January, 2010 IEEE P802.15-10-0012-00-004g

IEEE P802.15

Wireless Personal Area Networks

Project IEEE P802.15Working Group forWireless Personal Area Networks (WPANs)

Title Clause 5 OFDM PHY Draft

Date Submitted January 11, 2010

Source Tim Schmidl E-mail: schmidl@ti.com

Re Task Group 15.4g

Abstract This document is a draft of an amendment for Clause 5, containing the parts of the OFDM PHY.

Purpose Review

Draft

5. General description

5.1 Introduction

Change the last paragraph of 5.1 as indicated:

In addition, three~~two~~ optional PHYs are specified. A UWB PHY with optional precision range finding,, ~~ranging is one option while~~ a 2450 MHz CSS PHY ,-and a scalable OFDM PHY ~~operating in the 2450 MHz band is the second. As a further addition, an optional OFDM PHY is specified.~~

5.2 Components of the IEEE 802.15.4 WPAN

5.3 Network topologies

5.4 Architecture

5.4.1 Physical layer (PHY)

Insert the following text to the end of the first dashed list in 5.4.1:

Insert the following paragraph after the dashed list:

In addition to the unlicensed bands specified, the OFDM radio may also operate using TV white spaces.

5.4.1.1 Advantages of the UWB PHY for LR-WPAN

5.4.1.2 Advantages of the CSS (2450 MHz) PHY for LR-WPAN

5.4.1.3 UWB band coexistence

Insert the following subclause after 5.4.1.3:

5.4.1.3a Advantages of the OFDM PHY for LR-WPAN

The OFDM PHY uses a scalable FFT so that the OFDM Symbol Time and OFDM Frequency Subcarrier spacing can be maintained “constant” irrespective of the Bandwidth Option that is chosen. Bandwidth scaling from 1MHz down to less than 100KHz is achieved in this fashion by scaling the FFT options from 128 point FFT down to 8 point. Because of this, the OFDM Physical layer definition is “RF Band Agnostic”. OFDM is a spectrally efficient modulation with RF robustness and performance and is adaptable to multiple regulatory considerations.

5.4.2 MAC sublayer

Insert the following text after the second paragraph:

5.5 Functional overview

5.5.1 Superframe structure

5.5.2 Data transfer model

5.5.2.1 Data transfer to a coordinator

5.5.2.2 Data transfer from a coordinator

5.5.2.3 Peer-to-peer data transfers

Insert the following paragraph at the end of 5.5.2.3:

5.5.3 Frame structure

5.5.3.1 Beacon frame

Insert the following figure (Figure 10a) after Figure 10:

Figure 10a shows the structure of the beacon frame and the OFDM PHY packet.

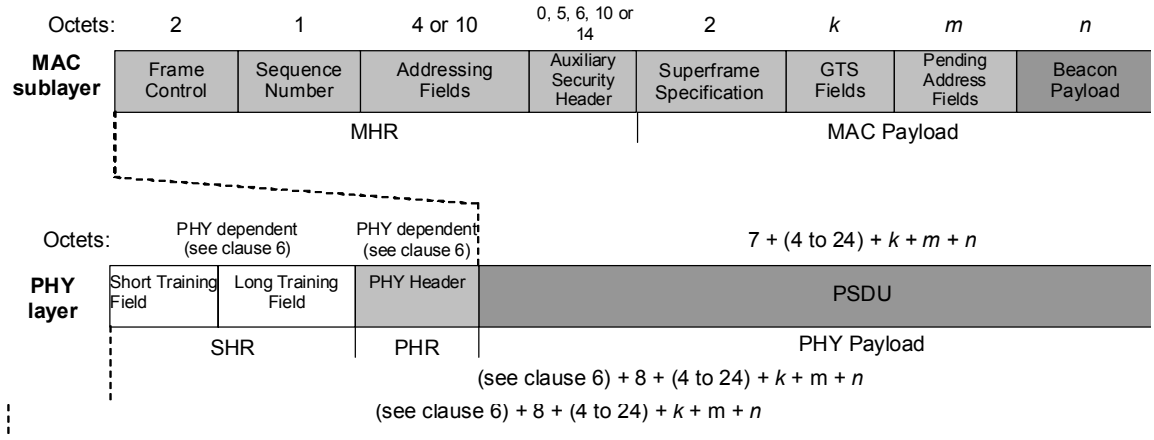

Figure 10a—Schematic view of the beacon frame and the OFDM PHY packet

5.5.3.2 Data frame

Insert the following figure (Figure 11a) after Figure 11:

Figure 11b shows the structure of the data frame and the OFDM PHY packet.

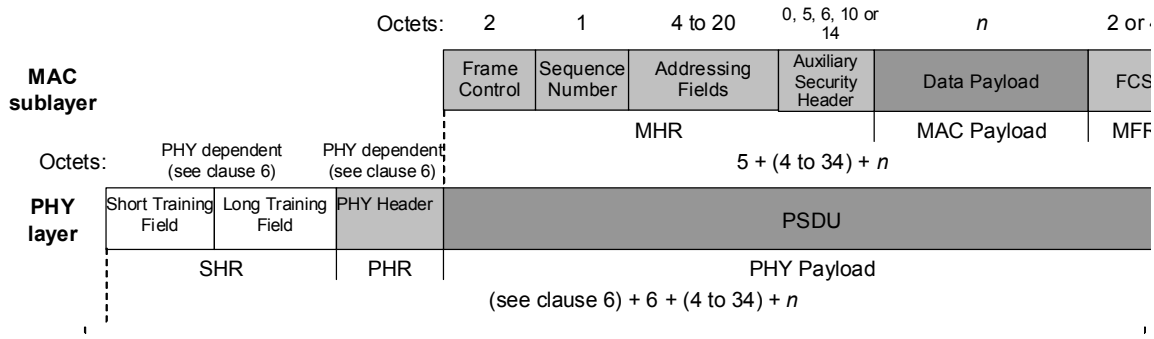

Figure 11b—Schematic view of the data frame and the OFDM PHY packet

5.5.3.3 Acknowledgment frame

Insert the following figure (Figure 12a) after Figure 12:

Figure 12c shows the structure of the acknowledgment frame and the OFDM PHY packet.

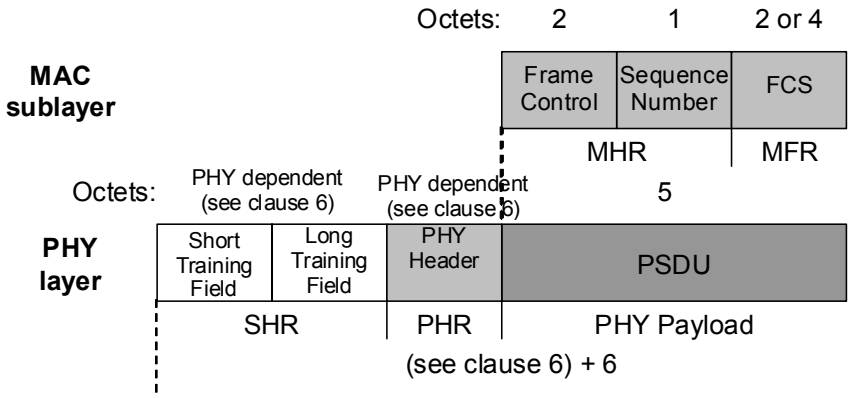

Figure 12c—Sche-

5.5.3.4 MAC command frame

Insert the following figure (Figure 13a) after Figure 13:

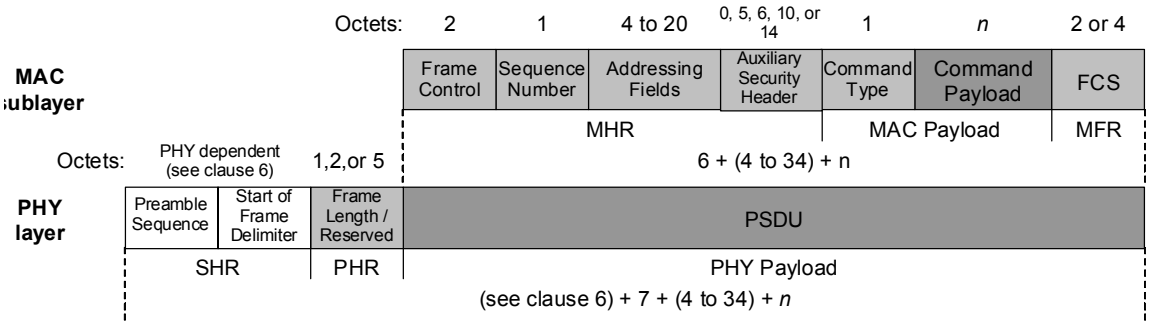

Figure 13d—Schematic view of the MAC command frame and the OFDM PHY packet

Figure 13a shows the structure of the MAC command frame and the OFDM PHY packet.

5.5.4 Improving probability of successful delivery

5.5.4.1 CSMA-CA mechanism

5.5.4.2 ALOHA mechanism for the UWB device

5.5.4.3 Frame acknowledgment

5.5.4.4 Data verification

5.5.4.5 Enhanced robustness features for the UWB PHY

Insert the following new subclause after 5.5.4.5:

5.5.4.5a Enhanced robustness features for the OFDM PHY

The OFDM PHY was specifically designed to provide enhanced robustness for LR-WPAN applications. This enhanced robustness is a result of several PHY features:

— The use of a cyclic prefix and frequency domain equalization provides very robust performance under harsh multipath conditions.

— A forward error correction (FEC) system provides flexible and robust performance under harsh multipath conditions.

— The use of frequency domain spreading provides robust performance even in low signal-to-noise ratio conditions.

5.5.5 Power consumption considerations