**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **Text-Input-RPO-OFDM Dimming** | |
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| Abstract | [Description of document contents.] | |
| Purpose | [Description of what the author wants P802.15 to do with the information in the document.] | |
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# 1.0 PHY Layer Operating mode(s)

# 2.0 PHY specifications

# 3.0 PHY Layer Dimming Method

Reverse polarity optical OFDM (RPO-OFDM) is defined as an optional feature in this specification to facilitate dimming capabilities. This modulation scheme is expected to work in conjunction with eU-OFDM, but it can also be realized using DCO-OFDM. The eU-OFDM specification should be used for the generation of a unipolar signal, which would be indicated with the 'eU' bit defined in subclause 6.2.3.2. The current subclause provides the means for generating a RPO-OFDM signal using the DCO-OFDM waveform or the eU-OFDM waveform generated using the eU-OFDM specification. Note that RPO-OFDM modulation does not prevent the use of SC-OFDMA precoding and/or adaptive bit loading and/or MIMO encoding.

The RPO-OFDM modulation incorporates dimming while maintaining the average power per time-domain OFDM symbol and eliminating energy-intensive and adaptive DC component that carries no additional information. Accordingly, a constant signal-to-noise ratio (SNR) for a wide dimming range is achieved, the full active operational range of the device is utilized and high energy efficiency is realized. Here, the time-domain samples polarity of individual OFDM symbols is properly set to generate an OFDM waveform that has similar characteristics of a pulse-width modulation (PWM) signal in controlling the dimming percentage. Such OFDM waveform also has two periods equivalent to the “on-time” and “off-time” periods of a PWM signal. Over an equivalent PWM period, the average forward current through the device is equivalent to the target dimming percentage. Assuming a 1Amp maximum forward current through the LED, the RPO-OFDM signal for two different dimming ratios of 20% and 70% duty cycle are shown in Fig. 6.3.8.1. The method of deriving the RPO-OFDM is detailed in H. Elgala and T.D.C. Little, “Reverse polarity optical OFDM (RPO-OFDM): dimming compatible OFDM for gigabit VLC links”, Optics Express, vol. 21, issue 20, pp. 24288 – 24299, 2013.



Figure 6.3.8.1: RPO-OFDM signal.

# 4.0 PPDU format

# 5.0 PHY PIB attributes

# 6.0 Superframe Structure

# 7.0 MAC frame formats

# 8.0 MAC PIB attributes