**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Wireless Personal Area Networks |
| Title | **Yet another document explaining PAN ID Compression** |
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| Re: | 802.15.4 Revision Preparation  |
| Abstract | Submission to Maintenance standing committee: Proposed revised format and content for the PAN ID compression table and other related things. Provides specific editing instructions apply to the draft to resolve ballot comments on PAN ID usage and the PAN ID Compression field.  |
| Purpose | Promote useful work and reduce confusion.  |
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**Use of PAN ID compression**

# Suggested Change to 7.2.1.5

## Revised Text (agreed by SCM in Kona)

Create a simplified table for setting PAN ID compression for Frame Version == 2. Use the normative text from 802.15.4-2011 for frame version is 0 or 1[[1]](#footnote-1). The resulting suggested change:

Replace text in 7.2.1.5 with:

When the frame version field value is 0 or 1: If both destination and source addressing information is present, the MAC sublayer shall compare the destination and source PAN identifiers. If the PAN identifiers are identical, the PAN ID Compression field shall be set to one, and the source PAN identifier shall be omitted from the transmitted frame. If the PAN identifiers are different, the PAN ID Compression field shall be set to zero, and both Destination PAN Identifier and Source PAN Identifier fields shall be included in the transmitted frame. **If the PAN ID Compression field is set to zero, then the PAN Identifier field shall be present if and only if the corresponding address is present.**

When the frame version field value is 2: The PAN ID Compression Field shall be set based on the addressing fields present according to Table ZZZ; combinations of destination and source address with destination and source PAN ID and PAN Compression not shown in Table ZZZ shall not be generated.

Add the following as a footnote to table rows marked in orange:

If both destination and source addressing information is present and either is a short address, the MAC sublayer shall compare the destination and source PAN identifiers and the PAN ID Compression field shall be set to one only if the PAN identifiers are identical.

Table ZZZ: PAN ID Compression for Beacon, Data, Acknowledgement, Command frames when Version field = 2 or 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Destination Address  | Source Address  | Destination PAN ID | Source PAN ID | PAN ID Compression |
| Not Present | Not Present | Not Present | Not Present | 0 |
| Not Present | Not Present | Present | Not Present | 1 |
| Present | Not Present | Present | Not Present | 0 |
| Present | Not Present | Not Present | Not Present | 1 |
| Not Present | Present | Not Present | Present | 0 |
| Not Present | Present | Not Present | Not Present | 1 |
| Extended | Extended | Present | Not Present | 0 |
| Extended | Extended | Not Present | Not Present | 1 |
| Short | Short | Present | Present | 0 |
| Short | Extended | Present | Present | 0 |
| Extended | Short | Present | Present | 0 |
| Short | Extended | Present | Not Present | 1 |
| Extended | Short | Present | Not Present | 1 |
| Short | Short | Present | Not Present | 1 |

# Correction to 7.3.1.1 regarding PAN ID Field Use

Problem: The following sentence appears in the 7.3.1.1:

“The Source PAN ID field, when present, shall contain the PAN ID”

This has at least two issues identified in sponsor ballot comments:

1. When only one PAN ID field is present in the frame, per 7.2.1.5 it is the Destination PAN ID field.
2. “the PAN ID” is not precisely defined in this context.

Relevant to (1) is to note that there are (since 2006) several places in the standard where the Destination PAN ID ***field*** is used to contain the PAN ID ***value*** of the sending (source) device. If we assume that (2) is meant to mean the local PAN ID, which is the value of the attribute *macPanId*, then we can conclude that “source PAN ID field” is an error but means instead that the PAN ID *value* used should be the value of *macPanId*. To that end the following changes are suggested.

## Suggested Change to 7.3.1.1

Change the last paragraph of 7.3.1.1 as follows:

When the Frame Version field is 0b10 (Enhanced Beacon frame), the MHR may or may not contain a sequence number, and may contain any addressing fields supported by the general frame format. ~~The order of fields in the MHR of the Enhanced Beacon frame shall conform to the order of the general MAC frame as illustrated in Figure 86.~~ ~~The Source PAN ID field, when present, shall contain the PAN ID~~ If the response requires a PAN ID value, then the Destination PANID field is set to the value of *macPanId*, and the source PAN ID field is omitted. The Source Address field shall contain the MAC address of the device transmitting the beacon. When the beacon is generated in response to an Enhanced Beacon Request command, the Frame Version field shall be set to 0b10 (Enhanced Beacon frame), ~~and~~ the Destination Address field shall contain the source address contained in the received Enhanced Beacon Request command, and the PAN ID Compression field shall be set according to 7.2.1.5.

Explanation: This now clearly specifies the addressing field contents such that the information given in 7.2.1.5 can be applied to set the PAN ID Compression field correctly.

# Ripple effects of PAN ID Compression

A sponsor voter (Kivinen) observes that some text originating in 15.4-2006 specifies redundantly PAN ID compression and address field settings and in some places it appear use of legacy frame formats and are assumed. Suggested remedy is to scrub all text and update as necessary. In so doing we found that the legacy text was incorrect on several levels. In general the fix is to specify how the address fields are to be set and then refer to 7.2.1.5 for setting PAN ID Compression field, thus removing repetition of (incorrect) normative text. The following table provides specific editing instructions.

## Suggested Changes to fix PAN ID Compression in Command Frames

|  |  |
| --- | --- |
| Sub-clause | Change |
| 7.5.2 | Association Request command - needs change for Frame version 2.Change last sentence of the sixth paragraph as indicated:When the command frame version field is set to 0b10, the Source PAN ID is omitted, otherwise the Source PAN ID field shall contain the broadcast PAN ID. |
| 7.5.3 | Needs correction for frame version 2, which requires PAN ID compression to be 0 in this case (both source and destination are extended addressing).Change sixth paragraph as indicated:~~The PAN ID Compression field shall be set to one. In accordance with this value of the PAN ID Compression field,~~ tThe Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The Destination Address field shall contain the extended address of the device requesting association. The Source Address field shall contain the value of *macExtendedAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5.  |
| 7.5.4 | Disassociation Notification commandChange sixth paragraph as indicated:~~The PAN ID Compression field shall be set to one. In accordance with this value of the PAN ID Compression field,~~ tThe Destination PAN ID field shall contain the value of macPanId, ~~while~~ the Source PAN ID field shall be omitted. If the coordinator wants an associated device to leave the PAN, then the Destination Address field shall contain the address of the device being removed from the PAN. If an associated device wants to leave the PAN, then the Destination Address field shall contain the value of either *macCoordShortAddress*, if the Destination Addressing Mode field is equal to two, or *macCoordExtendedAddress*, if the Destination Addressing Mode field is equal to three. The Source Address field shall contain the value of *macExtendedAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.5 | Data Request CommandChange 7th paragraph as indicated:If the Destination Addressing Mode field is set to indicate that destination addressing information is not present~~, the PAN ID Compression field shall be set to zero and~~ the source PAN ID shall contain the value of *macPanId*. Otherwise, ~~the PAN ID Compression field shall be set to one. In this case and in accordance with the PAN ID Compression field,~~ the Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.6 | PAN ID Conflict Notification commandChange the 5th paragraph as indicated:The ~~PAN ID Compression field shall be set to one. In accordance with this value of the PAN ID Compression field, the~~ Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The Destination Address field shall contain the value of *macCoordExtendedAddress*. The Source Address field shall contain the value of *macExtendedAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.7 | Orphan Notification commandChange 5th paragraph as indicated:The ~~PAN ID Compression field shall be set to one. In accordance with this value of the PAN ID Compression field, the~~ Destination PAN ID field shall contain the value of the broadcast PAN ID, while the Source PAN ID field shall be omitted. The Destination Address field shall contain the broadcast short address. The Source Address field shall contain the value of *macExtendedAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.10 | Coordinator realignment commandChange the first sentence of the 7th paragraph as indicated:The Destination PAN ID field when present shall contain the broadcast PAN ID. |
| 7.5.13 | DSME Association Response commandChange the 5th paragraph as indicated:The ~~PAN ID Compression field of the Frame Control field shall be set to one. In accordance with this value of the PAN ID Compression field, the~~ Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The Destination Address field shall contain the extended address of the device requesting association. The Source Address field shall contain the value of *~~aExtendedAddress~~*. *macExtendedAddress.* The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.19 | DSME Beacon Allocation Notification commandChange the 4th paragraph as indicated:The ~~PAN ID Compression field of the Frame Control field shall be set to one. In accordance with this value of the PAN ID Compression field, the~~ Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The Destination Address field shall be set to 0xffff. The SourceAddress field shall contain the value of *macShortAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5. |
| 7.5.20 | DSME Beacon Collision Notification commandChange the 4th paragraph as indicated:The ~~PAN ID Compression field of the Frame Control field shall be set to one. In accordance with this value of the PAN ID Compression field, the~~ Destination PAN ID field shall contain the value of *macPanId*, while the Source PAN ID field shall be omitted. The Destination Address field shall be set to the node address that has requested later. The Source Address field shall contain the value of *macShortAddress*. The PAN ID Compression shall be set as specified in 7.2.1.5. |

# Background and Details

## Regarding PAN ID Compression definition in 7.2.1.5

Summary explanation of the PAN ID compression differences for frame version 2:

A means is provided to omit PAN ID completely from frames:

1. Use of PAN ID compression with only one address present is defined: when PAN ID compression is set to one, PAN ID is omitted; when PAN ID compression is set to zero, the PAN ID corresponding to the address is present (same as 2011).
2. When both addresses are present and are **extended**, PAN ID compression is set to one to indicate that no PAN ID is in the frame. PAN ID Compression is set to zero to indicate presence of a destination PAN ID in the frame. Note: the destination PAN ID field is sometimes used to contain the value of the sender (source) PAN ID, e.g. Association Response command. The field name specifies the position in the frame, but is not necessarily descriptive of the content.
3. When both addresses are present and either is a short address, PAN ID compression is used as per 2011[[2]](#footnote-2).

**Setting PAN ID Compression when frame version equal to 0 or 1 (2011 rules):**

For Beacon, Data and Command Frames:

1. When only one address is present, PAN ID compression is set to ZERO and the PAN ID corresponding the address included is contained in the frame:
	1. Source address present -> one PAN ID field, set to source PAN ID
	2. Destination address present -> one PAN ID field, set to the destination PAN ID
2. When no addresses are included in the frame no PAN IDs are included in the frame; Only valid for Acknowledgment frame;
3. When both source and destination address are present:
	1. IF the source and destination PAN IDs are equal, PAN ID compression is set to 1 and the PAN ID field contains the (one) PAN ID (according to figure 35 of 2011, the Source PAN Identifier field is present and the Destination PAN Identifier field is absent)
	2. IF the source and destination PAN ID values are NOT EQUAL, the PAN ID compression field is set to ZERO and BOTH source and destination PAN ID fields are present in the frame.

For Acknowledgement frames: PAN ID Compression is always zero, and no addressing is contained in the frame.

PAN ID Compression field is always zero when the frame contains only one address.

Issues from 2006/2011 related to PAN ID:

1. Specifies the broadcast PAN ID be used when PAN ID of destination not known; Address filtering is ambiguous when a destination address other than broadcast is included in a frame with the destination PAN ID set to broadcast.

**Setting PAN ID Compression when Frame Version >= 2 (802.15.4e Rules with corrections)**

The use and meaning of the PAN ID compression field is different depending on:

* Frame version
* Address fields present
* Addressing modes used

For Beacon, Data, Command and Acknowledgement frames:

1. When the Source Address is present and Destination address is not present
	1. If the frame contains the Source PAN ID field, PAN ID Compression field is set to zero;
	2. If the frame contains no PAN ID, the PAN ID Compression field is set to one;
2. When the Source Address field is not present and the Destination address field is present
	1. If the frame contains the Destination PAN ID field, PAN ID Compression field is set to zero;
	2. If the frame contains no PAN ID field, the PAN ID Compression field is set to one;
3. When Source Address is not present and Destination Address is not present
	1. PAN ID compression set to zero if the frame contains the destination PAN ID.
	2. If the frame contains no PAN ID field, the PAN ID Compression field is set to one
4. When the Source Address field is present and the Destination address field is present and both contain Extended Addresses
	1. When a PAN ID field is present and frame PAN ID compression field is set to zero the Destination PAN ID is present; when the frame type is Beacon, the PAN ID is interpreted as the source PAN ID.
	2. When no PAN ID field is present, PAN ID compression field is set to one;
5. When the Source Address field is present and the Destination address field is present and one or both of source address or destination address fields contain a short address
	1. IF the source and destination PAN IDs are equal, PAN ID compression is set to 1 and the PAN ID field contains the (one) PAN ID (according to figure 35 of 2011, the Source PAN Identifier field is present and the Destination PAN Identifier field is absent)
	2. IF the source and destination IDs are NOT EQUAL, the PAN ID compression field is set to ZERO and BOTH source and destination PAN ID fields are present in the frame.



1. In 802.15.4-2003 (Frame version 0) the field is named “Intra-PAN” rather than “PAN ID Compression”, but it is in the same position and has the same effect as the PAN ID Compression field in 802.15.4-2006 – only the name and perhaps the intended usage was changed. [↑](#footnote-ref-1)
2. This is true in 802.15.4e-2012 per how use of PAN ID fields are specified in normative text, but the addressing mode conditions are omitted from Table 2a. [↑](#footnote-ref-2)