IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGbb Task Group on Light Communications  September, 2019 Hanoi Minutes | | | | |
| Date: 2018-09-19 | | | | |
| Author: | | | | |
| Name | Affiliation | Address | Phone | Email |
| Sang-Kyu Lim | ETRI |  |  | [sklim@etri.re.kr](mailto:sklim@etri.re.kr) |
| Matthias Wendt | Signify |  |  | [matthias.wendt@signify.com](mailto:matthias.wendt@signify.com) |
| Nikola Serafimovski | pureLiFi |  |  | [nikola.serafimovski@purelifi.com](mailto:nikola.serafimovski@purelifi.com) |
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Abstract

This document contains the Task Group on Light Communications (TGbb) meeting minutes from the IEEE 802.11 Hanoi meeting, September 2019.

**IEEE 802.11 Task Group TGbb**

**Monday, September 16, 2019, AM2 Session**

Attendance: around 30 people.

1. The IEEE 802.11 TGbb meeting was called to order at by the Chair, Nikola Serafimovski (pureLiFi). Sang-Kyu Lim (ETRI) as a temporary Secretary recorded the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines and attendance recording procedures.
   * It is reminded all to record their attendance.
2. The Chair introduced the overall agenda in doc. 11-19/1413r1 for the week. Volker requested to change some of schedule because he has not uploaded his contribution. The Chair will upload the updated agenda document 11-19/1413r2 after the session.

* Submissions to be discussed for the week
  + Draft D0.1 ToC
  + Evaluation Framework document
  + Hear PHY proposals
  + Hear MAC proposals
  + Conference call schedule
  + Timeline
* Submissions to be discussed on Monday
  + Approve the agenda
  + Approve the minutes from July
  + Approve the minutes from the teleconference calls
  + Draft D0.1 ToC
  + Evaluation Framework document
  + Hear PHY proposals

1. **TGbb Motion** to approve the agenda for the week in document 11-19/1413r2.

**Approve the proposed agenda in doc. 11-19/1413r2 for the week**

**Move: Harry Bims**

**Second: Tuncer Baykas**

**It was approved with unanimous consent.**

1. **TGbb Motion** to approve the teleconference minutes.

**Approve the minutes, doc. 11-19/1567r0, from the teleconference meetings held between the July 2019 session and the Sept. 2019 session**

**Move: Tuncer Baykas**

**Second: Evgeny Khorov**

**Motion passed with unanimous consent.**

1. **TGbb Motion** to approve the July Plenary meeting minutes.

**Approve the minutes from the July 2019 session in doc. 11-19/1343r0**

**Move: Matthias Wendt**

**Second: Evgeny Khorov**

**Motion passed with unanimous consent.**

1. After the motions to approve the teleconference minutes and July meeting minutes, Lennert pointed out that his affiliation recorded on the first page of the teleconference minutes, doc. 11-19/1567r0, was wrong. So, the teleconference minutes will be changed and uploaded again.
2. Volker Jungnickel (Fraunhofer HHI) presented doc. 11-19/1475r0 as Proposed ToC of PHY text for D0.1.
3. In this presentation, Volker mentioned that he is an expert on PHY but he is not an expert on MAC, so TGbb may need another Technical Editor for MAC. Volker gave some background on ITU-T and IEEE issue. The group discussed the issues about the timeline for D0, the structure of D0, the new description for adaptive bit-loading in terms of how to implement and integrate it, and the terminology on MCS. As examples, the structures of IEEE 802.11 standards were introduced by Nikola.
4. So, Nikola Serafimovski (pureLiFi) suggested that it would be better if Volker Jungnickel (Fraunhofer HHI) could propose the updated ToC tomorrow based on the feedback to be discussed tomorrow at the Technical Editors meeting feedback.
5. Nikola presented the Framework document, doc. 11-19/1000r2, and briefly introduced some changes and new text updated from doc. 11-19/1000r2.
6. **TGbb Motion** to include the Evaluation Methodology for the MAC.

**Instruct the Technical Editor to include the content of doc. 11-19/1000r2 into the Evaluation Methodology document (11-19/0187r4) and create a new version of the Evaluation Methodology document**

**Move: Nikola Serafimovski**

**Second: Harry Bims**

**Y (9) / N (0) / A (7)**

1. Nikola presented doc. 11-19/1625r0 as Proposed common-mode mandatory PHY.
2. Nikola mentioned that LC base-band interface circuit introduced on slide #3 in this presentation is a trivial circuitry and the circuit can be implemented through the RFIC technology if there is a very minor change to the circuit.
3. Nikola also showed the video clip on the experimental demonstration in this presentation. According to the video clip, the data rate was 400Mbit/s and the working was stopped when an obstacle covered the optical wireless channel.
4. It was asked what the difference between the responses showed on slide #6 and #8 is, and Nikola answered that the response showed on slide #8 was measured by University of Edinburgh.
5. It was discussed that TGbb doesn’t have a mandatory PHY on July meeting, and Nikola answered that this is a proposal.
6. In the discussion on slide #9 of the presentation, one person wanted to mainly focus on the industrial use case and hospital use case as the first use case for TGbb, but Nikola said he didn’t think so. Nikola mentioned that Li-Fi is used when LoS channel is good and Wi-Fi is used when LoS channel is not good. The group also discussed the differences of NLoS performance between Enterprise-Conference Room and Residential.
7. Three criteria to determine which wavelength should be chosen was explained in this presentation, and the group discussed the detector responsivity and why the common-mode mandatory wavelength is needed, but the group decided to continue the discussion on PM1 session.
8. The meeting recessed.

**Monday, September 16, 2019, PM1 Session**

Attendance: around 20 people.

1. 13:30 The Chair, Nikola Serafimovski (pureLiFi), called the meeting to order and asked for attendance check. Sang-Kyu Lim (ETRI) as a temporary Secretary recorded the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines.
2. The Chair introduced the overall agenda for the week again, and then some of schedule was changed from 11-19/1413r2. The Chair will upload the updated agenda document 11-19/1413r3 after the session.

* Submissions to be discussed on Monday session
  + Approve the agenda
  + Approve the minutes from July
  + Approve the minutes from the teleconference calls
  + Draft D0.1 ToC
  + Evaluation Framework document
  + Specification Framework document
  + Hear PHY proposals (doc. 11-19/165r0)

1. **TGbb Motion** to approve the agenda for the week in document 11-19/1413r3.

**Approve the proposed agenda in doc. 11-19/1413r3 for the week**

**Move: Matthias Wendt**

**Second: Volker Jungnikel**

**It was approved with unanimous consent.**

1. Nikola Serafimovski (pureLiFi) continued to presented doc. 11-19/1625r1 on Common-mode mandatory PHY.
2. During this presentation and discussion, Tuncer Baykas (Vestel) took over the role as Chair to allow Nikola Serafimovski to contribute to the technical discussion.
3. There was so much discussion on why TGbb needs the common-mode mandatory wavelength range and what the reasonable range for the common-mode mandatory wavelength is in terms of how to implement the system efficiently.
4. In this discussion, Nikola especially addressed the WDM (Wavelength Division Multiplexing) technologies for future use, but the WDM issue was excluded from the main discussion because it need the expensive optical filtering for the real implementation and is also an another issue. Some of physics for understanding the Silicon detector responsivity were also discussed to justify the detector responsivity curves.
5. As a result of the discussion, the common-mode mandatory wavelength range for Straw Poll was changed to 800nm-1,000nm from 900nm-950nm.
6. Straw Poll: Should TGbb make 800nm – 1000nm the common-mode mandatory wavelength for all TGbb STAs in doc. 11-19/1625r2 ?

Y (7) / N (0) / A (11)

1. After the Straw Poll for the common-mode mandatory wavelength, Nikola continued to present the simulation set-up and the simulation results. Volker gave a comment in terms of LED driver and the efficiency, and another person commented in terms of battery power limit which should also be considered.
2. TGbb will continue to discuss on the common-mode mandatory wavelength issue on Tuesday PM2 sessions.
3. The meeting recessed.

**Tuesday, September 17, 2019, PM1 Session**

Attendance: around 25 people.

1. The IEEE 802.11 TGbb meeting was called to order at by the Chair, Nikola Serafimovski (pureLiFi). Sang-Kyu Lim (ETRI) as a temporary Secretary recorded the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines and attendance recording procedures.
   * It is reminded all to record their attendance.
2. The Chair introduced the overall agenda in doc. 11-19/1413r3 for the week. The group had a short discussion about the timeline schedule for today and the overall timeline in doc. 11-18/1290r3 because it says the schedule of ToC for D0.1. The Chair will upload the updated agenda document 11-19/1413r4 after the session.

* Submissions to be discussed on Tuesday PM1
  + Draft D0.1 ToC
  + Hear PHY proposals
    - Doc. 11-19/1647r0
    - Doc. 11-19/1566r2

1. **TGbb Motion** to approve the agenda for the week in document 11-19/1413r4.

**Approve the proposed agenda in doc. 11-19/1413r4 for the week**

**Move: Matthias Wendt**

**Second: Athanasios Stavridis**

**It was approved with unanimous consent.**

1. The group discussed the issue on ToC for D0.1 in terms of how many clauses for PHY and MAC, how to implement the initial draft and how to handle it. As an example, the Technical Editor, mentioned that it may have two or three clauses which means one clause for MAC, one clause for PHY, and one clause for something in one document. The Chair asked the Technical Editor how he wants to handle it and whether he wants some straw poll for the draft ToC now or not. Consequently, the group decided to discuss the draft ToC for D0.1 on Thursday PM2 session.
2. Volker presented doc. 11-19/1647r0 and doc. 11-19/1566r2 as Overview of proposed LC-optimized PHY. As a summary of new features of the proposed LC-optimized PHY for TGbb, the issues on How 802.11 RF PHYs work, Why adaptive bit-loading, Why distributed MIMO, How LC-optimized PHY supports distributed MIMO, Why higher bandwidth, How LC-optimized PHY enables higher bandwidth, Why implementation is so easy, and Integration with 11ax were presented in this contribution.
3. After the presentation on doc. 11-19/1647r0 and doc. 11-19/1566r2, the group had some discussion about Block Error Rate shown in doc. 11-19/1566r2 and Packet Error Rate issue for clarification, what Pre-FEC and Post-FEC shown in doc. 11-19/1566r2 mean, and the issue on how to integrate the functional blocks in terms of baseband, RFIC, and power amplifier. Volker also showed the video clip on the experimental demonstration for industrial use case applying optical MIMO.
4. Straw Poll: The proposed LC-optimized PHY will support

- Adaptive bit loading

- Distributed MIMO

- Bandwidth up to 1 GHz

- Easy implementation

- Integration with 11ax

LC-optimized PHY is to be considered as one mode of operation in TGbb.

Y (9) / N (0) / A (8)

1. The meeting recessed.

**Tuesday, September 17, 2019, PM2 Session**

Attendance: around 40 people.

1. The Chair, Nikola Serafimovski (pureLiFi), called the meeting to order and asked for attendance check. Sang-Kyu Lim (ETRI) as a temporary Secretary recorded the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines.
2. The Chair introduced the agenda in doc. 11-19/1413r4 for PM2 session.

* Submissions to be discussed on PM2 session
  + Channel Flatness test
    - 30min – Doc. 11-19/1639r0
  + Hear PHY proposals
    - 40min – Doc. 11-19/1647r0
    - 40min – Doc. 11-19/1625r3

1. During this session, Tuncer Baykas (Vestel) took over the role as Chair to allow Nikola Serafimovski to contribute to the technical discussion.
2. Ardimas Purwita (University of Edinburgh) presented doc. 11-19/1639r0 as Spectral Flatness Test of the TGbb’s Reference Channel Models with HE Waveform. The background, the clarification of flatness, the spectral flatness measurement in 802.11ax (D3.0), the system model, and the results were given in this presentation. Ardimas Purwita mentioned that there was wrong caption on slide #11 and the black area means active subcarriers on slide #11. The group had some discussion about the center frequency, the spectral flatness deviations around 8dB specified in 802.11ax (D3.0), the need to double-check the CIR and confirm the channel model derived by ray tracing, and further studies to quantify the gain of the adaptive bit loading in flat and non-flat cases.
3. Again, Nikola presented doc. 11-19/1625r3 as Proposed common-mode mandatory PHY and showed the video clip on the experimental demonstration. The group decided to delay two motions in doc. 11-19/1625r3 for some time because people needed some time for their decision.
4. So, as an unbiased process, Volker also presented again doc. 11-19/1647r1 including doc. 11-19/1566r2 and showed the video clip on the experimental demonstration for industrial use case applying optical MIMO. In the discussion after his presentation, Volker mentioned that the very good PHY and 802.11 MAC supporting mobility and hand-over already exist, and so he really want the experts to implement good working system.
5. The group came back to the motions in doc. 11-19/1625r3.
6. **TGbb Motion** to adopt the 800nm – 1000nm wavelength spectrum as the mandatory, common mode wavelength for all TGbb STAs.

**Moved: Nikola Serafimovski**

**Seconded: Lennert Bober**

**Result (Y / N / A): 23 / 0 / 3**

**The motion was passed by a 100% majority rule.**

1. The group had some discussion about the unfair aspect between the mandatory and the optional PHY modes, what is the mandatory, what is optional, and what we need to clarify the optional again. So, consequently, the sentence for the second motion in doc. 11-19/1625r3 was changed from “Move to adopt the SISO, 20 MHz bandwidth 11ax PHY as a mandatory, common mode for all TGbb STAs and use other 11ax features or an LC-optimized PHY based on the ITU-T Rec. G.9991 as optional for all TGbb STAs” to “Move to adopt the SISO, 20 MHz bandwidth 11ax PHY as a mandatory, common mode for all TGbb STAs and, in addition, as optional use other 11ax features or an LC-optimized PHY based on the ITU-T Rec. G.9991 for all TGbb STAs”.
2. **TGbb Motion** to adopt the SISO, 20 MHz bandwidth 11ax PHY as a mandatory, common mode for all TGbb STAs and, in addition, as optional use other 11ax features or an LC-optimized PHY based on the ITU-T Rec. G.9991 for all TGbb STAs.

**Moved: Nikola Serafimovski**

**Seconded: Suhwook Kim**

**Result (Y / N / A): 17 / 0 / 8**

**The motion was passed by a 100% majority rule.**

1. The meeting recessed until Wednesday AM1.

**Wednesday, September 18, 2019, AM1 Session**

Attendance: around 26 people.

1. The IEEE 802.11 TGbb meeting is called to order by the Chair, Nikola Serafimovski (pureLiFi). Matthias Wendt (Signify) records the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines and attendance recording procedures.
   * It is reminded all to record their attendance.
2. The Chair introduced the overall agenda for the meeting as contained in doc. 11-19/1413r5.

* Submissions to be discussed on Wednesday AM1 session
  + Hear PHY proposals
  + Hear MAC proposals
    - Doc. 11-19/1612r1 – “Multi-Band Operation in LC and Hybrid LC/RF Networks”
    - Doc. 11-19/1666r0 – “MAC layer design for LC”
  + Timeline
    - Deadline for text proposals to be submitted
  + ITU-T liaison
    - Doc. 11-19/1663r0 – “ITU TSB Response to G.9991 Copyright Request”

1. The Chair runs a motion to approve the amended Agenda.

**Approve the proposed agenda in doc. 11-19/1413r5 for the week**

**Move: Matthias Wendt**

**Second: Suhwook Kim**

**It is approved with unanimous consent.**

1. Athanasios Stavridis (Ericsson) presents doc. 11-19/1612r1 “**Multi-Band Operation in LC and Hybrid LC/RF Networks**“

* Straw Poll:  
  **Should the 802.11bb amendment support multi-band operation between any band in the optical and sub-3 THz RF spectrum?**

**Y / N / A : 17 / 0 / 5**

* Motion:  
  **Instruct the editor to add the following sentence to the IEEE 802.11bb draft:**

“X.Y.Z Light Communication (LC) STA

The main MAC features in a 802.11bb STA are the following:

* + - * Mandatory support for fast session transfer (FST) in the multi-band capable devices supporting light and other sub-72 GHz RF bands“

**Move: Athanasios Stavridis**

**Second: Miquel Lopez**

* Motion to amend the motion:  
  new text  
  **Instruct the editor to add the following sentence to the IEEE 802.11bb draft:**

“4.Y.Z Light Communication (LC) STA

The main MAC features in a 802.11bb STA are the following:

* + - * Mandatory support for fast session transfer (FST) in the multi-band capable devices supporting light and other sub-72 GHz RF bands“

**Move: Athanasios Stavridis**

**Second: Guido Hiertz**

**Y / N / A : 14 / 1 / 4**

* Motion:  
  **Instruct the editor to add the following sentence to the IEEE 802.11bb draft:**

“4.Y.Z Light Communication (LC) STA

The main MAC features in a 802.11bb STA are the following:

* + - * Mandatory support for fast session transfer (FST) in the multi-band capable devices supporting light and other sub-72 GHz RF bands“

**Move: Athanasios Stavridis**

**Second: Miquel Lopez**

**Y / N / A : 3 / 7 / 8 Motion fails**

* Motion:  
  **Instruct the editor to add the following sentence to the IEEE 802.11bb draft:**

“4.Y.Z Light Communication (LC) STA

The main MAC features in a 802.11bb STA are the following:

* + - * Optional support for fast session transfer (FST) in the multi-band capable devices supporting light and other sub-300 GHz RF bands“

**Move: Andrew Myles**

**Second: Max Riegel**

**Y / N / A : 14 / 0 / 6 Motion passes**

1. Suhwook Kim (LG Electronics) presents doc. 11-19/1666r0 "**MAC layer design for LC**".

It contains a collection of prepared straw polls:

* Straw poll 1:  
  **Which option do you prefer for LC MAC?**
  1. - Option 1: LC MAC mandates EDCA and exclude HE MAC
  2. - Option 2: LC MAC mandates EDCA and support HE MAC optionally
  3. - Option 3: LC MAC mandates HE MAC

**Option 1 :**

**Option 2 : 2**

**Option 3 :**

**Abstain : 17**

* Straw poll 2:  
  **Do you agree that all management frames shall be transmitted by mandatory PHY?**

Y / N / A : 1 / 4 / 15

1. The group recessed until Thursday AM2.

**Thursday, September 19, 2019, AM2 Session**

Attendance: around 16 people.

1. The IEEE 802.11 TGbb meeting was called to order at by the Chair, Nikola Serafimovski (pureLiFi). Sang-Kyu Lim (ETRI) as a temporary Secretary recorded the minutes.

1. The Chair reviewed the IEEE-SA patent policy, logistics, and reminders, including meeting guidelines and attendance recording procedures.
   * It is reminded all to record their attendance.
2. The Chair introduced the overall agenda for the meeting as contained in doc. 11-19/1413r6. The Chair will upload the updated agenda document 11-19/1413r6 after the session.

* Submissions to be discussed on Thursday AM2 session
  + Timeline
    - Deadline for text proposals to be submitted
  + ITU-T liaison
    - Doc. 11-19/1663r0
  + Draft D0.1 ToC
  + Teleconferences
  + AOB

1. **TGbb Motion** to approve the agenda for the week in document 11-19/1413r6.

**Approve the proposed agenda in doc. 11-19/1413r6 for the week**

**Move: Volker Jungnickel**

**Second: Matthias Wendt**

**It was approved with unanimous consent.**

1. The Chair brought doc. 11-19/1663r1 to the screen, and the group briefly discussed the ITU-T liaison issue including some concerns and how to handle it. The concerns have been addressed by IEEE staff who have clarified that there is only a requirement to make a reference in specific sections of the draft text.
2. The group discussed how to implement the initial draft text and the schedule for it. The discussion was compressed into two approaches, and the group had a straw poll for two approached. A motion was run to instruct the Chair to only consider motions on text contributions to the TGbb draft that have been made available (uploaded to mentor) at least 7 calendar days before the start of the meeting.
3. Straw Poll:

Path forward for TGbb:

1. Create SFD and add initial text
2. Create D0.1 and only consider adding text that has been uploaded at least 7 calendar days before the start of the meeting

Op.1: 1

Op.2: 8

Abs.: 3

1. **TGbb Motion** to instruct the Chair to only consider motions on text contributions to the TGbb draft that have been made available (uploaded to mentor) at least 7 calendar days before the start of the meeting.

**Move: Volker Jungnickel**

**Second: Matthias Wendt**

**Y (6) / N (3) / A (3) : Motion passes**

1. The group discussed the overall timeline. The chair brought doc. 11-18/1290r3 to the screen and began to update it. The group checked where we are and whether the updated timeline is reasonable or not. Consequently, the doc. 11-18/1290r3 was updated to the doc. 11-18/1290r4, and the Chair runs a motion to approve the updated TGbb timeline presented in doc. 11-18/1290r4.

1. **TGbb Motion** to approve the updated TGbb timeline presented in doc. 11-18/1290r4.

**Move: Matthias Wendt**

**Second: Volker Jungnickel**

**It was approved with unanimous consent.**

1. The group discussed the issue on the draft ToC for D0.1. Technical Editor mentioned that he didn’t have enough time to prepare the draft D0.1. He also talked about some of unclear things for the draft ToC. As the result of the discussion, the initial draft ToC for D0.1 will be uploaded after the session.
2. The group discussed teleconference schedule between September and November, and the Chair runs a motion to approve the teleconference schedule.
3. **TGbb Motion** to approve the teleconference schedule as contained in document 11-19/1413r6.

**TGbb would like to request the following teleconference times:**

**09:30 AM EDT for 1h on 23 Oct.**

**Move: Athanasios Stavridis**

**Second: Lennert Bober**

**It was approved with unanimous consent.**

1. The meeting adjourned.