**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | Resolution for Primitives for Specifying Rx Enable for ERDEV | |
| Date Submitted | [July 2019] | |
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| Re: | Re: | |  |
| Abstract | Text for possible inclusion in IEEE 802.15.4z MAC | |
| Purpose | Provision of the text to facilitate its incorporation into the draft text of the IEEE 802.15.4z standard currently under development in the 802.15 TG4z. | |
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***Goal of this submission:***

*The objective of this submission is to provide text, for inclusion into the 15.4z draft, to standardize primitives for receiver enable time.*

*The changes are based on 802.15.4*

*This document is a resolution to the following comments:*

*i-1143, i-1780, i-2079*

*Revise Section 8.2.10 as follows*

**8.2.10 Primitives for specifying the receiver enable time**

These primitives are used to enable or disable a device’s receiver at a given time.

**8.2.10.1 MLME-RX-ENABLE.request**

The semantics of this primitive are as follows:

MLME-RX-ENABLE.request (

DeferPermit,

RxOnTime,

RxOnDuration,

RangingRxControl

)

The primitive parameters are defined in Table 8-26. *Use appropriate Table Number*

**Table 8-26 — MLME-RX-ENABLE.request parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| DeferPermit | Boolean | TRUE, FALSE | TRUE if the requested operation can be deferred until the next superframe if the requested time has already passed. FALSE if the requested operation is only to be attempted in the current superframe. This parameter is ignored for nonbeacon-enabled PANs.  TRUE if the requested operation can be deferred to the next beacon interval for beacon enabled ERDEV or deferred after the wraparound of the RSTU counter for non-beacon enabled ERDEV. FALSE if the requested operation is only to be attempted only before the wraparound.  If the issuing device is the PAN coordinator, the term superframe refers to its own superframe. Otherwise, the term refers to the superframe of the coordinator through which the issuing device is associated. For ERDEVs, term beacon interval refers to the beacon interval of the controller. |
| RxOnTime | Integer | 0x000000–0xffffff | For non ERDEV this parameter specifies the ~~The~~ number of symbols measured from the start of the superframe before the receiver is to be enabled or disabled. This is a 24-bit value, and the precision of this value shall be a minimum of 20 bits, with the lowest 4 bits being the least significant. This parameter is ignored for nonbeacon-enabled PANs. If the issuing device is the PAN coordinator, the term *superframe* refers to its own superframe. Otherwise, the term refers to the superframe of the coordinator through which the issuing device is associated.  For ERDEV this parameter is used to specify receiver enable time(s) in RSTU based on the Timestamp reported by MCPS-DATA primitives or the MLME-BEACON-NOTIFY.indication primitive. |
| RxOnDuration | Integers | 0x000000–0xffffff | The number of symbols for which the receiver is to be enabled. For ERDEV, this refers to the number of RSTUs for which the receiver is to be enabled.  If this parameter is equal to 0x00000000, the receiver is to be disabled. |
| RxAutoOff | Boolean | TRUE, FALSE | For ERDEV, when RxAutoOff is TRUE, the receiver is disabled immediately after the reception of a frame, otherwise it remains enabled for the RxOnDuration even after the reception of a frame. |
| RangingRxControl | Enumeration | RANGING\_OFF,  RANGING\_ON | Configure the transceiver to Rx with ranging for a  value of RANGING\_ON or to not enable ranging for RANGING\_OFF. |

The next higher layer of ERDEVs may request that the receiver is either enabled for a finite duration or disabled, multiple times in a ranging round by through a single MLME-RX-ENABLE.request primitive. This is done by configuring the RxOnTime and RxOnDuration parameters as a list of integers as shown in Table 8-27 with other parameters as in Table 8-26.

*Add the Table 8-27*

**Table 8-TX2 — MLME-RX-ENABLE.request vector parameters for ERDEV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| RxOnTime | List of Integers | 0x00000000–0xffffffff | The list of RSTU counter values at which the receiver is to be enabled or disabled. This is a 24-bit value, and the precision of this value shall be a minimum of 20 bits, with the lowest 4 bits being the least significant. |
| RxOnDuration | List of Integers | 0x00000000–0xffffffff | The number of RSTUs for which the receiver is to be enabled, corresponding to the RxOnTime. The length of this list shall be equal to the length of RxOnTime list. If this parameter is equal to 0x00000000, the receiver is to be disabled. |
| RxAutoOff | List of Boolean | TRUE, FALSE | For ERDEV, when RxAutoOff is TRUE, the receiver is disabled immediately after the reception of a frame, otherwise it remains enabled for the RxOnDuration even after the reception of a frame. The length of this list shall be equal to the length of RxOnTime list. |

In the case of non-Beacon enabled ERDEVs, MAC receives the RSTU counter value to specify the RxOnTime from the next higher layer. When TxTimeSpecified parameter of MCPS-DATA.indication is set to RSTU\_TIME, the next higher layer should use the TimeStamp parameter of the most recent RCM as a reference for the RSTU counter values to specify the RxOnTime. The next higher layer may use the TimeStamp parameter of MCPS-DATA.indication from any other message to maintain synchronization. When the RSTU counter value for RxOnTime is lesser than the current RSTU value, the RxOnTime shall be interpreted as referring the RSTUs for the counter values following the wraparound when DeferPermit is TRUE.

For beacon enabled ERDEVs, when TxTimeSpecified parameter of MCPS-DATA.indication is set to RSTU\_TIME, the next higher layer should use the TimeStamp parameter of the most recent beacon (enhanced beacon frame) as a reference for the RSTU counter values to specify the RxOnTime.

The MLME-RX-ENABLE.request primitive is generated by the next higher layer and issued to the MLME to enable the receiver for a fixed duration, at a time relative to the start of the current or next superframe on a beacon-enabled PAN or immediately on a nonbeacon-enabled PAN. For ERDEV, the times are specified using the RSTU counter values. This primitive may also be generated to cancel a previously generated request to enable the receiver. The receiver is enabled or disabled exactly once per primitive request. For ERDEV, the receiver is enabled based on the times in the unit of RSTU specified by the integer or list of integers in RxOnTime and disabled after the RxOnDuration or corresponding duration(s) chronologically specified by the list of integers in RxOnDuration. The length of the list of integers specified in RxOnTime and RxOnDuration shall be the same.

The MLME will treat the request to enable or disable the receiver as secondary to other responsibilities of the device (e.g., GTSs, coordinator beacon tracking, or beacon transmissions). When the primitive is issued to enable the receiver, the device will enable its receiver until either the device has a conflicting responsibility or the time specified by RxOnDuration has expired. In the case of a conflicting responsibility, the device will interrupt the receive operation. After the completion of the interrupting operation, the RxOnDuration will be checked to determine whether the time has expired. If so, the operation is complete. If not, the receiver is re-enabled until either the device has another conflicting responsibility or the time specified by RxOnDuration has expired. When the primitive is issued to disable the receiver, the device will disable its receiver unless the device has a conflicting responsibility.

On a nonbeacon-enabled PAN, the MLME ignores the DeferPermit and RxOnTime parameters and requests that the PHY enable or disable the receiver immediately. If the request is to enable the receiver, the receiver will remain enabled until RxOnDuration has elapsed. For ERDEV, the MLME the DeferPermit and RxOnTime parameters are applicable as specified in the Table 8-TX1.

Before attempting to enable the receiver on a beacon-enabled PAN, the MLME first determines whether (RxOnTime + RxOnDuration) is less than the beacon interval, as defined by *macBeaconOrder*. If (RxOnTime + RxOnDuration) is not less than the beacon interval, the MLME issues the MLME-RXENABLE. confirm primitive with a Status of ON\_TIME\_TOO\_LONG.

The MLME then determines whether the receiver can be enabled in the current superframe for PANs or for the specified RSTU counter number for ERDEV. If the current time measured from the start of the superframe is less than (RxOnTime – *macSifsPeriod*), the MLME attempts to enable the receiver in the current superframe. For ERDEV, if the current RSTU counter value is lower than the specified counter value for RxOnTime, the MLME attempts to enable the receiver in the current ranging round. If the current time measured from the start of the superframe is greater than or equal to (RxOnTime – *macSifsPeriod*) and DeferPermit is equal to TRUE, the MLME defers until the next superframe and attempts to enable the receiver in that superframe. Otherwise, if the MLME cannot enable the receiver in the current superframe and is not permitted to defer the receive operation until the next superframe, the MLME issues the MLME-RX-ENABLE.confirm primitive with a Status of PAST\_TIME. For ERDEV, if the current RSTU counter value is higher than the specified counter value for RxOnTime and DeferPermit is equal to TRUE, the MLME defers until the RSTU counter wraparound and attempts to enable the receiver in that ranging round. Otherwise, if the MLME cannot enable the receiver in the current ranging round and is not permitted to defer the receive enable operation until after the wraparound, the MLME issues the MLME-RX-ENABLE.confirm primitive with a Status of PAST\_TIME.

If the RxOnDuration parameter is equal to zero, the MLME requests that the PHY disable its receiver.

*Revise Section 8.2.10.2 as follows*

**8.2.10.2 MLME-RX-ENABLE.confirm**

The MLME-RX-ENABLE.confirm primitive reports the results of the attempt to enable or disable the receiver.

The semantics of this primitive are as follows:

MLME-RX-ENABLE.confirm (

Status

)

The primitive parameters are defined in Table 8-28 and Table 8-29 for vector corresponding to MLME-RX-ENABLE.request vector parameters for ERDEV.

The MLME-RX-ENABLE.confirm primitive is generated by the MLME and issued to its next higher layer in response to an MLME-RX-ENABLE.request primitive. This primitive returns a Status of either SUCCESS, if the request to enable or disable the receiver was successful, or the appropriate error code, for each of the enable and disable request in MLME-RX-ENABLE.request. The Status values are fully described in 8.2.10.2.

*Change Table Number 8-27 to 8-28 and add a Table 8-29*

**Table 8-28—MLME-RX-ENABLE.confirm parameter**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| Status | Enumeration | SUCCESS, PAST\_TIME,  ON\_TIME\_TOO\_LONG,  INVALID\_PARAMETER,  RANGING\_NOT\_SUPPORTED | The result of the request to enable or disable the  receiver. |

**Table 8-29—MLME-RX-ENABLE.confirm vector parameter for ERDEV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| Status | List of Enumeration | SUCCESS, PAST\_TIME,  ON\_TIME\_TOO\_LONG,  INVALID\_PARAMETER,  RANGING\_NOT\_SUPPORTED | The result of the request to enable or disable the  receiver. |

*Add Section 8.2.10.3 as follows and add Table 8-30*

**8.2.10.3 MLME-RX-ENABLE.indication**

The semantics of this primitive are as follows:

The MLME-RX-ENABLE.indication primitive for ERDEV reports a time-out if no frame was received for the duration specified by RxOnTime+RxOnDuration for each instance of RxOnTime.

The semantics of this primitive are as follows:

MLME-RX-ENABLE.indication (

TimeStamp

)

The primitive parameters are defined in Table 8-30.

**Table 8-30. MLME-RX-ENABLE.indication parameter for ERDEV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| TimeStamp | Integer | 0x00000000–0xffffffff | The TimeStamp parameter reports the current value of the RSTU counter along with the indication. This is a 24-bit value, and the precision of this value shall be a minimum of 20 bits, with the lowest 4 bits being the least significant. |