**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | Editorial instruction for Extended DSME | |
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| Re: | [TG4k LECIM MAC support] | |
| Abstract | Editorial instruction for Extended DSME MAC additions necessary to support the LECIM PHYs | |
| Purpose | Draft standard development | |
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* ***Add the following paragraphs and Figure 34ga at the end of 5.1.10.1:***

When *macExtendedDSMEEnabled* is TRUE, The value of MO is not upper-bounded by BO, and is SO ≤ MO ≤ 22. Since the value of MO can be larger than that of BO, there can be multiple beacon intervals, BIs, within a MD.

An example of a multi-superframe structure when the value of MO is larger than that of BO is shown in Figure 34ga.

**Figure 34ga – Example of DSME multi-superframe structure (MO>BO)**

* ***In 5.1.10.5.3 DSME-GTS expiration,***

***Add the following attributes to Table 1a –***

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** |
| *macAllocationOrder* | Integer | 0x00-0x08 | As defined in 5.3.11.3.6.  If MO≤BO, the value of AO shall be set to zero. |
| *macBeaconIntervalIndex* | Integer | 0x00-0xff | As defined in 5.3.11.3.7. |

* ***Add the following sub-clauses before 5.2.4.10***

**5.2.4.9a Extended DSME PAN descriptor IE**

When *macExtendedDSMEEnabled* is TRUE, the Extended DSME PAN Descriptor IE shall be included in enhanced beacons that are sent every beacon interval in an Extended DSME-enabled PAN.

The format of the Extended DSME PAN Descriptor element shall be as illustrated in Figure 48va.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Octets: 2** | **Variable** | **2** | **8** | **variable** | **variable** | **0/1** | **variable** |
| Superframe Specification | Pending  Address | Extended  DSME Superframe Specification | Time Synchronization Specification | Beacon Bitmap | Channel Hopping Specification | Hopping Sequence Length | Hopping Sequence |

**Figure 48va – Format of Extended DSME PAN Descriptor IE**

The Superframe Specification field is described in 5.2.2.1.2.

The Pending Address field is described in 5.2.2.1.6.

The Extended DSME Superframe Specification field is described in 5.2.4.9a.1a.

The Time Synchronization field is described in 5.2.4.9.2.

The Beacon Bitmap field is described in 5.2.4.9.3.

The Channel Hopping Specification field is described in 5.2.4.9.4. This field is valid only in the channel hopping mode (i.e., the value of Channel Diversity Mode field in DSME Superframe Specification is set to one).

The Hopping Sequence Length field is described in 5.3.11.3.4. This field is valid only if Hopping Sequence List Flag field of Extended DSME Superframe Specification field is one.

The Hopping Sequence field is described in 5.3.11.3.5. This field is valid only if Hopping Sequence List Flag field of Extended DSME Superframe Specification field is one.

**5.2.4.9a.1a Extended DSME Superframe Specification**

The Extended DSME Superframe Specification field shall be formatted as illustrated in Figure 48wa.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bits: 0-7** | **8** | **9** | **10** | **11** | **12** | **13-15** |
| MO | Channel Diversity Mode | Reserved | CAP Reduction Flag | Deferred Beacon Flag | Hopping Sequence  List Flag | Reserved |

**Figure 48wa. Format of the Extended DSME Superframe Specification field**

Multi-superframe Order field, Channel Diversity Mode field, CAP Reduction Flag field, and Deferred Beacon Flag field are described in 5.2.4.9.1.

The Hopping Sequence List Flag field shall be set to one if an association request command is received before the enhanced beacon transmission and Hopping Sequence ID of one is used in the DSME-enabled PAN.

* ***In 5.3.11.2 DSME-Association request command***

***Replace Figure59g with the following one:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Octets:variable**  **(refer to 5.2.2.4.1)** | **1** | **1** | **1** | **2** | **0/1** |
| MHR fields | Command Frame Identifier | Capability  Information | Hopping Sequence ID | Channel Offset | Extended  DSME-GTS Allocation |

**Figure 59g – DSME Association request command format**

* ***Replace 5.3.11.2.2 with the following one:***

The Capability Information field shall be formatted as illustrated in Figure 59ga.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bits:0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| Reserved | Device Type | Power Source | Receiver On When Idle | DSME Association  Type | Reserved | Security Capability | Allocate Address |

**Figure 59ga – Capability Information field**

Device Type field, Power Source field, Receiver On When Idle field, Security Capability field, and Allocate Address field are described in 5.3.1.2.

The DSME Association Type filed shall be set to one if a device wishes to associate to a coordinator as a child. Otherwise, DSME Association Type field shall be set to zero.

* ***In 5.3.11.2 DSME-Association response command***

***Replace Figure59h with the following one:***

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Octets: variable** | **1** | **2** | **1** | **0/1** | **variable** | **0/1** | **0/1** | **0/2** | **0/1** | **0/2** |
| MHR fields | Command Frame Identifier | Short Address | Association Status | Hopping Sequence Length | Hopping Sequence | Allocation Order | BI Index | Superframe ID | Slot ID | Channel Index |

**Figure 59h – DSME Association response command format**

* ***Add the following sub clause before 5.3.11.3.***

5.3.11.2.5 Extended DSME-GTS Allocation field

The Extended DSME GTS Allocation field shall present if *macExtendedDSMEEnabled* is TRUE. This field shall be formatted as illustrated in Figure xxx.

The Direction field shall indicate the DSME-GTSs are being allocated for TX (the data transmission) or for RX (the data reception) of the requesting device. The value of this field is set to zero if the allocation is for TX. The value of this field is set to one if the allocation is for RX.

The Allocation Order field is described in 5.3.11.3.6.

The Hopping Sequence Request field shall be set to one if *macHoppingSequenceID* is one. Otherwise, this field shall be set to zero.

|  |  |  |  |
| --- | --- | --- | --- |
| **Bits:0** | **1-4** | **5** | **6-7** |
| Direction | Allocation Order | Hopping Sequence Request | Reserved |

**Figure 59g – DSME Association request command format**

* ***Add the following sub clauses before 5.3.11.4.***

5.3.11.3.6 Allocation Order field

The Allocation Order field shall indicate the DSME-GTS allocation interval. This field shall be set to the value of *macAllocationOrder*,AO. The value of AO and DSME-GTS allocation interval are related as follows: DSME-GTS allocation interval = 2(MO-BO)/2AO.

5.3.11.3.7 BI Index field

The BI Index field shall be present if *macExtendedDSMEenabled* is TRUE. This field shall contain the index of beacon interval, BI, in which the DSME-GTS needs to be allocated. The BI Index is the sequence number of the BI in a multi-superframe beginning from zero. The beacon interval in which the PAN coordinator sends its beacons serves as the reference point (BI Index 0).

5.3.11.3.8 Superframe ID field

The Superframe ID field shall be present if *macExtendedDSMEenabled* is TRUE. This field shall contain the index of the superframe in which the DSME-GTS needs be allocated. The Superframe ID is the sequence number of the superframe in a multi-superframe beginning from zero. The superframe in which the PAN coordinator sends its beacons serves as the reference point (Superframe ID 0). An example of superframe IDs are illustrated in Figure 34h.

5.3.11.3.9 Slot ID field

The Slot ID field shall be present if *macExtendedDSMEenabled* is TRUE. This field shall contain the index of the DSME-GTS to be allocated. The slot ID is the sequence number of the DSME-GTS (not including beacon or CAP slots) in a superframe beginning from zero. An example of slot IDs are illustrated in Figure 34h.

5.3.11.3.10 Channel Index field.

Channel Index field shall be present if *macExtendedDSMEenabled* is TRUE and the PAN runs on channel adaptation mode, i.e. *macChannelDiversityMode* is 0x00. This field shall contain the channel number of the DSME-GTS to be allocated.

* ***In 6.2.2.1 MLME-ASSOCIATE.request,***

***Add the following parameters:***

MLME-ASSOCIATE.request (

…

Association Type,

Direction,

Allocation Order,

Hopping Sequence Request

)

***Add the following parameters to Table Table 9.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Association Type | Integer | 0x00-0x01 | As defined in 5.3.11.2.2 |
| Direction | Integer | 0x00-0x01 | The direction of DSME-GTS. 0x00: TX (Transmission) 0x01: RX (Reception) |
| Allocation Order | Integer | 0x00-0x08 | As defined in 5.3.11.3.6 |
| Hopping Sequence Request | Integer | 0x00-0x01 | Indicates if hopping sequence is requested: 0x00: Not requested 0x01: requested |

* ***In 6.2.2.2 MLME-ASSOCIATE.indication,***

***Add the following parameters:***

MLME-ASSOCIATE.indication (

…

Association Type,

Direction,

Allocation Order,

Hopping Sequence Request

)

***Add the following parameters to Table Table 10.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Association Type | Integer | 0x00-0x01 | As defined in 5.3.11.2.2 |
| Direction | Integer | 0x00-0x01 | The direction of DSME-GTS. 0x00: TX (Transmission) 0x01: RX (Reception) |
| Allocation Order | Integer | 0x00-0x08 | As defined in 5.3.11.3.6 |
| Hopping Sequence Request | Integer | 0x00-0x01 | Indicates if hopping sequence is requested: 0x00: Not requested 0x01: requested |

* ***In 6.2.2.3 MLME-ASSOCIATE.response,***

***Add the following parameters:***

MLME-ASSOCIATE.response (

…

Association Type,

BI Index,

Superframe ID,

Slot ID,

Channel Index,

Hopping Sequence Length,

Hopping Sequence

)

***Add the following parameters to Table Table 11.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Association Type | Integer | 0x00-0x01 | As defined in 5.3.11.2.2 |
| BI Index | Integer | 0x00-0xff | As defined in 5.3.11.3.7. |
| Superframe ID | Integer | 0x0000-0xffff | As defined in 5.3.11.3.8 |
| Slot ID | Integer | 0x00-0x0e | As defined in 5.3.11.3.9 |
| Channel Index | Integer | 0x00-0x1f | As defined in 5.3.11.3.10 |
| Hopping Sequence Length | Integer | 0x00-0xff | As defined in 5.3.11.3.4 |
| Hopping Sequence | List of Integers | 0x0000–0x01ff for each channel | As defined in 5.3.11.3.5 |

* ***In 6.2.2.4 MLME-ASSOCIATE.confirm,***

***Add the following parameters:***

MLME-ASSOCIATE.confirm (

…

Association Type,

BI Index,

Superframe ID,

Slot ID,

Channel Index,

Hopping Sequence Length,

Hopping Sequence

)

***Add the following parameters to Table Table 12.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Association Type | Integer | 0x00-0x01 | As defined in 5.3.11.2.2 |
| BI Index | Integer | 0x00-0xff | As defined in 5.3.11.3.7. |
| Superframe ID | Integer | 0x0000-0xffff | As defined in 5.3.11.3.8 |
| Slot ID | Integer | 0x00-0x0e | As defined in 5.3.11.3.9 |
| Channel Index | Integer | 0x00-0x1f | As defined in 5.3.11.3.10 |
| Hopping Sequence Length | Integer | 0x00-0xff | As defined in 5.3.11.3.4 |
| Hopping Sequence | List of Integers | 0x0000–0x01ff for each channel | As defined in 5.3.11.3.5 |

* ***In 6.4.3.2 General MAC PIB attributes for functional organization,***

***Insert the following attributes to Table 52a:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| *macExtendedDSMEcapable* | Boolean | TRUE,  FALSE | IF TRUE, the device is capable of functionality specific to ExtendedDSME | Implementation specific |
| *macExtendedDSMEenabled* | Boolean | TRUE,  FALSE | IF TRUE, the device is using functionality specific to ExtendedDSME | Implementation specific |

* ***In 6.4.3.6 DSME specific MAC PIB attributes,***

***Replace the attribute macMultisuperframeOrder in Table 52h with the following:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| *macMultisuperframeOrder* | Integer | 0-22 | The length of a multi-superframe, which is a cycle of the repeated superframes | TBD |

***Add the following attributes to Table 52h***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| *macAllocationOrder* | Integer | 0-8 | As defined in 5.3.11.3.6 | 0 |
| *macBeaconIntervalIndex* | Integer | 0-255 | As defined in 5.3.11.3.7 | 0 |

***Add the following attribute to Table 52i:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** |
| *macAllocationOrder* | Integer | 0-8 | As defined in 5.3.11.3.6. |