

Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [idle pattern issue for dimming]

Date Submitted: [21 January, 2010]

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Re: [Response to call for proposals]

Abstract: [This document describes a idle pattern issue for dimming]

Purpose: [Proposal to IEEE 802.15.7 VLC TG]

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Idle pattern issue for dimming (CID 53)

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Function of Idle pattern

- Frame flicker compensation (6.8.1)
 - To prevent the LED from appearing “dimmer” during the packet frame transmission time
 - An idle pattern is sent between frames
- Lighting dimming (6.8.2)
 - Idle pattern is used for dimming and Off time is inserted to reduce the average intensity of the light for dimming
 - Can also insert on time to increase the average intensity of the light

Idle pattern for frame flicker compensation

- To prevent frame flicker
 - The optical power of idle pattern must be the same optical power of packet frame
- Examples
 - Manchester, OOK : 50% optical power
 - Idle pattern : 01010101....
 - 4PPM : 25% optical power
 - Idle pattern : 000100010001...

Idle pattern for dimming (6.8.2)

- To change the brightness of source
 - Idle pattern which has a specific brightness is inserted between frames and idle time
 - Off time is inserted into either idle pattern or into the data frame

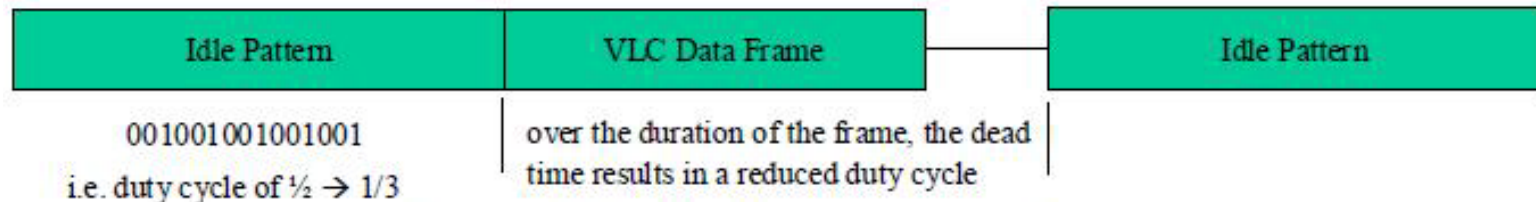


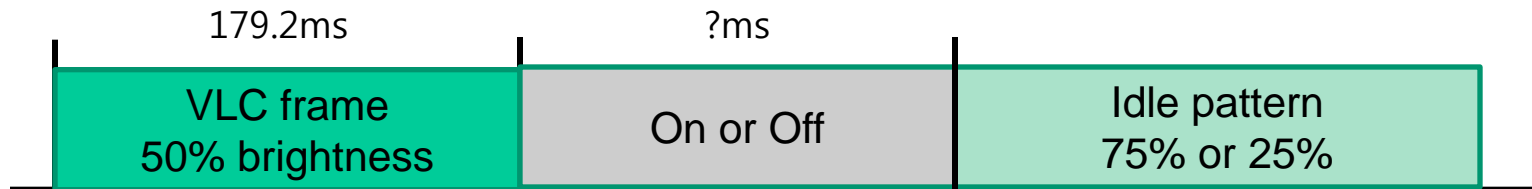
Figure 30—Flicker compensation

Serialization time for one frame

- data rate using OOK
 - PHY1: 6.25kbps ~ 100kps
 - PHY2: 9.6Mbps ~ 96Mbps
- Max frame size
 - Max PSDU size (aMaxPSDUPacketSize) : 127bytes, 64kbytes
 - PHY1 frame: 140bytes = 1120bits
 - PHY2 frame: 64kbytes = 512kbits
- Serialization time for 1 frame (Max size)
 - = TX frame size / optical rate
 - = Max PPDU size*CC*FEC / optical rate
 - = Max PPDU size / data rate
 - 6.25kbps : 1120bits/ 6.25kbps = 179.2ms
 - 100kbps : 1120bits/ 100kbps = 11.2ms
 - 9.6Mbps : 512kbits/ 9.6Mbps = 53.3 ms
 - 96Mbps : 512kbits/ 96Mbps = 5.3 ms

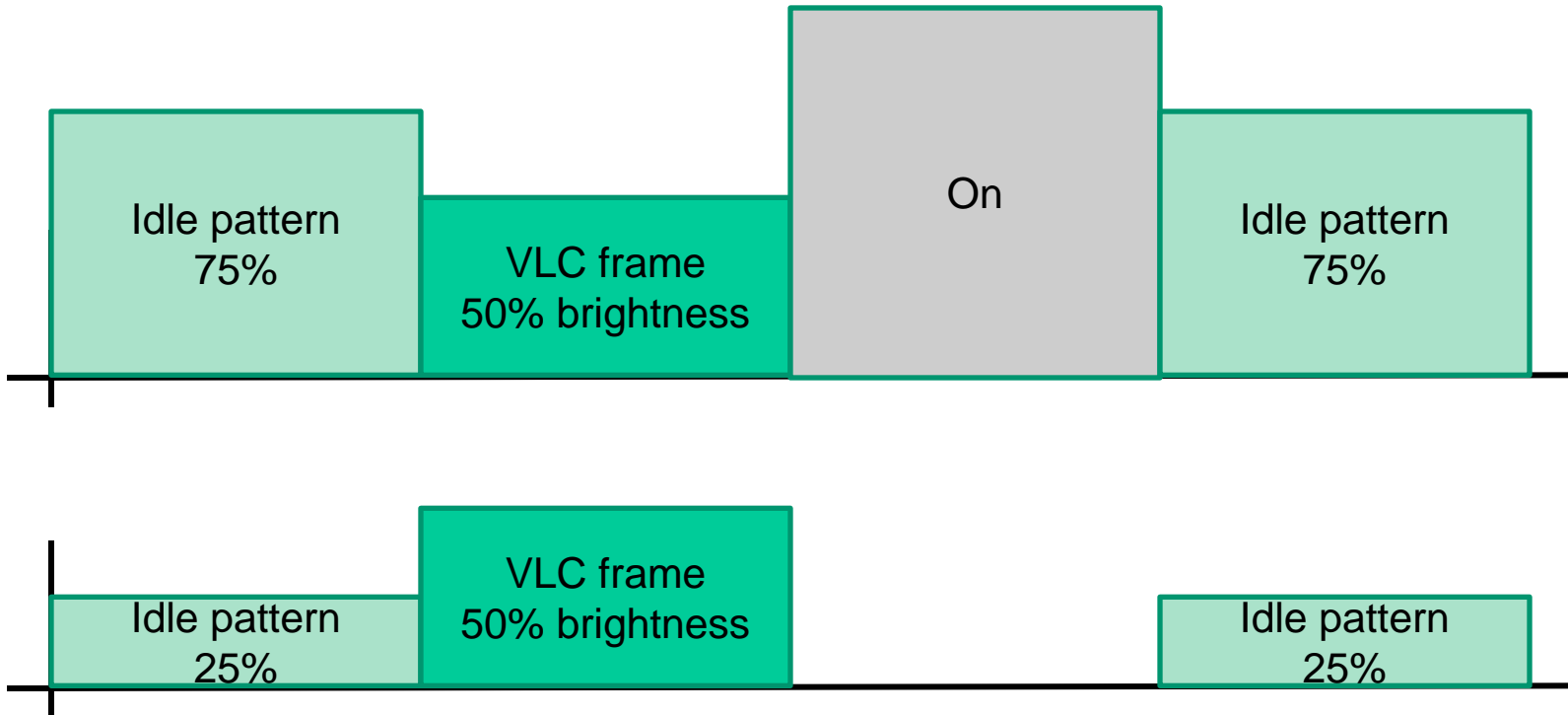
Example of Idle Pattern for dimming

- Make 75% or 25% brightness at PHY 1 6.25kbps
 - Data rate and frame length : 6.25kbps, 140bytes
 - Manchester and OOK : 50% brightness



- How long on or off time is required?
 - Simply 179.2ms of on(100%) time for 75% and off(0%) time for 25% is required
 - On or off time is a dead time. It reduces the communication throughput
 - Frame flicker problem:
 - When use on or off time: 50% ↔ 100%(0%) ↔ 75%(25%)
 - When do not use on or off time: 50% ↔ 75%(25%)
 - 179.2ms >>> MFTP(5ms)

Flickering example



Solution?

- Solution is that we transmit a frame within the limited time such as MFTP(5ms), but ...
- Frame size for 5ms is too small at PHY1
 - 4 bytes at 6.25kbps
 - 62 bytes at 100kbps
 - Preamble is 4 bytes
 - MAC Header is 3 ~ 40 bytes.

How do we use idle pattern

- The idle pattern for dimming is conflict with the idle pattern for frame flicker compensation.
 - If we restrict a max serialization time for example MFTP 5ms, a flickering will not occur
- When the idle pattern is used for dimming, on and off time is a essential factor but also it is a burden at communication efficiency aspect.
- It would be better that idle pattern is used for only frame flicker compensation.
- If we want to use the idle pattern for dimming, we need to use at the flicker independent application such as P2P mobile communication or PHY Type 2.