IEEE P802.15

Wireless Personal Area Networks

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | Proposed Resolution for 10.21 | |
| Date Submitted | November 13 2024 | |
| Sources | Kangjin Yoon (Spark Microsystems)  Yoons.2k15@gmail.com |  |
| Re: |  | |
| Abstract |  | |
| Purpose | To propose resolution for “P802.15.4ab™/D01 Draft Standard for Low-Rate Wireless Networks” | |
| Notice | This document does not represent the agreed views of the IEEE 802.15 Working Group or IEEE 802.15.4ab Task Group. It represents only the views of the participants listed in the “Sources” field above. It is offered as a basis for discussion and is not binding on the contributing individuals. The material in this document is subject to change in form and content after further study. The contributors reserve the right to add, amend or withdraw material contained herein. | |

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| --- | --- | --- | --- | --- | --- |
| CID | Pg | Ln | Comment | Proposed Change | Disposition |
| 336 | 33 | 28 | After the table 10-104 the base specification has paragraph that tells which request command is to be sent. This text requires updating. | Add instructions to add text like "If UwBControleeAssociation is TRUE, then MLME generates a HRP UWB Association Request command as specified in 10.40.4.1." | **Revised**  The new text for 10.40 (in this document) adds, “and then MLME generates a HRP UWB Association Request command as specified in 10.40.4.1.” following Table 10-X1. |
| 352 | 37 | 12 | Do not duplicate values here. | Remove last two sentences, they are not needed, as whether the association was successful or not can be seen frm the association status. Also small numbers would need to be spelled out if you keep duplicating this information. | **Revised**  Accepted the proposal, but in the new text for 10.40. |
| 1052 | 33 | 8 | Is the word "UWB" needed here, controller should be enough since the base standard defines a controller: as "An ERDEV that controls the ranging and defines the ranging parameters by sending an RCM." | if the base standard definition is compatible with the type of device being associated with here, then delete "UWB", otherwise some new definition is needed for this to replace "UWB controller". Also review/rename the new parameter UwbControleeAssociation to ControlerAssociation (same page line 21 and in Table 10-104) | **Revised**  Accepted the proposal, but in the new text for 10.40. |
| 1053 | 33 | 28 | I think this is missing description after the parameter table to say that the (UWB) controller association command frame is sent when the new parameter is true. | Add appropriate description of the activity of the MAC in response to this primitive when the parameter is true, i.e. sending the new association command frame, and in particular indicate which of the other parameters are used / not used in doing this. | **Revised**  See CID#336 |
| 1054 | 33 | 28 | I think this is missing description after the parameter table to say what parameters of the indication primitive are valid in the case for this (UWB) controller association command frame being received | Add appropriate description . | **Revised**  The table 10-X1 in the new text for 10.40 only has params for the Controller Association. |
| 1055 | 35 | 16 | Some description is probably needed here as a result of the new the parameter in the table | Add appropriate description . | **Rejected**  The table 10-X in the new text for 10.40 includes enough description for new params. |
| 1056 | 36 | 8 | Some description is probably needed here as a result of the new the parameter in the table. Also what happens next, this is not giving any slot assignment etc to the newly associated device, is this described already or is in needed here? | Add appropriate description, of what parameters are valid in this case. And describe/ reference what happens next, slot assignment etc. | **Revised**  The new text adds “If the association attempt is a success, the controlee may monitor Control Messages from the controller to learn the session configuration in the AC IE and scheduling information in the Scheduling IE.” |
| 1057 | 36 | 13 | Maybe controlee is enough here | change: "HRP-EMDEV controlee" to "controlee" | **Revised**  Accepted the proposal, but in the new text for 10.40. |
| 1058 | 36 | 13 | Should the first step be scanning for AC IE with Association Availability field indicating the controller accepting such association attempts. Could either update the Passive Scan to allow for this, or have the next higher layer just turn on its receiver and examine received frames for one carrying the appropriate AC IE. | If seeing Association Availability indication from the controller should be the first step, then describe that step in the text. | **Rejected**  We already have a related text in 10.40.3. |
| 1266 | 164 | 19 | Since the next higher layer is in the loop here with MLME-ASSOCIATE.indication and MLME-ASSOCIATE.response primitives, we have to make sure that the requisite information is included in both to allow for this, and then change this sentence to make the parameters here come from the MLME-ASSOCIATE.response. | Check/Change MLME-ASSOCIATE.indication and MLME-ASSOCIATE.response primitives as per comment, and change the paragraph to explain how the Source Addressing Mode and Destination Addressing Mode fields values are determined from the MLME-ASSOCIATE.response primitive., | **Revised**  Now refer the corresponding primitive. |
| 1267 | 165 | 4 | Since the next higher layer is in the loop here with MLME-ASSOCIATE.indication and MLME-ASSOCIATE.response primitives, we have to make sure that the requisite information is included in both to allow for this, and then change this sentence to make the parameters here come from the MLME-ASSOCIATE.response. | Check/Change MLME-ASSOCIATE.indication and MLME-ASSOCIATE.response primitives as per comment, and change the paragraph to explain how the Destination Address field value is determined from the MLME-ASSOCIATE.response primitive., | **Revised**  Now refer the corresponding primitive. |
| 1402 | 37 | 17 | Device roles missing in Figure 5. | Add controller/controlee device roles to figure. | **Revised**  Accepted the proposal, but in the new text for 10.40. |
| 1436 | 33 | 28 | The description on 'UwbControleeAssociation' in Table 10-104 is not completed. Description for 'FALSE' need to be added. | add description. | **Revised**  The new text has no ‘UwbControleeAssociation’ parameter. |
| 1437 | 34 | 22 | The description on 'UwbControleeAssociation' in Table 10-105 is not completed. Description for 'FALSE' need to be added. | add description. | **Revised**  The new text has no ‘UwbControleeAssociation’ parameter. |
| 1438 | 35 | 16 | The description on 'UwbControleeAssociation' in Table 10-106 is not completed. Description for 'FALSE' need to be added. | add description. | **Revised**  The new text has no ‘UwbControleeAssociation’ parameter. |
| 1439 | 36 | 8 | The description on 'UwbControleeAssociation' in Table 10-107 is not completed. Description for 'FALSE' need to be added. | add description. | **Revised**  The new text has no ‘UwbControleeAssociation’ parameter. |

[Editor: Remove sub-clause 10.21 in 4ab-D01. The sub-clause 10.21 has been merged into 10.40]

We (I and commenters) thought it would be better to move 4ab text in 10.21 under 10.40 for following reasons:

1. The subclause 10.21 includes many parameters which are not related to UWB operations.
2. It is not ideal to have two separate sub-clauses for the Controller Association feature. (Currently, the new MLME primitives are described in 10.21, while the new commands are described in 10.40.)

[Editor: New text in blue]

The new text includes 4ab text in 10.21 and changes based on comments.

**10.40.3 Controller Association**

A controller indicates its availability for associations with new controlees by setting the Association Availability field in the AC IE. A controlee shall send the HRP UWB Association Request command in a block when the Association Availability field is set to one. The HRP UWB Association Request command shall be sent in the slots specified by the Contention Slots Info field in the AC IE, described in 10.39.7.1. If the Contention Slots Info field is not present in the AC IE, the HRP UWB Association Request command may be sent in any unscheduled slot in the round.

A controlee is instructed to associate through the MLME-CONTROLLER-ASSOCIATE.request primitive. The MAC sublayer of an unassociated device initiates the association procedure by sending a Controller Association Request command to the controller of an existing session.

The Controller Association Request command shall be sent as described in 10.40.4.1.

A controller MAC receiving a Controller Association Request command issues the MLME-ASSOCIATE.indication primitive to its next higher layer with the ControleeAddress parameter conveying the address of the requesting controlee.

To indicate acceptance or not of the association request the controller’s next higher layer issues an MLME-CONTROLLER-ASSOCIATE.response primitive with the AssociationResult parameter either indicating successful association if the controller’s next higher layer accepts the association request or indicating the reason for the rejection if the controller’s next higher layer rejects the association request.

Upon receipt of an MLME-CONTROLLER-ASSOCIATE.response primitive, the MAC sublayer shall send a Controller Association Response command as described in 10.40.4.2. The Controller Association Response command shall be sent in the scheduled slot in the next block, unless the controller has no available slot in the next block.

If the request is successful, the Controller Association Response command contains an Association Status field indicating a successful association. If the request fails, the Controller Association Response command contains an Association Status field indicating the reason the request failed. The controller may deny the association request based on capability information, duplicated short address, or another reason.

If the requesting controlee does not receive a Controller Association Response command from the controller in the next block, the MLME shall issue the MLME-CONTROLLER-ASSOCIATE.confirm primitive with a Status of NO\_DATA, and the association attempt shall be deemed a failure.

If the requesting controlee receives a Controller Association Response command from the controller in the next block, the MLME shall issue the MLME-CONTROLLER-ASSOCIATE.confirm primitive with a Status of SUCCESS.

The AssociationStatus parameter of the MLME-ASSOCIATE.confirm primitive provides additional information as to whether the association attempt is deemed a success or a failure. ~~If the value of AssociationStatus is either 0 or 2, the association attempt has succeeded. If the value of AssociationStatus is 1, 3, or 4, the association attempt has failed.~~ If the association attempt is a success, the controlee may monitor Control Messages from the controller to learn the session configuration in the AC IE and scheduling information in the Scheduling IE.

The HRHP UWB Association Response command shall be sent as described in 10.40.4.2.

Figure 10-X0 illustrates a sequence of messages for the controller association.

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Description automatically generated

Figure 10-X0-Message sequence chart for controller association

**10.40.3.1 Short address generation**

A controlee shall use extended addressing when the controller is using its extended addressing. When the controller is using its short address, a controlee shall generate a short address and use the short address for the HRP UWB Association Request command. How to generate the short address is out of scope of this standard. A controlee also conveys its capability information in the HRP UWB Association Request command.

When the controller sends the HRP UWB Association Response command to indicate success with the Association Status field value zero or two, (as described in Table 47), the Association Response command from the controller shall contain the Session Configuration field. When the short address chosen by the controlee already exists, the controller may send Association Response command with the Association Status field set to indicate a successful association successful with updated short address, (i.e., a Status field value of two), to update the short address for the controlee. In this case, the Association Response command shall contain an Updated Short Address field whose value is unique in the session. When two or more controlees send an Association Request with the same short address in the same round, the controller should send an Association Response command with the Association Status field indicating that the association is denied because of duplicate short addresses, (i.e., a Status field value of three) to inform the controlees to try again with a different short address.

**10.40.4 Controller Disassociation**

The disassociation procedure is initiated by the next higher layer by issuing the MLME- CONTROLLER-DISASSOCIATE.request primitive, as described in 10.40.5.2.2, to the MLME.

When the controller’s MLME receives the MLME-CONTROLLER-DISASSOCIATE.request primitive and the DeviceAddress parameter matches one of the associated controlees’ addresses, the controller shall send the Disassociation Notification command to the associated controlee with the matching address.

When the controlee’s MLME receives the MLME-CONTROLLER-DISASSOCIATE.request primitive and the DeviceAddress parameter matches the controller’s address, the controlee shall send the Disassociation Notification command to the controller.

If the acknowledgment to Disassociation Notification command is not received, the transmitting device should consider the intended receiver disassociated.

The next higher layer of the requesting device shall be notified of the result of the disassociation procedure through the MLME-DISASSOCIATE.confirm primitive, as described in 10.40.5.2.4.

Figure 10-X1 illustrates a sequence of messages for the controller disassociation.

A black background with white lights

Description automatically generated

Figure 10-X1-Message sequence chart for controller disassociation

[Editor: Updates on 10.40.4.2 Controller Association Response command, page 164, line 19]

The Source Addressing Mode field and the Destination Addressing Mode field shall be set ~~to the same mode as indicated in the HRP UWB Association Request command to which the HRP UWB Association Response command refers.~~ according to the addressing mode specified by the MLME-CONTROLLER-ASSOCIATE.response primitive, as described in 10.40.5.1.4.

[Editor: Updates on 10.40.4.1 Controller Association Request command, page 163, line 8]

The Source Addressing Mode field and the Destination Addressing Mode field shall be set ~~to the same mode as indicated by the AC IE in the control message to which the HRP UWB Association Request command refers.~~ according to the addressing mode specified by the MLME-CONTROLLER-ASSOCIATE.request primitive, as described in 10.40.5.1.2.

[Editor: Updates on 10.40.4.2 Controller Association Response command, page 165, line 4]

The Destination Address field shall ~~contain the short address or the extended address of the device requesting association, depending on the Destination Addressing Mode field setting.~~ be set according to the controlee address specified by the MLME-CONTROLLER-ASSOCIATE.response primitive, as described in 10.40.5.1.4.

[Editor: Updates on 10.40.4.1 Controller Association Request command, page 163, line 15]

The Destination Address field shall ~~contain the short address or the extended address of the device requesting association, depending on the Destination Addressing Mode field setting.~~ be set according to the controller address specified by the MLME-CONTROLLER-ASSOCIATE.request primitive, as described in 10.40.5.1.2.

[Editor: Add followings after the sub-clause 10.40.4.2]

**10.40.4.3 Controller Disassociation Notification command**

The controller, or an associated controlee may send the Controller Disassociation Notification command.

The Source Addressing Mode field and the Destination Addressing Mode field shall be set according to the addressing mode specified by the MLME-CONTROLLER-DISASSOCIATE.request primitive, as described in 10.40.5.2.2.

The Frame Pending field shall be set to zero and ignored upon reception, and the AR field shall be set to one.

The Destination Address field shall be set according to the DeviceAddress parameter in the MLME-CONTROLLER-DISASSOCIATE.request primitive, as described in 10.40.5.2.2.

The Source Address field shall contain the *macShortAddress* or *macExtendedAddress*, depending on the Source Addressing Mode field setting.

The Disassociation Notification command Content field shall be formatted as illustrated in Figure 10-X2.

|  |
| --- |
| Octets: 1 |
| Disassociation Reason |

Figure 10-X2 Disassociation Notification command Content field format

Valid values of the Disassociation Reason field are defined in Table 10-X0.

Table 10-X0 Valid Disassociation Reason codes

|  |  |
| --- | --- |
| Disassociation reason | Description |
| 0x00 | The controller wishes the controlee to leave the association. |
| 0x01 | The controlee wishes to leave the association. |
| 0x02-0xff | Reserved. |

**10.40.5 MAC management service primitives for controller association and disassociation**

**10.40.5.1 Association primitives**

**10.40.5.1.1 General**

These primitives are used when a controlee becomes associated with a HRP UWB controller.

**10.40.5.1.2 MLME-CONTROLLER-ASSOCIATE.request**

The MLME-CONTROLLER-ASSOCIATE.request primitive is used by a controlee to request an association with a controller.

The semantics of this primitive are as follows:

MLME-CONTROLLER-ASSOCIATE.request (

AddrMode,  
ControllerAddress,  
CapabilityInformation  
)

The primitive parameters are defined in Table 10-X1.

Table 10-X1 MLME-CONTROLLER-ASSOCIATE.request parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the ControllerAddress of this primitive |
| ControllerAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the controller with which to associate. |
| *CapabilityInformation* | Bitmap | As defined in 10.40.4.1 | The operational capabilities of the controlee requesting association. |

On receipt of the MLME-CONTROLLER-ASSOCIATE.request primitive, the MLME of an unassociated controlee first updates the appropriate PHY and MAC PIB attributes, as described in 10.40.3, and then MLME generates a HRP UWB Association Request command as specified in 10.40.4.1.

**10.40.5.1.3 MLME-CONTROLLER-ASSOCIATE.indication**

The MLME-CONTROLLER-ASSOCIATE.indication primitive is used to indicate the reception of a Controller Association Request command specified in 10.40.4.1.

The semantics of this primitive are as follows:

MLME-CONTROLLER-ASSOCIATE.indication (

AddrMode,  
ControleeAddress,  
CapabilityInformation  
)

The primitive parameters are defined in Table 10-X2.

Table 10-X2 MLME-CONTROLLER-ASSOCIATE.indication parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the ControleeAddress of this primitive |
| ControleeAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the controlee requesting association. |
| *CapabilityInformation* | Bitmap | As defined in XXX | The operational capabilities of the controlee requesting association. |

When the next higher layer of a controller receives the MLME-CONTROLLER-ASSOCIATE.indication primitive, the controller determines whether to accept or reject the unassociated controlee using an algorithm outside the scope of this standard.

**10.40.5.1.4 MLME-CONTROLLER-ASSOCIATE.response**

The MLME-CONTROLLER-ASSOCIATE.response primitive is used to initiate a response to an MLME-CONTROLLER-ASSOCIATE.indication primitive.

The semantics of this primitive are as follows:

MLME-CONTROLLER-ASSOCIATE.response (

AddrMode,  
ControleeAddress,  
UpdatedShortAddress,  
AssociationStatus  
)

The primitive parameters are defined in Table 10-X3.

Table 10-X3 MLME-CONTROLLER-ASSOCIATE.response parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the ControleeAddress of this primitive |
| ControleeAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the controlee requesting association. |
| UpdatedShortAddress | Integer | 0x0000-0xffff | The short address allocated by the controller. This parameter is used either when the ControleeAddress of the MLME-CONTROLLER-ASSOCIATE.indication primitive is extended address or duplicated short address. |
| AssociationStatus | Integer | As defined in Table 47 | The association status of the association attempt as defined in 10.40.4.2. |

**10.40.5.1.5 MLME-CONTROLLER-ASSOCIATE.confirm**

The MLME-CONTROLLER-ASSOCIATE.confirm primitive is used to inform the next higher layer of the initiating controlee whether its request to associate was successful or unsuccessful.

The semantics of this primitive are as follows:

MLME-CONTROLLER-ASSOCIATE.confirm (

UpdatedShortAddress,  
AssociationStatus  
)

The primitive parameters are defined in Table 10-X4.

Table 10-X4 MLME-CONTROLLER-ASSOCIATE.confirm parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| UpdatedShortAddress | Integer | 0x0000-0xffff | The short address allocated by the controller. This parameter is used either when the ControleeAddress of the MLME-CONTROLLER-ASSOCIATE.indication primitive is extended address or duplicated short address. |
| AssociationStatus | Integer | As defined in Table 47 | The association status of the association attempt as defined in 10.40.4.2. |
| Status | Enumeration | SUCCESS, NO\_DATA, also see 8.2.2. | The status of the association attempt. |

**10.40.5.2 Disassociation primitives**

**10.40.5.2.1 General**

These primitives are used by a controlee to disassociate from a HRP UWB controller or by the controller to disassociate a controlee from the controller.

**10.40.5.2.2 MLME-CONTROLLER-DISASSOCIATE.request**

The MLME-CONTROLLER-DISASSOCIATE.request primitive is used by an associated controlee to notify the controller of its intent to leave the association. It is also used by the controller to instruct an associated controlee to end its association with the controller.

The semantics of this primitive are as follows:

MLME-CONTROLLER-DISASSOCIATE.request (

AddrMode,  
SessionId,  
DeviceAddress,  
DisassociateReason  
)

The primitive parameters are defined in Table 10-X5.

Table 10-X5 MLME-CONTROLLER-DISASSOCIATE.request parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the DeviceAddress of this primitive |
| SessionId | Integer | 0x00000000-0xffffffff | The Session ID of the device to which to send the Disassociation Notification command. |
| DeviceAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the device to which to send the Disassociation Notification command. |
| DisassociationReason | Integer | 0x00-0xff | The reason for the disassociation, as described in |

**10.40.5.2.3 MLME-CONTROLLER-DISASSOCIATE.indication**

The MLME-CONTROLLER-DISASSOCIATE.indication primitive is used to indicate the reception of a Disassociation Notification command.

The semantics of this primitive are as follows:

MLME-CONTROLLER-DISASSOCIATE.indication (

AddrMode,  
SessionId,  
DeviceAddress,  
DisassociateReason  
)

The primitive parameters are defined in Table 10-X6.

Table 10-X6 MLME-CONTROLLER-DISASSOCIATE.request parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the DeviceAddress of this primitive |
| SessionId | Integer | 0x00000000-0xffffffff | The Session ID of the device to which to send the Disassociation Notification command. |
| DeviceAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the device requesting disassociation. |
| DisassociationReason | Integer | 0x00-0xff | The reason for the disassociation, as described in |

**10.40.5.2.4 MLME-CONTROLLER-DISASSOCIATE.confirm**

The MLME-CONTROLLER-DISASSOCIATE.confirm primitive reports the results of an MLME-CONTROLLER-DISASSOCIATE.request primitive.

The semantics of this primitive are as follows:

MLME-CONTROLLER-DISASSOCIATE.confirm (

AddrMode,  
SessionId,  
DeviceAddress,  
DisassociateReason  
)

The primitive parameters are defined in Table 10-X7.

Table 10-X7 MLME-CONTROLLER-DISASSOCIATE.confirm parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| AddrMode | Enumeration | SHORT, EXTENDED | The addressing mode for the DeviceAddress of this primitive |
| SessionId | Integer | 0x00000000-0xffffffff | The Session ID of the session in which the device of DeviceAddress is. |
| DeviceAddress | Short address or extended address | As specified by the AddrMode parameter | The address of the controlee that has either requested disassociation or been instructed to disassociate by its controller. |
| Status | Enumeration | SUCCESS. Also see 8.2.2. | The status of the disassociation attempt. |