

**IEEE P802.15**  
**Wireless Specialty Networks**

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Project	IEEE P802.15 Working Group for Wireless Specialty Networks (WSNs) – 802.15.6ma	
Title	<b>Proposed text for 6ma – MAC Formats</b>	
Date Submitted	July 4, 2024	
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Re:	Contribution to IEEE 802.15.6ma	
Abstract	This document provides a text draft of 6ma MAC for specifying frames formats to support coexisting dependable BANs in clause 5.	
Purpose	Support development of technical content for the draft	
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*Revise the sub-clause 5.2 as follows:*

## 5.2

### 5.2.1

#### 5.2.4.9 Frame Subtype subfield

**Table 7—Subtype subfield encoding**

Type field	b9–b12	Subtype frame description
Management	0000	Beacon
Management	0001	Association Request
Management	0010	Association Response
Management	0011	Disassociation
Management	0100	Group Beacon
Management	0101	Group Allocation Map
Management	0110	Group Association
Management	0111	Group Disassociation
Management	1000	Group Coordinator Resign
Management	1001	Group Coordinator Challenge
Management	1010	Group Coordinator Migration
Management	1011	Group Merging Challenge
Management	1100	Group Merging
Management	1101	Group Disband
Management	1111	Reserved
Control	0000	R2S
Control	0001	TF
Control	0010	TFA
Control	0011	Block ACK Request
Control	1000	Block ACK
Control	1001	ACK

Control	1011-1111	Reserved
Data	0000	Data
Data	0001	Null
Data	0010-1111	Reserved

Revise the sub-clause 5.6 as follows:

## 5.6 Management frames

### 5.6.1 Format of management frames

The format of a management frame is defined in Figure 9-74

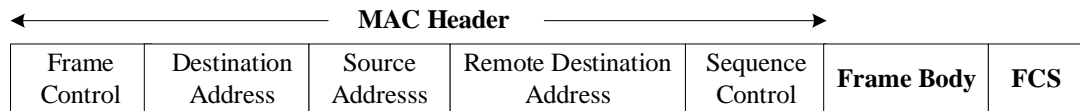


Figure 14—Management frame format

### 5.6.2 Beacon Frame Body format

The frame body of a Beacon frame contains the information shown in Table 19.

Table 19— Beacon Frame Body encoding

Octet	Bits	Field name	Description
0–7		Timestamp	This field represents the timing synchronization function (TSF) timer of the conveying MAC frame.
8-9		BAN ID	5.5.1.1.1
10		Capability information	5.5.1.1.2
11-13		Beacon Interval	This field specifies the transmission interval of beacon by the number of time slots
14		Superframe Order	This field specifies the length of active superframe duration by the number of time slots calculated as $2^{\text{SuperframeOrder}}$ .
15		CFP Length	This field specifies the length of Contention Free Period by the number of time slots.
16		CFP Descriptor Count	This field specifies the number of nodes that is allowed to access CFP.
var		CFP Descriptor List	This field specifies the list of CFP descriptor information as defined in Table 5.xx, which specifies the location and length of CFP slots assigned for a node to be allowed to access CFP. The size of CFP Info List is specified by CFP Count. A node may request to configure CFP slots such as consecutive allocation or distributed allocation.

Table 5.xx— Format of the CFP descriptor information

Octet	Bits	Field name	Description
0–5		Node Address	This field represents the address of a node to access CFP.

6	0-1	CFP Slot Configuration	This field specifies the configuration of CFP slots distribution. 0 : single consecutive slots allocation 1 : equally distributed slots allocation 2: unequally distributed slots allocation 3: reserved
6	2-7	Slot Parts Count	This field specifies the number of distributed slot parts in a CFP. For CFP slots distribution type 0, this field is set to 1.
var		Slot Parts Descriptor List	This field specifies the list of CFP distributed slot parts information as defined in Table 5.xx, which specifies the start slot number, slot transmission direction, and the number of slots allocated. The size of CFP Distributed Slot Parts List is specified by Distribution Parts Count.

Table 5.xx— Format of the CFP slot parts descriptor

Octet	Bits	Field name	Description
0		Start Slot	This field represents the starting slot number of a slot parts in a CFP.
1	0-2	Direction	This field represents the direction of transmission for CFP slots. 0 : a slot downward transmission from the coordinator 1 : a slot upward transmission from the node
1	3-7	Slot Count	This field specifies the length of consecutive slots for a distributed slot part.

### 5.6.2.1 The BAN ID subfield

The BAN ID consists of the first 16 octets of output of the security hash SHA-224 with input the first timestamp concatenated with the coordinator's MAC address.

### 5.6.2.2 Capability Information subfield

#### — Capability Information subfield encoding

Bits	Capability Information	Description
b136	Group Coordinator	Device is a group coordinator.
b137	QoS	Device has QoS capabilities
b138	HARQ	Device has HARQ capability

b139	Spectrum* Measurements	Spectrum measurements enable.
b140	Link* Measurements	Link measurements enable.
b141	Traffic Indication Map**	Traffic Indication Map is present.
b142–b143	Reserved	

\* Spectrum Measurements and Link Measurements measures channel qualities and radio performance. It enables a BAN or Group BAN to learn the wireless environment and use wireless resources such as spectrum, power, and bandwidth more effectively.

\*\* The TIM identifies the devices for which traffic is pending and buffered in the coordinator.

### 5.6.3 Disassociation frame body format

The Disassociation frame body contains the information shown in Table 17.

**Table 23—Disassociation Frame body**

Octet	Description
1	Reason Code

The Reason Code indicates the reason for the generation of an unsolicited Dissociation frame.

**Table 23—Reason code encoding**

Value	Description
0	Reserved.
1	Unspecified reason.
2	Invalid authentication: Previous authentication is no longer valid.
3	Leaving network: Sending device is leaving (or has left) the BAN
4	Leaving group: Sending coordinator is leaving (or has left) the Group BAN
5	Inactivity: Disassociated due to inactivity
6	BAN at capacity: Disassociated because the coordinator is unable to handle more devices
7	Group at capacity: Disassociated because the group coordinator is unable to handle more BANs.
8	Not authenticated: Device requesting (re)association is not authenticated with responding coordinator

9	Not enough bandwidth: Disassociated because coordinator lacks sufficient bandwidth for this QoS.
10	Missing ACKs: Disassociated because excessive number of frames need to be acknowledged, but are not acknowledged due to coordinator activity and/or poor channel conditions.
11	Exceeded GTX: Disassociated because the group member is transmitting outside the limits of its Group allocation period.
12	Timeout: Requested from device due to timeout
13-256	Reserved

NOTE—The Deauthentication frame has the same frame format.

#### 5.6.4 Association Request body frame format

The Association frame body contains the information shown in Table 23.

**Table 23— Association Request body frame encoding**

Octet	Bits	Field name	Description
0–1		Capability Information	Capability information of device requesting association (5.5.1.1.2)
2–18		BAN ID	Requesting association to BAN identified with BAN ID
		Supported rates	Supported rates of the device requesting association Annex E)
		Supported FEC	Supported FEC mechanisms of device requesting association
		QoS capability I (coordinator)	The subfield is present (Table 24) if QoSOption1Implemented in MIB is true. Otherwise, absent.
		QoS capability II (non-coordinator)	The subfield is present (Table 25) if QoSOption2Implemented in MIB is true. Otherwise, absent.
		Supported Channels	List of supported channels of device requesting association.
		Cipher Suite Capability	
		Public Key	
		Key Session	
19		CFP Descriptor	This set of subfield specifies the requested CFP slots configuration as defined in Table x29.

Table 24— QoS Capability I field

Octet	Bits	Field name	Description
0	b0-b3	Update count	Incremented by one every time there is a change in QoS during a session.
	b4	Queue request	
	b5	GTX request	
	b6-b7	Reserved	

Table 25— QoS Capability II field

Octet	Bits	Field name	Description
0	b0	AC_VO Flag	It shall be set to one in [Re]Association Request frames to indicate the type of traffic AC_VO generated by a node or bridge. Otherwise, it is set to zero.
	b1	AC_VI Flag	It shall be set to one in [Re]Association Request frames to indicate the type of traffic AC_VI generated by a node or bridge. Otherwise, it is set to zero.
	b2	AC_BK Flag	It shall be set to one in [Re]Association Request frames to indicate the type of traffic AC_BK generated by a node or bridge. Otherwise, it is set to zero.
	b3	AC_BE Flag	It shall be set to one in [Re]Association Request frames to indicate the type of traffic AC_BE generated by a node or bridge. Otherwise, it is set to zero.
	b4-b5	Max Buffer	It indicates the maximum number of buffered MSDUs the node is prepared to receive during any session triggered by the node
	b6	More ACK	Node can process ACK frames with the More Data bit in the Frame Control field equal to 1 and remains in the awake state. Otherwise, it is set to zero.
	b7	Reserved	

The type of traffic (AC\_VO, AC\_VI, AC\_BK, AC\_BE) is used by a coordinator to associate such AC with the node. Also, it indicates the type of traffic (AC\_VO, AC\_VI, AC\_BK, AC\_BE) is trigger-enabled AC and delivery-enabled AC.

NOTE— Delivery-enabled AC enables the coordinator to deliver data from such AC to a node or bridge triggered or requested by the node or bridge.



NOTE— Trigger-enabled AC enables a Data frame from a node or bridge to trigger a session with such AC, if one is not in progress.

**Table 26—Max Buffer subfield**

b4–b5	Description
00	The node is prepared to receive all buffered MSDUs.
01	The node is prepared to receive a maximum of two MSDUs per session
10	The node is prepared to receive a maximum of four MSDUs per session.
11	The node is prepared to receive a maximum of six MSDUs per session.

**Table 27— Supported Channels field**

Octet	Bits	Field name	Description
0	b0–b1	Channelization Plan	Frequency band channelization (Table 28)
	b2–b7		The supported channel number from the channelization plan is indicated as $i-2$ if bit $b_i$ shall be set to one for $i=2,3,\dots,15$ . Otherwise, it is set to zero.
1	b8–b15		Example if bit $b_2=1$ , then the channel number 0 ( $2-2$ ) is supported from Channelization Plan of Table 28.

**Table 28—Channelization Plan subfield**

b0–b1	Description
00	Frequency band channelization 1 (Annex F)
01	Frequency band channelization 2 (Annex F)
10	Reserved.
11	Reserved.

**Table x29—CFP Descriptor**

Octet	Bits	Field name	Description
0	0-1	CFP Slot Configuration	This field specifies the configuration of CFP slots distribution. 0 : single consecutive slots allocation 1 : equally distributed slots allocation

			2: unequally distributed slots allocation 3: reserved
0	2-7	Slot Parts Count	This field specifies the number of distributed slot parts in a CFP. This field is set to 1 for CFP slots distribution type 0.
var		Slot Parts Descriptor List	This field specifies the list of CFP distributed slot parts information as defined in Table x30, which specifies the start slot number, slot transmission direction, and the number of slots allocated. The size of CFP Distributed Slot Parts List is specified by Distribution Parts Count.

**Table x30— Format of the CFP slot parts descriptor**

Octet	Bits	Field name	Description
0		Start Slot	This field represents the starting slot number of a slot parts in CFP.
1	0-2	Direction	This field represents the direction of transmission for CFP slots. This field is set to 0 for a slot downward transmission from the coordinator, and set to 1 for a slot upward transmission from the node.
1	3-7	Slot Count	The length of consecutive slots for a distributed slot part.

### 5.6.5 Association Response frame format

The Association frame body contains the information shown in Table 29.

**Table 29— Association Response body frame encoding**

Octet	Bits	Field name	Description
0–1		Capability Information	Capability information of device requesting association (5.5.1.1.2)
2–18		Device ID	Assigned ID to the device.
		Supported rates	Supported rates by the coordinator (MIB)
		Supported FEC	Supported FEC mechanisms by the coordinator (MIB)
		FEC Configuration	Assigned FEC configuration (Table 30)
		QoS Map	The subfield is present (Table 31) if QoSMapActivated in MIB is true. Otherwise, absent.
		QoS capability II (non-coordinator)	The subfield is present (Table 25) if QoSOption2Implemented in MIB is true. Otherwise, absent.
		Supported Channels	List of supported channels of device requesting association (Annex F)

		Cipher Suite Configuration	
		Public Key	
		Key Session	
19		CFP Descriptor	This set of subfield specifies the assigned CFP slots configuration as defined in Table x29.

5.6.5.1 FEC Configuration subfield

— FEC Configuration subfield encoding

Octet	Coexistence Class	FEC Configuration	Eight possible FEC configurations from 8 possible User Priorities
0-1	0	0-7	Table 91
	1	8-15	Table 92
	2	16-23	Table 93
	3	24-31	Table 94
	4	32-39	Table 95
	5	40-47	Table 96
	6	48-55	Table 97
	7	56-63	Table 98

5.6.5.2 QoS Map subfield

The QoS Map field is transmitted from a coordinator to a node in a (Re)Association Response frame to provide the mapping of higher layer QoS constructs to User Priorities (UPs) to be used for transmission of Data frames. The QoS Map field maps the higher layer priority from the DSCP field used with the Internet Protocol onto User Priority as defined by this standard. The QoS Map field is shown in Table 31.

The DSCP List field contains zero or more DSCP subfields (Table 32) with a maximum value of 10.

—QoS Map field

Number of Octets	Subfield	Description
1	N	List length
2	DSCP_1	Table 32
	...	

2	DSCP_N	
2	UP0_2_DSCP	
2	UP_1_DSCP	
2	UP_2_DSCP	
2	UP_3_DSCP	
2	UP_4_DSCP	
2	UP_5_DSCP	
2	UP_6_DSCP	
2	UP_7_DSCP	

**Table 32—DSCP\_n subfield**

Number of Octets	Subfield	Description
1	DSCP Value	The DSCP value is in the range 0 to 63, or 255
1	UP	The UP value is in the range 0 to 7

When a node begins transmission of a Data frame containing the Internet Protocol, it matches the DSCP field in the IP header to the corresponding DSCP value contained in this field.

The node attempts to match the DSCP value to a DSCP\_n subfield. If successful, it uses the corresponding UP value (Table 32). If unsuccessful, the node attempts to match the DSCP value of the UP<sub>m</sub>\_2\_DSCP subfield and uses the m as the UP if successful; and otherwise uses a UP of 0.

The DSCP value is between 0 and 63, or 255.

**5.6.6 Group Beacon frame body format**

The Group Beacon frame body contains the information shown in Table x33.

**Table x33— Group Beacon frame body format**

Octet	Bits	Field name	Description
0–7		Timestamp	This field represents the timing synchronization function (TSF) timer of the conveying MAC frame.
8		Group ID	Assigned ID to the Group BAN.
9		Supported rates	Supported rates by the coordinator (MIB)

10		Supported FEC	Supported FEC mechanisms by the coordinator (MIB)
11-12		FEC Configuration	Assigned FEC configuration (Table 30)
13-14		Supported Channels	List of supported channels of device requesting association (Annex F)
15-17		Group Beacon Interval	The length of group beacon interval in the number of time slots.
var		Group BAN Descriptor	This set of subfield specifies the Group BAN configuration as defined in Table x34.

#### 5.6.6.1 Group BAN descriptor subfield

**Table 34— Group BAN descriptor**

Octet	Bits	Field name	Description
0		Group BAN Count	The number of BANs joined in the group BAN.
var		BAN Descriptor List	This set of subfield specifies the list of BAN joined in the group BAN in order of allocation, as defined in Table x35

**Table 35—BAN descriptor**

Octet	Bits	Field name	Description
0-1		BAN ID	Assigned ID to the BAN.
2-7		BAN Coordinator address	The address of the BAN coordinator.
8		Superframe Order	This field specifies superframe order of the BAN

#### 5.6.7 Group allocation map frame body format

The Group allocation map frame body contains the information shown in Table x36.

**Table x36— Group allocation map frame body format**

Octet	Bits	Field name	Description
0-7		Timestamp	This field represents the timing synchronization function (TSF) timer of the conveying MAC frame.
8		Group ID	Assigned ID to the Group BAN.
9-11		Group Beacon Interval	The length of group beacon interval in the number of time slots.

var		Group Allocation Descriptor	This set of subfield specifies the Group allocation map as defined in Table x37.
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### 5.6.7.1 Group BAN descriptor subfield

**Table 37— Group Allocation descriptor**

Octet	Bits	Field name	Description
0		Group BAN Count	The number of BANs joined in the group BAN.
var		Allocation Descriptor List	This set of subfield specifies the list of active superframe allocation of the BANs joined in the group BAN, as defined in Table x38

**Table 38—BAN Allocation descriptor**

Octet	Bits	Field name	Description
0-1		BAN ID	Assigned ID to the BAN.
2-7		BAN Coordinator address	The address of the BAN coordinator.
8		Superframe Order	This field specifies superframe order of the BAN
9-11		Start slot	The slot number of starting active superframe duration of the BAN

### 5.6.8 Group association frame body format

The Group association frame body contains the information shown in Table x39.

**Table x39— Group association frame body format**

Octet	Bits	Field name	Description
0-1		BAN ID	Assigned ID to the BAN.
2-7		BAN Coordinator address	The address of the BAN coordinator.
8-10		Beacon Interval	The length of BAN beacon interval in the number of time slots.
11		Superframe Order	This field specifies superframe order of the BAN
12		Supported rates	Supported rates by the coordinator (MIB)
13		Supported FEC	Supported FEC mechanisms by the coordinator (MIB)

14		QoS capability I (coordinator)	The subfield is present (Table 24) if QoSOption1Implemented in MIB is true. Otherwise, absent.
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### 5.6.9 Group disassociation frame body format

The Group disassociation frame body contains the information shown in Table x40.

**Table x40— Group disassociation frame body format**

Octet	Bits	Field name	Description
0-1		BAN ID	Assigned ID to the BAN.
3		Reason code	As defined in Table 23.

### 5.6.10 Group coordinator resign frame body format

The Group coordinator resign frame body contains the information shown in Table x41.

**Table x41— Group coordinator resign frame body format**

Octet	Bits	Field name	Description
0		Group BAN ID	Assigned ID to the Group BAN.

### 5.6.11 Group coordinator challenge frame body format

The Group coordinator challenge frame body contains the information shown in Table x42.

**Table x42— Group coordinator challenge frame body format**

Octet	Bits	Field name	Description
0		Group BAN ID	Assigned ID to the Group BAN.
1-2		BAN ID	Assigned ID to the BAN.
3-5		Beacon Interval	The length of BAN beacon interval in the number of time slots.
6		Superframe Order	This field specifies superframe order of the BAN
7		CFP Descriptor Count	This field specifies the number of nodes that is allowed to access CFP.

**5.6.12 Group coordinator migration frame body format**

The Group coordinator migration frame body contains the information shown in Table x43.

**Table x43— Group coordinator migration frame body format**

Octet	Bits	Field name	Description
0		Group BAN ID	Assigned ID to the Group BAN.
1-7		Group coordinator address	The address of the BAN coordinator designated as a group coordinator.
8-10		Group Beacon Interval	The length of group beacon interval in the number of time slots.
var		Group Allocation Descriptor	This set of subfield specifies the Group allocation map as defined in Table x37.

**5.6.13 Group merging challenge frame body format**

The Group merging challenge frame body contains the information shown in Table x44.

**Table x44— Group merging challenge frame body format**

Octet	Bits	Field name	Description
0-7		Timestamp	This field represents the timing synchronization function (TSF) timer of the conveying MAC frame.
8		Group BAN ID	Assigned ID to the Group BAN.
9-11		Group Beacon offset	This field represents the offset of the next group beacon slot time relative to the current group beacon slot time, in the number of time slots. If the value is less than 0, the next group beacon will start earlier by offset number of slots.
12-14		Group Beacon Interval	This field specifies the length of group beacon interval that will be changed from the next group beacon.
var		Group BAN Descriptor	This set of subfield specifies the Group BAN configuration as defined in Table x34.

**5.6.14 Group merging frame body format**

The Group merging frame body contains the information shown in Table x45.

**Table x45— Group merging frame body format**

Octet	Bits	Field name	Description
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0–7		Timestamp	This field represents the timing synchronization function (TSF) timer of the conveying MAC frame.
8		Group BAN ID	Assigned ID to the Group BAN.
9–11		Group Beacon offset	This field represents the offset of the next group beacon slot time relative to the current group beacon slot time, in the number of time slots. If the value is less than 0, the next group beacon will start earlier by offset number of slots.
12-14		Group Beacon Interval	This field specifies the length of group beacon interval that will be changed from the next group beacon.
var		Group Allocation Descriptor	This set of subfield specifies the Group allocation map as defined in Table x37.

### 5.6.15 Group disband frame body format

The Group disband frame body contains the information shown in Table x46.

**Table x46— Group disband frame body format**

Octet	Bits	Field name	Description
0-1		Group BAN ID	Assigned ID to the group BAN.
3		Reason code	As defined in Table 23.

### 5.6.16 Dependable BAN information elements

A header information element (IE) is optionally contained in certain management type frames as the last field of the header. It has Element ID subfield, Length subfield, and Information subfield.

The Element ID field is set to the value that identifies the information element according to Table x47.

The Length field is set to the length, in octets, of the IE-specific Information field that follows.

The Information field is set based on the Element ID as defined in the remainder of this subclause.

**Table x47— Dependable BAN Information elements**

Element ID in decimal value	IE name	Description
0	Beacon change notification IE	Specifies the changed superframe structure from the next beacon interval
1	Group change notification IE	Specifies the changed group superframe structure from the next group beacon interval

**5.6.16.1 Beacon change notification IE**

The BAN coordinator notifies a change of the superframe structure by broadcasting Beacon change notification header IE in the beacon frame. The Beacon change notification IE is formatted as shown in Table x48.

**Table x48—Beacon change notification IE format**

Octet	Bits	Field name	Description
0–2		Beacon offset	This field represents the offset of the next beacon slot time relative to the current beacon slot time, in the number of time slots. If the value is less than 0, the next beacon will start earlier by offset number of slots.
3-5		Beacon Interval	This field specifies the length of beacon interval that will be changed from the next beacon.

**5.6.16.2 Group change notification IE**

The group BAN coordinator notifies a change of the group superframe structure by broadcasting Group change notification header IE in the group beacon frame. The Group change notification IE is formatted as shown in Table x49.

**Table 49— Group change notification IE format**

Octet	Bits	Field name	Description
0–2		Group Beacon offset	This field represents the offset of the next group beacon slot time relative to the current group beacon slot time, in the number of time slots. If the value is less than 0, the next group beacon will start earlier by offset number of slots.
3-5		Group Beacon Interval	This field specifies the length of group beacon interval that will be changed from the next group beacon.
var		Group Allocation Descriptor	This set of subfield specifies the Group allocation map as defined in Table x37.