Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**TDS-OFDM PHY for 802.16m downlink**
Date Submitted	**2007-11-09**

Source(s)	Lin Yang, Thomas Li, Zhongkai Wang, Weijun Xu, Jing Wang, Xibin Xu, Xin Su and Shidong Zhou Legend Silicon Corp., Fremont, CA, USA Tianjin Bowei Corp., Tianjin, China Tianjin Hi-Tech Industrial Park, Tianjin, China Tianjin Municipal Government, Tianjin, China Tsinghua University, Beijing, China	Voice: +1-510-656-9888 E-mail: lyang@legendsilicon.com thomasli@legendsilicon.com wangjk@thip.gov.cn xwj@tipp.gov.cn wangj@tsinghua.edu.cn xuxb@tsinghua.edu.cn suxin@tsinghua.edu.cn zhousd@tsinghua.edu.cn

Re:	
Abstract	A proposal for TDS-OFDM PHY using in 802.16m downlink
Purpose	To be discussed and adopted by TGm for use in the 802.16m SDD
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>.

TDS-OFDM PHY for 802.16m Downlink

Lin Yang, Thomas Li, Zhongkai Wang, Weijun Xu
Jing Wang, Xibin Xu, Xin Su, Shidong Zhou

Legend Silicon Corp.
Tianjin Bowei Corp.
Tianjin Hi-Tech Industrial Park
Tianjin Municipal Government
Tsinghua University

Introduction

TDS-OFDM, an alternative PHY solution for broadband communications, was successfully applied to GB20600-2006, the Chinese terrestrial digital television broadcasting standard [1]. In August 2006, China announced that GB 20600-2006 will be the mandatory terrestrial digital television broadcasting standard in mainland China from August 1, 2007. In April 2007, Hong Kong adopted China GB 20600-2006 as terrestrial digital television broadcasting standard.

Through extensive field trials and real-world applications, the TDS-OFDM-based China GB 20600-2006 standard has shown its superior performance to CP-OFDM-based DVB-T, in both throughput and mobility. In summary, the advantages of TDS-OFDM are as follows:

1. Fast frame synchronization
2. Simple carrier and timing recovery algorithms
3. Accurate channel estimation in dynamic mobile environments
4. High spectral efficiency because there is no need for pilot subcarriers

In this contribution, a TDS-OFDM-based downlink PHY scheme is proposed and its performance is shown by comparing the China GB 20600-2006 standard with the DVB-T standard based on field trial data.

Proposed TDS-OFDM Downlink PHY

As we know, it has been proven that OFDM signals using cyclic prefix and zero-padding prefix are equivalent [2]. The replacement of zeros in ZP-OFDM by a known PN sequence will bring a number of benefits such as fast synchronization, accurate channel estimation and high spectral efficiency. These benefits are critical for wireless broadband communications. PN sequences can be used to replace CP for PUSC, FUSC and AMC permutations directly in downlink applications. Both the CP-based and TDS-based OFDM symbol structures are shown in Figures 1 and 2. It can be seen that the only difference between these two schemes lies in the use of different prefix signals, while the rest remains the same.

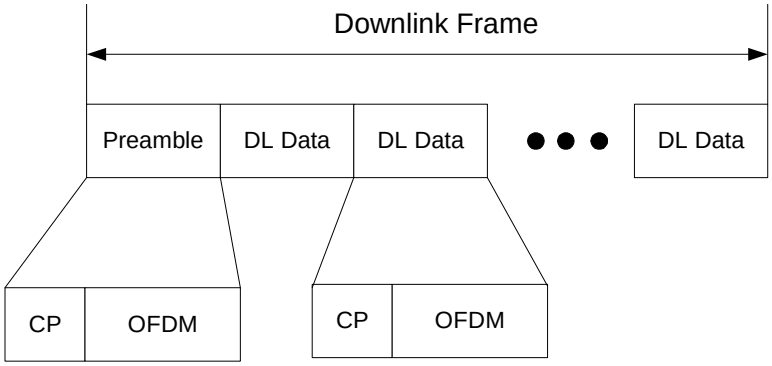


Figure 1. CP-based OFDM Symbol

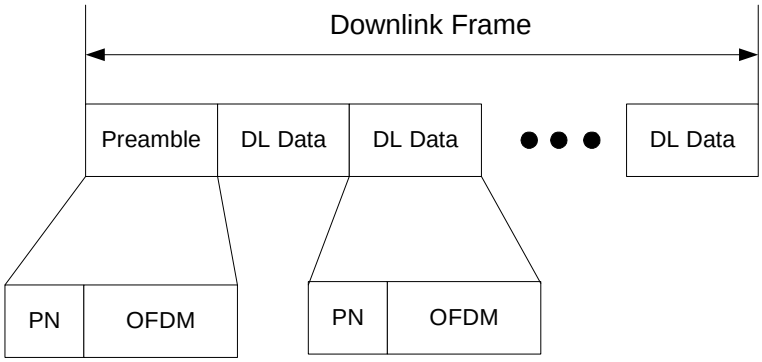
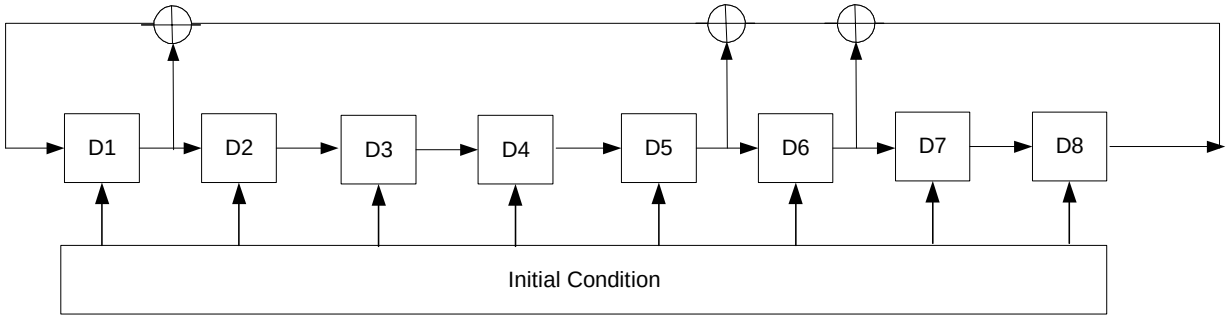


Figure 2. TDS-OFDM Symbol

The time-domain PN sequences can be generated by using a polynomial generator G(x). One polynomial generator used in China GB 20600-2006 is shown in Figure 3. The length of PN sequences can be chosen as 1/4, 1/8, 1/16 or 1/32 of an OFDM symbol length. The PN sequences should be selected to minimize the cross-correlation and should meet the bandwidth requirements. Additionally, a power boost may be applied to PN sequences.



$G(x) = 1 + x + x^5 + x^6 + x^8$

Figure 3. Time-domain PN generator

Summary

In this contribution, a TDS-OFDM PHY is proposed to 802.16m downlink. The performance of TDS-OFDM PHY in downlink is illustrated through comparing China GB 20600-2006 and DVB-T based on the data collected from field trials [3][4].

References

[1] “Framing structure, channel coding and modulation for digital television terrestrial broadcasting system”, GB 20600-2006, August 2006.

[2] B. Muquet, Z. Wang, G.B. Giannakis, M. de Courville and P. Duhamel, “Cyclic-prefixing or zero-padding for wireless multicarrier transmissions,” IEEE Trans. On Communications. Vol.50, pp2136-2148, Dec. 2002.

[3] http://www.ofta.gov.hk.

[4] http://www.dvb.org