IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)		
Title	**Exemplary Text for Intel Comment 202**		
Date Submitted	Jan 2017		
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Re:	The proposed text is in response to comment 202 in document 15-17-0031-06-007a-d1-combined-comments		
Abstract	Asking for the committee to consider the proposed text for clause 5.2, MAC Frame Formats, that is believed to provide a unified framework for the MAC frame description while also accommodating the specific PHY needs. It is believe this will also resolve the following comments: 191, 195, 202 and 207 and also all 40 follwing comments that are resolved by the resolution of comment 191. I'll be working with Trang and Vinay for agreement.		
Purpose	Adopt this text for resolution of 191, 195, 202 and 207.		
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5.2 MAC frame formats

This subclause specifies the format of the MAC frame (MPDU). Each MAC frame consists of the following basic components:

a) A MHR, which comprises frame control, sequence number, address information, and security-related information.
b) A MSDU, of variable length, which contains information specific to the frame type. Acknowledgment frames do not contain a payload.
c) A MFR, which contains a FCS.

The frames in the MAC sublayer are described as a sequence of fields in a specific order. All frame formats in this subclause are depicted in the order in which they are transmitted by the PHY, from left to right, where the left most bit is transmitted first in time. Bits within each field are numbered from 0 (left most and least significant) to $k - 1$ (right most and most significant), where the length of the field is k bits. Fields that are longer than a single octet are sent to the PHY in the order from the octet containing the lowest numbered bits to the octet containing the highest numbered bits.

For every MAC frame, all reserved bits shall be ignored upon receipt.

Use of over-the-air MAC frame configuration shall not be done for PHY types IV, V and VI, which shall accomplish MAC frame configuration via the MAC PIB. There shall be no "base default" transmission mode for PHY types IV, V and VI. The MAC PIB shall not be transmitted; rather, it shall be written by the Device Management Entity which shall be read by the MAC layer.

5.2.1 General MAC frame formats

The MAC frame format is composed of a MHR, a MSDU, and a MFR. The fields of the MHR appear in a fixed order; however, the addressing fields may not be included in all frames. The general MAC frame shall be formatted as illustrated in Figure 71.

Octets: 2	**1**	**0/2**	**0/2/8**	**0/2**	**0/2/8**	**0/3/9**	**0/2/8**	**0/5/6/10/14**	**variable**	**2**
Frame Control (5.2.1.1)	Sequence Number (5.2.1.2)	Destination OWPAN Identifier (5.2.1.3)	Destination Address (5.2.1.4)	Source OWPAN Identifier (5.2.1.5)	Source Address (5.2.1.6)	Acknowledge Field	Polling Field	Auxiliary Security Header (5.2.1.7)	Frame Payload (5.2.1.10)	FCS (5.2.1.11)
		Addressing fields								
MHR									MSDU	MFR

Figure 71—General MAC frame format

5.2.1.1 Frame control field

The frame control field is 2 octets in length and contains information defining the frame type, addressing fields, and other control flags. The frame control field shall be formatted as illustrated in Figure 72. Reserved bits are set to zero on transmission and ignored on reception.

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Bits: 0–1	2–5	6–8	9	10	11	12–13	14–15
Frame Version	Reserved	Frame Type	Security Enabled	Frame Pending	Ack Request	Dest Addressing Mode	Source Addressing Mode

Figure 72—Format of the frame control field

5.2.1.1.1 PHY 1, II and III

Frame Version subfield

The Frame Version subfield specifies the version number corresponding to the frame. This subfield shall be set to 0b00 to indicate a frame compatible with IEEE Std 802.15.7 and set to 0b01 to indicate a frame compatible with IEEE Std 802.15.7-20xx. All other subfield values shall be reserved for future use.

Frame type subfield

The Frame Type subfield shall be set to one of the nonreserved values listed in Table 11.

Table 11—Values of the Frame Type subfield

Frame type value $b_2\ b_1\ b_0$	Description
000	Beacon
001	Data
010	Acknowledgment
011	Command
100	CVD
101	Control
110–111	Reserved

Security Enabled subfield

The Security Enabled subfield is 1 bit in length, and it shall be set to one if the frame is protected by the MAC sublayer and shall be set to zero otherwise. The Auxiliary Security Header field of the MHR shall be present only if the Security Enabled subfield is set to one.

Frame Pending subfield

The Frame Pending subfield is 1 bit in length and shall be set to one if the device sending the frame has more data for the recipient. This subfield shall be set to zero otherwise (see 5.1.10.3).

The Frame Pending subfield shall be used only in beacon frames or frames transmitted either during the CAP by devices operating on a beacon-enabled OWPAN or at any time by devices operating on a nonbeacon-enabled OWPAN.

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At all other times, it shall be set to zero on transmission and ignored on reception.

Acknowledgment Request subfield

The Acknowledgment Request subfield is 1 bit in length and specifies whether an acknowledgment is required from the recipient device on receipt of a data or MAC command frame. If this subfield is set to one, the recipient device shall send an acknowledgment frame only if, upon reception, the frame passes the third level of filtering as shown in 5.1.10.2. If this subfield is set to zero, the recipient device shall not send an acknowledgment frame.

Destination Addressing Mode subfield

The Destination Addressing Mode subfield shall be set to one of the nonreserved values listed in Table 12.

If this subfield is equal to zero and the Frame Type subfield does not specify that this frame is an acknowledgment or beacon frame, the Source Addressing Mode subfield shall be nonzero, implying that the frame is directed to the OWC coordinator with the OWPAN identifier as specified in the Source OWPAN Identifier field. If this subfield is equal to 01, the Source Addressing Mode subfield shall be equal to 01, implying that the frame is a broadcast frame, and no source or destination address fields are present in the frame.

Table 12—Possible values of the Destination Addressing Mode and Source Addressing Mode subfields

Addressing mode value b_1 b_0	Description
00	OWPAN identifier and address fields are not present.
01	No address field (broadcast only mode with no address fields present). Addresses with all ones of 16 bits or 64 bits are defined as broadcast.
10	Address field contains a 16-bit short address.
11	Address field contains a 64-bit extended address.

Source Addressing Mode subfield

The Source Addressing Mode subfield shall be set to one of the nonreserved values listed in Table 12.

If this subfield is equal to zero and the Frame Type subfield does not specify that this frame is an acknowledgment frame, the Destination Addressing Mode subfield shall be nonzero, implying that the frame has originated from the coordinator with the OWPAN identifier as specified in the Destination OWPAN Identifier field.

If this subfield is equal to 01, the Source Addressing Mode subfield shall be equal to 01, implying that the frame is a broadcast frame, and no source or destination address fields are present in the frame.

5.2.1.1.2 PHY IV

Not used.

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5.2.1.1.3 PHY V

RS-FSK frame control

This sub-clause specifies the format of the RS-FSK MAC frame (MPDU). Each MAC frame consists of the following basic components:

b) A MFH, which comprises frame control, sequence number and address information.

c) A MFDU, of variable length, which contains information specific to the frame type. Acknowledgement frames do not contain a payload.

c) A MFT, which contains a FCS.

The frames in the MAC sub-layer are described as a sequence of fields in a specific order. All frame formats in this sub-clause are depicted in the order in which they are transmitted by the PHY, from left to right, where the left most bit is transmitted first in time. Bits within each field are numbered from 0 (left most and least significant) to k-1 (right most and most significant), where the length of the field is k bits. Fields that are longer than a single octet are sent to the PHY in the order form the octet containing the lowest numbered bits to the octet containing the highest numbered bits.

For every MAC frame, all reserved bits shall be ignored upon receipt.

The Frame Control field is 1 octet in length and contains information defining the frame type, addressing fields, and other control flags. The frame control field shall be formatted as illustrated in Figure 85. Reserved bits are set to zero on transmission and ignored on reception.

Bits: 0-2	3	4	5	6	7
Frame Type	Reserved	Security Enabled	Frame Pending	Destination Addressing Mode	Source Addressing Mode

Figure 12 - Format of the frame control field

Figure 73—Format of the frame control field

The Frame Type subfield shall be set to one of the non-reserved values listed in Table 16.

Table 13—Values of the frame type subfield

Frame Type Value b2 b1 b0	Description
000	Reserved

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Table 13—Values of the frame type subfield

Frame Type Value b2 b1 b0	Description
001	Data
010	Command
011	Security Configuring Mode
100-111	Reserved

The Security Enabled subfield is 1 bit in length, and it shall be set to one if the frame is protected by the MAC sublayer and shall be set to zero otherwise. Prior to enable this field, the transmitter should configure the receiver into Security Enabled prepared state through the Frame Type subfield.

The Frame Pending subfield is 1 bit in length and shall be set to one if the device sending the frame has more data for the recipients. This subfield shall be set to zero otherwise. The Frame Pending subfield shall be used only during the DF, at SF it shall be set to zero on transmission and ignored on reception.

If the Destination PAN Address is equal to zero then it shall not be included.

If the Source PAN Address is equal to zero then it shall not be included.

5.2.1.1.4 PHY VI

VTASC frame control

The Frame Version Subfield specifies the version number corresponding to the frame. This subfield shall be set to 0b01 to indicate a frame compatible with IEEE Standard 802.15.7r1. And all other subfield values shall be reserved for future use.

The Frame Type Subfield specifies the Frame Type used in MAC Frame. This field shall be set to one of the non-reserved values listed in Table 17.

Table 14—IEEE802.15.7r1 Frame Type Subfield

Frame type value b_2 b_1 b_0	Description
000	Beacon
001	Data
010	Data Acknowledgment
011	Command
100-111	Reserved

The Security Enabled Subfield species the Security on Data Frame is enable or not on transmission. This field is 1 bit in length, and it shall be set to one if the frame is protected by the MAC sublayer and shall be set

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to zero otherwise. The Auxiliary Security Header field of the MHR shall be present only if the Security Enabled subfield is set to one.

The Frame Pending Subfield species the Pending on Data Frame is available or not on transmission. This field is 1 bit in length and shall be set to one if the device sending the frame has more data for the recipient. This subfield shall be set to zero otherwise.

The Acknowledgment Request Subfield specifies whether an acknowledgment is required from the recipient device on receipt of a data or MAC command frame. This field is 1 bit in length and this subfield is set to one, the recipient device shall send an acknowledgment frame. If this subfield is set to zero, the recipient device shall not send an acknowledgment frame.

Invisible data embedded frame control

Frame Version Subfield: Specifies the version number corresponding to the frame. This subfield shall be set to 0b01 to indicate a frame compatible with IEEE Standard 802.15.7r1. And all other subfield values shall be reserved for future use.

Frame Type Subfield: Specifies the Frame Type used in MAC Frame. This field shall be set to one of the non-reserved values listed in Table 18.

Table 15— IEEE802.15.7r1 Frame Type Subfield

Frame type value b_2 b_1 b_0	Description
000	Beacon
001	Data
010	Acknowledgment
011	Command
100 - 111	Reserved

Security Enabled Subfield: Species the Security on Data Frame is enable or not on transmission. This field is 1 bit in length, and it shall be set to one if the frame is protected by the MAC sublayer and shall be set to zero otherwise. The Auxiliary Security Header field of the MHR shall be present only if the Security Enabled subfield is set to one.

Frame Pending Subfield: Species the Pending on Data Frame is available or not on transmission. This field is 1 bit in length and shall be set to one if the device sending the frame has more data for the recipient. This subfield shall be set to zero otherwise.

Acknowledgment Request Subfield: Specifies whether an acknowledgment is required from the recipient device on receipt of a data or MAC command frame. This field is 1 bit in length and this subfield is set to one, the recipient device shall send an acknowledgment frame. If this subfield is set to zero, the recipient device shall not send an acknowledgment frame.

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5.2.1.2 Sequence Number field

5.2.1.2.1 PHY I, II and III

The Sequence Number field is 1 octet in length and specifies the sequence identifier for the frame.

For a beacon frame, the Sequence Number field shall specify a BSN. For a data, acknowledgment, or MAC command frame, the Sequence Number field shall specify a DSN that is used to match an acknowledgment frame to the data or MAC command frame.

5.2.1.2.2 PHY IV

Not used.

5.2.1.2.3 PHY V

RS-FSK sequence number

The Sequence Number field is 1 octet in length and specifies the sequence identifier for the frame.

5.2.1.2.4 PHY VI

VTASC sequence number

The Sequence Number field is 1 octet in length and specifies the sequence identifier for the frame.

For a beacon frame, the Sequence Number field shall specify a BSN. For a data, acknowledgment, or MAC command frame, the Sequence Number field shall specify a DSN that is used to match an acknowledgment frame to the data or MAC command frame.

Invisible data embedded sequence number

The Sequence Number field is 1 octet in length and specifies the sequence identifier for the frame.

For a beacon frame, the Sequence Number field shall specify a BSN. For a data, acknowledgment, or MAC command frame, the Sequence Number field shall specify a DSN that is used to match an acknowledgment frame to the data or MAC command frame.

5.2.1.3 Destination OWPAN Identifier field

5.2.1.3.1 PHY 1, II and III

The Destination OWPAN Identifier field, when present, is 2 octets in length and specifies the unique OWPAN identifier of the intended recipient of the frame. A value of 0xffff in this field shall represent the broadcast OWPAN identifier, which shall be accepted as a valid OWPAN identifier by all devices currently listening to the channel.

This field shall be included in the MAC frame only if the Destination Addressing Mode subfield of the frame control field is 10 or 11.

5.2.1.3.2 PHY IV

Not used.

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5.2.1.3.3 PHY V

Not used.

5.2.1.3.4 PHY VI

Not used.

5.2.1.4 Destination Address field

5.2.1.4.1 PHY I, II and III

The Destination Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Destination Addressing Mode subfield of the frame control field, see , and specifies the address of the intended recipient of the frame. A 16-bit value of 0xffff in this field shall represent the broadcast short address, which shall be accepted as a valid 16-bit short address by all devices currently listening to the channel.

This field shall be included in the MAC frame only if the Destination Addressing Mode subfield of the frame control field is nonzero.

5.2.1.4.2 PHY IV

Not used.

5.2.1.4.3 PHY V

RS-FSK Destination Address

The Destination PAN Address, when present, is 2 octets in length, and specifies the address of the intended recipient of the frame. A 16-bit value of 0xFFFF in this field shall represent the broadcast address, which shall be accepted as a valid 16-bit address by all devices currently listening to the channel.

This field shall be included in the MAC frame only if the Destination Addressing Mode subfield of the frame control field is nonzero.

5.2.1.4.4 PHY VI

VTASC destination address field

The Destination Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Destination Addressing Mode subfield of the frame control field, and specifies the address of the intended recipient of the frame.

A 16-bit value of 0xffff in this field shall represent the broadcast short address, which shall be accepted as a valid 16-bit short address by all devices currently listening to the channel.

This field shall be included in the MAC frame only if the Destination Addressing Mode subfield of the frame control field is nonzero.

Invisible data embedded destination address field

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The Destination Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Destination Addressing Mode subfield of the frame control field, and specifies the address of the intended recipient of the frame.

A 16-bit value of 0xffff in this field shall represent the broadcast short address, which shall be accepted as a valid 16-bit short address by all devices currently listening to the channel.

This field shall be included in the MAC frame only if the Destination Addressing Mode subfield of the frame control field is nonzero.

5.2.1.5 Source OWPAN Identifier field

5.2.1.5.1 PHY I, II and III

The Source OWPAN Identifier field, when present, is 2 octets in length and specifies the unique OWPAN identifier of the originator of the frame. This field shall be included in the MAC frame only if the Source Addressing Mode is nonzero.

The OWPAN identifier of a device is initially determined during association on a OWPAN, but may change following a OWPAN identifier conflict resolution as discussed in 5.1.6.

5.2.1.5.2 PHY IV

Not used.

5.2.1.5.3 PHY V

Not used.

5.2.1.5.4 PHY VI

Not used.

5.2.1.6 Source Address field

5.2.1.6.1 PHY I, II and III

The Source Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Source Addressing Mode subfield of the frame control field, as shown in , and specifies the address of the originator of the frame. This field shall be included in the MAC frame only if the Source Addressing Mode subfield of the frame control field is 10 or 11.

5.2.1.6.2 PHY IV

Twinkle VPPM source address field

Twinkle VPPM uses the source address field.

5.2.1.6.3 PHY V

RS-FSK source address

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The Source PAN Address, when present, is 2 octets in length, and specifies the address of the originator of the frame. This field shall be included in the MAC frame only if the Source Addressing Mode subfield of the frame control field is nonzero.

5.2.1.6.4 PHY VI

VTASC source address

The Source Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Source Addressing Mode subfield of the frame control field, , and specifies the address of the originator of the frame.

This field shall be included in the MAC frame only if the Source Addressing Mode subfield of the frame control field is 10 or 11.

Invisible data embedded source address

The Source Address field, when present, is either 2 octets or 8 octets in length, according to the value specified in the Source Addressing Mode subfield of the frame control field, , and specifies the address of the originator of the frame.

This field shall be included in the MAC frame only if the Source Addressing Mode subfield of the frame control field is 10 or 11.

5.2.1.7 Auxiliary Security Header field

5.2.1.7.1 PHY I, II and III

The Auxiliary Security Header field has a variable length and specifies information required for security processing, including how the frame is actually protected (security level) and which keying material from the MAC security PIB is used (see 7.5.1). This field shall be present only if the Security Enabled subfield is set to one. For details on formatting, see 7.4.

5.2.1.7.2 PHY IV

Not used.

5.2.1.7.3 PHY V

Not used.

5.2.1.7.4 PHY VI

Not used.

5.2.1.8 Frame Payload field

5.2.1.8.1 PHY I, II and III

The Frame Payload field has a variable length and contains information specific to individual frame types. If the Security Enabled subfield is set to one in the frame control field, the frame payload is protected as defined by the security suite selected for that frame.

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5.2.1.8.2 PHY IV

Twinkle VPPM payload field

Twinkle VPPM uses only the frame payload.

5.2.1.8.3 PHY V

RS-FSK payload field

The MFDU contains the frame payload, which has a variable length and contains information specific to individual frame types. If the frame control is configured to Security Enabled previously, then the frame payload is protected as defined by the security suite selected at that time.

PWM/PPM mode 1 payload field

PHY payload contains of 6 bits of data (x_0 - x_5). Packet address A (a_0, a_1) is represented as (x_1, x_4) and packet data D (d_0, d_1, d_2, d_3) is represented as (x_0, x_2, x_3, x_5).

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.

PWM/PPM mode 2 payload field

PHY payload contains of 6 bits of data (x_0 - x_{11}). A packet consists of address A (a_0 - a_3), data Da (d_{a0} - d_{a6}), data D_b (d_{b0} - d_{b3}), and stop bit S (s). They correspond as

$$\begin{vmatrix} x_0 & x_1 & x_2 \\ x_3 & x_4 & x_5 \\ x_6 & x_7 & x_8 \\ x_9 & x_{10} & x_{11} \end{vmatrix} = \begin{vmatrix} d_{a0} & s & d_{b0} \\ d_{a1} & a_0 / d_{a6} & d_{b1} \\ d_{a2} & a_1 / d_{a5} & d_{b2} \\ d_{a3} & a_2 / d_{a4} & a_3 / d_{b3} \end{vmatrix}$$

x_4, x_7, x_{10}, and x_{11} correspond either of them in accordance with the packet division rule described below.

MAC frame is divided into some packets as shown in Figure 86 to Figure 92.

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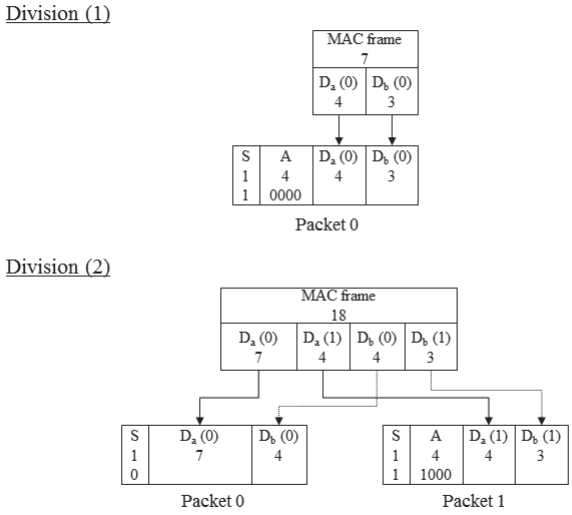

Figure 74—1-division (No division) pattern

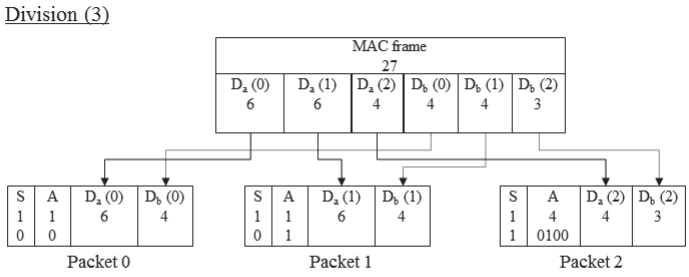

Figure 75—3-division pattern

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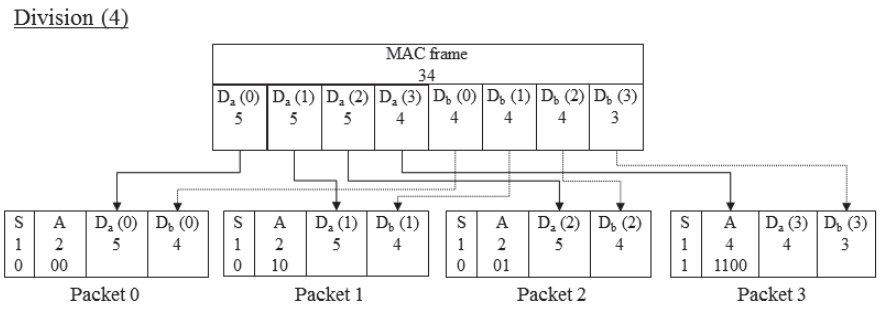

Figure 76—4-division pattern

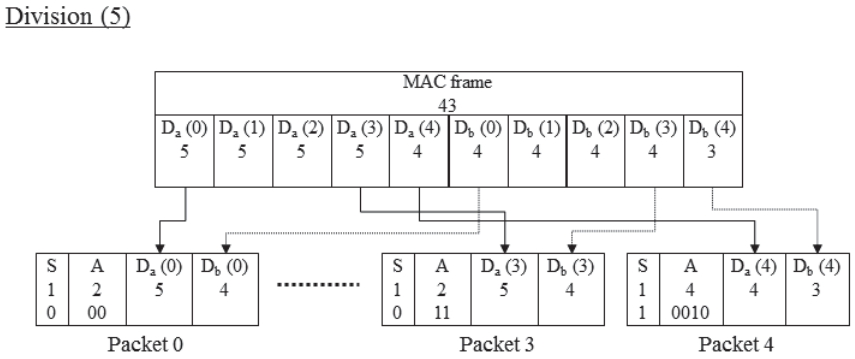

Figure 77—5-division pattern

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Division (N = 6, 7, 8)

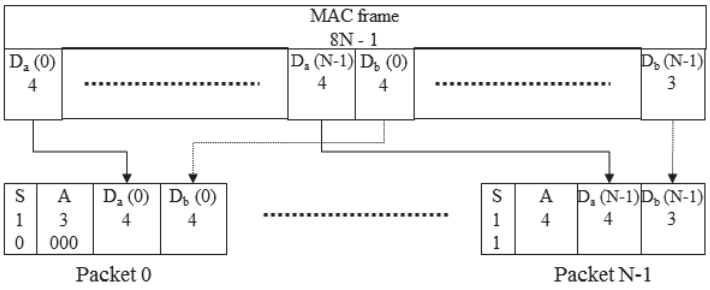

Figure 78—N-division pattern (N = 6, 7, 8)

Division (8)

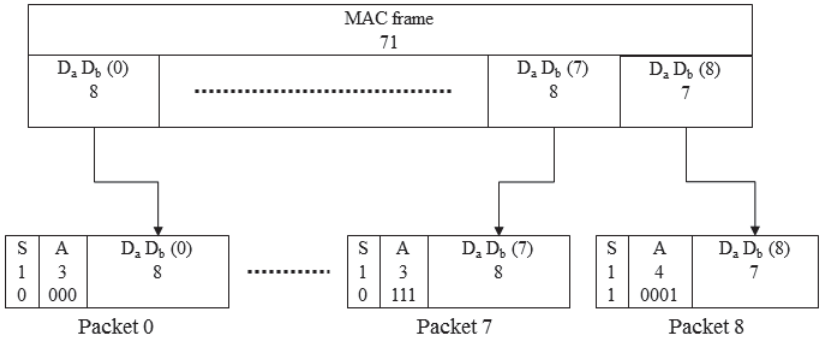

Figure 79—9-division pattern

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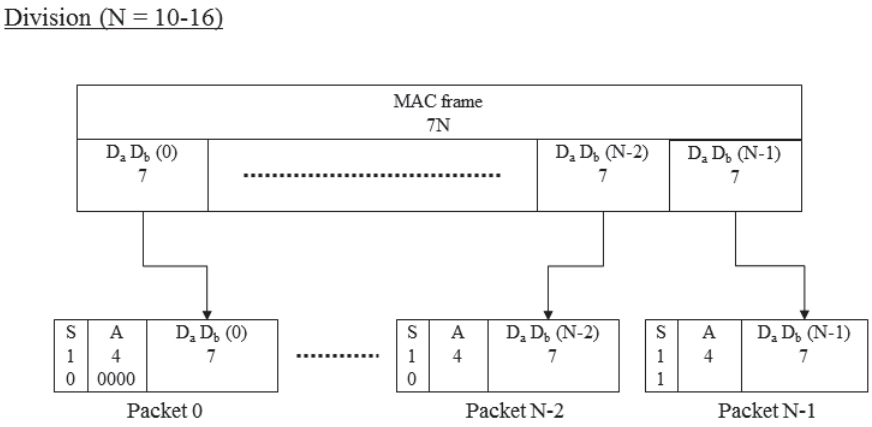

Figure 80—N-division pattern (N = 10 - 16)

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.

5.2.1.8.4 PHY VI

VTASC payload field

The Frame Payload field has a variable length and contains information specific to individual frame types. If the Security Enabled subfield is set to one in the frame control field, the frame payload is protected as defined by the security suite selected for that frame.

Invisible data embedded payload field

The Frame Payload field has a variable length and contains information specific to individual frame types. If the Security Enabled subfield is set to one in the frame control field, the frame payload is protected as defined by the security suite selected for that frame.

5.2.1.9 FCS field

5.2.1.9.1 PHY I, II and III

The FCS field is 2 octets in length and is explained in Annex C. The FCS is calculated over the MHR and MSDU parts of the frame. The FCS shall be only generated for payloads greater than zero bytes.

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5.2.1.9.2 PHY IV

Not used.

5.2.1.9.3 PHY V

RS-FSK FCS field

Currently MFT contains only the frame checksum (FCS). The FCS field is 2 octets in length and is explained in somewhere else in the document. The FCS is calculated over the MFH and MSDU part of the frame. The FCS shall be only generated for payloads greater than zero bytes.

5.2.1.9.4 PHY VI

VTASC FCS field

The FCS field is 2 octets in length and the FCS is calculated over the MHR and MSDU parts of the frame. The FCS shall be only generated for payloads greater than zero bytes.

The FCS is option is given as an optional option, it is adaptive to RS/CRC/NONE.

Invisible data embedded FCS field

The FCS field is 2 octets in length and the FCS is calculated over the MHR and MSDU parts of the frame. The FCS shall be only generated for payloads greater than zero bytes.

The FCS is option is given as an optional option, it is adaptive to RS/CRC/NONE.

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Table 101—MAC sublayer constants *(continued)*

Constant	Description	Value
aMaxMPDUUnsecuredOverhead	The maximum number of octets added by the MAC sublayer to the PSDU without security.	25
aMaxSIFSFrameSize	The maximum size of an MPDU, in octets, that can be followed by a SIFS period.	18
aMinCAPLength	The minimum number of optical clocks forming the CAP. This ensures that MAC commands can still be transferred to devices when GTSs are being used. An exception to this minimum shall be allowed for the accommodation of the temporary increase in the beacon frame length needed to perform GTS maintenance (as defined in 5.2.10.1.5).	440
aMinMPDUOverhead	The minimum number of octets added by the MAC sublayer to the PSDU.	9
aNumSuperframeSlots	The number of slots contained in any superframe.	16
aUnitBackoffPeriod	The number of optical clocks forming the basic time period used by the unslotted random access algorithm.	20

6.4.2 MAC PIB attributes

The MAC PIB comprises the attributes required to manage the MAC sublayer of a device. The attributes contained in the MAC PIB are presented in Table 102 and Table 110. Attributes marked with a dagger (†) are read-only attributes (i.e., attribute can only be set by the MAC sublayer), which can be read by the next higher layer using the MLME-GET.request primitive. All other attributes can be read or written by the next higher layer using the MLME-GET.request or MLME-SET.request primitives, respectively. Higher layers may impose additional constraints on read/write operations, without making devices non-compliant. Attributes marked with a diamond (◆) are optional for a device (i.e., not operating as a coordinator).

The read-only attribute *macAckWaitDuration* is dependent on a combination of constants and PHY PIB attributes. The formula for relating the constants and attributes is shown in Equation (1).

$$AckWaitTime = backoff\ period + aTurnaroundTime\text{-}RX\text{-}TX + clock\ period \times numSymAckFrame \quad (1)$$

where numSymAckFrame is the number of bits in the acknowledgment frame and is equal to 103 for PHY I and II and 111 for PHY III. For B-ACK mode, the AckWaitTime would be larger, depending on the number of acknowledgments in the B-ACK mode as explained in 5.2.10.2. The clock period is obtained via the optical rates specified in Table 117, Table 118, and Table 119.

The attribute *macMaxFrameTotalWaitTime* may be set by the next higher layer and is dependent upon a combination of PHY and MAC PIB attributes and constants. The formula relating the attributes and constants is shown in Equation (2).

$$macMaxFrameTotalWaitTime = \quad (2)$$

$$\left[\left(\sum_{k=0}^{m-1} 2^{macMinBE+k}\right) + (2^{macMaxBE} - 1)\cdot(macMaxCSMABackoffs - m)\right] \bullet aUnitBackoffPeriod + phyMaxFrameDuration$$

where

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Table 102—MAC PIB attributes *(continued)*

Attribute	Identifier	Type	Range	Description	Default
macTxDataType	0x94	Unsigned	0-255	This attribute indicates the type of data to be transmitted. 0 : Normal Data (Media Content, Information Content based on the Application used for) 1 : ID Data 2 : Authentication Data	0
maxDataLength	0x95	Integer	0-65535	This attribute specify the length of the data to be transmitted	0
macLEDIDusage	0x96	Unsigned	0-255	This attribute indicates the type of data transmitted using Flash Light Transmitter. 0 : LED IT 1 : With or Without LED ID and IP address	0
macFrameControl	0x97	Unsigned	2 octets	See clause 5.2.1.1.	
macSequenceNumber	0x98	Unsigned	1 octets	See clause 5.2.1.2.	
macDestinationOWPANIdentifer	0x99	Unsigned	2 octets	See clause 5.2.1.3.	
macDestinationAddress	0x9a	Unsigned	2 or 8 octets	See clause 5.2.1.4.	
macSourceOWPANIdentifier	0x9b	Unsigned	2 octets	See clause 5.2.1.5.	
macSourceAddress	0x9c	Unsigned	2 or 8 octets	See clause 5.2.1.6.	
macAcknowledgeField	0x9d	Unsigned	variable length	See clause 5.2.1.7.	
macFramePayload	0x100	Unsigned	variable length	See clause 5.2.1.8.	
macFCS	0x101	Unsigned	2 octets	See clause 5.2.1.9.	

Table 103—Ambiguity Resolution Method

PIB Attribute Value	Method Name	Method
0	ID without payload	Preappend ID to SSID
1	ID and SSID hash	Preappend ID to hash resolved SSID
2	w/ or w/o ID and IP address	Preappend ID to provided IP address

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