
**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks
(WPANs)**

Submission Title: Terminology usage for link establishment in D2

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Re:

Abstract: proposes resolution to link establishment terminology

Purpose:

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CIDs 233, 676, 670, 833, 835,
836, 837, 838, 839

CID 233

The mandatory data rates for link establishment are not clearly defined.

Recommended remedy

- Define terms “synchronization” and “device discovery” and delete all reference to “link establishment” (accepted in Beijing meeting)
- Define mandatory rates for synchronization for all PHY types
- Define mandatory rates for device discovery for all PHY types

Instruction to editor

Define synchronization in Section 6.1 of D2

- The MAC shall select the optical clock rate for communication during the clock rate selection process as defined in Section 7.8. The preamble shall be sent at clock rate chosen by the TX and supported by the RX. The preamble is a time domain sequence and does not have any modulation, channel coding or line coding. The PHY header shall be sent at the lowest data rate for the chosen clock rate. The clock rate does not change through the frame between the preamble, header and payload

Text related to synchronization.

Section 6.6. Add

- For PHY I, the PHY header shall be sent at 11.67 kbps if the 200 KHz optical clock rate is selected or at 35.56 kbps if the 400 KHz optical clock rate is selected. Support for 11.67 kbps at 200 KHz optical clock is mandatory.

Section 6.7 add

- For PHY II, the PHY header shall be sent at 1.25 Mbps, 2.5 Mbps, 6 Mbps, 12 Mbps, 24 Mbps or 48 Mbps, depending on the selected optical clock rate. Support for 1.25 MHz at optical clock of 3.75 MHz is mandatory.

Section 6.8 add

- For PHY III, the PHY header shall be sent at 12 Mbps if the 12 MHz optical clock rate is selected or at 24 Mbps if the 24 MHz optical clock rate is selected. Support for 12 Mbps at 12 MHz is mandatory.

Instruction to editor

Define device discovery in Section 7.6.2.4 of D2

- Device discovery shall be performed at 11.67 Kbps with a 200 KHz optical clock for PHY 1 and at 1.25 Mbps with a 3.75 MHz optical clock for PHY II. PHY III does not provide device discovery support and shall rely on device discovery using PHY I or PHY II before operating in that mode. The dimmed OOK mode can be used to support dimming in the device discovery process. The MAC and PHY capabilities are exchanged in the device discovery process. The clock rate support capabilities are also exchanged. Once the capabilities are exchanged, regular data transmission mode resumes for all three PHY types. Device discovery requires bi-directional communication and is not applicable for broadcasting

Update all references to PHY link establishment to “synchronization” and MAC link establishment to “device discovery”

CID 676, 670

I think I understand the idea behind Table 76 but I'm not sure it is captured correctly in the table.

- The problem is that indicating the max supported clock rate is not the same as indicating the PHY options supported. Table 72 - bits 16, 17 and 18 - are already indicating which PHY options are supported. So if you support PHY I and/or PHY II then the clock rates are already implemented. So in Table 76 we do not need the first two rows. I'd be OK if we just kept the last 6 rows to indicate with MCS choices are supported for the CSK PHY option. But a better way is just to indicate the highest MCS number supported for the CSK PHY, and this could actually be done in table 72 by inserting in the row 18 the highest supported CSK MCS (5 bit binary integer). So table 76 could be deleted and in table 72 indicate the highest supported CSK MCS as a 5 bit binary number.

Max supported TX clock and Max supported RX clock Why do we need this information? Doesn't the bits 16, 17 and 18 of table 72 convey this information?

Clarification/ Instruction

Bits 16-18 only mention the type of PHY support (PHY I, II and/or III) and not the optical clock rate capabilities

Only the lowest optical clock rate for all PHY types is mandatory in the specification.

Also, the TX and RX clock support can be different within a device as they are separate and independent circuits.

Hence, the lowest supported TX and RX clock needs to be explicitly and independently mentioned.

CSK PHY can use 100 and 101 depending on 12 or 24 MHz clock support

Instruction to editor

- Reject comments. Mention above clarification text for CSK PHY wrt Table 76.

CID 833

Clock rate selection

Use MCS selection instead of clock selection

Recommendation

- Reject. MCS selection is typically used as part of rate adaptation, is used only for the payload and need not be standardized. Clock rate selection is needed to establish the clock rates for the preamble, header and payload.

CID 835

The text in section 7.8.1 says ...

- ***The header shall be sent at lowest data rate for the chosen clock rate. The payload can choose any data rate belonging to the chosen clock rate.***

The text in section 6.8 says ...

The CSK mode shall use 12Mbps, 4-CSK, for link establishment after which an alternate data rate may be used for ensuring data communications.

Off-hand these two statements appear to be in conflict. The committee needs to help clarify this situation.

Instruction to editor

- Accept comment. Update section 6.8 as per discussion on synchronization and device discovery. CSK mode does not perform device discovery.

CID 836

Suggested alternative way of doing this ...

- An alternative method of specifying the supported data rates in a PHY is by indicating the highest supported MCS index for that particular PHY type and then specifying that the device must support all lower MCS indices. I would prefer this method instead of specifying by clock frequency.

The optical clock rate support is critical for VLC devices. A VLC device may support 100 kbps at 200 KHz but may not support 35.56 kbps at 400 KHz, even though 35.56 kbps is lower than 100 kbps.

Instruction to editor. Reject alternative method

CID 837

The text says ...

The coordinator will send a broadcast message via a beacon to all nodes such as devices 2 and 3 and inform them of its supported clock rates.

How is this information encapsulated in the beacon (section 7.2.2.1). It is sent in the beacon payload? Is a MAC command frame used? Is the MAC command frame used the Clock rate change notification?

Instruction to editor: Accept. add clarification text – “The information about the coordinator capabilities is broadcast using the capabilities IE. The current clock used and any change of clock is communicated via the clock rate change notification. “

CID 838

The text says ...

Figure 164 and Figure 165 show the clock rate selection for broadcast/multicast topologies assuming bidirectional communication.

Off-hand this seems like an oxymoron. Delete the refer to bi-directional broadcast. Also the next sentence reference to unidirectional broadcast, by definition broadcasts are unidirectional. I suggest we modify figures 164 and 165 to be broadcast only.

Instruction to editor. Accept the problem but not the solution. Remove usage of “broadcast” with respect to clock rate selection and retain the term as “multicast”. Clock rate selection is not applicable to broadcast as there is no negotiation.

CID 839

The text says ...

For unidirectional broadcast, the co-ordinator should use the lowest clock rate for broadcasting to ensure all devices can receive the information.

I don't entirely agree with this statement. A broadcast node can send the headers of a frame at the lowest data rate and then indicate that the packet body is at a higher data rate. Is this mode of operation consistent with the statement in 7.8.3? Modify the text to indicate that the frame payload can be at a higher than the frame headers. Modify figures 164 and 165 to show a rate change at the packet body.

Instruction to editor. Resolved as per earlier CID 838. Text not applicable for broadcast. Change broadcast to multicast.

Terminology usage for link establishment in D2

Confusion on terminology

What does link establishment mean?

- Applicable to preamble, header transmission during packet transmission ?
- Applicable to establishing a link when network is formed?
 - Network is not applicable for broadcasting

Recommendation – delete all usage of the term

- Use “synchronization” for preamble, header during packet transmission (PHY)
- Use “device discovery” for forming the network (MAC)

Definition: Device discovery mode

PHY type I and II use OOK (VPM with 50% duty cycle) at lowest data rate in this mode for modulation. PHY III is not used in the device discovery mode.

Can use the optional PHR extension discussed in Intel contribution for dimming support

MAC and PHY capabilities are exchanged in the device discovery process

Clock rate support is also exchanged

Once the capabilities are exchanged, regular data transmission mode resumes for all 3 PHY types

Device discovery is not applicable for broadcasting

Definition: Synchronization

PHY concept

Preamble is sent at clock rate chosen by the TX and supported by the RX

Preamble is defined as a time domain sequence

Preamble does not have any modulation, channel or line coding

PHY header is sent at the lowest data rate for the chosen clock rate

Clock rate does not change between preamble, header and payload

Recommendation

The term “synchronization” should be defined in D2 in the overview section

The term “device discovery” should be defined in D2 in the overview section

All link establishment terms in D2 related to the preamble and header transmission should refer to “synchronization”

All link establishment terms in D2 related to the discovery of devices and network formation should refer to “device discovery”

This should hopefully, clarify all issues related to link establishment. There should be no reference to link establishment in the document