**IEEE P802.15**

**Wireless Personal Area Networks**

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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)

See table 73, 74 or 75 from IEEE802.15.7-2011 for an example table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PHY Operating Modes** | | | | |
| **Modulation** | **RLL Code** | **Optical Clock Rate** | **FEC** | **(Typical) Data Rate** |
| Packet PWM | None | 100 kHz | Temporal repeat coding | 5.5 kbps |
| Packet PPM | None | 100 kHz | Temporal repeat coding | 8 kbps |
|  |  |  |  |  |
|  |  |  |  |  |
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|  |  |  |  |  |

# 2.0 PHY specifications

## 2.1 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.

## 2.2 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.

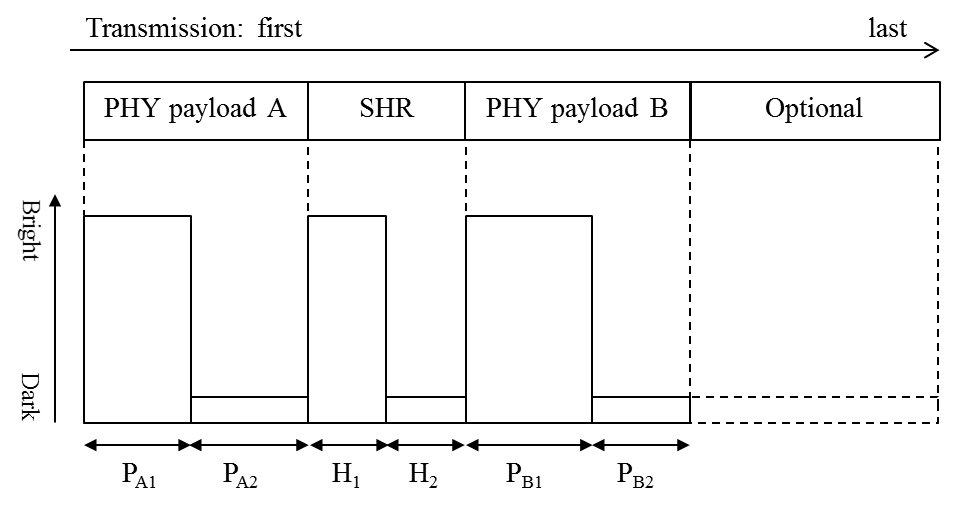
# 3.0 PHY Layer Dimming Method

Dimming level is controlled by averaged brightness of the Optional field.

# 4.0 PPDU format

## 4.1 PPDU format of Packet PWM

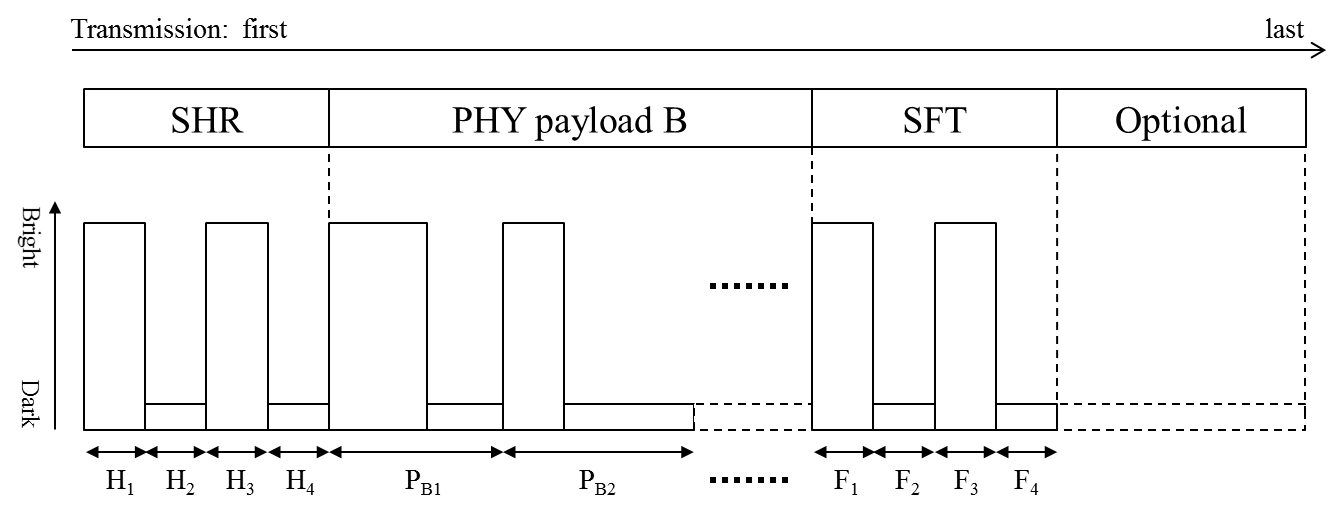
Packet PWM consists of SHR, PHY payload A, PHY payload B, SFT, and Optional fields as shown in Figure 1.



(a) Packet PWM mode 1



(b) Packet PWM mode 2



(c) Packet PWM mode 3

Figure 1 – Packet PWM

SHR field consists of two or four pulses. Patterns of the pulse width show transmission mode as shown in the Table 1.

Table 1 – SHR field patterns of Packet 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) |

PHY payload contains of 6 bits of data (*x0* – *x5*) in mode 1, 12 bits of data (*x0* – *x11*) in mode 2, or variable bits of data (*x0* – *xn*) in mode 3. Let yk are defined as

In mode 1 and 2, they 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 A and PHY payload B fields are half-optional. A transmitter can transmit both of them, one of them, or a part of them, i.e., PA3, PA4, PB1, and PB2 in mode 2.

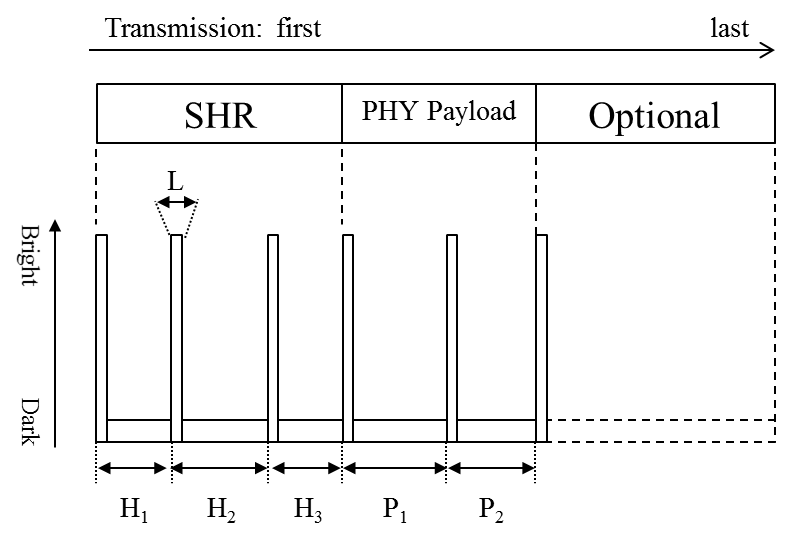
In mode 3, PHY payload lasts until SFT or next SHR field is transmitted.

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.

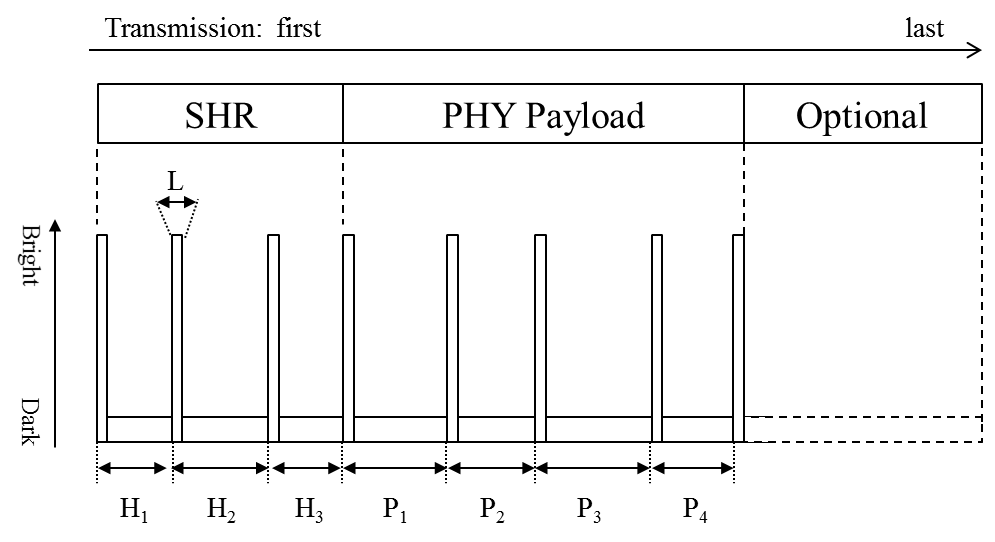
Transmitter can transmit any kind of signal in Optional field. However, the signal must not contain SHR field pattern. Optional field can be used for DC compensation and dimming control.

## 4.2 PPDU format of Packet PPM

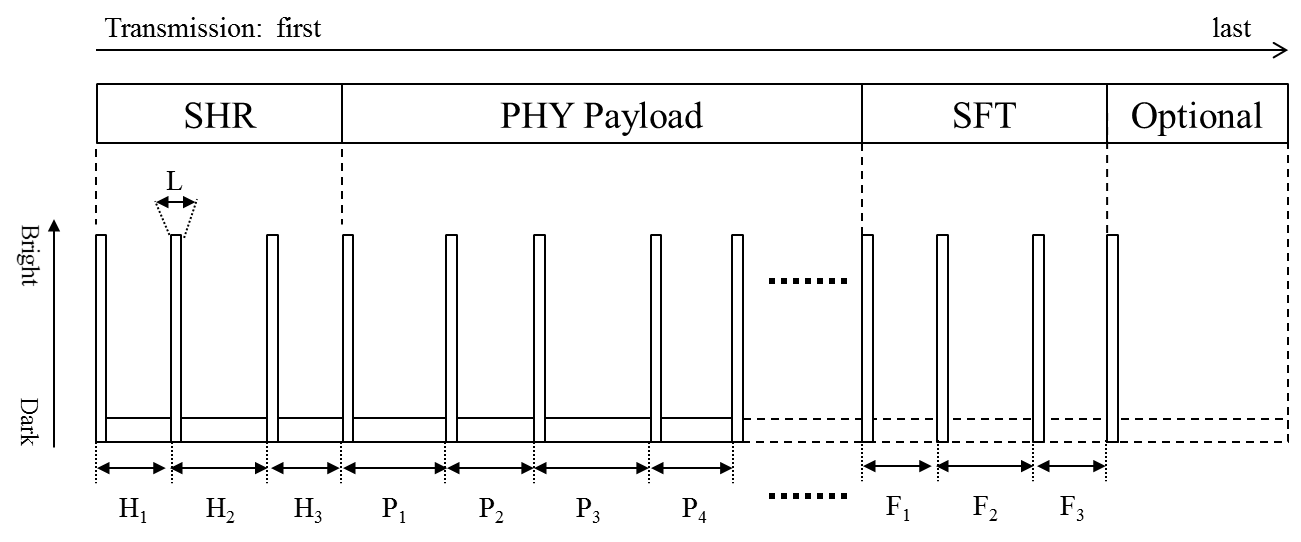
Packet PPM consists of SHR, PHY payload, SFT, and Optional fields as shown in Figure 2. Time length of the short bright pulse, shown as *L* in the Figure, is less than ten micro seconds.



1. Packet PPM mode 1



1. Packet PPM mode 2



1. Packet PPM mode 3

Figure 2 – Packet PPM

SHR field consists of three intervals of successive four pulses. The patterns of intervals show transmission mode as shown in Table 2.

Table 2 – SHR field patterns of Packet PPM

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

PHY payload contains of 6 bits of data (*x0* – *x5*) in mode 1, 12 bits of data (*x0* – *x11*) in mode 2, or variable bits of data (*x0* – *xn*) in mode 3. Let yk are defined as

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

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.

# 5.0 PHY PIB attributes

See IEEE802.15.7-2011 Table 100 for the current PHY PIB Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PHY PIB Table 100 Additions** | | | | |
| **Attribute** | **Identifier** | **Type** | **Range** | **Description** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

# 6.0 Superframe Structure

Packet PWM and Packet PPM does not have beacon nor superframe structure as same as UFSOOK.

# 7.0 MAC frame formats

## 7.1 MAC frame format of Packet PWM/PPM mode 1

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

MAC frame consists of 16 bits of data D00 D10 D01 D11, where Dk is data D of packet whose address A is k.

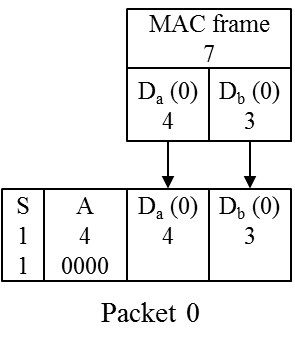
The native MPDU has too much overhead for this MAC frame and most of the fields are not needed for a short, repetitive MSDU. Therefore, this MAC frame does not have MHR field and the MFR field is optional.

## 7.2 MAC frame format of Packet PWM/PPM mode 2

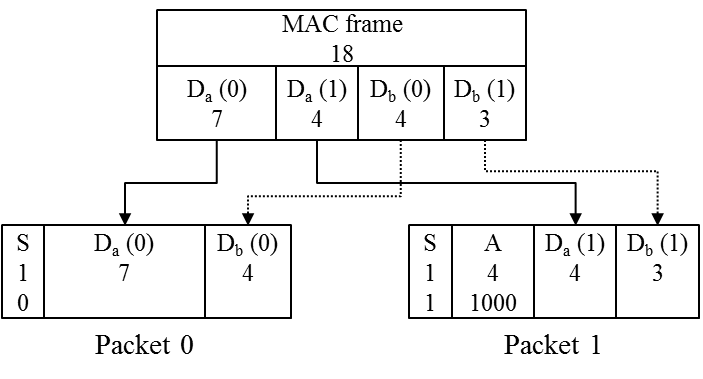
PHY payload contains of 6 bits of data (*x0* – *x11*). A packet consists of address A (*a­­0* – *a3*), data Da (*da0­* – *da6*), data Db (*db0* – *db3*), and stop bit S (*s*). They correspond as

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

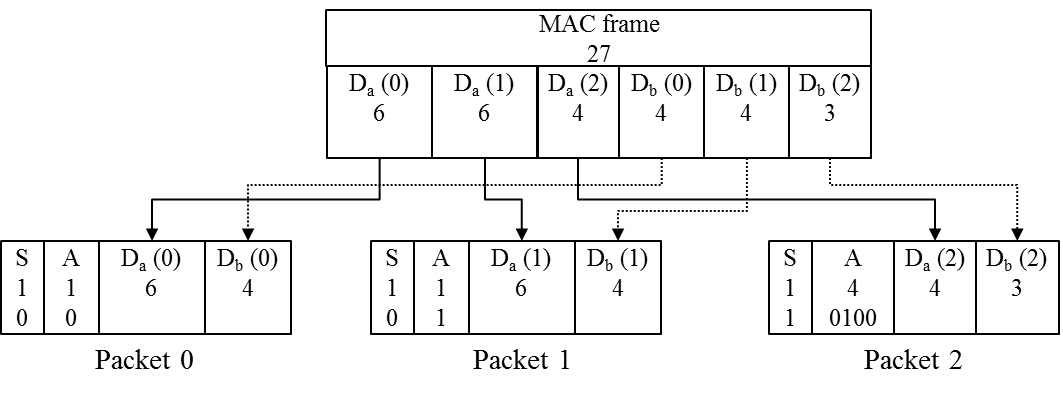
MAC frame is divided into some packets as shown in Figure 3.



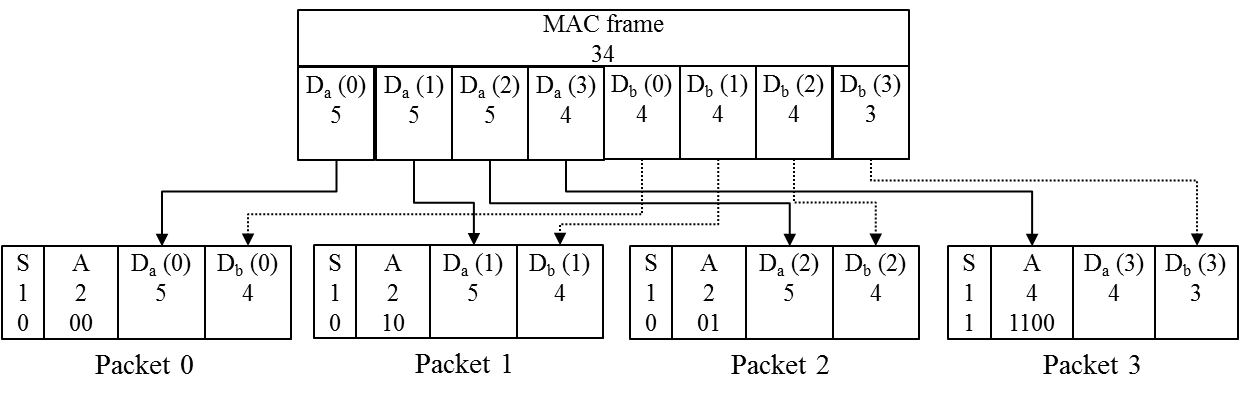
1. 1-division (No division) pattern



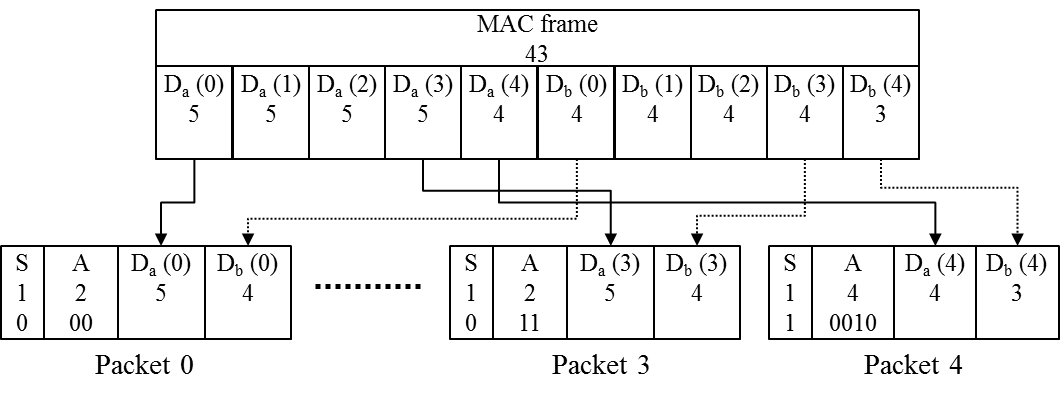
1. 2-division pattern



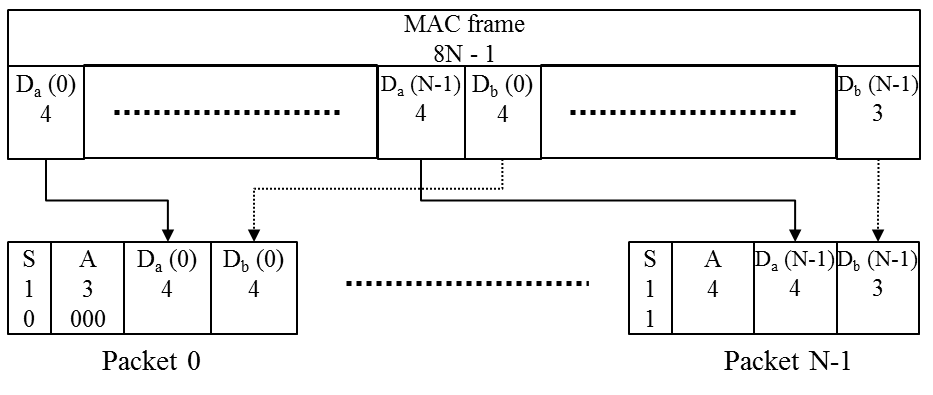
1. 3-division pattern



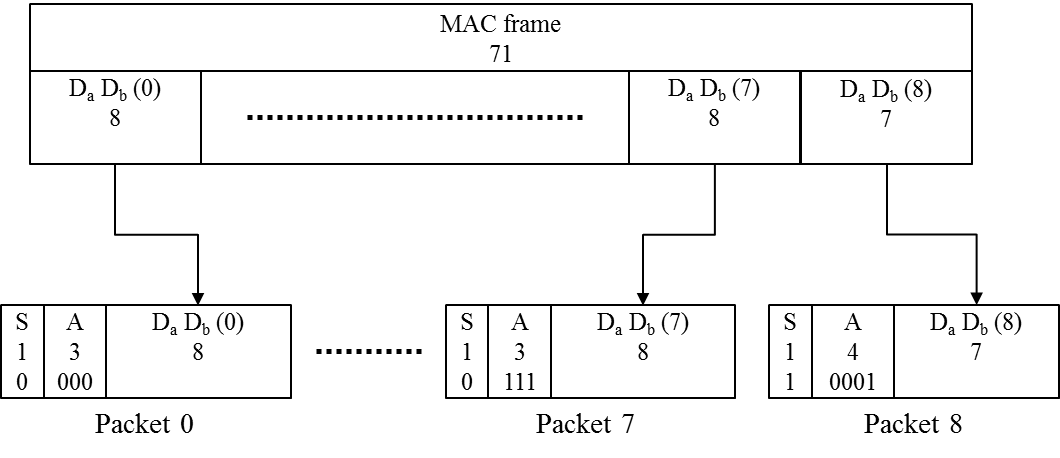
1. 4-division pattern



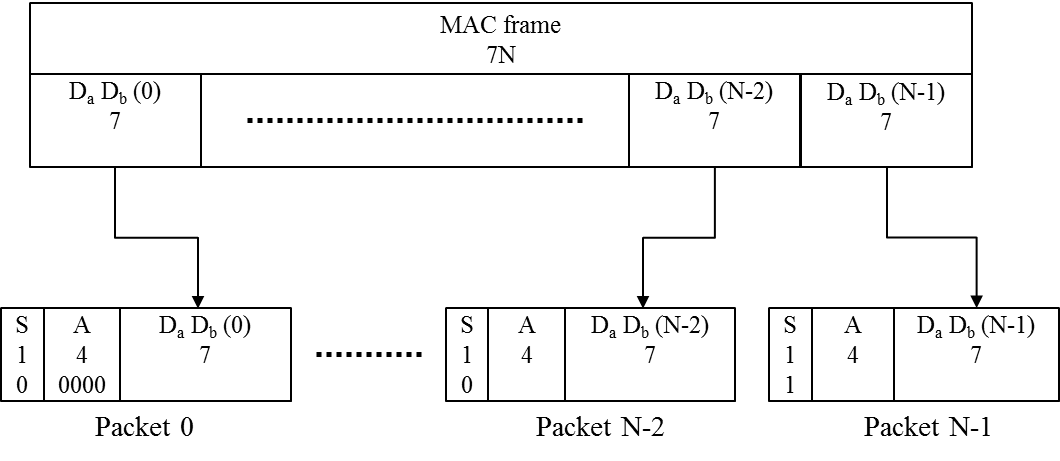
1. 5-division pattern



1. N-division pattern (N = 6, 7, 8)



1. 9-division pattern



1. N-division pattern (N = 10 – 16)

Figure 3 – Packet division pattern of Packet PWM/PPM mode 2

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.

## 7.3 MAC frame format of Packet PWM/PPM mode 3

(TBD)

# 8.0 MAC PIB attributes

See table 60 in IEEE802.15.7-2011 for the current MAC PIB Table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **MAC PIB Table 60 Additions** | | | | | |
| **Attribute** | **Identifier** | **Type** | **Range** | **Description** | **Default** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |