IEEE P802.15
Wireless Specialty Networks

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| IEEE 802.15.13 May, 2018 Warsaw Meeting Minutes |
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Abstract

# This document contains the TG13 Multi-Gigabit/s Optical Wireless Communications Meeting minutes from the IEEE 802.11 Warsaw meeting, May 2018.

**IEEE 802.15.13**

**Monday, May 7, 2018, AM2 Session**

Attendance: around 20 people

1. The IEEE 802.15.13 TG meeting was called to order by the Chair, Volker Jungnickel (HHI)
2. Chair introduced the patent policy and logistics of the group
3. Approval of meeting minutes of March in 18-0158/00
	1. Unanimous
4. Self-introduction of attendees.
5. Chair went through the agenda of the week
	1. The agenda was approved
6. Sang-Kyu Lim presented 18-0166r2 “Evaluation results on preamble of PM-PHY”
	1. Question: on slide 21, detection in AWGN seems worse than some cases with larger delay spread. It was later found that AWGN shows similar performance with other evaluation assumptions, but not worse.
	2. Questions were raised on how down sampling was performed. Sang-Kyu explained that 1 GHz ADC is used for sampling. For each bit symbol, multiple samples are obtained and averaged to get one bit symbol.
	3. Questions on which PHY was assumed for simulation.
		1. Pulsed Modulation-PHY. Chair also introduced three PHY types in the draft and different use cases.
7. Sang-Kyu Lim presented 18-0169r2 “Evaluation Results on header of pm phy”
	1. Questions raised on why theoretical performance is worse than the case with RS encoding?
		1. It was later clarified that theoretical performance means the performance with 2-PAM in AWGN channel. Therefore it can be worse than the cases when transmitted data are encoded.
	2. How un-coded transmission shows better performance than when encoded?
		1. No clear explanation, need to double check the evaluation assumptions.
	3. Question on how channel modeling is performed.
		1. It is based on the ray tracing.
8. Sang-Kyu presented 18-0171r2 “Evaluation Results on Payload of PM PHY”
	1. Sang-Kyu mentioned the RS code rate used is [255 239] instead of [255 248]. Because simulation toolbox does not support [255 248] and that [255 239] is used in a couple of standards.
		1. Concerns raised that if [255 248] has certain issues, it may not the adopted in the standard
	2. Question on whether there is any proposals to the draft. Sang-Kyu responded that not yet. The text proposal for PM-PHY currently contains two preamble designs and still further consensus is needed.
9. Volker presented 18-0170r2 “PM PHY Synch Evaluation”
	1. Question: why threshold is set according to 0.1% false alarm rate
		1. It was agreed previously that preamble need to achieve 0.1% false alarm rate and header need to achieve 1% error rate. Furthermore payload need to achieve 10% error rate.
10. The meeting recessed until PM1.

**Monday, May 7, 2018, PM1 Session**

Attendance: around 15 people

1. The IEEE 802.15.13 TG meeting was called to order by the Chair, Volker Jungnickel (HHI)
2. Chair introduced the patent policy and logistics of the group
3. Volker presented 18-0173r0 “PM PHY Header and Payload Evaluation”
	1. Volker pointed out that the 8B10B scheme does not show any coding gain which is not reasonable.
		1. There were suggestions that SNR calculations may not be correct.
	2. Comment: BER curve with channel encoding should cross over the BER curve without channel coding, but the results does not appear so.
	3. Concerns raised that the evaluation results show some unexplained phenomenon and cannot be used for decisions.
	4. Volker pointed out that the benefits of 8B10B is in dealing with baseline wander.
		1. Issues with current channel model: only propagation is modelled while transfer function of LED and photo detector were not modelled. These transfer functions will show the effects of baseline wandering.
		2. The group suggested that the channel modeling should be extended to take into account of the characteristics of LED and photo detectors.
4. Volker presented 18-0190/r0 “On PM PHY parametrization”
	1. Question on whether the proposal is use a long preamble sequence with 394 symbol
		1. Volker clarified that it is for discussion. The results show that if HCM is used, then a long sequence is needed for preamble. The length of the preamble may be adaptive and decided by higher layer.
	2. There were suggestions that if preamble sequences with different lengths are introduced, it may be beneficial to use unified structure. For example to long sequences may be built from the same short base sequence. It could reduce the efforts on blind detection on the receiver side.
5. Daniel Chew presented 18-0187/r1 “Partial Evaluation of PM-PHY using TG7r1 Channels”
	1. Q: Do you need an ADC to include pulse shaping?
	2. A: No, there are analog methods of adding the pulse shaping that are cost effective
	3. Q: how would an RRC PAM compare to an OFDM PHY.
	4. A: what depends on the beta factor (roll off factor), if the same roll off factor then it should be the same. OFDM would have a much larger PAPR but you have to bring in a DAC. OFDM BER performance is going to be worse, because PAM will allow more energy per bit.
	5. Q: Are you doing time domain equalization and if so why?
	6. A: Didn’t see the benefit to go from time domain from the PAM to the frequency domain. In OFMD, you get the frequency domain for free. The equalizer worked very well in the time analysis.
	7. Q: How does the RRC compare to using Gaussian filter?
	8. A: Gaussian Filter has a problem with inflicting ISI which causes issues. To do this a viterbi coder would need to be implemented to track state.
6. The meeting recessed until Tuesday.

**Tuesday, May 7, 2018, AM1 Session**

Attendance: 12 people. Pat Kinney, Ben were invited for a discussion on MAC

1. The IEEE 802.15.13 TG meeting was called to order by the Chair, Volker Jungnickel (HHI).
2. Chair reminded attendees to check attendance.
3. Chair introduced the current situation of MAC developments in TG13.
	1. Pat commented that in 802.15 there are two different types of MAC, i.e. 15.4 MAC and 15.3 MAC. 15.4 MAC is intended to simple devices with low cost; 15.3 MAC was designed for high throughput. Suggested to clarify the need of the task group.
4. Chong Han presented “18-167/r0 Proposal of polling mechanism in both CFP and CAP”
	1. Question on how sensing is made in CAP.
		1. No sensing, just backoff; scattered light can be used for sensing; RTS/CTS is introduced to avoid collision.
	2. Questions on the purpose of CAP and CFP
		1. CAP is mainly used for association and maintenance, and data transmission without a constant connection. CFP is used for when there is a constant connection.
	3. Question on hidden nodes problem. Light propagation is supposed to be strongly directional. How to solve the hidden node problem
		1. RTS/CTS was introduced to alleviate the issue.
	4. Does the standard support peer to peer and star topologies?
		1. Both are supported. However these two topologies do not exist at the same time.
	5. What is the expected energy requirements?
		1. Diverse requirements, light on the ceiling does not care energy consumptions while mobile device is more sensitive.
	6. Why CAP is also used for data transmission since GTS and CFP is already introduced.
		1. GTS is obtained when asked, it is needed when there is a constant need for connection.
	7. Discussions on whether both full duplex and half duplex are supported
		1. Any PHY exclusively for full duplex? No.
		2. For full duplex, it was recommended to study the Ethernet MAC protocol.
	8. It is suggested that for CFP, some GTS could be shared by multiple devices. Thus polling could be used.
5. Kai Lennert Bober presented “18-202/r1 TG13 MAC considerations for distributed MIMO”
	1. Does front haul has an address? No
	2. Why it was suggeste “Superframe spec” to be transmitted in ad hoc way rather than in beacon?
		1. Because there are potentially a large number of devices in the same VPAN. And spatial reuse can increase the throughput
	3. How long channel can be stable so that the channel measurement feedback can be useful?
		1. around10ms?
	4. What do you consider as low latency? Volker said less than 5 ms or even sub-millisecond.
6. Meeting recessed.

**Tuesday, 08 May 2018 – AM2**

Attendance:

* Volker Jungnickel (HHI) – Chair
* Kai Lennert (HHI)
* Sang-Kyu (ETRI)
* John Li (Huawei)
* Tuncer Baykas (Mediopol University)
* Nikola Serafimovski (pureLiFi)
* Chong Han (pureLiFi)
* Masood Maqbool (Apple)
* Chris Hartman (Apple)
* Brima Ibrahim (NXP)
1. Chair called the meeting to order.
2. John Li (Huawei) presented doc. 15-18/0185r0.
	1. There was discussion about the purpose of the “Frame pending” control field in Slide 4.
	2. Question about the need to provide the destination of the address for the station to be provided in two locations.
		1. The source for having 2 fields was the relay feature using Decode & Forward.
		2. If there is a decode & forward, then does it make sense to also identify the source of the packet?
			1. Tuncer has agreed to provide a contribution about the relaying concept to check this information and introduce the relevant parts.
	3. Question about the need for security to be introduced in the current text
	4. The security could either be made optional or removed
	5. There was a question about the Integrity Check Value introduced in Annex H
		1. Chong (pureLiFi) presented doc. 15-18/0228r1 to explain the meaning and value.
		2. Chong to provide the brief explanation text for the ICV in the revised MAC proposal.
	6. Slide 11 Questions:
		1. The group agreed to adopt the general MAC frame format
		2. The group agreed to adopt the proposed structure for the Frame control.
			1. Chong (pureLiFi) and Kai (HHI) proposed to remove the Frame Pending field on slide 4.
			2. The group decided to take Option 2 (two octets) on slide 5.
			3. The group decided to agree on the general structure on slide 6, provided that more information will be made available at the next 802.15.13 meeting in July 2018.
			4. The group did not reach a decision on this point
				1. There was a discussion about the length and structure of the Address Field and understanding the required/optional elements.
			5. The group agreed to adopt the security protocols from 802.15.4-2015 as an optional feature.
			6. There was a discussion about the use of the security fields and what security suits could be implemented.
3. The meeting is in recess until Tuesday, PM1.

**Tuesday, 08 May 2018 – PM1**

Attendance:

* Volker Jungnickel (HHI) – Chair
* Kai Lennert (HHI)
* Sang-Kyu (ETRI)
* John Li (Huawei)
* Tuncer Baykas (Mediopol University)
* Nikola Serafimovski (pureLiFi)
* Chong Han (pureLiFi)
* Masood Maqbool (Apple)
* Chris Hartman (Apple)
* Brima Ibrahim (NXP)
1. Chair called the meeting to order.
2. John Li (Huawei) presented doc. 15-18/0185r0.
	1. Slide 11 Questions:
	2. The group decided to use the 32-bit CRC generator proposed in Annex H
	3. John will upload the revised version of 15-18/0185r1.

**MOTION:**

**The TG13 MAC will be based on the decisions on Slide 11 in doc.15-18/0185r1.**

**Yes: 3 No: 0 Abstain: 1**

1. The group agreed that contributions to the MAC should be made in separate documents following the structure of Section 5.
2. Alternatively, comments can also be made against D2, to be released by the end of May, that would represent the proposed changes to the baseline text. As an example, a comment against D2 would be to move part of the Annex to a particular section in the next draft.
3. The agenda was modified to reflect the addition of the discussion of the timeline.
4. There was a discussion around the timeline (doc. 15-17/0288r3) to try and accelerate the development. The committee agreed to continue working on Draft D2.0 and provide a more complete D3.
5. The committee agreed to hold 8 meetings in the July Plenary session.
6. There was a discussion about hosting teleconferences to address before the July meeting. It was agreed that these conference calls will be held with 7 days notice.
7. The key list of actions that need to be completed before the next meeting in July include:
	1. Simulation results for the PM-PHY, LB-PHY and HB-PHY
	2. Comments against the PM-PHY (doc. 15-18/0003r6) and LB-PHY (doc. 15-18/0168r3)
	3. Text proposals on MAC general frame structure
	4. Text proposals on HB-PHY
8. Conference calls to be arranged for:
	1. May 21 between 13:00 – 14:00 CET
	2. June 5 between 13:00 – 14:00 CET
	3. June 25 between 13:00 – 14:00 CET
9. The conference call dial-in details have been shared on the TG13 email reflector.
10. The group discussed the new references added in doc. 15-18/0003r6 in particular talking about the coding gain that should be seen from an 8B10B encoder.
11. The committee is in recess until Wednesday, PM1.

**Wednesday, 09 May 2018 – PM1**

Attendance:

* Volker Jungnickel (HHI) – Chair
* Sang-Kyu (ETRI)
* John Li (Huawei)
* Tuncer Baykas (Mediopol University)
* Nikola Serafimovski (pureLiFi)
* Chong Han (pureLiFi)
* Ryan Mennecke (JHU-APL)
* Christophe Jurczak (Lucibel)
1. Chair called the meeting to order.
2. John Li (Huawei) presented doc. 15-18/0232r0.
	1. The discussion was to include a table that would show the bits and the meaning of each format.
	2. Participants are required to provide their MAC proposals in a different document/submission using doc. 15-18/0232r0 as a template.
3. The committee agreed to issue a call for proposals for the MAC based on doc. 15-18/0232r0 as a basis.
4. Chong (pureLiFi) presented doc. 15-18/0168r2.
	1. Discussion about the source of the PN-sequence and the source of the filter.
		1. There was a request to do evaluation results to see the peak-to-average-power ratio (PAPR) of the PN-sequence
	2. Discussion about the use of an appended advanced modulation header.
	3. Discussion about the use of HCS and the need for the field
	4. Discussion on the “High reliability MAC header”
		1. The naming should be changed because the “MAC header” is not appropriate for this functionality.
	5. Discussion about the “Length of pkt”
		1. This information may be redundant considering the existing the information in the Basic PHY Header.
		2. This is necessary because it reduces the computational complexity.
		3. Discussion if some of the fields defined in the PHY should be defined in a common fashion for all of the PHYs in the MAC.
	6. There is no consensus and there is no need for agreement when there are multiple PHY modes, as long as all of the relevant information elements are defined in the relevant parts of the document.
		1. The example of 60 GHz was given where there are two entirely parallel MAC/PHY definitions.
		2. Discussion on the pulse shaping sequence
5. John (Huawei) would like to revisit doc. 15-17/0579r0.
	1. Nikola (pureLiFi) and Chong will provide feedback tomorrow (Thursday, 10 May) against the due actions.
6. Tuncer presented doc. 15-18/0182r0.
	1. There is interest to have support for the relaying support to be introduced in the other PHY modes in addition to the LB-PHY.
7. Sang-Kyu (ETRI) presented doc. 15-18/0235r0.
	1. This is a response to questions why the uncoded data seems to have better performance than the 8B10B coded data.
	2. The questions were around why the 8B10B does not provide any improvement in the context of error correction.
		1. The role of 8B10B is not error correction. Instead, it is added to minimize the number of consecutive `1’s and `0’s to mitigate DC wander.
		2. The simple encoding/decoding in this case will not provide any coding gain as a “traditional” implementation.
8. Meeting is in recess.

**Wednesday, 09 May 2018 – PM2**

Attendance: 6

* Volker Jungnickel (JHUAPL)
* Dan Chew (JHUAPL)
* Chong Han (Purelifi)
* Sang-Kyu Lim (ETRI)
* John Li (Huawei)
* Tunçer Baykaş (Medipol University)
1. The meeting was called to order at 1611.
2. Discussion of PM PHY text doc 15-18-003/r6 was the first agenda item.
3. Chair stated to keep providing various simulations to aid in the adoption of the pulse modulation PHY types.
4. PM PHY Decision #1
	1. Can TG13 agree on the preamble lengths with 64 samples as defined in doc 15-18-0003/r7?
		1. Yes
	2. The consensus of the group was to use a 64 bit preamble length (extended gold sequence [A32, A32]) for the basic mode 2-PAM and 8B10B line coding and the sequence length 96, 192, and 384 in case HCM(1,N) with N=4, 8, 16. The group has decided that in blind detection and association the basic mode that should utilize the preamble length of 384 to properly support HCM(1,16) which is always used in the beacon. Devices can suggest other MCS.
5. PM PHY Decision #2
	1. Can TG13 agree on the channel estimation sequence defined in doc 15-18-0003/r7?
	2. The group has decided to accept the channel estimation sequences proposed in the document. A request was made to provide more channel estimation simulations using the proposed sequences to collect the data.
6. PM PHY Decision #3
	1. Can TG13 agree on the header defined in doc. 15-18-0003/r7?
	2. Postponed the question.
7. PM PHY Decision #4
	1. Can TG13 agree on the optional fields defined in doc. 15-18-0003/r7?
	2. Yes
8. PM PHY Decision #5
	1. Can TG13 agree on the payload defined in doc. 15-18-0003/r7?
	2. This question has been postponed.
9. A question was to use the timestamp field in the control/beacon packets proposed PM PHY document or should it be removed and put into the MAC layer? The timestamp field currently resides in the MAC therefore it should be removed from the PM PHY proposal.
10. Q: In the header it looks like we are freezing the number of sub-carriers to 16 for HCM, is this by design or a mistake in table 3 Descriptor for MCS?
	1. A: This is a misunderstanding. If you choose 0 there is no modulation and the maximum is 15 HCM codes. Also, a change to make the range from 0-15 to 1-15 to make it more clear. Changes to table 3 were made to at suggestion to make the implementation more clear and free up a bit in the use case of not implementing HCM.
11. Q: Is the Hadamard Code unipolar or bipolar, it is not defined?
	1. A: The comment has been noted in the document to help clarify and describe the Hadamard Code as unipolar.
12. Meeting is in recess.