1 -1 -1 +1 +1 -1 -1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 [640:671]
-1 -1 -1 -1 +1 +1 +1 +1 -1 +1 -1 -1 +1 +1 -1 +1 +1 -1 +1 +1 -1 +1 -1 +1 -1 -1 [672:703]
-1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 +1 -1 +1 -1 -1 +1 +1 -1 -1 +1 -1 +1 [704:735]
+1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [736:767]
+1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [768:799]
-1 -1 -1 -1 -1 -1 -1 +1 +1 +1 -1 -1 -1 -1 -1 -1 -1 -1 +1 +1 +1 +1 -1 +1 +1 -1 [800:831]
+1 +1 -1 -1 +1 -1 +1 +1 -1 +1 -1 +1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 -1 +1 [832:852]
};

```

This new preamble sequence has a PAPR of 4.2dB. Thus, in terms of PAPR, a considerable 1.1 dB gain can be obtained in comparison to the previous sequence.

5. Replace the text in page 217 in [1] with:

Replace the paragraph:

“The initialization vector of the pilot modulation PRBS (defined in 8.5.9.4.3) for the symbol in which the DL-MAP message starts, and two consecutive symbols thereafter is [0101010101].

These three symbols serve as the OFDMA DL preamble, in the sense that they indicate where

the OFDMA frame starts. The pilots shall be boosted and shall be modulated according to the following formula:"

With:

"The following sequence serves as the OFDMA DL preamble, in the sense that it indicates where the OFDMA frame starts. The pilots shall be boosted and shall be modulated according to the following formula:"

and add proposed sequence as Downlink preamble of the 2048 OFDMA mode.

6. Conclusion

The new proposed sequence has lower PAPR than the previously used one (4.2 dB in comparison to the 5.3 dB). We propose to add this sequence into TG d working document [2] for OFDMA DL preamble purposes.