**IEEE P802.15**

**Wireless Personal Area Networks**

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## 5.2.5 ~~Packet~~ Mirror PWM/PPM MAC frame format

Mirror PWM/PPM MAC frame format is composed of a MHR and a MSDU. The field of the MHR contains a sequence number and a stop bit. They are transmitted as mixed order for maximizing error check performance in upper layer.



Figure F1 – Mirror PWM/PPM general MAC frame format

### 5.2.5.1 ~~MAC frame format of Packet PWM/PPM mode 1~~Sequence Number and Stop Bit subfield

Sequence number bits and stop bit are transmitted as the following order by the bit size of PSDU.

~~PHY payload contains of~~  For 6 bits ~~of data~~ PSDU (*x0* – *x5*). ~~Packet address~~ Sequence number A (*a0, a1*) is ~~represented~~ located as (*x1, x4*) and ~~packet data~~ MPDU D (*d0, d1, d2, d3*) is ~~represented~~ located as (*x0, x2, x3, x5*).

For 8 bits PSDU (*x0* – *x7*). Sequence number A (*a0, a1*) is located as (*x1, x3*) and MPDU D (*d0, d1, d2, d3, d4, d5*) is located as (*x0, x2, x4, x5, x6, x7*).

~~MAC frame consists of 16 bits of data D~~~~00~~ ~~D~~~~10~~ ~~D~~~~01~~ ~~D~~~~11~~~~, where D~~~~k~~ ~~is data D of packet whose address A is k.~~

~~The native MPDU has too much overhead for this MAC frame and most of the fields are not needed for a short, repetitive MSDU. Therefore, this MAC frame does not have MHR field and the MFR field is optional.~~

## ~~5.2.5.2 MAC frame format of Packet PWM/PPM mode 2~~

~~PHY payload contains of 6~~ For 12 bits ~~of data~~ PSDU (*x0* – *x11*). ~~A packet~~ PSDU consists of ~~address~~ sequence number A (*a­­0* – *a3*), ~~data~~ MPDU Da (*da0­* – *da6*), ~~data~~ MPDU Db (*db0* – *db3*), and stop bit S (*s*). They correspond as

*x4, x7, x10,* and *x11* correspond either of them in accordance with the packet division rule described ~~below.~~

~~MAC frame is divided into some packets as shown~~ in Figure 78 to Figure 84.

*Figure 78 - 84*

The number of the second line of each box means bit size and the third line means bit value.

When transmitter transmit data of more than 112 bits or stream data, stop bit of packet 15 is 0, and the following data is transmitted from packet 0.

~~This MAC frame does not have MHR field and the MFR field is optional as same as mode 1.~~

## ~~5.2.6 MAC frame format of Packet PWM/PPM mode 3~~

~~(TBD)~~

## 8.6.7.4 ~~Three mode~~ Mirror PWM/PPM PPDU format

Mirror PWM consists of the SHR field, the PSDU filed, the SFT filed, and the optional field.

### 8.6.7.4.1 Mirror PWM/PPM SHR field

The SHR field consists of three or four slots. Patterns of the slots width indicate modulation constants.

### 8.6.7.4.1 Mirror PWM/PPM PSDU field

The PSDU field consists of two parts across the SHR filed. The two parts send the same data but they are modulated complementarily so that total brightness is constant.

### 8.6.7.4.1 Mirror PWM/PPM SFT field

The SFT filed indicates the end of PSDU filed.

### 8.6.7.4.1 Mirror PWM/PPM Optional field

The Optional field is used for DC compensation and dimming control.

## 14.4 ~~3 mode~~ Mirror PWM/PPM

### ~~14.4.1 PHY specifications~~

### ~~14.4.1.1 Packet PWM~~

~~Packet PWM is modulated with pulse width and pulse is shown as two state of brightness, bright and dark state, which are typically transmitted by on and off of a light. A chunk of PHY signal, which is called a packet, corresponds to a MAC frame. A transmitter transmits PHY packet repetitively and can transmit a set of PHY packets in no particular order.~~

### ~~14.4.1.2 Packet PPM~~

~~Packet PPM is modulated with position of short pulse. Packet PPM realizes deep dimming. Formats, wave forms and characteristics other than specially described are given same as Packet PWM.~~

The original text of this clause is moved from 8.6.7.4 based on an editor’s comment.

### 14.4.1 Mirror PWM

Mirror PWM modulation is shown in Figure F2.

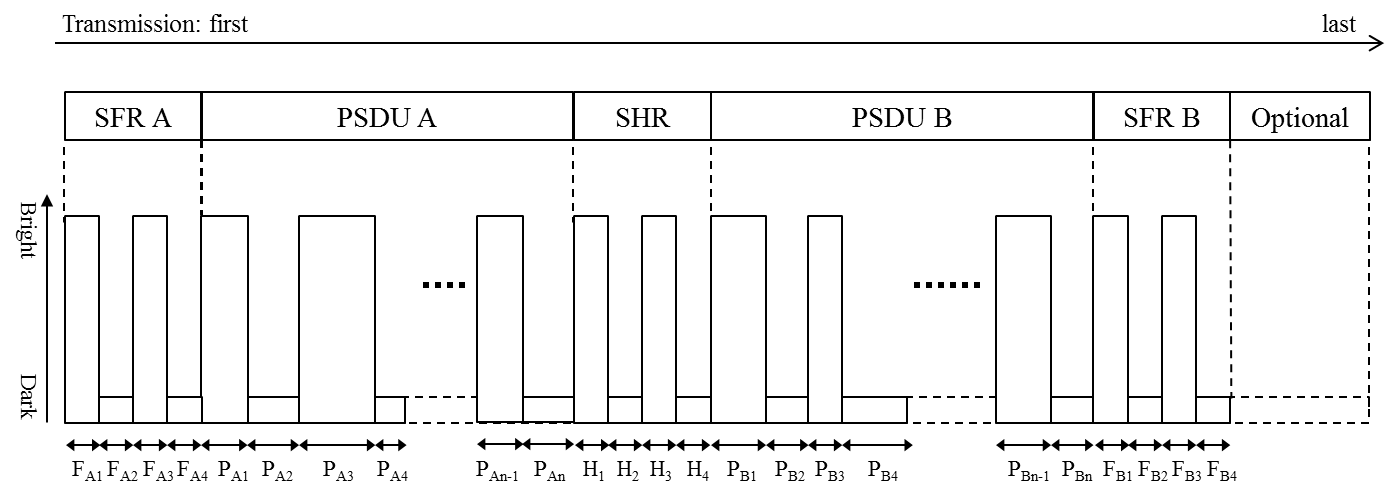


Figure 232, 233, 234 are generalized to this figure.

Figure F2 – Mirror PWM modulation

~~Packet PWM consists of SHR, PHY payload A, PHY payload B, SFT, and Optional fields as shown in Figure 1.~~

~~SHR field consists of two or four pulses.~~ Patterns of the pulse width ~~show transmission mode~~ of SHR field (H1, H2, H3, H4) indicate modulation constants as shown in the Table T1.

Table T1 – SHR field patterns of ~~Packet~~ Mirror PWM

|  |  |
| --- | --- |
| ~~Mode of Packet PWM~~ | ~~SHR pattern [micro seconds]~~ |
| ~~Mode 1~~ | ~~(100, 90)~~ |
| ~~Mode 2~~ | ~~(100, 90, 90, 100)~~ |
| ~~Mode 3~~ | ~~(50, 40, 40, 50)~~ |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (H1, H2, H3, H4) [micro seconds] | W1 | W2 | m | n | PSDU bits |
| (50, 40, 50, 50) | 60 | 30 | 2 | 4 | 8 |
| (70, 60, 70, 70) | 80 | 30 | 2 | 4 | 8 |
| (90, 80, 90, 90) | 100 | 30 | 2 | 4 | 8 |
| (70, 60, 60, 70) | 80 | 30 | 3 | 4 | 12 |
| (90, 80, 80, 90) | 100 | 30 | 3 | 4 | 12 |
| (100, 90, 90, 100) | 120 | 30 | 3 | 4 | 12 |
| (50, 40, 40, 50) | 60 | 20 | 2 | variable  (last until next SFT or SHR) | variable |

Original “modes” are added and  
 re-organized for future update

~~PHY payload contains of 6 bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~5~~*~~) in mode 1, 12 bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~11~~*~~) in mode 2, or variable bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~n~~*~~) in mode 3.~~ PSDU data bits (*x0, x1, …*) are modulated as follows. Let yk are defined as

Original formulas are generalized

~~In mode 1 and 2, they~~ PSDU are modulated to pulse width [micro seconds] as

~~In mode 3, they are modulated to pulse width [micro seconds] as~~

~~In mode 1 and 2, PHY payload~~ PSDU A and ~~PHY payload~~ PSDU B fields are half-optional. A transmitter can transmit both of them, one of them, or a part of them~~, i.e., P~~~~A3~~~~, P~~~~A4~~~~, P~~~~B1~~~~, and P~~~~B2~~ ~~in mode 2.~~

~~In mode 3, PHY payload lasts until SFT or next SHR field is transmitted.~~

~~SFT field in mode 3 consists of pulses with (40, 50, 60, 40) micro seconds. SFT field is optional field. A transmitter can transmit next SHR field instead of SFT field.~~

~~Transmitter can transmit any kind of signal in Optional field. However, the signal must not contain SHR field pattern. Optional field can be used for DC compensation and dimming control.~~

### 14.4.2 Mirror PPM

The original text of this clause is moved from 8.6.7.4 based on an editor’s comment.

Mirror PPM modulation is shown in Figure F3.

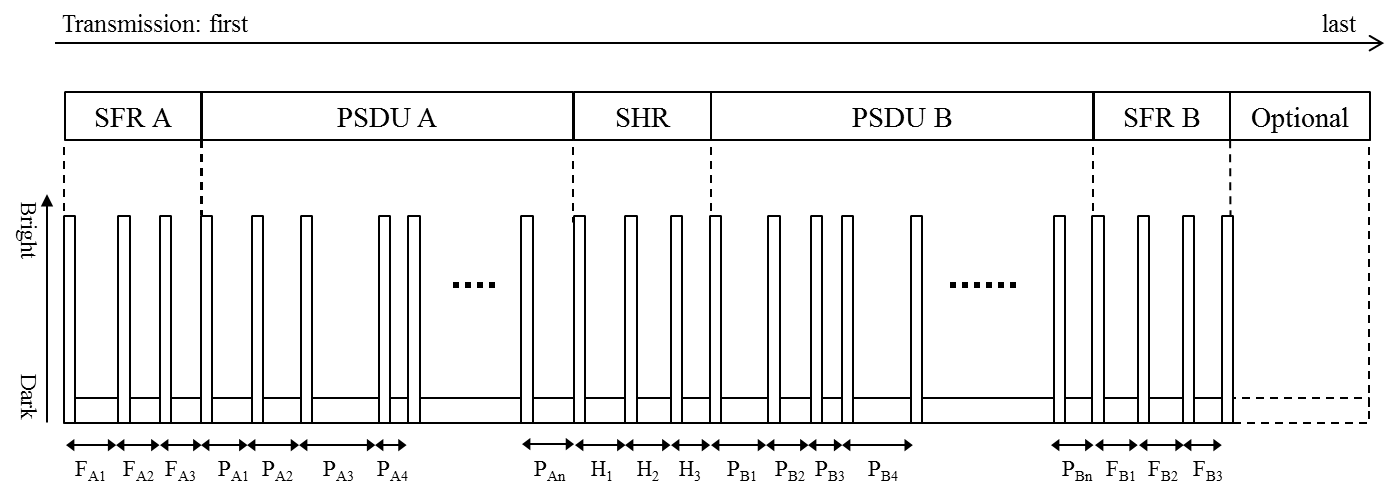


Figure 235, 236, 237 are generalized to this figure.

Figure F3 – Mirror PPM modulation

~~Packet PPM consists of SHR, PHY payload, SFT, and Optional fields as shown in Figure 2.~~

~~SHR field consists of three intervals of successive four pulses.~~ The patterns of pulse intervals ~~show transmission mode~~ of SHR field (H1, H2, H3) indicate modulation constants as shown in Table T2.

Table T2 – SHR field patterns of ~~Packet~~ Mirror PPM

Original “modes” are added and  
 re-organized for future update

|  |  |
| --- | --- |
| ~~Mode of Packet PPM~~ | ~~SHR pattern [micro seconds]~~ |
| ~~Mode 1~~ | ~~(160, 160, 160)~~ |
| ~~Mode 2~~ | ~~(160, 180, 160)~~ |
| ~~Mode 3~~ | ~~(80, 90, 80)~~ |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (H1, H2, H3) [micro seconds] | W1 | W2 | m | n | PSDU bits |
| (130, 130, 130) | 140 | 30 | 3 | 2 | 6 |
| (120, 130, 120) | 140 | 30 | 2 | 4 | 8 |
| (120, 110, 120) | 140 | 30 | 3 | 4 | 12 |
| (150, 150, 150) | 160 | 30 | 3 | 2 | 6 |
| (140, 150, 140) | 160 | 30 | 2 | 4 | 8 |
| (140, 130, 140) | 160 | 30 | 3 | 4 | 12 |
| (170, 170, 170) | 180 | 30 | 3 | 2 | 6 |
| (160, 170, 160) | 180 | 30 | 2 | 4 | 8 |
| (160, 150, 160) | 180 | 30 | 3 | 4 | 12 |
| (80, 90, 80) | 100 | 20 | 2 | variable (last until next SFT or SHR) | variable |

~~PHY payload contains of 6 bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~5~~*~~) in mode 1, 12 bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~11~~*~~) in mode 2, or variable bits of data (~~*~~x~~~~0~~* ~~–~~ *~~x~~~~n~~*~~) in mode 3.~~ PSDU data bits (*x0, x1, …*) are modulated as follows. Let yk are defined as

~~In mode 1 and 2, they~~ PSDU are modulated to pulse width [micro seconds] as

Original formulas are generalized

PSDU A and PSDU B fields are half-optional as same as Mirror PWM.

~~In mode 3, they are modulated to pulse width [micro seconds] as~~

~~In mode 3, PHY payload lasts until SFT or next SHR field is transmitted.~~

~~SFT field in mode 3 consists of pulses intervals with (90, 80, 90) micro seconds. SFT field is optional field. A transmitter can transmit next SHR field instead of SFT field.~~

~~Transmitter can transmit any kind of signal in Optional field. However, the signal must not contain SHR field pattern. Optional field can be used for DC compensation and dimming control.~~