**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title |  | |
| Date Submitted | [6 March, 2015] | |
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| Re: | Resolutions and responses to LLDN-related problems in IEEE 802.15.4 REVc. The LLDN-related problems are listed in document 15-14-0224-06. | |
| Abstract | This document provides resolutions and responses to issues in IEEE 802.15.4 REVc related to the Low Latency Deterministic Network mode (LLDN). The LLDN-related problems are listed in document 15-14-0224-06.  This document is a first step to a thorough resolution of comments and issues in IEEE 802.15.4 REVc related to Low Latency Deterministic Networks (LLDN), so that the LLDN mode stays in REVc of the IEEE 802.15.4 standard. | |
| Purpose | to re-insert and to keep the specification of Low Latency Deterministic Networks of IEEE 802.15.4e in the REVc of IEEE 802.15.4. | |
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**Resolutions and responses to LLDN-related problems listed in 15-14-0224-06-0mag-problems-with-802-15-4.ods**

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| 41 | What is a simple address and shouldn't this be defined along side the other addresses? |  |  | Technical | Moderate |

A „simple address“ is an 8-bit MAC address. It is defined in the tables for the addressing mode in the general MAC frame definition alongside the other address formats. (see 5.2.1.1.6 in 15.4e).

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| 42 | LL Beacon references 2450 MHz PHY, yet none exists | Delete the equation and figure out what the hell this is supposed to mean. |  | Technical | Moderate |

The term „2450 MHz PHY“ has been taken from IEEE 802.15.4-2006. The „2450 MHz PHY“ is described in clause 6.5 of IEEE 802.15.4-2006. Will be updated to „O-QPSK PHY in the 2450 MHz band“.

Furthermore, the description and naming of the Timeslot Size field is indeed confusing and not easily understood. The naming should be changed to what is really contained in the field.

Resolution:

Change the term „2450 MHz PHY“ into the term used in REVc for this PHY (2450 MHz DSSS PHY employing O-QPSK modulation). This should be the „O-QPSK PHY in the 2450 MHz band“.

Change description of Timeslot Size field:

*Change in Clause 5.2.2.5.2 LL Beacon frame format:*

[…]

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| **Octets: 1** | **0/1** | **0/1/5/6/10/**  **14** | **1** | **1** | **1** | **1** | **0/1** | **variable** | **2** |
| Frame Control | Sequence Number | Auxiliary Security Header | Flags | LLDN PAN  coordina- tor ID field | Configuration Sequence Number | Expected Max Data Payload Size | Number of Base Timeslots in Superframe | Group Acknow- ledgment | FCS |
| MHR | | | MAC Payload | | | | | | MFR |

Figure 48c—Format of the LL Beacon Frame

[…]

The Expected Max Data Payload Size field contains the expected maximum number of octets of the data payload of an LL-data frame.

The content of the Expected Max Data Payload Size field is used in the calculation of the actual timeslot size *tTS* in seconds. The actual timeslot size *tTS* is calculated as

*tTS* : = (*p* *sp* + (*m* + *n*) *sm* + *macMinSIFSPeriod) / v*

if *m* + *n* *aMaxSIFSFrameSize* octets, or

*tTS* : = (*p* *sp* + (*m* + *n*) *sm* + *macMinLIFSPeriod) / v*

if *m* + *n* > *aMaxSIFSFrameSize* octets.

with the description of the parameters and values for the O-QPSK PHY in the 2450 MHz band as an example as shown in Table [3e.](#bookmark179)

Table 3e—Description of parameters for calculation of actual timeslot size

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| **Parameter** | **Description** | **Values for O-QPSK PHY in 2450 MHz band with no security enabled** |
| *p* | Number of octets of PHY header | 6 octets |
| *sp* | Number of symbols per octet in PHY header | 2 symbols per octet |
| *m* | Number of octets of MAC overhead (MHR + MFR) | 3 octets for LL-Data frames |
| *n* | Expected maximum number of octets of data payload | Value of Expected Max Data Payload Size field of LL-Beacon frame |
| *sm* | Number of symbols per octet in PSDU | 2 symbols per octet |
| *v* | Symbol rate | 62 500 symbols/s |
| *macMinSIFSPeriod* |  | 12 symbols |
| *macMinLIFSPeriod* |  | 40 symbols |
| *aMaxSIFSFrameSize* |  | 18 octets |
| *tTS* | Actual size of timeslot in seconds | with n=2 octets: 0.544 ms  with n=20 octets: 1.568 ms |

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| 43 | GACK is referred to as a GACK frame, yet it is an IE. Can it be sent with other information in a frame? Shall it only be sent alone? | Determine what the correct name is to be used if at all. Do we deprecate LLDN? | LL discussion. Would be solved by deprecation | Technical | High |

I checked the occurrences of GACK, GACK frame, group ACK, Group ACK IE, and Acknowledgment, and it is quite clear that this comment with its high severity has been raised.

The actual cause is: The description of the DSME group acknowledgment in 5.1.10.3 and 5.2.4.12 is mixing up terminology, definitions, and even 15.4e scopes (or modes, such as DSME and LLDN).

The group acknowledgment in the LLDN actually works. It is defined in 5.2.2.5.4. The group acknowledgment of LLDN is an LL-Acknowledgment frame with a special acknowledgment payload containing a bitmap for the group acknowledgment.

The group acknowledgement in the DSME is probably an Enhanced Acknowledgment frame containing a Group ACK IE. This is vaguely mentioned in the definition of the Group ACK IE, but otherwise, the term GACK frame is used and confusion is provided.

Moreover, the sentence „This field shall not exist in the GACK frame in the LLDN mode.“ in the definiton of the Group ACK IE does not make sense and is incorrect! The LLDN mode does not use IEs! And the DSME mode cannot use LL-Acknowledgments. There is no connection between the DSME group ACK and the LLDN group ACK, nor between the Group ACK IE and the LLDN mode!

The actual resolutions are:

* keep the LLDN in the revision of 15.4. I will fix minor inaccurracies and make terminology more clear (e.g. LL-G-ACK).
* either fix the group acknowledgement of the DSME or remove the group ack of the DSME.

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| 44 | Is it going to be GACK, group ACK, G-ACK? | Change to G-ACK and then change all acknowledgement frame to be ACK frame. | Resolved | Editorial | Low |

Editorial. Resolution as the editor decided.

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| 45 | Group ACK flags is referenced in the MAC protocol, but it is not a field name in the Group ACK IE. | Potentially deprecated? |  | Technical | Moderate |

The correct field is „GACK Bitmap of the Group ACK IE“ instead of „“Group Ack Flags” field of a GACK frame“.

The problem behind this confusion is the mix-up of GACK frames of the DSME mode and the LLDN mode, which does not make sense an is incorrect: The group acknowledgment of the DSME mode and the group acknowledgment of the LLDN mode are completely independent from each other (see also reply to line 43).

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| 46 | Move LL generic to the generic frame format. Move the LL frames to the command section (perhaps?). |  |  | Editorial | Low |

The idea was and the proposed resolution (with adapted clause numbers) is :

* „5.2.2.5 Low Latency Frame format“ as format of an individual frame type, since all Low Latency Frames have the same 15.4 frame type.
* „5.2.2.5.1 General LL frame format“ similar to 5.2.1 General MAC frame format
* 5.2.2.5.2-5 frame formats of LL frame sub-types (LL-Beacon, LL-Data, LL-Acknowledgment, LL-Command)

The LL-frames are frame sub-types, so they should stay in the frame format section.

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| 47 | Delete MHR and MFR from command figures, i.e., only specify the Payload field? |  |  | Editorial | Low |

LLDN commands should follow the general layout fo the command frame structure. Will be changed accordingly.

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| 49 | Serious problems with the Group ACK IE definition | not used anywhere, delete | Resolved | Technical | High |

The Group ACK IE is used in DSME, but the text on the DSME group acknowledgment is very lax with terminology (5.1.10.3 in 15.4e). This is independent from the existing technical problems with the Group ACK IE, which have been described by James Gilb.

Only the DSME group acknowledgment needs to be deleted. The LLDN definition can stay in the standard document.

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| 62 | The Discovery Parameters field of the LL Discover Response command is undefined | Mark as deprecate, if party wishes to keep they must fix. | LL discussion. | Technical | High |

LLDN should be kept in the standard.

I will provide more specific text on the payload of the LL Discover Response command in a separate document, so that LLDN can stay in the revision of the standard.

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| 63 | All of the LL MAC commands are incorrectly defined | Define the Command Payload fields of the commands, mark as deprecate, if party wishes to keep they must fix | LL discussion. | Technical | High |

LLDN should be kept in the standard.

I will provide more specific text on the payload of the LL commands in a separate document, so that LLDN can stay in the revision of the standard. (see also comment of line 62).

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| 64 | What's with all the new MAC commands being mandatory? That makes older devices non-compliant, e.g., this is not backwards compatible | Change the mandatory nature of the new commands to match the optional feature that they are used to implement., mark as deprecate, if party wishes to keep they must fix. | LL discussion. | Technical | High |

LLDN should be kept in the standard.

I will review the text and make the context of the LL command explicit, so that it is clear that they are only mandatory for devices implementing LLDN.

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| 65 | In “The CTS command may be sent using LL MAC Command frames.” <ed note: I changed “can” to “may”, perhaps it should be “shall”> | What is correct here? mark as deprecate, if party wishes to keep they must fix. | LL discussion. | Technical | High |

LLDN should be kept in the standard.

„may be sent“ and „can be sent“ are indeed ambiguous statements. However, I would prefer „is sent using“ instead of shall. Text will be changed accordingly.

The underlying issue is of a more general nature: The structure of the command definition is independent from the structure of the surrounding command frame, so a command can be sent with any type of command frame. In 15.4e, there are actually two types of command frames: 15.4-2006 MAC command frame and the LL-command frame, and the command can be used with any type of command frame (if the command is understood by the recipient). „is sent“ defines the use for a specific type of command frame, but keeps it open for other types of command frames. „shall be sent“ restricts it to a certain type of command frame and prohibits the possible use with other types of command frames.

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| 66 | Replace “command frame” with just “command” | Please be consistent. | Resolved | Editorial | Low |

Editorial. Resolution as the editor decided.

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| 67 | How should we list what MAC frames are mandatory for which types of devices? | In the table (similar to RFD and FFD), separate text in MAC protocol? |  | Editorial | Moderate |

Editorial. Resolution as the editor decided.

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| 70 | Do we need to name commands LL, DSME and AMCA? | If there isn't a reason for this, delete the extra modifiers |  | Editorial | Low |

Editorial. Will make a suggestion for each one of the LL-commands.

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| 82 | Does anyone seriously believe that RTS and CTS commands, as currently defined, will actually work? | The description is not complete on the use of RTS, CTS and CTS to group. | LL discussion. | Technical | High |

I believe that RTS and CTS commands work. I will review the description in order to fill the gaps.

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| 84 | In “Online state” the frame names aren't correct. | The sublcause and probably most of LLDN needs serious help. | LL discussion. | Technical | Moderate |

Frame names will be corrected. I will also make a review of the whole LLDN description.