IEEE P802.11  
Wireless LANs

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| IEEE 802.11 Topic Interest Group on Light Communications  March, 2017 Vancouver Meeting Minutes | | | | |
| Date: 2017-03-16 | | | | |
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Abstract

Topic Interest Group on Light Communications meeting minutes from the IEEE 802.11 Vancouver meeting, March 2017.

**IEEE 802.11 Topic Interest Group on Light Communications**

**Monday, March 13, 2017, AM1 Session**

Attendance: around 25 people

1. The IEEE 802.11 LC TIG meeting was called to order at by the Chair, Nikola Serafimovski (pureLiFi).
2. Chair reviewed the IEEE-SA patent policy, logistics, and reminders on TIG rules, including meeting guidelines and attendance recording procedures.
   1. Chair asked if anyone has any questions about the IEEE-SA patent policy, logistics or reminders. No questions.
   2. Chair asked if there were any questions on any of the above items. None.
   3. It is reminded all to record their attendance.
3. Volker Jungnickel (HHI) was appointed Secretary
4. John Li (Huawei) was appointed as Technical Editor
5. Chair indicated there will be an additional time slot Tuesday PM1 in Vancouver to make progress. Agenda is approved by unanimous consent.
6. Rui Yang (Interdigital) presented <https://mentor.ieee.org/802.11/dcn/17/11-17-0427-00-00lc-draft-response-to-the-technical-feasibility-questions.docx>
   1. Volker Jungnickel (HHI) raised the question on should advanced filtering be considered to further reduce the PAPR
   2. Rui Yang (Interdigital) explains that SCM is only introduced as an example here, maybe more references could be added
   3. Li Qiang (Huawei) comments also other waveforms for optics like OOK and PPM, he will add them
   4. Agreed that revised text from the contribution is included in 17/0023/r4
7. Chair leads the discussion of the working document <https://mentor.ieee.org/802.11/dcn/17/11-17-0023-03-00lc-lc-tig-draft-report-outline.docx>
   1. Flickering not noticeable above 10 kHz
   2. Include explanation impact on for human eyes (??)
   3. NLOS explanation is o.k.
   4. Multipath fading text is o.k.
   5. Modulations text shall be revised (more references and OOK+PPM) will be done by John
   6. Substandard or amendment: TIG shall make a recommendation
   7. Discuss if this should be a new working group: Should eventually be an own working group
   8. First understand the procedure: Include a straw poll into the document about how this activity shall be hosted
8. John Li (Huawei) presented <https://mentor.ieee.org/802.11/dcn/17/11-17-0375-00-00lc-suggested-modifications-to-draft-response-to-the-technical-feasibility-questions.pptx>
   1. Agreed that the proposed text in the contribution be included in 17/0023/r4
9. Chair leads the discussion on the liaison statement <https://mentor.ieee.org/802.11/dcn/17/11-17-0272-02-00lc-liaison-statement-for-lc-stakeholders.docx>
   1. Chair introduce the target lighting organizations in <https://mentor.ieee.org/802.11/dcn/17/11-17-0457-00-00lc-march-2017-liaison-organizations.ppt>
   2. Osama (Huawei): Lighten first sentence of second paragraph, appears too strong. IEEE 802.11 was not even thinking about light communication. Is also in favor of not sending this out.
   3. Ralf de Vegt (Qualcomm): Remove “commercial” from first sentence. Second is that not clear how long TIG will be active, and if after passing the IEEE processes, which takes time, it is not already outdated to invite others to meetings where potentially it is decided not to continue with this activity. Korea is next meeting.
   4. Chair is in favor of moving forward with it because Korea is center for lighting industry.
   5. Ralf said straw poll makes no sense as this is decided in WG
   6. Osama said to better explain the role of the TIG, as opposed to SG and TG.
   7. Text will be changed and shall be represented at the WG plenary on Wednesday, get their views. Need to run a motion.
10. Chair advised to attend IEEE meeting on travel issues
11. Meeting is recessed until Tuesday PM1

**Tuesday, March 14, 2017, PM1 Session**

Attendance: around 25 people

1. Meeting called to order by chair
2. Chair reviewed the IEEE-SA patent policy, logistics, and reminders on TIG rules, including meeting guidelines and attendance recording procedures.
   1. Chair asked if anyone has any questions about the IEEE-SA patent policy, logistics or reminders. No questions.
   2. Chair asked if there were any questions on any of the above items. None.
   3. It is reminded all to record their attendance.
3. Chair leads the discussion on the liaison statement <https://mentor.ieee.org/802.11/dcn/17/11-17-0272-03-00lc-liaison-statement-for-lc-stakeholders.docx>
   1. The discussion in the group is to include the appropriate emails for contacting the different industry associations.
4. Chair leads discussion on the LC link margin calculations <https://mentor.ieee.org/802.11/dcn/17/11-17-0479-00-00lc-lc-tig-link-margin-caluclations.docx>
   1. There is a discussion in the group about the similarities of LC to RF communications.
5. Meeting recessed until Thursday AM1

**Thursday, March 16, 2017, AM1 Session**

Attendance: around 25 people

1. Meeting called to order by chair
2. Chair reviewed the IEEE-SA patent policy, logistics, and reminders on TIG rules, including meeting guidelines and attendance recording procedures.
   1. Chair asked if anyone has any questions about the IEEE-SA patent policy, logistics or reminders. No questions.
   2. Chair asked if there were any questions on any of the above items. None.
   3. It is reminded all to record their attendance.
3. Soo-Young Chang (SYCA) presented <https://mentor.ieee.org/802.11/dcn/17/11-17-0473-00-00lc-high-speed-lifi-light-communication-lc-using-color-space-modulation.pdf>
   1. John Li (Huawei): Is there a need to have one LED light for one constellation point?
   2. Soo-Young: No, you can use RGB LED. By allocating different intensity on each LED to generate a combined color on the constellation.
   3. Chair: How to deal with color shift due to LED? How to maintain the light to be perceived white?
   4. Soo-Young replied that color shift issue cannot be solved right now. To achieve white light, use White color as target point.
4. Nikola (PureLIFI) presented: <https://mentor.ieee.org/802.11/dcn/17/11-17-0497-01-00lc-light-communication-use-cases.pptx>
   1. Agreed to include the “Enterprise” part of the proposed text into 17/0023/r4
   2. Agreed to include the “Home” part of the proposed text into 17/0023/r4
   3. Agreed to include the “IoT” part of the proposed text into 17/0023/r4, except for the “factories of the future section” where Mike McInnis (Boeing) would like to further expand.
5. Chair leaded the discussion on <https://mentor.ieee.org/802.11/dcn/17/11-17-0023-03-00lc-lc-tig-draft-report-outline.docx>
   1. On “LC metric” part of the document, the following text is agreed

***LC Metrics***

*The LC link budget is shown in doc. 17/0262r0. The entire methodology for the link budget calculations is presented in doc. 17/0262r0. The link budget for a specific example deployment with specific components has been calculated to be between 30 – 40 dB when deployments at ranges of 2m – 4m in the referenced doc. 17/0262r0. However, the LC systems have been demonstrated to operate at various distances from 0.1m to 200m.*

*The strict definition of the remaining LC metrics is left to the Study Group.*

1. *Data rate*
2. *SNR Link Margin Latency – average range*
   1. *PHY and MAC*
3. *Channel access fairness*
4. *Area capacity (area spectral density (bit/s/sqm))*
5. *Considerations for the MAC efficiency on the capacity – measured at the MAC SAP*
   1. On “Form of standard” part of the document, Chair suggests that since this TIG is within 802.11 it is unreasonable to recommend a new working group (802.xx). If SG of LC is not approved, then a new working group can be considered. Fisher (NXP): at this point, the focus should be the subject of the group rather than the form. It should be a SG issue. The following text is agreed

*Form of standardization*

*The decision of whether LC should be a standalone standard (ie., 802.11.3) or an amendment (802.11xx), should be left to the Study Group. However, the benefits of inheriting the upper portion of the 802.11 MAC and services it provides are seen as key enablers for the commercial success of the technology and therefore the LC TIG recommends that LC should be considered to become an 802.11 amendment rather than a standalone standard.*

* 1. Discussion on “Compatibility with other 802 wireless protocols”, Fisher (NXP) points out the general issue for 802 is, does it support 802 bridging model and 802.11 security mechanism. PHYs are not compatible with each other by definition. Mike (Boeing) suggest to consider the possibility to handoff to other 802.11 PHYs. The following text is agreed to be included in 17/0023/r4

*Compatibility with other 802 wireless protocols*

1. *Considering the LC TIG recommendation that the LC becomes an amendment to 802.11, then the LC TIG sees that the new amendment would be compatible with the relevant 802 protocols.*
2. *The LC TIG would envision coexistence and hand-over between different 802.11 PHY types.*
   1. Discussion on “Difference with on-going 802 light communication standards (eg., 802.15.7m) and ITU-T G.vlc”. Chair suggests that 802.11 protocol is inherently diferent from ITU protocol. 802.11 protocol and 802.15 protocol has different MAC, and address WLAN rather than specialty network. The following text is agreed to be included in 17/0023/r4
3. Straw poll: *Should the LC TIG request an extension to continue its work until the July 2017 plenary session to present its report to the 802.11 Working Group?*
4. *The different MAC and PHY models between the IEEE 802.11 and the ITU-T recommendations effectively create two entirely different standards.*
5. *The difference between LC and the existing 802 light communications standards is the use of the 802.11 MAC and associated services that are focused on local wireless area networks relative to the existing (802.15.7m) and future (802.15.13) efforts that are focusing on deploying the technology for wireless specialty networks. In addition, the coexistence and hand-over with other 802.11 PHY types creates a unique market capability for LC as part of 802.11.*
   1. Y: 20; N: 0; A: 0
6. Meeting is recessed until Thursday PM2

**Thursday, March 16, 2017, PM2 Session**

Attendance: around 20 people

1. Meeting called to order by chair
2. Chair reviewed the IEEE-SA patent policy, logistics, and reminders on TIG rules, including meeting guidelines and attendance recording procedures.
   1. Chair asked if anyone has any questions about the IEEE-SA patent policy, logistics or reminders. No questions.
   2. Chair asked if there were any questions on any of the above items. None.
   3. It is reminded all to record their attendance.
3. Mike McInnis (Boeing) provided text for “factories of the future” section for <https://mentor.ieee.org/802.11/dcn/17/11-17-0023-03-00lc-lc-tig-draft-report-outline.docx>, after discussion, the following texts were agreed

*In industrial and manufacturing scenarios, nowadays only wired solutions are used, because of high requirements with respect to robustness, security and low latency.   
RF systems do provide large coverage and are easily deployed. But manufacturing belongs to the so-called dense wireless scenarios with multiple links maintained simultaneously all offering the above mentioned high service quality.   
One big issue is coexistence with other services. Using other RF links in the same spectrum requires protocols like “listen before talk” which implies unpredictable delays and contradicts low latency requirements. Getting dedicated spectrum for industrial wireless is one way. LC operates in unused spectrum and could be another way to solve the current situation.   
Moreover, it is possible for actors to easily jam the used RF spectrum from great distances outside the plant with simple RF devices. The use of RF-based wireless links instead of cables has obviously a potentially harmful impact on the safe operation of the connected manufacturing facilities in general. LC is inert against RF jamming and propagation is confined inside the plant. Thus LC is inert against outside jamming. In addition, the presence of strong electromagnetic interference may not be suitable for RF communication like in a steel mill, in nuclear power plants or in a power station.   
In manufacturing scenarios, LC can deliver safe wireless communications with low latency because it does not need to consider coexistence, has well-confined propagation conditions in very small cells, and is robust against jamming and EMI. Moreover, LC can be used complementary to RF systems for data off-loading.  
If industrial protocols are utilized (i.e. Profinet) there is a need to assign regular network access to the clients and to ensure the transmission of data within a specific period and low latency.*

1. Chair leaded the discussion on “Reuse of 802.11 MAC – which MAC (ah/ad?)?” part of <https://mentor.ieee.org/802.11/dcn/17/11-17-0023-03-00lc-lc-tig-draft-report-outline.docx>. After discussion, the following texts were agreed.
   1. *The LC protocol is expected to reuse the existing facilities within 802.11. However, modifications specific for the operation of LC may be suggested that could improve the efficiency for particular implementations.*
   2. *Assumptions that are potentially not valid in the LC context*
      1. *STA may not necessarily see interference from neighboring STAs as shown in Fig. 4. However, this is a system design consideration and not a fundamental limitation.*
2. Chair leaded the discussion on co-existing issues. After discussion, the following texts were agreed to be included into 17/0024/rev4

*Does LC interfere with existing products that use the light medium, e.g., remote controls for TV sets?*

* + 1. *No, because the lower part of the base-band bandwidth, e.g., less than 100k kHz, can be easily removed such that it is not subject to any interference from slow varying signals and does not cause interference to other slow varying light signals.*

1. Mike McInnis (Boeing) raised the issue whether the color of the light will be changed due to LC. After discussion the following text are agreed to be included into 17/0024/rev4
   1. *Does LC impact the color quality of lighting?*
      1. *No. Work in [3] shows that LC does not impact the quality of lighting.*
2. Chair presented the planed calendar for conference calls and meeting. The calendar was approved by unanimous consent.
3. Meeting is adjourn until May, 2017