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Title	**TDS-OFDM PHY for 802.16m downlink**
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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	
Release	
Patent Policy	

TDS-OFDM PHY for 802.16m Downlink

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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.

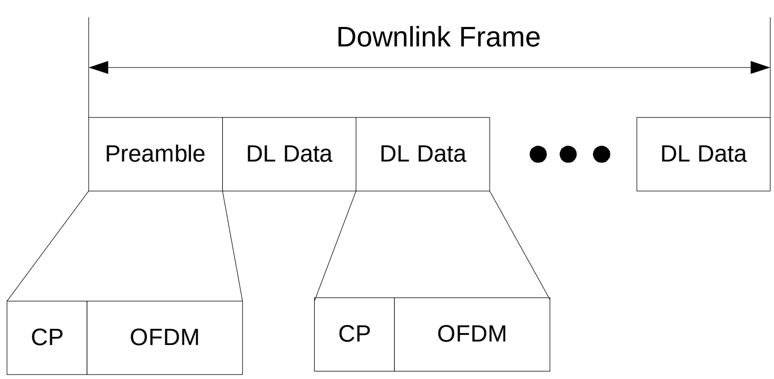


Figure 1. CP-based OFDM Symbol

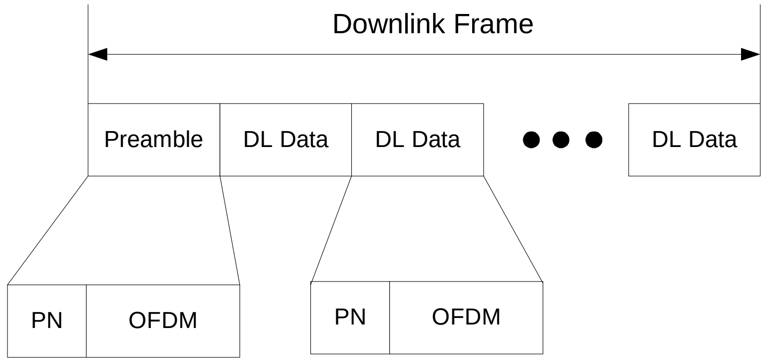
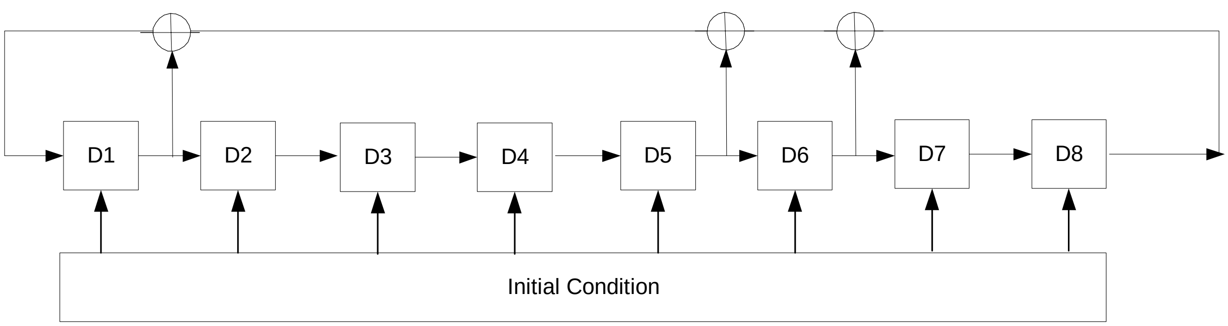


Figure 2. TDS-OFDM Symbol

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