**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | IEEE 802.15.4z comment resolutions for D2 |
| Date Submitted | 09/18/2019 |
| Source | Zheda Li (Samsung), Aditya Vinod Padaki (Samsung), Mingyu Lee (Samsung), Kangjin Yoon (Samsung), Billy Verso(Decawave) |
| Re: |  |
| Abstract | This contribution proposes updated text for the baseline draft P802.15.4z-D2 |
| Purpose | Provision of the text to facilitate its incorporation into the draft text of the IEEE 802.15.4z standard currently under development in TG4z. |
| Notice | This document does not represent the agreed views of the IEEE 802.15 Working Group. It represents only the views of the participants listed in the “Source(s)” field above. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. |
| Release |  |
| Patent Policy | The contributor is familiar with the IEEE-SA Patent Policy and Procedures:<http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and<http://standards.ieee.org/guides/opman/sect6.html#6.3>.Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and<http://standards.ieee.org/board/pat>. |

* **CID-0025, Page 7, Sub-clause 6.9.1.2.5, line 17-20**

**Resolution: Revise Resolution Detail:**

*Replace line 17-21 on page 7 by the following texts*

TDOA is a technique to locate a mobile device, (e.g., a radio frequency identification (RFID) device), based on the relative arrival times of a single message or multiple messages. There are typical two cases of TDOA. In one case, a single message is periodically broadcast by the mobile device to multiple fixed nodes that are synchronized in some way so that the arrival times can be compared. Typically, the message sent by the mobile device is referred to as a blink. In the other case, multiple synchronized nodes broadcast messages sequentially with known transmission offset(s) with respect to each other. For any pair of fixed synchronized nodes, the difference in arrival time of the blink at the fixed nodes in the first case, or the broadcast messages at the mobile device in the second case, places the mobile device on a hyperbolic surface. Note that in the second case, the transmission offset shall be taken into account to calculate the difference in arrival time of messages from synchronized nodes.

* **CID-0072, Page 14, Sub-clause 6.9.4.2, line 20**

**Resolution: Accept**

* **CID-0074, Page 14, Sub-clause 6.9.4.2, line 24**

**Resolution: Accept**

* **CID-0065, CID-0066, CID-0067, CID-0069, CID-0070, CID-0073, CID-0075, CID-0076, Page 14, Sub-clause 6.9.4.2**

**Resolution: Revise Resolution Detail:**

*Replace the sub-clause 6.9.4.2 by the following texts and figure*

**6.9.4.2 Managing DCS**

Figure 5 shows a suggested message sequence chart to configure a selected UWB channel. It illustrates how the communications capability of the RDEV can be used to accomplish the DCS.



**Figure 5-A message sequence chart to configure a selected channel**

When DCS is being employed, the RCPCS IE (described in 7.4.4.46) may be transmitted to select the complex channels for the ranging exchange. For the multi-node ranging schemes described in 6.9.7, only the controller shall send an RCPCS IE, which can be inserted in the ranging control message (RCM).

In the coordination process of a ranging channel, the next higher layer in each participating devices fulfills the configuration of the updated channel at the appropriate time after the Channel Configuration Interval (CCI). The setting of CCI is determined by the originator next higher layer, which may be exchanged via RCPCS IE. CCI has to be long enough for PHY to configure a channel switch. The interactions between next higher layer and MAC in the dotted box illustrate the use of the MLME-DCPS primitives, as described in 8.2.15 to configure the dynamic channel selection.

Upon the assertion of the MLME-DCPS.confirm primitives with Status SUCCESS, as illustrated in Figure 5, PHYs of both sides will use selected channel, where future Ranging Round(s) will be operated on. The channel selection shall reflect the regional regulation, otherwise the DCS will fail, and the MLME-DCPS.confirm primitive shall report Status DCPS\_NOT\_SUPPORTED. After the effective time duration for DCS, i.e., DCPS Duration as illustrated in Figure 5, the MAC sublayer shall initiate the MLME-DCPS.indication to the next higher layer as described in 8.2.15.3. Not shown in the Figure 5, it is the next higher layer’s responsibility to disable the DCS by initiating MLME-DCPS.request with DcpsDuration value being zero. Then, the PHYs shall return to use the phyCurrentChannel from the PIB.

**7.4.4.46 Ranging Channel and Preamble Code Selection IE (RCPCS IE)**

*Replace the Figure 63 on page 78 by the following one:*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bits: 1** | **1** | **1** | **1** | **4** | **Octets:0/4** | **0/3** | **0/1** | **0/1** | **0/2** |
| CCIP | DDP | PSP | Reserved | Channel Number | CCI | DCPS Duration | TX Preamble Code | RX Preamble Code | PSR |

**Figure 63-RCPCS IE Content field format**

*Add the following paragraph between line 6 and line 7 of page 78:*

The DDP field when 1 indicates the presence of the DCPS Duration field, or when 0 that it is not present.

*Add the following paragraph between line 12 and line 13 of page 78:*

The 3-octet DCPS Duration field specifies the effective time duration for the dynamic channel & preamble code selection, whose unit is in RSTU (as defined in 6.9.1.5) for the ERDEV. For non-ERDEV, it is in number of symbols.

*Replace the sub-clause 8.2.15 on page 88*

**8.2.15 Primitives for specifying dynamic ~~preamble~~ channel and preamble selection**

**8.2.15.1 MLME-~~DPS~~ DCPS.request**

The MLME-DCPS.request primitive allows the next higher layer to request that the PHY utilize a give pair of preamble codes, or channel number, or both. **~~for a single use pending expiration of the DpsIndexDuration.~~**

The semantics of this primitive are as follows:

MLME-~~DPS~~ DCPS.request (

 TxDpsIndex,

 RxDpsIndex,

 ChannelNumber,

 ~~DpsIndexDuration,~~

 DcpsDuration

 )

The primitive parameters are defined in Table 8-36.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| TxDpsIndex  | Integer  | 0, 13–16, 21–32 ~~24~~ | The index value for the transmitter. A value of 0 disables the index and indicates that the phyCurrentCode value is to be used, as defined in 16.2.5.1. Other values indicate the preamble code, as defined in Table 16-7 and Table 37.  |
| RxDpsIndex  | Integer  | 0, 13–16, 21–32 ~~24~~  | The index value for the receiver. A value of 0 disables the index and indicates that the phyCurrentCode value is to be used, as defined in 16.2.5.1. Other values indicate the preamble code, as defined in Table 16-77 and Table 37.  |
| ChannelNumber | Integer  | 0-15 | UWB channel as per 10.1.2.4 for the HRP UWB PHY and 10.1.2.7 for the LRP UWB PHY, for the forthcoming message exchanges.  |
| ~~DpsIndexDuration~~  | ~~Integer~~  | ~~0x000000–0xffffff~~  | ~~The number of symbols for which the transmitter and receiver will utilize the respective DPS indices if a MCPS-DATA.request primitive is not issued. If the value is zero the no MLME-DPS.indication will be generated.~~  |
| DcpsDuration  | Integer  | 0x000000–0xffffff  | For non ERDEV, this time is in the number of symbols for which the transmitter and receiver will utilize the respective DPS indices. For ERDEV, this time shall be in the unit of RSTU (as defined in 6.9.1.5). If the value is zero, then no MLME-DPS.indication will be generated.  |

This primitive may also be generated to cancel a previously generated request to enable ~~the transmitter and receiver dynamic preambles~~ the dynamic preamble selection, or dynamic channel selection, or both. ~~The use of the index for the transmitter and receiver is enabled or disabled exactly once per primitive request.~~

The MLME starts the timer that assures that the device returns to a normal operating state with default preambles ~~if a following MCPS-DATA.request primitive does not occur.~~ and channel number. After starting the timer, the MLME responds with a MLME-~~DPS~~ DCPS.confirm primitive with the appropriate Status parameter.

**8.2.15.2 MLME-~~DPS~~ DCPS.confirm**

The MLME-~~DPS~~ DCPS.confirm primitive reports the results of the attempt to enable or disable the DCPS. The semantics of this primitive are as follows:

MLME- ~~DPS~~ DCPS.confirm (

 Status

 )

**Table 8-37-MLME-~~DPS~~ DCPS.confirm parameter**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Status | Enumeration  | SUCCESS, ~~DPS~~ DCPS\_NOT\_SUPPORTED | The result of the request to enable or disable dynamic preamble and channel |

The MLME- ~~DPS~~ DCPS.confirm primitive is generated by the MLME and issued to its next higher layer in response to an MLME- ~~DPS~~ DCPS.request primitive.

If any parameter in the MLME- ~~DPS~~ DCPS.request primitive is not supported or is out of range, the Status of ~~DPS~~ DCPS \_NOT\_SUPPORTED is returned. If the request to enable or disable the ~~DPS~~ DCPS was successful, the MLME issues the MLME- ~~DPS~~ DCPS.confirm primitive with a Status of SUCCESS.

**8.2.15.3 MLME-~~DPS~~ DCPS.indication**

The MLME- ~~DPS~~ DCPS.indication primitive indicates the expiration of the ~~DpsIndexDuration~~ DcpsDuration ~~and the resetting of the DPS values in the PHY~~. Resetting the DPS and DCS values in the PHY is the responsibility of the next higher layer.

The semantics of this primitive are as follows:

MLME- ~~DPS~~ DCPS.indication ()

~~If a MCPS-DATA.request primitive is not received before the timer expires, the MLME issues the MLME-DPS.indication primitive to the next higher layer.~~

* **CID-0091, Page 17, Sub-clause 6.9.6.3, Figure 6**

**Resolution: Revise Resolution Detail:**

*Replace the first sentence on page 16, at line 28 by the following one:*

Figure 6 shows the message sequence chart for this exchange, where RRMC(0) IE indicates an RRMC IE with the Ranging Control Information field value of 0.

* **CID-0152, Page 25, Sub-clause 6.9.7.1, line 12**

**Resolution: Accept**

* **CID-0153, CID-155, Page 25, Sub-clause 6.9.7.1, line 15**

**Resolution: Reject Resolution Detail:**

*How to deal with erroneous timestamp when collision occurs is up to implementation details. There are various promising applications based on the contention-based ranging, which necessitates the contention-based ranging to be specified in IEEE.*

* **CID-0154, Page 25, Sub-clause 6.9.7.1, line 15**

**Resolution: Revise Resolution Detail:**

*Replace line 15-18 by the following paragraph:*

For contention-based ranging, the ERDEV, i.e., initiator or responder, contend to transmit at the appropriate time slots. The Ranging Contention Phase Structure IE (RCPS IE) defined in 7.4.4.38 is used to specify different phases (see 6.9.7.2) for initiators and responders to contend, which can be conveyed in the RCM (in addition to the ARC IE). To ensure the relative fairness among contending ERDEVs, the max number of attempts in a set of ranging round(s) configured by the same RCM is determined by the next higher layer of the controller. This information may be exchanged by the Ranging Contention Maximum Attempts IE (RCMA IE), as described in 7.4.4.39, in the RCM. Furthermore, if the controller knows the identities of the controlees, the RDM IE can be used to allocate ranging roles, i.e., initiator or responder, among ERDEVs.

* **CID-0156, Page 25, Sub-clause 6.9.7.1, line 19**

**Resolution: Accept Resolution Detail:**

*Move texts of line 19-27 on page 25, and Figure 15 on page 26 to a new sub-clause 6.9.7.9 Ranging Message Non-receipt Exchange. And revise the figure number accordingly.*

* **CID-0157, Page 25, Sub-clause 6.9.7.1, line 20**

**Resolution: Revise Resolution Detail:**

*Change the first two sentences of line 19-20 on page 25*

A data frame can be used to convey the non-receipt of messages during a ranging round. This procedure can be used whenever ERDEVs are scheduled to send messages bearing payload to the controller.

* **CID-0158, Page 25, Sub-clause 6.9.7.1, line 21**

**Resolution: Accept**

* **CID-0159, Page 25, Sub-clause 6.9.7.1, line 21**

**Resolution: Reject Resolution Detail:**

The message should be a unicast message to the controller. In the example of Figure 15, the controller is also the initiator.

* **CID-0161, Page 25, Sub-clause 6.9.7.1, line 25**

**Resolution: Revise Resolution Detail:**

*Replace the last sentence at page 25*

 For the Responder-1, once the controller/initiator receives its ranging response message, the controller also knows that RCM has been received by Responder-1.

* **CID-0163, Page 26, Sub-clause 6.9.7.2, line 5**

**Resolution: Accept**

* **CID-0170, Page 26, Sub-clause 6.9.7.2, line 16**

**Resolution: Accept**

* **CID-0172, Page 27, Sub-clause 6.9.7.2, line 5**

**Resolution: Accept**

* **CID-0173, Page 27, Sub-clause 6.9.7.2, line 6**

**Resolution: Revise Resolution Detail:**

*Add the following sentence at the end of line 8 page 27*

As described in 6.9.7.3.1, the RCUM conveys the scheduled time of the first RIUM, while the RIUM may convey the scheduled time of the next RIUM (if used) before the next Ranging Block starts.

* **CID-0174, Page 27, Sub-clause 6.9.7.2, line 12**

**Resolution: Accept**

* **CID-0176, Page 27, Sub-clause 6.9.7.2, line 18 (it should be line 18)**

**Resolution: Revise Resolution Detail:**

*Replace the line 18 by the following sentence:*

Ranging Phase (RP): A phase which should comprise RIP, RRP, and maybe RFP.

* **CID-0177, Page 27, Sub-clause 6.9.7.2, line 20**

**Resolution: Accept**

* **CID-0178, Page 27, Sub-clause 6.9.7.2, line 22**

**Resolution: Revise Resolution Detail:**

*Change the sentence at line 23 on page 27 by the following one:*

If present, this phase shall be at the last slot of a set of ranging rounds configured by the RCM.

* **CID-0179, Page 27, Sub-clause 6.9.7.2, line 23**

 **Resolution: Reject Resolution Detail:**

RCUP is at the last slot of a set ranging rounds configured by the RCM. There is no ranging slot after the RCUP in a ranging round. Also see resolution to CID-0178.

* **CID-0184, Page 28, Sub-clause 6.9.7.2, line 5**

**Resolution: Accept**

* **CID-0185, Page 28, Sub-clause 6.9.7.2, line 5**

**Resolution: Revise Resolution Detail:**

*Replace the sentence at line 5-6 by the following one:*

Where ranging phases for different ranging roles are not specified by the RCPS IE, the ERDEVs may contend for the remaining slots of the ranging round.

* **CID-0188, Page 28, Sub-clause 6.9.7.2, line 6**

**Resolution: Accept**

* **Conflicts in the proposed change: CID-0191 and CID-0192, Page 28, Sub-clause 6.9.7.2, line 11,**

**Resolution Notes: Request to be discussed in the group.**

* **CID-0193, Page 28, Sub-clause 6.9.7.2, line 21**

**Resolution: Accept**

* **CID-0194, Page 28, Sub-clause 6.9.7.2, line 23**

**Resolution: Revise Resolution Detail:**

*Replace the sentence in the bracket by the following one:*

(e.g., an ERDEV can use AOA from multiple ERDEVs to determine location).

* **CID-0197, Page 29, Sub-clause 6.9.7.2, line 3**

**Resolution: Accept Resolution Detail:**

Delete the first condition at line 3 of page 29. Explain why the number is 16: the number 16 is to ensure the interoperability to support both HRP and LRP PHY for the ranging with fixed reply time.

* **CID-0198, Page 29, Sub-clause 6.9.7.2, line 3**

**Resolution: Revise Resolution Detail:**

*Replace the last sentence at line 2 page 29 by the following one:*

Furthermore, the following conditions should be satisfied such that the response frames fit into the allocated slots will not overlap.

* **CID-0199, Page 29, Sub-clause 6.9.7.2, line 3**

**Resolution: Revise Resolution Detail:**

*Add the following sentence after line 8 on page 29:*

The requested fixed reply times can be exchanged via the RFRT IE (described in 7.4.4.47) before the ranging starts or via an out-of-band mechanism.

* **CID-0200, Page 29, Sub-clause 6.9.7.2, line 5**

**Resolution: Accept**

* **CID-0201, Page 29, Sub-clause 6.9.7.2, line 6**

**Resolution: Revise Resolution Detail:**

*At line 6 on page 29, change the right side of inequality “N” by “N+1”.*

* **CID-0202, Page 29, Sub-clause 6.9.7.2, line 8**

**Resolution: Accept**

* **CID-0204, Page 29, Sub-clause 6.9.7.2, line 9**

**Resolution: Revise Resolution Detail:**

*Delete the sentence at line 9 on page 29.*

* **CID-0233, Page 30, Sub-clause 6.9.7.3, line 9**

**Resolution: Accept**

* **CID-0235, CID-0234, Page 30, Sub-clause 6.9.7.3, line 11-12**

**Resolution: Revise Resolution Detail:**

*Replace the sentence at line 11-13 by the following one:*

The key difference between block-based mode and interval-based mode is that the mean time between successive ranging rounds in block-based mode is assumed to be constant (i.e., using a time structure with uniform spacing), while interval-based mode adopts a time structure with adaptive spacing, and the time between successive ranging rounds may vary dynamically.

* **CID-0236, Page 30, Sub-clause 6.9.7.3, line 13**

**Resolution: Revise Resolution Detail:**

*Replace “The Controller” by “the next higher layer of the Controller” at line 13 of page 30.*

* **CID-0368, Page 47, Sub-clause 6.9.7.8.2, line 8**

**Resolution: Revise Resolution Detail:**

*Replace the sentence at line 8-10 on page 47 by the following one:*

The MAC sublayer of each device reports the time-stamp of the received RFRAME to its next higher layer via the MCPS-DATA.indication, so that this information can be used to calculate reply time or round-trip time measurement.

* **CID-0370, Page 47, Sub-clause 6.9.7.8.2, line 20**

**Resolution: Revise Resolution Detail:**

*Replace “message exchange chart” by “message sequence chart” at line 20 on page 47.*

* **CID-0462, CID-0463, CID-0467, CID-0469, CID-0470, Page 69, Sub-clause 7.4.4.35, line 11**

**Resolution: Accept Resolution Detail**

*Replace texts at line 11-15 on page 69 by the following table.*

**Table XX-RTW operation based on the fields of RTWISP and RTWMP**

|  |  |  |
| --- | --- | --- |
| **RTWMP field value** | **RTWISP field value** | **Meaning** |
| **0** | **0** | RTW operation is disabled for the next ranging round: a controller will send the RCM without any RTW.  |
| **1** | **0** | RTW operation is disabled for the next ranging round: a controller will send the RCM without any RTW. |
| **1** | **1** | RTW operation is enabled for the next ranging round: a controller will send the RCM at random timing within the RTW period. The size of RTW period is fixed at the value specified by the RTW Initial Size field. |
| **0** | **1** | RTW operation is enabled for the next ranging round: a controller will send the RCM at random timing within the RTW period. The size of RTW is determined by the RTW Initial Size field and RTW Multiplier field.  |

* **CID-0531, Page 73, Sub-clause 7.4.4.42, line 10**

**Resolution: Revise Resolution Detail:**

*Replace the first sentence at line 10 of page 73 by the following sentence:*

The RDM IE is used by the controller to control devices participating in a Ranging Round(s) when the controller knows the device identities

*Add the following paragraph after line 31 of page 73:*

The RDM IE can be used by the controller to exchange scheduling information among the ERDEVs for a set of ranging rounds configured by the same RCM. Upon reception of the RCM, a controlee knows whether it is selected to participate in the ranging round(s).

* **CID-0533, Page 73, Sub-clause 7.4.4.42, line 15**

**Resolution: Reject Resolution Detail: texts at line 14-16 on page 73 of 7.4.4.42, and page 70 of 7.4.4.38 have clarified the functionalities of these two IEs.**

**Resolution Note (Clarification):** *when the SIU field value is zero, the RDM IE is used to assign the ranging roles of ERDEVs, i.e., initiator or responder. This is intended for the contention-based ranging with known device identities by the controller. The RCPS IE is used to specify the ranging phases, which does not require the controller knows the device identities.*

* **CID-0579, CID-0580, Page 76, Sub-clause 7.4.4.44, line 12**

**Resolution: Revise Resolution Detail:**

*Replace the first sentence from line 12 to line 15 on page 76 by the following one:*

The RX-to-TX Reply Time field is an unsigned integer that conveys the time difference between the receive time of the most recent relevant RFRAME eliciting a response and the transmit time of the response RFRAME. The RRMC IE with reply time request (as described in 7.4.4.43) is typically inserted in the received RFRAME, except the one with SP3 packet format.

**[CID-XXXX, not a comment during ballot but necessary to revise.]**

**Comment: page 76, sub-clause 7.4.4.44, line 24-29**

Invalid AOA value, e.g., negative number of AOA Azimuth field, shall be treated as the report of erroneous estimation.

**Proposed change:** Add texts to clarify.

**Resolution: Revise**

**Resolution Detail:**

*Add the following sentence as a new paragraph after line 29 of page 76*

Invalid field value with respect to the AOA, e.g., negative number of AOA Azimuth field, shall be treated like the report of erroneous estimation.