**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | IEEE802.15.13 Meeting Minutes |
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| Abstract | [Minutes of January 2018 Session]  |
| Purpose | [Description of what the author wants P802.15 to do with the information in the document.] |
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**Task group 802.15.13 met for 9 meetings during the January 2018 Interim Session in Irvine, CA.**

**Meeting #1, Monday AM 2 (10:30 – 12:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

Self-Introduction within the group.

Chair introduced document 17r0

* Approval of the November minutes: unanimous
* Chair introduced time slot assignment for this week
* Chair introduced the planned activities of the week
* Chair introduced the agenda of the week. The agenda was approved

Chair introduced the comments submitted to 15.7m letter ballot, especially the comment from 15.13 on PHY II, III of 15.7m.

* Chair suggest to have some joint session with 15.7m
* There were suggestions to join the 15.7m session right now as 15.7m would start from the comments submitted from 15.13
* The group decided to recess after the agenda was approved

The meeting was recessed until PM1 to allow group members to join 15.7m comment resolution.

**Meeting #2, Monday PM1 (13:30 – 15:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

Nikola Serafimovski (pureLifi) made a motion to include his comments that were submitted after the deadline to the email reflector of TG13 into the overall list and resolve them after the other comments submitted so far during this meeting. The motion was approved with unanimous consent.

The Chair reviewed doc. 15-18/0002r0 on the “ETRI’s Proposals for Pulsed Modulation PHY” as Sang-kyu Lim (ETRI) asked him before the meeting to present it. There were some comments from committee members that this is rather difficult situation because the required Q&A can only be very limited. Proposers should be available at the meeting in the future.

* A discussion was held on the document.
* The committee suggested that the Preamble should only be used as a synchronization sequence and not carry any topology information.
* Topology information is clearly needed, but it should be treated as a separate field in either the PHY or MAC headers, which is to be discussed.
* The length of the Preamble was discussed and it is unclear what is the requirement for the wide range of short to very long preamble sequences. This was obviously taken over from 15.7 and needs clarification. What is the rationale behind the 15.7 preamble design?
* Burst mode was discussed and it may be useful to reduce the overhead but is not clear what benefit it brings at this early stage of discussion.
* The PHY Header proposal was discussed and there was a discussion about the use of the same clock for preamble, header and data. This is considered the natural approach and was not put into question by the participants.
* A Header Check Sequence (HCS) should be left as proposed.
* The committee discussed the various data rates available for the Pulsed Modulation PHY modes and in particular the possibility to extend the optical clock rate to 100 MHz.
* The committee discussed the possible use of RS codes and scrambler/interleaver.
* It was commented that scrambling maybe useful in the coordinated topology to randomize data sent in other parts of the coverage area which could act as interference for a given link.

The meeting was recessed until Tuesday AM1.

**Meeting #3, Tuesday AM1 (08:00 – 10:00)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

The committed discussed the comments submitted against the Draft1 document (**doc. 15-18/0001r0**). Resolutions are contained in a revised documents **doc. 15-18/0001rx** uploaded onto Mentor.

* The committee was discussing what the purpose of the nonbeacon-enabled OWPAN is in the text. It was explained that this was is an optional mode
* For a non-beacon-enabled network, there is no superframe structure and it could be a suitable place to introduce the polling-algorithm proposed by pureLiFi.
* The committee discussed the comments on the removal of the “indirect transmission” from the text. There was a suggestion that the mode can be useful for certain scenarios, therefore it should be maintained but the committee should rather investigate the integration of a “direct transmission” method in the MAC.
	+ This is effectively addressed in the Contention-Free Period.
* There was a discussion on the need to keep the GTS deallocation mechanism that automatically defragments the contention free period to provide a contiguous allocation of resources.
	+ The argument for keeping it is that it saves energy from a coordinator perspective by ensuring transmission when the coordinator is turned on as well as saving signaling for allocation/deallocation of different users.
	+ The argument for removing it is that it might make it more difficult to create a scheduling system where the resources blocks (GTS) from overlapping coordinators are positioned to be orthogonal to each other to minimize interference.
* There was a discussion on the need for the “Inactive” period of the super-frame.
	+ It is not clear what the advantage of having an “inactive” part in the super frame is.

The meeting was recessed until AM2.

**Meeting #4, Tuesday AM2 (10:30 – 12:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

The first part of the meeting was spent for a joint session with 802.15.7r1 and the WG chair to discuss the comments pertaining to the deprecation of the PHY II and PHY III from the 802.15.7r1 Draft 1. For this part, see the meeting minutes of TG7m.

The committed further discussed the comments submitted against the Draft1 document (**doc. 15-18/0001r0**). Resolutions are contained in a revised documents **doc. 15-18/0001rx** uploaded onto Mentor.

* Nikola Serafimofski (pureLiFi) is requested to provide a response to Comments 27 and 28 for the next meeting. These comments will be kept for future comment resolution by the Technical Editor.

The meeting was recessed until PM2.

**Meeting #5, Tuesday PM1 (13:30 – 15:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

The committee discussed that it would need 10 slots for the next meeting in March 2018.

The committed further discussed the comments submitted against the Draft1 document (**doc. 15-18/0001r0**). Resolutions are contained in a revised documents **doc. 15-18/0001rx** uploaded onto Mentor.

The meeting was recessed until Wednesday PM1.

**Meeting #6, Wednesday PM1 (13:30 – 15:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

The committee discussed **doc. 15-18/0003r1**. Particular discussions focused on the definition of the fixed duration for the cyclic prefix and the general numerology in Table 1.

The committed further discussed the comments submitted against the Draft1 document (**doc. 15-18/0001r1**). Resolutions are contained in a revised documents **doc. 15-18/0001rx** uploaded onto Mentor.

* There was a discussion on how the clock rate is recovered and if there should be a different clock rate between the preamble, header and payload.

The committee also discussed the need for an ad-hoc meeting to consolidate the different PHY proposals. This ad-hoc could be hosted by Fraunhofer HHI before the May 2018 Meeting in Warsaw.

The meeting recessed until Wednesday PM2

**Meeting #7, Wednesday PM2 (16:00 – 18:00)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

Volker introduced doc. 15-18/0003r01 “text proposal for pulsed modulation PHY”

* Question was why the time duration is fixed and whether it is fixed for all PHY types
* Volker replied that the time duration will be consistent with that of high bandwidth PHY, but may not be with low bandwidth PHY
* Suggestion was raised to unify among all PHY types.
* Why is there a need to fix the time of T-seq and T-CP?
* Volker explained how the proposal suggests to divide the PHY data stream into blocks and each block is extended by a CP.
* Questions were raised on why frequency-domain equalization is needed for PM-PHY
* Volker explained for low bandwidth operation, time domain processing works fine, even without any equalization, while for high-bandwidth operation, depending on the optical frontend design, frequency-domain equalization provides a good trade-off between complexity and performance.

The meeting was recessed until Thursday AM2.

**Meeting #8, Thursday AM2 (10:20 – 12:30)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

The Chair discussed the agenda for the Irvine session again and suggested to first finish all other discussion before further discussing the PM PHY. This was agreed in the committee.

First topic was a joint workshop with ITU-T Q18/SG15 G.vlc which will be held on February 7, 2018 in Geneva. Two task group members could arrange to be at this meeting.

First the chair introduced the main objectives of the joint meeting.

* + both groups prepare similar technologies having similar timelines
	+ IEEE 802.15.13 has more Li-Fi experts
	+ ITU-T Q18/SG15 has more chipset vendors
	+ IEEE 802.15.13 discusses HB-PHY according to G.hn recommendation.
	+ Letters of assurance need to be requested

It was discussed that the difference between the two standards is also on the MAC layer rather than only the PHY. The use of the HB PHY from G.hn in 802.15.13 is still seen controversial by some committee members. It was suggested to decide this at a later point in time.

The Chair argued that it will be very difficult, if not impossible, to get chipsets makers on board that will implement the IEEE 802.15.13 standard that achieves the Multi-Gb/s objective in the PAR. Keeping the same PHY is necessary to get any such support in the short time window.

It was further discussed that the HB PHY should be operated under 802.15.13 MAC and asked how this can be made possible. Volker replied that the data pipeline in the PHY is typically implemented as a hardware accelerator to achieve high bandwidth while all MAC layer processing is basically software that can be modified to support the 802.15.13 MAC.

A committee member argued that this architecture can be considered as de-facto industry standard applicable for many broadband communication chipset implementations available today. Volker added that one way to keep implementation effort low is to keep only a few frame types used in G.hn for 802.15.13.

To consider this approach further, integration of G.hn PHY with 802.15 MAC needs technical support from ITU-T Q18/SG15 members. It was discussed what questions to be asked to ITU-T.

Following questions have been agreed among TG13 members.

* + What PHYs are being used in G.vlc?
	+ How to resolve coexistence issues between different PHYs?
	+ Under what conditions G.hn PHY can be integrated into the 802.15.13 MAC?

Next topic was to discuss what will be presented in Geneva. TG13 cannot be formally represented as this needs confirmation from WG, 802 and IEEE, the effort for which is considered unnecessary. Accordingly, Nikola and Volker will attend the joint meeting and present a joint contribution from TG13 members. It will present scope, status and timeline of TG13. Moreover, an introduction into PHY and MAC architecture will be given. Finally, possible forms of cooperation shall be discussed, how it can be organized and what benefits are expected.

There was a quick discussion on the general scope of the planned presentation to the ITU-T. Following points were identified.

* + Introduction to the 802.15.13 history/group
	+ Scope of the project and intended use-cases
	+ Structure of the draft
		- Major decision that it is based on the 802.15.7r1 with major changes
		- Introduction of the PHYs and MAC
	+ Questions from the group to the ITU-T
	+ Questions from the ITU-T to the group

For preparing the joint presentation, the following timeline has been agreed upon

* First ToC until Jan. 22 submitted to TG13 reflector by Volker
* Feedback on ToC from committee members until Jan. 24 also via the email reflector
* Based on ToC, Volker will provide a first draft Jan. 28 to the TG13 reflector
* Reviews/comments shall be sent to the reflector due until Jan. 31
* Final draft of the presentation is made available on Jan. 4
* Contributors who will support the joint presentation shall provide clearance until Feb. 6

Next topic was TG13 Call for Proposals on OFDM-based PHYs. A draft was prepared by the Chair and discussed in the committee. The proposals should be in a consistent form with specific proposals for smaller steps (clauses) that can be accepted/rejected one-by-one.

The following text was agreed upon:

“TG13 requests revised proposals for OFDM-based PHYs, in the agreed-upon writing style

PPDU format, Preamble (Synchronization sequence, Channel estimation sequences), Header content, Header check sequence, Channel coding for the header, Channel coding for data with variable code rate, Scrambler, Interleaver

Proposals shall be submitted until April 20 and will be discussed at the next interim meeting in Warsaw. Proposals can be submitted as slides or text being accompanied by a slide set.”

Next topic was to discuss the major points on the Agenda for the March 2018 meeting in Rosemont. Following points have been agreed upon.

* D2 will be prepared until February 3, 2018 and made available by the Technical Editor
* Comments are expected until April 22
* 10 sessions have been requested from WG Chair
* Should be not on Tuesday because LC comments on PAR will come in
* Resolve first comments against D2
* Look at evaluation results for PM-PHY
* Present initial proposals for OFDM PHY
* It was agreed to have teleconferences with 10 day notice if required.

Last topic was update of timelines. The revised timeline is contained in doc. 15-17-0288/r2.

**Meeting #9, Thursday PM1 (16:00 – 18:00)**

Attendees:

* Volker Jungnickel (Fraunhofer HHI)
* Li Qiang (Huawei)
* Mohamed Abdullah (HBQ)
* Mohammad Noshad (VLNComm)
* Ryan Mennecke (JHU-APL)
* Nikola Serafimovski (pureLiFi)
* Around 15 members from other task groups in 802.15 WG.

The meeting was called to order by the Chair Volker Jungnickel (Fraunhofer HHI).

Last major topic on the agenda was to finish technical discussion of the PM PHY. Volker further introduced doc. 15-18/0003r01 “text proposal for pulsed modulation PHY”. However, presentation with Q&A could only be conducted until clause 1.2.2.3.1. in doc. 15-18/0003r01.

However, after hearing further parts of the contribution, the Technical Editor felt uncomfortable with the situation that full text has been provided, that already looks like a specification, although this was explicitly asked for by the Technical Editor and the reason for issuing the Call for text proposals during the last meeting.

The Technical Editor suggested reorganizing this process in the future as he has made other experience from his previous work in 3GPP. None of the other committee members have ever attended 3GPP meetings, and the Technical Editor thus explained the methodology used there.

The Chair notified the Technical Editor that changing the process now will significantly delay the delivery of the draft. It was, however, decided by the committee to follow the approach suggested by the Technical Editor and postpone any discussion until committee members have reviewed the proposed text in all its details. Q&A will be done via the email reflector of TG13 and finished before the March meeting.

Back to the methodology used in 3GPP as explained by the Technical Editor. When a new PHY is being build, 3GPP first agrees on a so-called skeleton which is a table containing the main fields in the PPDU and how it is suggested to be filled in by the proposer. As nobody else was familiar with this methodology, it was decided that the Technical editor creates an example of such a table together with the committee members and that future proposals will be accompanied by such table. The result is contained in doc. 15-18-XXXXr0.

Finally it was shortly discussed to accompany proposals with simulation results, mainly to enable justification for the link parameters used by the proposer. The following evaluation framework has been agreed upon.

“TG13 requests full or partial evaluation results for the PM-PHY. Major objective is to fix parameters and see the overall performance over realistic channel conditions

Use of simplified or TG7r1 channel models is recommended

<https://mentor.ieee.org/802.15/dcn/15/15-15-0746-01-007a-tg7r1-channel-model-document-for-high-rate-pd-communications.pdf>

Evaluation results shall be submitted together with the Proposals until April 20.

The Chair asked if there is any other business which was not the case.

The meeting has been adjourned until March in Rosemont.