IEEE P802.15
Wireless Specialty Networks

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| IEEE 802.15.13 March, 2018 Chicago Meeting Minutes |
| Date: 2018-03-08 |
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Abstract

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

**IEEE 802.15.13**

**Monday, March 5, 2018, AM1 Session**

Attendance:

Volker Jungnickel (Fraunhofer HHI)

Sang-kyu Lim (ETRI),

Wang Xu (VLNcomm),

Oliver Luo (Huawei),

John Li Qiang (Huawei),

Chong Han (PureLiFi),

Soo-Young Chang (SYCA),

Vaj (?)

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 January in 18-0067/01
	1. Questions on submission guidelines, the Technical Editor clarifies that he will generate a table to summarize all proposals for a clear view after all submissions are received.
	2. The revised minutes in 18-0067/02 was approved
4. The chair remind the attendees to check the attendance
5. John suggested moving Session PM1 Tuesday to PM2 Monday for coordination with 802.11 activities, Chair will check the availability of the room first.
6. Chair introduced the incoming election in WG
7. Chair went through the agenda of the week
	1. There are requests on an introduction of LIFI congress during Feb
	2. The agenda was approved
8. Chair introduced LIFI congress in Paris France during Feb
9. Chair reviewed the progress of joint workshop of 15.13 and G.vlc, which was held on Feb 7, 2018 in Geneva (18-0084/01)
	1. Nikola and Volker attended the joint meeting
	* Volker presented status and timeline of TG13
	* It needs permission from ITU-T General secretary to copy any text
	* Creating own text is not considered as a good idea by G.vlc
	* If G.hn PHY is intended to be used, suggested to use references
	* IPR issues to be solved with SDO that owns the original text
	* Exchange of drafts: ITU-T G.vlc members should get access to IEEE draft, TG13 members should get access to ITU-T G.vlc draft
	* Interaction through comments and resolution in each group
	* WG Chair asked when such exchange will happen
	* Answer of TG13: October 2018 (i.e. with TG13 D4 same time as WG LB), see 15-17/0288r3
10. Sang-Kyu presented 18-0002/r1, there was no time for discussion. The technical discussion would be on PM1.
11. The meeting recessed until PM1.

**Monday, March 5, 2018, PM1 Session**

Attendance: 10 people

Volker Jungnickel (Fraunhofer HHI)

Sang-kyu Lim (ETRI),

Wang Xu (VLNcomm),

Oliver Luo (Huawei),

John Li Qiang (Huawei),

Chong Han (PureLiFi),

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. Sang-kyu Lim (ETRI) presented the evaluation results of PM-PHY in doc. 18-0106/r0.

C: channel modeling is ready, however evaluation framework needs to be developed.

C: Need to decide on a target error frame rate first. Header should be ten times better than the payload;

Q: what was the purpose for FLP? Is it really necessary?

A: For synchronization

C: The overhead of the preamble seems too much, 16, 384

Q: Why different TDP patterns for different topology?

A: To differentiate different topology and to reduce interference.

C: Deployments tend to have similar topology in the same area. Two coordinators with the same topology will results in the same sequence.

Q: Why there are more than 5 consecutive zeros or ones in the Gold sequence proposed. The presenter will check that.

C: How to perform cross correlation, the repetition pattern is correlated with itself. 0.1% can be good target.

Q: why putting the differentiation of topology in the preamble?

A: Open to change that

Q: Channel coding for the header;

A: Can be RS code with lower code rate, not considered in proposal.

Q: Will MIMO be supported in PM-PHY?

A: Tuncer will try to develop MIMO also for PM-PHY.

Q: Will the presenter be open to higher-level PAM modulation?

A: Not applicable if using 8B10B

Q: Inter-leaver is not needed, what is the rationale behind that?

A (Volker): In case of interference, scrambling may be necessary in coordinated topology to make the interference like white noise.

C: Suggestions that interleaving may not be good together with RS code.

1. Volker Jungnickel (Fraunhofer HHI) presented 18-0003r3. While Volker giving the presentation, Vice Chair Sang-Kyu Lim (ETRI) functioned as the Chair.

Q: Does IoT need high bandwidth?

A: Not today, but in the future people may have different requirements.

1. The meeting recessed until PM2.

**Monday, March 5, 2018, PM2 Session**

Attendance: 10 people (Volker, Sang-Kyu, Wang Xu, John Li, Chong Han, etc)

The meeting was called to order by the Chair, Volker Jungnickel (HHI). While Volker was giving his presentation, the Vice Chair Sang-Kyu Lim (ETRI) acted as the Chair.

1. Volker continued presenting 18-0003r3.

Q: Why autocorrelation?

A: Cross-correlation is too complex implementation wise. Autocorrelation is much simpler from implementation point of view. However there is a difference in the reliability of detection. The preamble proposal from HHI and ETRI are similar in construction (repeated Gold sequences) but have different rationale behind.

Q: Is the preamble structure proposed to OFDM as well as PM?

A: Same basic scheme is used in OFDM PHYs, thus similar basic scheme is used in PM PHY. Because performance of payload is not yet fully clear, it is still possible that preamble length will have other length at the end. Just the way it is constructed will be similar. OFDM preamble is optimized by feeding random preamble into experiment that searches fro an input sequence with minimum PAPR. Due to lower PAPR, preamble power can be boosted by around 6 dB compared to random OFDM data. That is why performance is about 6 dB better with such boosting. OFDM PHY preamble therefore can be much shorter compared to binary PM preamble.

Q: Why this is so important?

A: Volker explains that spreading gain of 12 dB from using HCM(1,16) requires relatively long preamble and what preamble length is used by VLNcomm. The capability of the change the number of the code from HCM(15,16) down to HCM(1,16) allows to reduce the data rate in case of poor channel condition, e.g. there are 20~30dB loss from blockage of the LOS, by reducing the data rate the link can be kept operational in such situations.

Q: What device makes the channel estimation? AP or receiver?

A: Depends on the direction of the link, and in both directions it is made by the receiver. Cross-correlation of the received signal and known sequence allows to obtain the channel impulse response.

Q: 2-PAM is used in HB-OFDM PHY? A: No. 2-PAM is for PM PHY, M-QAM is used in HB PHY.

Q: What about MCS?

A: If you are not considering MIMO, MCS is a vector, otherwise it is a number. The information should be added. MIMO reference sequences should be included in the optional field then the header works works for SISO as well.

Q: The optional field is covered by HCS? Isn’t it better to move MCS and other control information into the basic header and leave only the MIMO reference sequences in the optional field.

A: Yes, the control information should be moved from optional field into the basic PHY header. Which is likely to merge with the structure of ETRI's proposal.

Q: Probe frame is for channel estimation for MIMO?

A: Yes.

C: To unify the PHY frame types, it is better using a particular value to label the frame types, so we don't need to distinguish special frame types. A common practice to reduce the overhead for multiple purposes is to use a "wild" field, whose meaning depends on a flag bit. E.g., MCS field for data frame can be used as ERS in probe frame. LTE uses this approach.

A: Yes, it will be taken home for more careful consideration.

Request yb Volker to VLNcomm: Could we favor one HCM code length out of all possible lengths, such as 16.

Q: Time stamp is currently measured in 10 nanosecond steps in the proposal. A sequence number could also serve the purpose of a time-stamp.

A: Yes, this is another way. Measuring time in nanoseconds is just more intuitive. Overhead is not so critical in case of wideband air interface.

The meeting recessed until Tuesday AM1.

**Tuesday, March 6, 2018, AM1 Session**

Attendance: 7 people (Volker, Sang-Kyu, Xu Wang, John Li, Chong Han, etc.)

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order. While he gave his presentation, the Vice Chair, Sang-kyu Lim (ETRI) acted as the Chair.

1. Volker is going to construct the PHY header towards a previously discussed unified format.

C: It is not clear the order line coding -> channel coding -> line coding (parity check) will achieve lower error rate compared to channel coding -> line coding. Since RS is symbol-based correction, a bit error in the line encoded symbol will result one or more bit errors in the decoded symbol, however they are still within the same symbol. The RS decoding capability is not affected. Therefore having RS decoding before line coding decoding will not achieve better error rate.

A: Volker will send the literature reference what this is based on to the email reflector. Should be discussed again in May meeting.

C: Explain more wqhy scrambling is needed.

A: As said previously, scrambling is suggested in the coordinated topology. The srambling sequence should be configurable by the higher layer.

C: Even it is configurable, e.g., from a set of sequences, the set should still be defined.

A: Scrambling sequence should be short, e.g., a short Gold sequence.

C: If the spatial pre-coder is only used in the MIMO especially only in the coordinated topology. It should be labeled as optional only for MIMO.

A: But in star topology MIMO can be used as well and there is no need for scrambling. It is more related to coordinated topology.

C: Also the MIMO should be It should be configurable for one, two, four transmitters etc.

A: Agreed but set by higher layers (i.e. MAC) Just the channel estimation sequences and MCS per stream are defined in the PHY.

C: RS(256,248) should be labled as RS(255,248) because for the symbol width of 8 bit is used, the maximum codeword length is 255. The additional octet in the end works as a padding but won't help decode errors.

A: We can look at it and change it if necessAry, one thing to point out is that we are using 10-bit symbol width due to doing 8B10B before RS and the actually codeword length is much greater than 255, e.g., >500.

C: Then RS(256,248) is a shortened code using 10-bit symbol width.

A: Probably yes, needs to be confirmed by an expert.

C: Line decoding has a coding gain when bit errors cause invalid encoded input the decoder tries to decode based on the closed valid input. By having line coding outside the channel coding (line coding before channel coding) you loose the coding gain.

A: Volker will send the group the reference regarding the order of line coding and channel coding. The configuration having te lowest erroir rate has already been selected.

Q: DC reduced HCM is implemented by measuring the DC component online?

A: Xu will check this.

Q: It is preferred to have the code length configurable for different SNR.

A: It preferable to have a preferred HCM code length as default.

C: Table 6 should not be in the text as it is descriptive for HCM.

A: The table will be removed from the text and for next revision added to Annex.

Q: What is the lowest clock rate acceptable for HCM in order to maintain a lowest data rate greater than 1 Mbps considering the data rate reduction by using HCM code?

A: Will check that. We don't want to lose the flexibility of various clock rate for coarse data rate reduction.

Volker invites other committee members to co-author the PM PHY proposal after review. The intention is and was always to find consensus on new PHY that replaces PHY II from 15.7. Volker has most interest in getting this work done. His own interest is including efficient support for multiuser MIMO as suggested by several committee members after his presentation regarding the MAC layer for coordinated topology in Orlando. Volker is happy to integrate contributions and cover the interests of others. Discussion will be continued using the email distributor.

1. The committee discussed the deadline for submitting comments and evaluation and proposals. According to the minute of last meeting, the deadline is April 20th. It is requested and agreed by the committee to postpone the deadline for evaluation results to April 27th.
2. The committee continues to discuss and agree upon the framework of evaluation of PM PHY.

1) **Preamble:** Detection probability (for false alarm rate = 0.1%) vs. SNR (cf. doc. 15-18-0106/r0) and required SNR where prob. of misdetection (timing error) <0.1%

2) **Header:** BER vs. SNR for the header incl. 8B10B and RS(36,24) coding assuming random data for the header information

3) **Payload:** BER vs. SNR for the payload incl. 8B10B or HCM and RS(255,248) coding assuming random data for the payload

Results are expected for AWGN, D3 in scenario 3 and D7 in scenario 4 (Fig. 25) where LED1-6 are used together from <https://mentor.ieee.org/802.15/dcn/15/15-15-0746-01-007a-tg7r1-channel-model-document-for-high-rate-pd-communications.pdf>. CIRs: <https://mentor.ieee.org/802.15/dcn/15/15-15-0747-00-007a-tg7r1-cirs-channel-model-document-for-high-rate-pd-communications.zip> a companion file. In case of questions, please, use TG13 email reflector.

The meeting recessed until AM2.

**Tuesday, March 6, 2018, AM2 Session**

Attendance: 9 people (Volker, Sang-Kyu, Xu Wang, John Li, Chong Han etc)

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

21. The committee decide to request 10 session slots in meeting in May 2018.

22. The committee suggests pureLiFi to submit their proposal of LB-OFDM PHY following the skeleton in chapter 11 in draft D2.

23. The editor suggests the new proposals should focus on the technical details while putting the text aside. Once the technical part agreed upon, the text is minimal additional work.

24. The committee discuss the future priorities between more specific PHYs and a unified MAC that works with all PHYs.

25. Volker suggests that the deadline for proposals and evaluations be set e.g., April 27 for PM PHYs. For HB-OFDM PHY a deadline after the meeting in May is requested.

No agreement has been made until now for submission deadline of LB- and HB-OFDM PHY.

The committee discussed the again the framework of the evaluation.

Q: What is the evaluation is not successful for the proposed scheme?

A: Comment: The proposer can adjust the scheme as they see fit.

26. John Li presents the plan of processing of the proposals.

27. The committee starts resolution of the comments against draft D2.

The meeting recessed until Wednesday PM1.

**Wednesday, March 7, 2018, PM1 Session**

Attendance: 10 people (Volker, Sang-Kyu, Xu Wang, John Li, Chong Han etc)

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

28. The Chair starts the discussion on OFDM PHYs submission deadline. The original deadline to submit proposal is April 20th. Volker proposes to postpone this deadline substantially.

- PureLifFi will submit LB-OFDM PHY until April 27th. Maybe there is also some contribution also to HB-OFDM PHY.

- Volker proposes to further postpone the deadline for HB-OFDM PHY to July 1st.

In the next meeting in May, LB-OFDM PHY will be discussed to be added to the next draft. In the July meeting, HB-OFDM PHY will be discussed. The suggestion is agreed by the committee.

29. The Chair starts the discussion regarding the MAC sublayer specification update. The MAC sublayer of IEEE 802.15.4 (2006) was copied to IEEE 802.15.7. There were discussions if this was the final standard or kind of a draft. There is a new specification IEEE 802.15.4 (2015). According to comments from the WG, the new specification should be used to update IEEE P802.15.7m before it is published. IEEE P802.15.13 also shares most of the MAC with IEEE P802.15.7m. Both are a legacy of 802.15.7. There are several options.

1. TG13 and TG7m jointly handle the update.
2. TG13 should wait till TG7m to resolve the comments.
3. Proposed: The joint discussion between TG13 and TG7m should be kept offline.

The group selected option c)

30. The Technical Editor resumes resolution of the comments against D2

- The polling mechanism related comments are not resolved instead are postponed for a proposal submitted by pureLiFi before next meeting.

- The PSDU size is proposed to be removed from primitive PD-DATA.request. It is suggested, PSDU transfer is an implementation issue and can be handled separately from PD-DATA.request. It can be handled for instance by chip vendor. The agreement is to keep the PSDU in the primitive (comment rejected), since this method of pass PSDU from MAC to PHY is effective and should limit implementer to do it in their own way.

1. The Technical Editor suggests the task group agree on the frame type and sub-frame type before editing the text on the MAC.

It was proposed to decide about a procedure after agreeing on the MAC frame type (which has received certain level of agreement) to adding the MAC frame type from Annex (with agreed modification) to replace the TBD text.

The session recessed until PM2.

**Wednesday, March 7, 2018, PM2 Session**

Attendance: 6 people (Volker, Sang-Kyu, Xu Wang, John Li, Chong Han, Tuncer etc)

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

32. The Chair suggests, although the agenda is likely to be finished by this session, the three sessions on Thursday will remain open for work on the draft and further discussions on the way forward on the MAC.

33. The Technical Editor suggests two methods moving forward regarding MAC frame format by studying the latest version of IEEE 802.15.4 or using general MAC structure of IEEE 802.11. The Technical Editor suggests a presentation is uploaded by himself before the meeting in May explaining the IEEE 802.15.4 MAC, which was welcomed by the group.

34. The Chair explains the different topologies introduced by IEEE P802.15.13 to the original IEEE P802.15.7 that justify the TG13 to make a new standards, which is coordinated topology and heterogeneous OWC/RF and relay network functionalities.

35. Tuncer suggests a proposal regarding association process, capacity through relay nodes, will be made before meeting in May.

36. The Technical Editor resumes and finishes the comment resolution for comments against D2 both for technical and editorial comments, uploaded in doc. 15-18/0084r1 on Mentor.

37. Chair suggests work on MAC discussing the MAC principle and time line during the meetings tomorrow.

The session recessed until Thursday AM2.

**Thursday, March 8, 2018, AM2 Session**

Attendance: 8 people ((Volker, Sang-Kyu, Xu Wang, John Li, Chong Han, Tuncer etc)

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

38. The Chair leads the discussion of suggested timeline for SPEC generation.

It was suggested that PHY proposals that have been submitted can be commented against before the discussion in the meeting via submitting a comment table to the Mentor. The submitter may respond to the comment table also via the Mentor. If there is anything left to discuss, this can be discussed in the meeting. This way, submissions can be processed and improved faster and discussion is maintained open also between the meetings.

39. Chair leads the discussion on the tentative agenda for meeting in May.

40. John Li gives a presentation and leads a discussion on the MAC. He suggested review a suitable version of IEEE 802.15.4 and develop the MAC for IEEE P802.15.13 based on that. When a such suggested version is made by the expert of the WG, the review can start before the meeting in May. Proposals can be made based on the discussion in May.

41. The committee looks at the different versions of IEEE 802.15.4 2006, 2011, 2015. The committee agree that a suggestion is needed from the Working Group.

The session is recessed until PM1.

**Thursday, March 8, 2018, PM1 Session**

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

42. This session was used by committee members to review the draft and work on their contributions.

The meeting recessed until PM2.

**Thursday, March 8, 2018, PM2 Session**

The Chair, Volker Jungnickel (Fraunhofer HHI) calls the meeting to order.

43. This session was used by committee members to review the draft and work on their contributions.

The meeting adjourned until May in Warsaw.