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

Submission Title: [Comment resolution of No.320]
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Re: [Response to the SB 1st recirculation for the IEEE 802.15.7 standard]

Abstract: [This document describes the comment resolution of No.320]

Purpose: [To provide the comment resolution of No.320]

Comment resolution of No.320

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Comment No.320

Comment No.	Name	Page	Subclause	Line	Comment	Proposed Change
320	Joachim Walewski	247	10.6	4	According to subclause 8.5.2.3 the duty cycle d in Table 103 can only be changed in increments of 0.1. Possible values are thus 0.1, 0.2, ..., 0.9. No indication is provided in subclause 10.6 how this translates into the dimming level, and how to achieve intermediate dimming levels. According to sublclause 8.5.2.3, intermediate dimming levels are generally -i.e., also during data transmission- achieved with the "mixing" algorithm in Figure 113. However, Figure 113 only works for instances of visibility-frame transmission (explicit reliance on visibility patterns!). The reader is thus left in the unfortunate situation that subclause 8.5.2.3 clearly contains wrong information, and that subclause 10.6 does not explain, how intermediate dimming levels are to be achieved.	Change the wrongful statement in subclause 8.5.2.3 (contradiction with subclause 10.6). Indicate in subclause 10.6, how intermediate dimming levels are achieved. If this is done by changing the optical power associated to "low" and "high" simply state so.

Summary of Comment #320

1. Define the *d* value mapping mechanism according to the dimming level in 10.6 because 10.6 in the current draft describes only the range of "*d*" value.
2. 8.5.2.3 contains the description explaining the dimming mechanism to achieve the high resolution dimming level, 0.1%, in VPPM mode, but it's wrong. So, Rewrite 8.5.2.3.
3. 10.6 does not explain how to achieve the intermediate dimming levels in VPPM mode. So, Add how to achieve the intermediate dimming levels in VPPM-mode to10.6.

- *2nd issue and 3rd issue are the same. If we definitely describe the dimming mechanism to achieve the high resolution dimming level in 8.5.2.3, we don't need to describe it again in 10.6.*

1st Issue on Comment #320

- According to subclause 8.5.2.3 the duty cycle ***d*** in Table 103 can only be changed in increments of 0.1. Possible values are thus 0.1, 0.2, ..., 0.9. No indication is provided in subclause 10.6 how this translates into the dimming level.

➢ *Define the d value mapping mechanism according to the dimming level in 10.6 because 10.6 in the current draft describes only the range of "d" value.*

Table 103—Definition of data mapping for VPPM mode

Logical value	Physical value d is the VPPM duty cycle ($0.1 \le d \le 0.9$)	
0	High	$0 \le t < dT$
	Low	$dT \le t < T$
1	Low	$0 \le t < (1-d)T$
	High	$(1-d)T \le t < T$

10.6 Data mapping for VPPM

The data mapping for VPPM shall be defined as in Table 103. The physical value mapped from the logical data '0' has a transition from 'high' to 'low', and the physical value mapped from the logical data '1' has a transition from 'low' to 'high', as shown in Table 103. 'Low' and 'high' values are defined in 8.3.2. The variable d in Table 103 is the VPPM duty cycle.

1st Issue on Comment #320 (*cont.*)

- **8.5.2.3 VPPM-mode dimming**

  The VPPM-mode dimming is described in 4.4.3.1.5. *The VPPM PHY shall have basic dimming level support at 10% duty cycle resolution.* To support higher resolution for dimming from 0 to 100% in steps of 0.1%, the VPPM PHY shall use the algorithm as provided in Figure 113. For example, for supporting 25% dimming, the PHY shall alternately send 20% and 30% duty cycle VPPM symbols. It is recommended that the receiver change the matched filtering in step with the change in the transmitter symbol shape to enable optimum detection.

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ETRI's understanding on 1st issue

Key Points of 1st Issue

- VPPM waveform depends on "*d*" value which means VPPM duty cycle.
- "*d*" value is strongly coupled with the dimming level.
- 10.6 in the current draft describes only the range of "*d*" value.
- The mapping mechanism of *d* value according to the dimming level is not defined in the current draft.

➢ *So, we need to define the d value mapping mechanism according to the dimming level in 10.6.*

Table 103—Definition of data mapping for VPPM mode

Logical value	Physical value *d* is the VPPM duty cycle ($0.1 \le d \le 0.9$)	
0	High	$0 \le t < dT$
	Low	$dT \le t < T$
1	Low	$0 \le t < (1-d)T$
	High	$(1-d)T \le t < T$

Resolution of 1st issue

10.6 Data mapping for VPPM

The data mapping for VPPM shall be defined as in Table 103. The physical value mapped from the logical data '0' has a transition from 'high' to 'low', and the physical value mapped from the logical data '1' has a transition from 'low' to 'high', as shown in Table 103. 'Low' and 'high' values are defined in 8.3.2. The variable d in Table 103 is the VPPM duty cycle.

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0	High	$0 \le t < dT$
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	High	$(1-d)T \le t < T$

Change

10.6 Data mapping for VPPM

The data mapping for VPPM shall be defined as in Table 103. The physical value mapped from the logical data '0' has a transition from 'high' to 'low', and the physical value mapped from the logical data '1' has a transition from 'low' to 'high', as shown in Table 103. 'Low' and 'high' values are defined in 8.3.2. The variable *d* in Table 103 is the VPPM duty cycle, and it is assigned by the VPPM-mode dimming mechanism described in 8.5.2.3.

2nd Issue on Comment #320

- No indication is provided in subclause 10.6 how this translates into the dimming level, and how to achieve intermediate dimming levels. According to sublclause 8.5.2.3, intermediate dimming levels are generally -i.e., also during data transmission- achieved with the "mixing" algorithm in Figure 113. However, Figure 113 only works for instances of visibility-frame transmission (explicit reliance on visibility patterns!). The reader is thus left in the unfortunate situation that subclause 8.5.2.3 clearly contains wrong information.

- *8.5.2.3 contains the description explaining the dimming mechanism to achieve the high resolution dimming level, 0.1%, in VPPM mode, but it's wrong.*
- *So, Rewrite 8.5.2.3.*

2nd Issue on Comment #320 (*cont.*)

- **8.5.2.3 VPPM-mode dimming**

  The VPPM-mode dimming is described in 4.4.3.1.5. The VPPM PHY shall have basic dimming level support at 10% duty cycle resolution. To support higher resolution for dimming from 0 to 100% in steps of 0.1%, the VPPM PHY shall use *the algorithm as provided in Figure 113.* For example, for supporting 25% dimming, the PHY shall alternately send 20% and 30% duty cycle VPPM symbols. It is recommended that the receiver change the matched filtering in step with the change in the transmitter symbol shape to enable optimum detection.

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➢ *Only the algorithm to achieve the high resolution dimming level is similar to Figure 113 shown in 8.5.1.2, but we also think this text and Figure 113 can cause the reader to confuse.*

Main concept to achieve the high resolution dimming level in VPPM-mode

- **Let the following values be defined as**
  - Supported VPPM symbols : VS_0, VS_1, VS_2, … VS_K --> K=10
  - Desired dimming level = *Vd_L* (expressed as a percentage value) e.g., for a 25.3% dimming level, *Vd_L* = 25.3
  - Desired precision = *p*, $p \leq 0$, *p* is an integer (expressed as a logarithm value) e.g., for 0.1%, precision, *p* = -1
  - d_1 and d_2 are the duty cycle of VPPM symbol
- $K = 10, p = -1$
- $sel\_Vd\_level\_1 = \lfloor Vd\_L \cdot 0.1 \rfloor$
- $sel\_Vd\_level\_2 = \lceil Vd\_L \cdot 0.1 \rceil$
- $d_1 = 0.1 \cdot sel\_Vd\_level\_1$
- $d_2 = 0.1 \cdot sel\_Vd\_level\_2$
- $rep\_Vd\_level\_2 = 100 \cdot Vd\_L \cdot sel\_Vd\_level\_1$
- $rep\_Vd\_level\_1 = 100 - rep\_Vd\_level\_1$
- **Then, to achieve the desired dimming level Vd_L :**
  - Assign VPPM symbol with d_1 duty cycle *rep_Vd_level_*1 times, and
  - Assign VPPM symbol with d_2 duty cycle *rep_Vd_level_*2 times

An example

- VPPM has 10% diming level
  - $K = 10$
- Dimming resolution is 0.1%
  - $p = -1$
- Desired dimming level $Vd\_L = 25.3\%$

- $sel\_Vd\_level\_1 = \lfloor 25.3 \cdot 0.1 \rfloor = \lfloor 2.53 \rfloor = 2$
- $sel\_Vd\_level\_2 = \lceil 25.3 \cdot 0.1 \rceil = \lceil 2.53 \rceil = 3$
- $d_1 = 0.1 \cdot sel\_Vd\_level\_1 = 0.2$
- $d_2 = 0.1 \cdot sel\_Vd\_level\_2 = 0.3$
- $rep\_Vd\_level\_2 = 100 \cdot 25.3 \cdot 2 = 53$
- $rep\_Vd\_level\_1 = 100 - 53 = 47$

- Then, to achieve the desired dimming level 25.3%:
  - Assign VS_2 47 times, and
  - Assign VS_3 53 times

Resolution of 2nd Issue

- *We believe that this issue can be resolve if we restate the VPPM-mode dimming mechanism to achieve the high dimming resolution in 8.5.2.3.*
- *The modified text can be shown tomorrow.*

3rd Issue on Comment #320

- The reader is thus left in the unfortunate situation that subclause 10.6 does not explain, how intermediate dimming levels are to be achieved.

- *10.6 does not explain how to achieve the intermediate dimming levels in VPPM mode. So, Add how to achieve the intermediate dimming levels in VPPM-mode to10.6.*
- *We don't need to describe it again in 10.6 because the dimming mechanism to achieve the high resolution dimming level in VPPM-mode is already described in 8.5.2.3. In addition, 10.6 is for the data mapping, not for the dimming mechanism.*