**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | **Improved draft of LECIM LE mechanism** |
| Date Submitted | [19 April, 2012] |
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| Re: | [Proposed update materials to DCN 15-12-089-03, section 5.1.11.3, 5.3.12.2 and delete 5.2.4.8a] |
| Abstract | [Improvement of HWSL mechanism and corresponding command frames format suggestion to be considered in 4k MAC draft] |
| Purpose | [If approved, pass along to technical editor to revise draft] |
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* 1. MAC function description

5.1.11.3 LECIM alternate/hybrid LE scheme

5.1.11.3.1 General

*Modified figure 34sb as follow:*



**Figure 34sb—Basic LECIM LE mode operations**

5.1.11.3.2 LECIM LE transmission

*Modified the following description, line 5-line21, page 21.*

On receipt of data frame from endpoint device, the coordinator shall send back an acknowledgement frame in response to the received data frame. If the coordinator has a data frame to send to the same endpoint device, the coordinator shall indicate the pending frame by setting the Frame Pending field of the Frame Control field of the acknowledgement frame to one. Otherwise, the coordinator shall set the Frame Pending field to zero.

After sending the data frame to the coordinator, the endpoint device shall wait for *macAckWaitDuration*. If an acknowledgment frame containing the same DSN as the original transmission is received within *macAckWaitDuration*, the transmission is considered successful. Otherwise, the device shall conclude that the transmission has failed, and the device shall retransmit the data frame up to a maximum of *macMaxFrameRetries* times.

If the endpoint device received an acknowledgement frame from the coordinator, witch indicate the coordinator has pending frame to send, it shall send a data request frame to coordinator, and waiting for the corresponding data frame from coordinator. The Frame Pending field of the Frame Control field in the received data frame shall determine whether the endpoint device is to be kept on or turned off following the reception of the data frame.

5.1.11.3.2 Hybrid wakeup sample listening (HWSL)

*Modified the following description, line 10-line23, page 22.*

If the coordinator has a unicast frame to send, the destination address of the HWSL wakeup frame shall be set to the address of the corresponding endpoint device. On receipt of the unicast HWSL wakeup frame by the endpoint device through channel sampling, the endpoint device shall first check the destination address. If the destination address matches that of the endpoint device, the endpoint device shall request that the higher layer stop periodic channel sampling. The endpoint device shall send an data request frame to the coordinator and wait for a period of *macDataWaitDuration* for incoming unicast data frame.

If the coordinator received an data request frame from the corresponding endpoint device after sending an unicast HWSL wakeup frame, the coordinator shall stop sending the HWSL wakeup sequence and send the corresponding unicast data frame to the endpoint immediately. Following that, the coordinator shall wait for a period of *macAckWaitDuration* for the acknowledgment from the endpoint device.

On receipt of the incoming unicast data frame, the endpoint device shall send a corresponding acknowledgment to the coordinator. If the endpoint device still received unicast HWSL wakeup frame from coordinator with the matched address, when it has send the data request frame, the endpoint device shall retransmit the data request frame up to a maximum of *macMaxFrameRetries* times.

*Modified the following description, line 27-line37, page 23.*

An endpoint device receiving the broadcast HWSL wakeup frame through channel sampling shall request that the higher layer stop the periodic channel sampling. The endpoint device shall then send an data request frame to the coordinator and return to sleep for the remaining portion of time indicated by the broadcast HWSL wakeup frame. The endpoint device shall then turn on its receiver and wait for the corresponding broadcast data frame.

If the coordinator received an data request frame from the corresponding endpoint device after sending a broadcast HWSL wakeup frame, the coordinator shall keep sending the HWSL wakeup sequence until it has received data request frames from all the endpoint devices or until *macHWSLMaxPeriod* has expired. The coordinator shall send the corresponding broadcast data frame in the designed time.

5.2 MAC frame formats

5.2.4.2 Header information elements

*Delete items in “Table 4b—Element IDs, Header IEs”, page 25.*

**Table 4b—Element IDs, Header IEs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element ID** | **Content length** | **Name** | **Description** |
|  |  |  |  |
| TBD |  | MPDU Fragment Sequence Context Description | 5.2.4.23 |
| TBD | Variable | RSLN Descriptor | 5.2.4.24 |
| TBD | 8 | RSLN Data | 5.2.4.25 |

*Delete the whole section of “5.2.4.8a HWSL IE”, page 25.*

|  |  |
| --- | --- |
|  |  |
|  |  |

5.3 MAC command frames

*Delete items in “Table 5—MAC command frames”, page 31.*

**Table 5—MAC command frames**

|  |  |  |  |
| --- | --- | --- | --- |
| **Command frame identifier** | **Command name** | **Name** | **Subclause** |
| **Tx** | **Rx** |
| TBD | HWSL wakeup |  |  | 5.3.12.2 |
|  |  |  |  |  |
| TBD | Channel switching notification |  |  | 5.3.14 |
| …… | …… |  |  | …… |

5.3.4 Data request command

*Modified the following description, page 71, IEEE 802.15.4-2011.*

There are four cases for which this command is sent. On a beacon-enabled PAN, this command shall be sent by a device when *macAutoRequest* is equal to TRUE and a beacon frame indicating that data are pending for that device is received from its coordinator. The coordinator indicates pending data in its beacon frame by adding the address of the recipient of the data to the Address List field. This command shall also be sent when instructed to do so by the next higher layer on reception of the MLME-POLL.request primitive. In addition, a device may send this command to the coordinator *macResponseWaitTime* after the acknowledgment to an association request command. In the LECIM LE mode, this command shall be sent by an acknowledgement indicating that data are pending for that device, or the device received a HWSL wakeup frame which include the address of the device.

*Insert the following description before 5.3.5, page 72, IEEE 802.15.4-2011.*

If the data request command is being sent following the acknowledgement indicating that data are pending for that device from coordinator, the Destination Addressing Mode field shall be set according to the coordinator to which the data request command is directed. The Source Addressing Mode field shall be set to indicate short addressing.

If the data request command is being sent following the HWSL wakeup frame which include the address of the device in pending address list, the Destination Addressing Mode field shall be set according to the coordinator which send the HWSL wakeup frame. The Source Addressing Mode field shall be set according to the addressing mode used for the pending address.

* + 1. LE commands

5.3.12.2 HWSL wakeup command

*Insert following definitions:*

The HWSL wakeup command is used by a coordinator to wakeup an endpoint device to keep wakeup or wakeup at the indicated time to receive data fames from the coordinator. When *macHWSLEnabled* is TRUE, coordinators shall be capable of sending this command, and endpoint device shall be capable of receiving this command.

The HWSL wakeup command shall be formatted as illustrated in Figure 59ya.

|  |  |  |  |
| --- | --- | --- | --- |
| **Octets: variable (refer to 5.2.2.4.1)** | **1** | **4** | **2** |
| MHR fields | Command Frame Identifier (defined in Table 5) | HWSL Wakeup Information | FCS |

**Figure 59ya—HWSL Wakeup command format**

The HWSL Wakeup Information field shall be formatted as illustrated in Figure 59yb.

|  |  |  |
| --- | --- | --- |
| **Bits: 2** | **14** | **16** |
| Pending Frame Type | HWSL Remain Time | Wakeup Address |

**Figure 59yb—HWSL Wakeup Information field**

The Pending Frame Type field used to indicate the frame type of pending frame from coordinator, its format shall be set as defined in Table 7aa.

**Table 7aa—Values of Pending Frame Type filed**

|  |  |
| --- | --- |
| **Pending Frame Type value****b1b0** | **Description** |
|
| 00 | Unicast wakeup |
| 01 | Broadcast wakeup |
| 10-11 | Reserved |

The HWSL Remain Time specifies the remaining time of the incoming data frame. The range of the value of this field is 0x0000–0xffff, and the unit is 10 symbol durations. The HWSL Remain Time shall be set by the next higher layer when requesting the MAC sublayer to transmit, and the last HWSL wakeup command frame in the HWSL wakeup sequence shall have this field set to zero. For unicast HWSL wakeup command, this field shall be also set to zero.

The Wakeup Address field indicates the address of device which the coordinator wants to wakeup, this field is only exist when the Pending Frame Type field is set to indicate unicast HWSL wakeup command.

*Delete 5.3.12.3 in 15-12-0089-03-004k-preliminary-draft-for-tg4k:*