IEEE P802.11
Wireless LANs

|  |
| --- |
| 802.11ba Teleconference Minutes April and May 2017 |
| Date: 05-02-2017 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Leif Wilhelmsson | Ericsson AB | Mobilvägen 1, 22632 Lund, Sweden | +46-706-216956 | leif.r.wilhelmsson@ericsson.com |

Abstract

This document contains minutes from TG 802.11ba teleconferences in April and May 2017.

Rev 0: Minutes from TG 802.11ba teleconference on 3rd of April, 2017.

Rev 1: Minutes from TG 802.11ba teleconference on 17th of April, 2017 added.

Rev 2: Minutes from TG 802.11ba teleconference on 1st of May, 2017 added.

**Teleconference on Monday, April 3rd, 2017, 10:00 – 12:00 am (ET)**

**Agenda:**

1. Call the meeting to order
2. IEEE 802 and 802.11 IPR policy and procedure
3. Attendance reminder. Please send an email to Leif Wilhelmsson (leif.r.wilhelmsson@ericsson.com)
4. Presentations:
* PHY, 11-17-0326, WUR phase noise model follow-up, Minyoung Park, Intel
* PHY, WUR link budget analysis, Rui Cao, Marvell
* PHY, Waveform Generation for Waveform Coding, Junghoon Suh, Huawei
* PHY, 11/17-0385 “Concurrent transmission of data and a wake-up signal in 802.11ax - Follow-up”, Leif Wilhelmsson, Ericsson
* PHY, 11/17-0386 “Impact of reciprocal mixing on WUR performance”, Leif Wilhelmsson, Ericsson
* Comments regarding the 802.11ba usage model (17/0029), email sent 2017-02-17, Mark Rison, Samsung

Adjourn

The conduct of this meeting is governed by IEEE, IEEE-SA and IEEE LMSC policies, which include:
- IEEE Patent Policy
- Ethics
- 802 LMSC P&P
- 802LMSC Operations Manual (OM)

Links to the documents or web-pages describing the policies may be found here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1485911358009000&usg=AFQjCNEReA4YoFBtGsVMTHHqaQ7RqnFI-Q).

The following documents provide additional information on the governing IEEE-SA policies:
- Patent FAQ ([http://standards.ieee.org/faqs/patents.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Fpatents.pdf&sa=D&ust=1485911358009000&usg=AFQjCNHxk2o60zaB0vG017xCRjouRh2kNw))
- Affiliation FAQ ([http://standards.ieee.org/faqs/affiliation.html](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Faffiliation.html&sa=D&ust=1485911358009000&usg=AFQjCNEc4Oqh7kqbEYCU2ETtbL9lYgWfKw))
- Anti-Trust FAQ ([http://standards.ieee.org/develop/policies/antitrust.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Fdevelop%2Fpolicies%2Fantitrust.pdf&sa=D&ust=1485911358009000&usg=AFQjCNGKSQV0BTbcMs7UfJECydBzeH2_hw))

In addition, the conduct of this meeting is governed by IEEE 802.11 Operations Manual (OM), which is also linked from here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1485911358009000&usg=AFQjCNEReA4YoFBtGsVMTHHqaQ7RqnFI-Q)

**Chair Minyoung Park (Intel) calls the meeting to order at 10:02 (ET).**

Minyoung goes through the agenda and asks if there is anything that should be added to the agenda. No response.

The order of the presentations is updated to allow Mark Rison to present earlier.

Agenda is approved without objection.

Minyoung confirms that the Secretary is on the call and reminds about recording attendance by sending an email to the secretary.

Minyoung reviewes the IEEE 802 and 802.11 Policy and Procedure, and presents where to find the relevant documents. Minyoung asks if there is any potentially essential patent that people are aware of and if there are any questions.

No potentially essential patents reported and no questions asked.

**Presentations:**

**11/17-0399r1 “WUR link budget analysis,” Rui Cao, Marvell:** Based on link budget analysis, it is suggested that multiple data rates should be supported for the wake-up signal so that the robustness of the signal better can be matched to the requirements. To obtain higher data rates, either shorter OOK symbols or higher order modulation is mentioned as examples.

**Question/Comment (Q):** We have similar ideas and are in favor of this idea. What data rates do you have in mind?

**Answer (A):** We are open for proposal. 125kb/s, 250kb/s, and 500kb/s seem reasonable.

**Q:** If you only use 4 MHz for the transmitted signal, the totally used TX power will be reduced due to regulatory reasons.

**A:** I agree. This is also mentioned on page 8.

**Q:** You mention higher order modulation as one possible way to increase the data rate. This does not seem as straight forward as increasing the data rate by reducing the bit duration for OOK. Any suggestions for how to achieve this?

**A:** For instance PPM. It should still be possible to receive by non-coherent reception.

**Q:** How many different rates do you have in mind?

**A:** We are open for suggestions, perhaps 2 would be reasonable.

**Comments regarding the 802.11ba usage model (17/0029), email sent 2017-02-17, Mark Rison, Samsung:**

Comments with respect to usage model 1 related to that much more energy is needed for the curtain than for the main transceiver, and then the usage of a WUR is of limited interest.

Comments with respect to usage model 3 related to that there does not seems to be anything that time-critical that is relevant to a cattle farm, so the discussed usage model does not call for this low delay obtained by using a WUR.

**Q:** You don’t see the need for the reduced delay for the incoming call?

**A:** I believe what is possible to achieve with the standard today suffice. In general I believe we should start with what is achievable with what we have today. Basically we should not bend the use case to fit the need for a WUR.

Minyoung proposes Mark to work with Ross on the usage models offline.

**11-17/0376r0, “Waveform Generation for Waveform Coding,” Junghoon Suh, Huawei:**

**Q:** Did you compensate for the group delay of the filter in your simulations?

**A:** No.

**11/17-0385 “Concurrent transmission of data and a wake-up signal in 802.11ax - Follow-up,” Leif Wilhelmsson, Ericsson:**

**Q:** How do you apply Manchester coding using OFDMA?

**A:** The Manchester coding consists of two OFDM symbols.

**Q:** If you use vary the number of RUs allocated to the wake-up signal, how is the receive impacted?

**A:** In my case, not at all since I assume a 20 MHz BPF in front of the envelope detector. If you would assume that you in fact could have a narrower filter, you can adjust the filter bandwidth based on the bandwidth used for the wake-up signal to improve performance.

**11/17-0386 “Impact of reciprocal mixing on WUR performance,” Leif Wilhelmsson, Ericsson:**

**Q:** It may be that we want to use another phase noise model, with a higher phase noise level in which case reciprocal mixing may be a problem.

**A:** I agree. However, the phase noise needs to be increased significantly before it becomes a problem.

**Q:** With this very high phase noise, -6dBc integrated in-band, has anyone considered edge-jitter?

**A:** I have not.

**11-17-0326, “WUR phase noise model follow-up,” Minyoung Park, Intel:** To simulate the proposed phase noise model, this presentation proposes how this can be done and also gives a reference to Matlab code that can be used.

**Q:** You are suggesting an additive model. We have modelled it as multiplicative.

**A:** It is multiplicative. The phase noise is added in the phase used in the down-mixing.

Next meeting 17th of April.

**Meeting is adjourned at 11:58 (ET).**

**List of Attendees:**

|  |  |  |
| --- | --- | --- |
|  | Name | Affiliation |
| 1 | Minyoung Park | Intel |
| 2 | Leif Wilhelmsson | Ericsson |
| 3 | Joerg Robert | Univeristy Erlangen-Nuernberg |
| 4 | John Notor | Notor Research/ARM Inc. |
| 5 | Mark Rison | Samsung |
| 6 | Yunsong Yang | Huawei |
| 7 | Kome Oteri | InterDigital |
| 8 | Xiaofei Wang | InterDigital |
| 9 | Bo Sun | ZTE |
| 10 | Junghoon Suh | Huawei |
| 11 | Alphan Sahin | InterDigital |
| 12 | Dongguk Lim | LGE |
| 13 | Steve Shellhammer | Qualcomm |
| 14 | Osama Aboul-Magd | Huawei |
| 15 | Carl Kain | ? |
| 16 | Jinsoo Choi | LG |
| 17 | James Lepp | Blackberry |
| 18 | Reza Hedayat | Newracom |
| 19 | Lei Huang  | Panasonic |
| 20 | Po-Kai Huang | Intel |
| 21 | Eunsong Park | LGE |
| 22 | Sungeun Lee | Cypress Semiconductor |

**Teleconference on Monday, April 17th, 2017, 5:00 – 7:00 pm (ET)**

**Agenda:**

Agenda:

1. Call the meeting to order

2. IEEE 802 and 802.11 IPR policy and procedure

3. Attendance reminder. Please send an email to Leif Wilhelmsson (leif.r.wilhelmsson@ericsson.com)

4. Presentations:

April 17th 5pm ET:

1) MAC, “Assign and Update Wake-Up Signals in WLAN with Wake-Up Radio  Receivers”, Jianhan Liu, MediaTek

2) MAC, 11-17/387, Purpose Indication for WUR Packets, Xiaofei Wang, InterDigital

3) MAC, BSS management with WLS Wakeup frame, Liwen Chu, Marvell

4) MAC, Synchronization with Low Power Antenna, Liwen Chu, Marvell

5) MAC, Inter-BSS communication, Liwen Chu, Marvell

Adjourn

The conduct of this meeting is governed by IEEE, IEEE-SA and IEEE LMSC policies, which include:
- IEEE Patent Policy
- Ethics
- 802 LMSC P&P
- 802LMSC Operations Manual (OM)

Links to the documents or web-pages describing the policies may be found here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1491933437997000&usg=AFQjCNE-17PWCzAC2xYF8DKxfjLXWLxkbQ).

The following documents provide additional information on the governing IEEE-SA policies:
- Patent FAQ ([http://standards.ieee.org/faqs/patents.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Fpatents.pdf&sa=D&ust=1491933437997000&usg=AFQjCNElYakvis-cnJojNl7hEzF6mJNEGA))
- Affiliation FAQ ([http://standards.ieee.org/faqs/affiliation.html](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Faffiliation.html&sa=D&ust=1491933437997000&usg=AFQjCNGCGl_y1AuN8-MG411AtQLher2awA))
- Anti-Trust FAQ ([http://standards.ieee.org/develop/policies/antitrust.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Fdevelop%2Fpolicies%2Fantitrust.pdf&sa=D&ust=1491933437998000&usg=AFQjCNEAzvOg_Qeif1Q7n4sfNyYn_FE9Jw))

In addition, the conduct of this meeting is governed by IEEE 802.11 Operations Manual (OM), which is also linked from here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1491933437998000&usg=AFQjCNFLjG8jMHQSiHIP3Yw8mMKFS8YYaw).

**Chair Minyoung Park (Intel) calls the meeting to order at 5:00 pm**

Minyoung goes through the agenda and asks if there is anything that should be added or changed regarding the agenda. Based on the feedback, 11-17/387 is removed and 11-17/380 is added.

Minyoung confirms that the Secretary is on the call and reminds about recording attendance by sending an email to the secretary.

Minyoung reviewes the IEEE 802 and 802.11 Policy and Procedure, and presents where to find the relevant documents. The relevant links are in the meeting invitations and shown below the agenda above. Minyoung asks if there is any potentially essential patent that people are aware of and if there are any questions.

No potentially essential patents reported and no questions asked.

**Presentations:**

**11-17/0435r0 “Assign and Update Wake-Up Signals in WLAN with Wake-Up Radio  Receivers”, Jianhan Liu, MediaTek:** The contribution is concerned with the wake-up signal may have to be updated, for instance because the same of a sufficiently similar wake-up signal is used in a neighboring BSS which potentially leads to false alarms.

**Question/Comment (Q):** On slide 3, do you refer specifically to updating the identifier for the WUR?

**Answer (A):** Yes.

**Q:** On slide 5, this may not be the complete procedure.

**A:** Correct, we are elaborating further on this on page 6.

**Q:** If you want this to be applicable also for e.g. 802.11ac, you must define this 11ac?

**A:** Yes.

**11-17/0380r0 “WUR channel switch”, Suhwook Kim, LGE:**  The contribution discusses how to switch frequency channel used for transmitting the wake-up signal. In particular, the possibility to reuse the Channel Switch Announcement (CSA) element is discussed, either over the WLAN interface or over the WUR interface.

**Q:** The WUR channel may not be in the primary channel. Information about this must be sent.

**A:** I assume that the WUR channel is in the primary channel.

**Q:** I would prefer to use the WLAN channel for several reasons, like reliability and more efficiently transmission assuming the signaling contain some data. In addition, it may make the protocol more similar to what is already used.

**Q:** What kind of channelization do you assume? Can there be e.g. 1, 2, or 4 WUR channels within a primary channel? I believe we need to discuss this before going into details about the channel switch.

**11-17/437r1 “BSS management with WLS Wakeup frame”, Liwen Chu, Marvell:**

**Q:** On slide 4, you propose to send the WUR packet prior to the beacon?

**A:** Yes, but only if it contains new information.

**Q:** I would prefer if we don’t put management information into the WUR interface.

**Q:** On slide 8, I would envision that WUR frames only are transmitted after association.

**A:** We probably need to discuss the concept a bit more.

**11-17/447r0 “Synchronization with Low Power Antenna”, Liwen Chu, Marvell:** The contribution discusses how the Timing Synchronization Function (TSF) can be (re-)used also for the WUR.

**Meeting is adjourned at 6:56 pm.**

**List of Attendees:**

|  |  |  |
| --- | --- | --- |
|  | Name | Affiliation |
| 1 | Minyoung Park | Intel |
| 2 | Leif Wilhelmsson | Ericsson |
| 3 | Sue Leicht | NSA |
| 4 | John Notor | Notor Research/ARM Inc. |
| 5 | Jinsoo Ahn | Yonsei University |
| 6 | Yunsong Yang | Huawei |
| 7 | Hanseul Hong | Yonsei University |
| 8 | Xiaofei Wang | InterDigital |
| 9 | Suhwook Kim | LGE |
| 10 | Eunsong Park | LGE |
| 11 | Woojin Ahn | WILUS |
| 12 | Dongguk Lim | LGE |
| 13 | Po-Kai Huang | Intel |
| 14 | Liwen Chu | Marvell |
| 15 | Enrico-Henrik Rantala | Nokia |

**Teleconference on Monday, May 1st, 2017, 11:00 pm – 1:00 am (ET)**

**Agenda:**

1. Call the meeting to order

2. IEEE 802 and 802.11 IPR policy and procedure

3. Attendance reminder. Please send an email to Leif Wilhelmsson (leif.r.wilhelmsson@ericsson.com)

4. Presentations:

1) MAC, 379r0: SFD MAC Proposal, Suhwook Kim (LGE)

2) MAC, 11-17/0381, WUR MAC issues follow-up, Jeongki Kim, LGE

3) MAC, 11-17/0382r0, WUR Reference Signal, Woojin Ahn, WILUS

4) MAC, 11-17/387, Purpose Indication for WUR Packets, Xiaofei Wang, InterDigital

5) MAC, Inter-BSS communication, Liwen Chu, Marvell

~~6) MAC, 11-17/0402, WUR Wakeup Channel Access, Ronny Yongho Kim, KNUT~~

7) MAC, 11-17-0411-00-00ba-Consideration-of-WUR-Security, Kaiying Lv, ZTE Corp

5. Adjourn

The conduct of this meeting is governed by IEEE, IEEE-SA and IEEE LMSC policies, which include:
- IEEE Patent Policy
- Ethics
- 802 LMSC P&P
- 802LMSC Operations Manual (OM)

Links to the documents or web-pages describing the policies may be found here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1491933437997000&usg=AFQjCNE-17PWCzAC2xYF8DKxfjLXWLxkbQ).

The following documents provide additional information on the governing IEEE-SA policies:
- Patent FAQ ([http://standards.ieee.org/faqs/patents.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Fpatents.pdf&sa=D&ust=1491933437997000&usg=AFQjCNElYakvis-cnJojNl7hEzF6mJNEGA))
- Affiliation FAQ ([http://standards.ieee.org/faqs/affiliation.html](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Ffaqs%2Faffiliation.html&sa=D&ust=1491933437997000&usg=AFQjCNGCGl_y1AuN8-MG411AtQLher2awA))
- Anti-Trust FAQ ([http://standards.ieee.org/develop/policies/antitrust.pdf](https://www.google.com/url?q=http%3A%2F%2Fstandards.ieee.org%2Fdevelop%2Fpolicies%2Fantitrust.pdf&sa=D&ust=1491933437998000&usg=AFQjCNEAzvOg_Qeif1Q7n4sfNyYn_FE9Jw))

In addition, the conduct of this meeting is governed by IEEE 802.11 Operations Manual (OM), which is also linked from here: [http://www.ieee802.org/11/Rules/rules.shtml](https://www.google.com/url?q=http%3A%2F%2Fwww.ieee802.org%2F11%2FRules%2Frules.shtml&sa=D&ust=1491933437998000&usg=AFQjCNFLjG8jMHQSiHIP3Yw8mMKFS8YYaw).

**Chair Minyoung Park (Intel) calls the meeting to order at 11:00 pm**

Minyoung goes through the agenda and asks if there is anything that should be added or changed regarding the agenda. Minyoung informs the group that contribution 6 is withdrawn. No response.

Minyoung confirms that the Secretary is on the call and reminds about recording attendance by sending an email to the secretary.

Minyoung reviewes the IEEE 802 and 802.11 Policy and Procedure, and presents where to find the relevant documents. The relevant links are in the meeting invitations and shown below the agenda above. Minyoung asks if there is any potentially essential patent that people are aware of and if there are any questions.

No potentially essential patents reported and no questions asked.

**Presentations:**

**11-17/0379r1 “SFD MAC proposal”, Suhwook Kim, LGE:** The contribution is concerned with what parameters should be sent during the WUR negotiation procedure or the WUR initiation procedure. Examples of such parameters could be WUR channel information, duty cycle operation information, data rate and BW for the wake-up signal, etc.

**Question/Comment (Q):** Since the use of WUR is about power saving, do you believe we can integrate the signaling with the current power save protocol? It also seems one does not want to negotiate these parameters every time one enters the WUR mode, but only initially or when the parameters are changed.

**Answer (A):** I am open for such integration, but it may not be so easy.

**Q:** If designed with a duty cycle mode, it may not be possible to reuse the polling mechanism.

**11-17/0381r0 “WUR MAC issues follow-up”, Jeongki Kim, LGE:** The contribution discusses e.g. the need to explicitly signal the Wake-up Completion Time (WCT). The WCT is the time from transmitting the wake-up packet to a packet for the primary receiver is sent.

**Q:** Concerning packet type, this may not be explicitly signaled but can be implicit in the wake-up sequence used. Also, whether the packet is for wake-up or not wake-up is already included in the packet type.

**11-17/0382r0, WUR Reference Signal, Woojin Ahn, WILUS:** The contribution is about the beacon and what information it can contain that would be useful for the STAs, for instance with respect to mobility and power saving.

**Q:** Do you have any thoughts of the granularity of the mobility context, like only one bit for moving/not moving or more detailed information? Do you think of something else?

**A:** One example could be the existence of a BSS.

**Q:** Do you want to specify how a STA should use this information?

**A:** At this point, the discussion was only about the signaling.

**Q:** If a STA does not receive the beacon it can just enter the re-association procedure.

**11-17/387, Purpose Indication for WUR Packets, Xiaofei Wang, InterDigital:** The contribution points out that the purpose may be very different for different wake-up packets. The packets may be for wake-up, synchronization, AP discovery/association, etc.

**Q:** I believe the type field itself may actually contain this information.

The authors of the two last presentations are not present.

 **Teleconference is adjourned at 00:31 am.**

**List of Attendees:**

|  |  |  |
| --- | --- | --- |
|  | Name | Affiliation |
| 1 | Minyoung Park | Intel |
| 2 | Leif Wilhelmsson | Ericsson |
| 3 | Ross Yu | Huawei |
| 4 | John Notor | Notor Research/ARM Inc. |
| 5 | Jinsoo Ahn | Yonsei University |
| 6 | Yunsong Yang | Huawei |
| 7 | Hanseul Hong | Yonsei University |
| 8 | Xiaofei Wang | InterDigital |
| 9 | Suhwook Kim | LGE |
| 10 | Eunsong Park | LGE |
| 11 | Woojin Ahn | WILUS |
| 12 | Po-Kai Huang | Intel |
| 13 | Jeongki Kim | LGE |
| 14 | Lei Huang | Panasonic |