**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | **SNUST - Invisible Data Embedding MAC Frame Format and MAC PIB Attributes Specification Revision**  |
| Date Submitted | January, 2017 |
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| Re: | Draft D1 Comment Resolution based Invisible Data Embedding MAC Frame Format and MAC PIB Attributes Specification Revision |
| Abstract | Details of Resolutions regarding to the submitted Comments on D1 are suggested for Invisible Data Embedding MAC Frame Format and PIB Attributes specification. The Invisible data embedding method is designed to operate on the application services like IoT/IoL, LED ID, Digital Signage with Advertisement Information etc. |
| Purpose | D1 Comments Resolutions and Editorial Revision. |
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# **1. MAC FRAME FORMARTS FOR INVISIBLE DATA EMBEDDING**

# **Invisible Data Embedding MAC Frame Format**

The MAC frame structure is formatted as illustrated in Figure 5-1 for Invisible Data Embedding based 2 Dimensional codes.



**Figure 5-1 – Invisible Data Embedding MAC Frame Format**

**5.2.10.1 Frame Control Field**

The frame control field is formatted as illustrated in Figure 5-2 for Invisible Data Embedding based 2 Dimensional codes.

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**Figure 5-2 – Invisible Data Embedding MAC Frame Control Field Format**

**5.2.10.1.1 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.

* + - * 1. **Frame Type Subfield**

Specifies the Frame Type used in Invisible Data Embedding MAC Frame. This field shall be set to one of the non-reserved values listed in Table 5-1.



**Table** **5-1 – Invisible Data Embedding MAC Frame Type Subfield**

* + - * 1. **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.

* + - * 1. **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.

* + - * 1. **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.

**5.2.10.2 Sequence Number Field**

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.

**5.2.10.3 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.

**5.2.10.4 Source Address Field**

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.

**5.2.10.5 Frame 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.

**5.2.10.6 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 an optional filed in MAC frame format and the field information generated based on payload and FCS option used in the MAC frame from RS (64, 32) / RS (160,128) / None.

The FEC support for Invisible Data Embedding is given in Table 5-2.

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| **No** | **RS Method**  | **FECRate** |
| 1 | None | 1 |
| 2 | RS(64,32) | 32/64 |
| 3 | RS(160,128) | 128/160 |

**Table 5-2 – Invisible Data Embedding FEC Support**

# **2. MAC PIP ATTRIBUTES FOR INVISIBLE DATA EMBEDDING**

# **MAC PIB Attributes**

The MAC PIB comprises the attributes required to manage the MAC sublayer of a device. The attributes contained in the IEEE802.15.7-2011 MAC PIB are presented in Table 62 - MAC PIB Attributes.

The additional MAC PIB attributes added for Invisible Data Embedding MAC is presented the Table 100 — MAC PIB attributes (continued).

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| **MAC PIB Attributes Table 60 Additions** |
| **Attribute** | **Identifier** | **Type** | **Range** | **Description** | **Default** |
| macIDETxMode | 0xB1 | Unsigned | 0-255 | This attribute indicates the Invisible Data Embedding transmission modes.0 : IDE-BLEND Mode1 : IDE-WATERMARK Mode2 : SS IDE-BLEND Mode3 : SS IDE-WATERMARK Mode | 0 |
| macIDETxCamerEnable | 0xB2 | Unsigned | 0-255 | This attribute indicates the Transmitter is Enabled with Camera or not for Interactive Receiver distance specific data transfer control.0 : Camera not connected1 : Camera connected | 0 |
| macIDERxDistance | 0xB3 | Unsigned | 0-255 | This attribute notify the Receiver distance from Transmitter | 0 |
| macIDETxDataType | 0xB4 | Unsigned | 0-255 | This attribute indicates the type of data to be transmitted.0 : Normal Data (Media Content, Information Content based on the Application its used)1 : LED ID Data 2 : Authentication Data | 0 |
| maxIDEDataLength | 0xB5 | Integer | 0-65535 | This attribute specify the length of the data to be transmitted | 0 |
| maxIDECodedArea | 0xB6 | Unsigned | 0~255 | This attribute specify the Coded Area of the IDE0 : Full Screen1 : Partial Screen2~255 : Reserved | 0 |
| maxIDECodedLocation | 0xB7 | Unsigned | 0~255 | This attribute specify the Coded Location of the IDE0 : Center1 : Bottom Right2 : Bottom Left3 : Top Right4 : Top Left5~255 : Reserved | 0 |
| macIDETxHSize | 0xB8 | Integer | 0-65535 | This attribute specify the no of Horizontal Pixel in the 2D Display Transmitter | 1920 |
| macIDETxVSize | 0xB9 | Integer | 0-65535 | This attribute specify the no of Vertical Pixel in the 2D Display Transmitter | 1080 |
| macIDETxFrequency | 0xBA | Integer | 0-65535 | This attribute specify the frame rate of IDE sequence Transmission  | 1 |

**Table 100 — Invisible Data Embedding MAC PIB attributes (continued)**