IEEE P802.11  
Wireless LANs

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| Minutes 802.11 be PHY ad hoc Telephone Conferences,  April 2020 | | | | |
| Date: 2020-04-09 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Tianyu Wu | Apple |  |  | tianyu@apple.com |
|  |  |  |  |  |

Abstract

This document contains the PHY ad hoc meeting minutes for TGbe teleconferences held on:

* April 06, 2020
* April 09, 2020
* April 13, 2020

**Monday April 06th, 2020 10:00 – 13:00 ET**

**Introduction**

1. The Chair (Sigurd Schelstraete, Quantenna/ON Semiconductor) calls the meeting to order at 10:00am ET.
2. The Chair follows the agenda in 11-20/0425r17
3. The Chair goes through the IPR policy and asks if anyone is aware of any potentially essential patents. Nobody speaks up.
4. The Chair reminds everyone to report their attendance by using imat online tool <https://imat.ieee.org/802.11/attendance-log?d=04/06/2020&p=3031000005&t=47200043>  
   or sending an e-mail to the Co-chair, Tianyu Wu (Apple) or the Chair himself.
5. Discussions on the agenda. Planned presentation list for today:
   * [524r2](https://mentor.ieee.org/802.11/dcn/20/11-20-0524-02-00be-signaling-of-preamble-puncturing-in-su-transmission.pptx) Signaling-of-preamble-puncturing-in-su-transmission (Dongguk Lim)
   * [483r2](https://mentor.ieee.org/802.11/dcn/20/11-20-0483-02-00be-preamble-puncturing-for-ppdus-transmitted-to-multiple-stas.pptx) Preamble Puncturing for PPDUs Transmitted to Multiple STAs (Oded Redlich)
   * [545r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0545-00-00be-multi-segment-eht-sig-design-discussion.pptx) Multi-segment EHT-SIG design discussion (Ross Yu)
   * [575r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0575-00-00be-self-contained-signaling-for-e-sig.pptx) Self Contained Signaling for E-SIG (Ron Porat)
   * [578r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0578-00-00be-on-ru-allocation-singling-in-eht-sig.pptx) On RU Allocation Singling in EHT-SIG (Jianhan Liu)
   * StrawPolls on preamble, multi-RU allocation (439, 380, 285, 524, 373, 402, 483, 545, 575)
   * Remaining Straw Polls (020 etc)
   * [479r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0479-00-00be-240-mhz-channelization.pptx) 240 MHz channelization (Sigurd Schelstraete)
   * [456r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0456-00-00be-tx-evm-requirement-for-4k-qam.pptx) Tx EVM Requirement for 4k QAM (Qinghua Li)
   * [480r0](https://mentor.ieee.org/802.11/dcn/20/11-20-0480-00-00be-4096-qam-straw-polls.pptx) 4096 QAM Straw Polls (Sigurd Schelstraete)

**Attendance**

The following people recorded their attendance for this call:

Ben Arie, Yaron toga networks(a huawei company)  
Cao, Rui NXP Semiconductors  
Chen, Xiaogang Intel  
Choi, Jinsoo LG ELECTRONICS  
CHUN, JINYOUNG LG ELECTRONICS  
Ciochina, Dana Sony Corporation  
de Vegt, Rolf Qualcomm Incorporated  
Doostnejad, Roya Intel Corporation  
Duan, Ruchen SAMSUNG  
ElSherif, Ahmed Qualcomm Incorporated  
Erceg, Vinko Broadcom Corporation  
Guo, Qiang Futurewei Technologies  
Handte, Thomas Sony Corporation  
Hu, Mengshi HUAWEI  
Ji, Chenhe Huawei Technologies Co. Ltd  
jiang, feng Intel Corporation  
Jones, Vincent Knowles IV Qualcomm Incorporated  
Kasher, Assaf Qualcomm Incorporated  
Kedem, Oren 101 Consulting Corporation  
Kim, Myeong-Jin SAMSUNG  
Kim, Sanghyun WILUS Inc  
Kim, Youhan Qualcomm Incorporated  
Lalam, Massinissa SAGEMCOM BROADBAND SAS  
Lee, Wookbong SAMSUNG  
Levitsky, Ilya IITP RAS  
Li, Qinghua Intel Corporation  
Liang, dandan Huawei Technologies Co., Ltd  
Lim, Dong Guk LG ELECTRONICS  
Lin, Wei Huawei Technologies Co. Ltd  
LIU, CHENCHEN Huawei Technologies Co., Ltd  
Liu, Jianhan MediaTek Inc.  
Lopez, Miguel Ericsson AB  
Lou, Hanqing InterDigital, Inc.  
Lv, Lily Huawei Technologies Co. Ltd  
MELZER, Ezer Toga Networks, a Huawei company  
noh, yujin Newracom Inc.  
Pare, Thomas MediaTek Inc.  
Park, Eunsung LG ELECTRONICS  
PESIN, ANTHONY InterDigital, Inc.  
Petrick, Albert InterDigital, Inc.  
porat, ron Broadcom Corporation  
Puducheri, Srinath Broadcom Corporation  
Redlich, Oded Huawei  
Schelstraete, Sigurd Quantenna Communications, Inc.  
Sharma, Prashant NXP Semiconductors  
Shellhammer, Stephen Qualcomm Incorporated  
Shilo, Shimi HUAWEI  
Son, Ju-Hyung WILUS Inc.  
Srinivasa, Sudhir NXP Semiconductors  
SUH, JUNG HOON Huawei Technologies Co. Ltd  
Sun, Bo ZTE Corporation  
Sundman, Dennis Ericsson AB  
Tian, Bin Qualcomm Incorporated  
Tsodik, Genadiy Huawei Technologies Co. Ltd  
Uln, Kiran Cypress Semiconductor Corporation  
Van Zelst, Allert Qualcomm Incorporated  
Varshney, Prabodh Nokia  
Vermani, Sameer Qualcomm Incorporated  
Wilhelmsson, Leif Ericsson AB  
Wu, Tianyu Apple, Inc.  
Xin, Yan Huawei Technologies Co., Ltd  
Yan, Aiguo Oppo  
YANG, RUI InterDigital, Inc.  
Yang, Steve TS MediaTek Inc.  
Young, Christopher Broadcom Corporation  
Yu, Jian Huawei Technologies Co., Ltd  
Yu, Mao NXP Semiconductors  
Zhang, Yan NXP Semiconductors

**New Submissions**

1. **11-20-0524r2 – Signalling of preamble puncturing in SU transmission –** Dongguk Lim (LG)

**Summary:** Proposed 3 options for signalling of preamble puncturing in SU transmission, including using BW field, BW + preamble puncturing pattern field and preamble puncturing information field.

**Discussion:**

C: Option 2 and 3 have too much overhead for preamble.

C: Signalling of preamble puncturing for SU and OFDMA case should be the same.

C: In option3, simple bitmap seems good enough.

SP deferred for discussion of other contributions on the same topic.

1. **11-20-0483r2 – Preamble Puncturing for PPDUs Transmitted to Multiple STAs –** Oded Redlich (Huawei)

**Summary:** Proposed 2 options of preamble puncturing for OFDMA case including option to cover majority of puncturing cases in an 80MHz and option to cover all possible puncturing cases.

**Discussion:**

C: This presentation reopen many area that we already have conclusion before. For example require processing of 160MHz. We already passed SP on only require to process 80MHz.

A: We believe it’s a good tradeoff to support more useful cases.

C: For slide7, we already spend a lot of time discussing the modes such as having 2 holes in 80MHz. It’s not a right balance of implementation complexity and benefit.

A: We discussed for SU PPDU but not OFDMA case. OFDMA case is totally different story. I agree with you in SU PPDU case.

C: For the 2 holes case in 80MHz, it’s ok you don’t assign any user on two channels, but you still need to keep the preamble in these channels. You are trying to increase the preamble puncturing modes for OFDMA case. The group is trying to limit the OFDMA puncturing modes which is a subset of non-OFDMA case.

A: With option 1, it’s totally aligned with passed SPs. Option 2 provide better tradeoff but we can go with option1.

A: If no allocation in a 20MHz, why need to send the preamble instead of release the channel for others.

SP deferred for discussion of other contributions on the same topic.

1. **11-20-0545r0 – Preamble Puncturing for PPDUs Transmitted to Multiple STAs –** Oded Redlich (Huawei)

**Summary:** Presented overhead analysis, application scenarios and some suggestions for multi-segment EHT-SIG.

**Discussion:**

C: Why limit SST in TWT? If MAC guys think there will be difficulty, they will limit it. PHY don’t need to add this limitation.

A: We do find some issues in MAC for STA parking on different 80MHz channels. We also mention other scenarios TBD which keep it open for MAC guys’ design.

C: I have different understanding of 11ax SST device. In 11ax, it’s not mandatory for SST devices to exit secondary channels after TWT SP. AP will not send to SST STA on primary channel even outside TWT SP.

SP deferred for discussion of other contributions on the same topic.

**Straw Polls**

1. **SPs from 380r0**

SP#1

* **Do you agree with allowing information in U-SIG to vary from one 80MHz to the next in an EHT PPDU of bandwidth >80MHz?**
  + **Notes**
    - **Each STA still needs to decode only one 80MHz segment in U-SIG**
    - **Within each 80MHz, U-SIG is still duplicated in every non-punctured 20MHz**

**Discussion for SP1:**

C: This SP requires some STA park on different 80MHz segments?

A: No, this is general SP just talking about allowing the U-SIG content vary on different 80MHz segments.

C: If all the STAs park on the primary 80MHz, I see no reason to have different U-SIG content for different 80MHz.

A: If every STA park on primary 80, you can use same U-SIG content.

C: If one STA park on secondary 80, can it know the puncturing on other 80Mhz?

A: Yes, it can. You can convey puncturing of other 80Mhz on your 80MHz. But this is not the focus of this SP.

SP result: Y/N/A: 25/ 15/15

1. **SPs from 439r0**

SP#2

* **Do you agree that EHT-SIG may carry different content in each 80MHz?**
  + **For PPDU BW larger than 80MHz.**
  + **SST operation using TWT is one applicable scenario, other scenarios are TBD.**

**Discussion for SP2:**

C: Need more discussion from MAC point of view.

C: Suggest to say “may carry” and add “example SST operation”

C: I have similar SP, can you defer this SP?

A: Disagree to defer because of some design details.

SP result: Y/N/A: 35/ 15/10

SP#2-1

* **Do you agree that EHT-SIG may carry different content in each 80MHz?**
  + **For PPDU BW larger than 80MHz.**

SP result: Y/N/A: 33/ 21/4

1. **Back to SP from 380r0**

SP#1-1

* **Do you agree with allowing information in U-SIG to vary from one 80MHz to the next in an EHT PPDU of bandwidth >80MHz?**
  + **Notes**
    - **Each STA still needs to decode only one 80MHz segment in U-SIG**
    - **Within each 80MHz, U-SIG is still duplicated in every non-punctured 20MHz**
    - **SST operation using TWT is one potential applicable scenario, other scenarios are TBD (Needs MAC discussion).**

**Discussion for SP1-1:**

C: This should include MAC discussion.

A: Let’s change to “potential scenario”

C: I don’t like different version of “U-SIG” for SST case and other cases.

A: It’s only one version. You may have different content in some scenarios.

SP result: Y/N/A: 34/ 8/16

1. **SP from 545r0**

SP#3

* **Do you agree that the following indication shall be the same considering symbol alignment within each segment from PHY point of view, if the fields are present in U-SIG:**
  + **Number of EHT-SIG symbols**
  + **GI+EHT-LTF Size**
  + **Number of EHT-LTF symbols**
  + **PE related parameters**

**Discussion for SP3:**

C: I against to SP for the details when EHT-SIG is not defined.

C: Change to “shall be the same” if these fields present.

SP result: Y/N/A: 40/ 6/12

1. **SP from 402r0**

SP#4

* **Do you agree to have at least one EHT PPDU format that has only one EHT-SIG symbol with MCS 0?**
  + **The EHT PPDU is intended to single user only**

**Discussion for SP4:**

C: We don’t know the content yet. Hard to determine whether it can fit into one EHT-SIG symbol.

C: It’s good to have one symbol with MCS0 but we can’t guarantee it for now.

A: I will defer this SP.

SP deferred for more discussion.

1. **SP from 524r2**

SP#5

* **Do you agree that EHT-SIG field included in EHT-PPDU sent to a single user is duplicated per 20MHz in BW?**

**Discussion for SP5:**

C: For 160MHz BW, EHT-SIG is repeated 8 times and 320MHz rep 16 times?

A: Yes.

C: Two content channels is more efficient. This SP is killing the efficiency which is opposite direction of the passed SP.

A: Two content channel carry same information for PPDU sent to a single user.

C: This is still pre-mature. Should check the design first.

SP result: Y/N/A: 12/ 29/17

1. **SP from 285r4**

SP#6

* **Do you support following in 11be?**
  + **Preamble of primary 20MHz channel shall not be punctured in any PPDU (Except TB PPDU)**

**Discussion for SP5:**

C: TB PPDU may not have any STA send in primary channel. The SP text is not accurate.

C: Propose to add “except TB PPDU”

SP result: Y/N/A: 45/ 1/10

SP#7

* **Do you agree to have STA-ID related information in the EHT PPDU preamble sent to a single user and multiple users?** **TB PPDU is TBD.**

**Discussion for SP5:**

C: EHT PPDU include MAC header. Do you mean in PHY header?

A: Yes.

C: TB PPDU may not include STA-ID. Please add TB PPDU TBD.

SP result: Y/N/A: 42/ 2/13

**Adjourn**

The meeting is adjourned at 13:00 ET

**Thursday April 09th, 2020 19:00 – 22:00 ET**

**Introduction**

1. The Chair (Sigurd Schelstraete, Quantenna/ON Semiconductor) calls the meeting to order at 19:00 ET.
2. The Chair follows the agenda in 11-20/0425r21
3. The Chair goes through the IPR policy and asks if anyone is aware of any potentially essential patents. Nobody speaks up.
4. The Chair reminds everyone to report their attendance by using imat online tool <https://imat.ieee.org/802.11/attendance-log?d=04/09/2020&p=3031000005&t=47200043>  
   or sending an e-mail to the Co-chair, Tianyu Wu (Apple) or the Chair himself.
5. Discussions on the agenda. Planned presentation list for today:
   1. Remaining SPs on BW/preamble puncturing
   2. New submissions on SIG fields.

**Attendance**

The following people recorded their attendance for this call:

Ansley, Carol CommScope  
Bei, Jianwei NXP Semiconductors  
Cao, Rui NXP Semiconductors  
Choi, Jinsoo LG ELECTRONICS  
CHUN, JINYOUNG LG ELECTRONICS  
de Vegt, Rolf Qualcomm Incorporated  
Doostnejad, Roya Intel Corporation  
Duan, Ruchen SAMSUNG  
ElSherif, Ahmed Qualcomm Incorporated  
Erceg, Vinko Broadcom Corporation  
Grandhe, Niranjan Marvell Semiconductor, Inc.  
Guo, Qiang Futurewei Technologies  
Hansen, Christopher Covariant Corporation  
Hu, Mengshi HUAWEI  
jiang, feng Intel Corporation  
Kedem, Oren Huawei Technologies Co. Ltd  
Kim, Sanghyun WILUS Inc  
Kim, Youhan Qualcomm Incorporated  
Ko, Geonjung WILUS Inc.  
Lansford, James Qualcomm Incorporated  
Lee, Wookbong SAMSUNG  
Li, Jialing Qualcomm Incorporated  
Li, Qinghua Intel Corporation  
Liang, dandan Huawei Technologies Co., Ltd  
Lim, Dong Guk LG ELECTRONICS  
LIU, CHENCHEN Huawei Technologies Co., Ltd  
Liu, Jianhan MediaTek Inc.  
Lou, Hanqing InterDigital, Inc.  
Lv, Lily Huawei Technologies Co. Ltd  
Merlin, Simone Qualcomm Incorporated  
Minotani, Jun Panasonic Corporation  
Nakano, Takayuki Panasonic Corporation  
noh, yujin Newracom Inc.  
Pare, Thomas MediaTek Inc.  
porat, ron Broadcom Corporation  
Puducheri, Srinath Broadcom Corporation  
Redlich, Oded Huawei  
Schelstraete, Sigurd Quantenna Communications, Inc.  
Sharma, Prashant NXP Semiconductors  
Shellhammer, Stephen Qualcomm Incorporated  
Shilo, Shimi HUAWEI  
SUH, JUNG HOON Huawei Technologies Co. Ltd  
Tian, Bin Qualcomm Incorporated  
Tsodik, Genadiy Huawei Technologies Co. Ltd  
Uln, Kiran Cypress Semiconductor Corporation  
Varshney, Prabodh Nokia  
Vermani, Sameer Qualcomm Incorporated  
Ward, Lisa Rohde & Schwarz  
Wu, Tianyu Apple, Inc.  
Yan, Aiguo Oppo  
Yang, Bo Huawei Technologies Co. Ltd  
YANG, RUI InterDigital, Inc.  
Yang, Steve TS MediaTek Inc.  
yang, xun Huawei Technologies Co., Ltd  
Young, Christopher Broadcom Corporation  
Yu, Jian Huawei Technologies Co., Ltd  
Yu, Mao NXP Semiconductors  
ZHANG, JIAYIN HUAWEI  
Zhang, Yan NXP Semiconductors

**Straw Polls**

1. **SPs from 483r2**

SP#1: SP1 in 483r2

* **Do you agree to allow puncturing structure 1001 in a given 80MHz segment for OFDMA PPDUs transmitted to STAs operating at BW>=80MHz?**
  + **Assuming 2 content channels are used**
  + **Puncturing signaling may be different for different 80MHz channels**
  + **In 802.11ax in such cases the BW drops to 20MHz**

**Discussion for SP:**

C: This is a rare pattern, not very useful. Add more complexity for more modes.

A: Disagree. In real life deployment we see OBSS in any 20MHz channel. Particular this pattern is very useful.

C: Why not change primary channel to solve the problem.

A: We should be more flexible that primary can be any location.

C: This is not about primary. This SP is for any 80MHz segment.

C: With 6GHz band, we have so many channels. Better to change a channel.

A: This puncture mode is not only for 6GHz band but also for 5GHz band. In some region, there may have less available channels.

SP result: Y/N/A: 31/ 13/16

SP#2: SP2 in 483r2

* **Do you agree to allow puncturing structure 1010 in a given 80MHz segment for OFDMA PPDUs transmitted to STAs operating at BW>=80MHz?**
  + **Assuming 2 content channels are used (Signaling TBD)**
  + **Puncturing signaling may be different for different 80MHz channels**
  + **In 802.11ax in such cases the BW drops to 20MHz**

**Discussion for SP:**

C: The signalling has some problem. It’s no longer transparent to STA.

A: We can add signalling TBD.

C: ACI is a problem. There may be leakage from both punctured channel so the 3rd 20MHz performance may have some problem.

A: May not allocated on both punctured channels. And you may not need to assign payload to the 3rd 20MHz.

C: I prefer defer this SP until we have design for signaling.

C: If EHT-SIG for each 80MHz are the same, there will be some information missing if both 2nd and 4th channels are punctured.

A: We mentioned 2 content channels are used.

C: Then you propose to shifting the content channel 2?

A: It’s TBD.

A: One idea can be put all signaling information to one content channel. Or you can change the order.

SP result: Y/N/A: 17/ 34/9

SP#3: SP3 in 483r2

* **Do you agree that U-SIG may include puncturing signaling/info about both 80MHz channels within each 160MHz channel?**
  + **Will be used only by devices that can decode pre-EHT on 160MHz**
  + **Will NOT affect the operation of STAs that decode pre-EHT on 80MHz**
  + **Applicable for BW=160,320MHz. For BW=240MHz applicable for P160 only**
  + **Signaling content is TBD**

**Discussion for SP:**

C: In U-SIG, should only tell where to find the EHT-SIG content channel. Indicate the RU allocation in EHT-SIG.

C: This is against a passed SP since this requires decode of whole 160MHz.

A: That SP is marginally passed.

C: What about we have new puncture modes in the future, do you need to indicate all possible pattern in U-SIG?

A: U-SIG have version dependent info. You can extend in version dependent info in the future.

C: Why not either indicate 80MHz pattern or the whole 320MHz pattern?

A: In dense environment, 320MHz STA is likely not be used.

C: We did not see 320MHz channel yet, how can you conclude most likely no 320MHz STA?

A: If you are in dense environment, it’s hard to find 320MHz. In sparse environment, you may not need to puncture.

C: The motivation is if one of the 80MHz has some content channel missing, content channel from the other 80MHz can be used. What about 80MHz device with only one content channel?

A: The motivation is to help 160MHz device better utilize the channel.

SP result: Y/N/A: 16/ 30/10

1. **SPs from 285r4**

SP#4: SP2 from 285r4

* **Do you support that U-SIG in each 80MHz shall carry puncturing channel info for at-least the specific 80MHz where it is transmitted?** 
  + **~~Note1: Each STA needs to decode U-SIG in only one 80MHz segment~~**
  + **Note~~2~~: Within each 80MHz segment, U-SIG is duplicated in every non-punctured 20MHz**
  + **Whether BW/Puncturing info can be different for different 80MHz is TBD**
  + **Whether BW and puncturing info ~~bits~~ in U-SIG are carried as a combined or a separate field is TBD**

**Discussion for SP:**

C: This SP is to exclude using EHT-SIG to carry puncturing channel?

A: No. If BW and puncturing info bits are separate, there can be some information in the EHT-SIG.

C: Delete “bits” in last sentence.

C: Can you delete note 1 since it is already covered by another SP.

A: Ok.

SP result: Y/N/A: 42/9/6

1. **SPs from 524r2**

SP#5: SP2 from 285r4

* **Do you agree that a subfield ~~which is not the BW field~~ for preamble puncturing pattern information separate from the BW field is included in U-SIG and/or EHT-SIG for the 11be PPDU transmitted to a single user?**

**Discussion for SP:**

C: Can you defer the SP since it excluded one single option.

C: Can you remove “**which is not the BW field**”?

C: Change to “separate from the BW field”?

C: “/” is not clear. Use “and /or”

C: This SP exclude the option with least signalling overhead (Option 1 in the contribution).

A: Option 1 will use more bits in version independent field which is more precious. Option 2 is more flexible for future wifi.

SP result: Y/N/A: 36/4/14

SP#6: SP3 from 285r4

* **Which option do you prefer to configure the preamble puncturing information for transmission to a single user?** 
  + **Approach. 1 : ~~BW field + puncturing pattern bits~~ BW field includes some puncturing information**
  + **Approach. 2 : ~~only puncturing pattern bits~~ BW field doesn’t include puncturing information. Puncturing information is a separate field.**
  + **Abs**

**Discussion for SP:**

C: The first approach is using BW field to include some high-level puncturing information and more information in another puncturing pattern field. The second approach is BW field only signal BW, no puncturing information.

C: Is this for SU transmission?

A: Yes. Add “for transmission to a single user”.

A: Approach 1 is similar to 11ax, BW field also include some puncture information.

C: Clarify approach 2 as “BW field doesn’t include puncturing information. Puncturing information is a separate field.”, approach 1 as “BW field includes some puncturing information”

SP result: Y/N/A: 17/30/10

**New Submissions**

1. **11-20-0575r0 – Self Contained Signaling for E-SIG –** Ron Porat (Broadcom)

**Summary:** Proposed self-contained EHT-SIG in which RU tables are removed from common field. An RU allocation table similar to Trigger frame is added to user field.

**Discussion:**

C: On slide 6, do you assume some bits shared by users?

A: Yes. CRC + Tail bits.

C: If each user have 10 bits for RU allocation. Our results show 4-8 users should be break even point, but your results shows 13.

A: Per common field have 102 bits, each user field have 16 more bits. 13 is the result for 2 common fields on 2 content channels.

C: For OFDMA + MU-MIMO case, the difference will be larger.

A: Will check.

SP deferred for discussion of other contributions on the same topic.

1. **11-20-0578r0 – On RU Allocation Singling in EHT-SIG –** Jianhan Liu (Mediatek)

**Summary:** Proposed HE-SIG-B based RU signalling method. Introduced a RU allocation table organized by RU size and enabled flexible RU signalling combined with per 80MHz EHT-SIG structure.

**Discussion:**

C: Need some time study the tradeoff for the two directions.

SP deferred for discussion of other contributions on the same topic.

**Adjourn**

The meeting is adjourned at 22:00 ET

**Monday April 13th, 2020 19:00 – 22:00 ET**

**Introduction**

1. The Chair (Sigurd Schelstraete, Quantenna/ON Semiconductor) calls the meeting to order at 19:00 ET.
2. The Chair follows the agenda in 11-20/0425r23
3. The Chair goes through the IPR policy and asks if anyone is aware of any potentially essential patents. Nobody speaks up.
4. The Chair reminds everyone to report their attendance by using imat online tool <https://imat.ieee.org/802.11/attendance-log?d=04/13/2020&p=3031000005&t=47200043>

or sending an e-mail to the Co-chair, Tianyu Wu (Apple) or the Chair himself.

1. Discussions on the agenda. Planned presentation list for today:
   1. Remaining SPs on 373, 575, 578 on EHT-SIG. Requested to have more time on this topic and defer to SP to PHY ad hoc meeting on April 23rd.
   2. Other remaining SPs from 1495r2, 65r3, 19r3 and 20r3.
   3. New submissions 479, 456, 480, 563, 565, 129 etc.

**Attendance**

The following people recorded their attendance for this call:

|  |  |  |  |
| --- | --- | --- | --- |
| TGbe (PHY) | 4/13 | An, Song-Haur | INDEPENDENT |
| TGbe (PHY) | 4/13 | Cao, Rui | NXP Semiconductors |
| TGbe (PHY) | 4/13 | Choi, Jinsoo | LG ELECTRONICS |
| TGbe (PHY) | 4/13 | CHUN, JINYOUNG | LG ELECTRONICS |
| TGbe (PHY) | 4/13 | Doostnejad, Roya | Intel Corporation |
| TGbe (PHY) | 4/13 | Duan, Ruchen | SAMSUNG |
| TGbe (PHY) | 4/13 | Erceg, Vinko | Broadcom Corporation |
| TGbe (PHY) | 4/13 | Grandhe, Niranjan | NXP Semiconductors |
| TGbe (PHY) | 4/13 | Hsieh, Hung-Tao | MediaTek Inc. |
| TGbe (PHY) | 4/13 | Hu, Mengshi | HUAWEI |
| TGbe (PHY) | 4/13 | Huang, Lei | Panasonic Asia Pacific Pte Ltd. |
| TGbe (PHY) | 4/13 | Ji, Chenhe | Huawei Technologies Co. Ltd |
| TGbe (PHY) | 4/13 | Kedem, Oren | Huawei Technologies Co. Ltd |
| TGbe (PHY) | 4/13 | Kim, Myeong-Jin | SAMSUNG |
| TGbe (PHY) | 4/13 | Kim, Sanghyun | WILUS Inc |
| TGbe (PHY) | 4/13 | Kim, Youhan | Qualcomm Incorporated |
| TGbe (PHY) | 4/13 | Lee, Wookbong | SAMSUNG |
| TGbe (PHY) | 4/13 | Li, Jialing | Qualcomm Incorporated |
| TGbe (PHY) | 4/13 | Li, Qinghua | Intel Corporation |
| TGbe (PHY) | 4/13 | Liang, dandan | Huawei Technologies Co., Ltd |
| TGbe (PHY) | 4/13 | Lim, Dong Guk | LG ELECTRONICS |
| TGbe (PHY) | 4/13 | LIU, CHENCHEN | Huawei Technologies Co., Ltd |
| TGbe (PHY) | 4/13 | Lou, Hanqing | InterDigital, Inc. |
| TGbe (PHY) | 4/13 | Lv, Lily | Huawei Technologies Co. Ltd |
| TGbe (PHY) | 4/13 | Montreuil, Leo | Broadcom Corporation |
| TGbe (PHY) | 4/13 | noh, yujin | Newracom Inc. |
| TGbe (PHY) | 4/13 | Pare, Thomas | MediaTek Inc. |
| TGbe (PHY) | 4/13 | Park, Eunsung | LG ELECTRONICS |
| TGbe (PHY) | 4/13 | Petrick, Albert | InterDigital, Inc. |
| TGbe (PHY) | 4/13 | Puducheri, Srinath | Broadcom Corporation |
| TGbe (PHY) | 4/13 | Redlich, Oded | Huawei |
| TGbe (PHY) | 4/13 | Schelstraete, Sigurd | Quantenna Communications, Inc. |
| TGbe (PHY) | 4/13 | Sharma, Prashant | NXP Semiconductors |
| TGbe (PHY) | 4/13 | Shellhammer, Stephen | Qualcomm Incorporated |
| TGbe (PHY) | 4/13 | Shilo, Shimi | HUAWEI |
| TGbe (PHY) | 4/13 | Son, Ju-Hyung | WILUS Inc. |
| TGbe (PHY) | 4/13 | SUH, JUNG HOON | Huawei Technologies Co. Ltd |
| TGbe (PHY) | 4/13 | Sun, Bo | ZTE Corporation |
| TGbe (PHY) | 4/13 | Tian, Bin | Qualcomm Incorporated |
| TGbe (PHY) | 4/13 | Uln, Kiran | Cypress Semiconductor Corporation |
| TGbe (PHY) | 4/13 | Urabe, Yoshio | Panasonic Corporation |
| TGbe (PHY) | 4/13 | Varshney, Prabodh | Nokia |
| TGbe (PHY) | 4/13 | Vermani, Sameer | Qualcomm Incorporated |
| TGbe (PHY) | 4/13 | Wu, Tianyu | Apple, Inc. |
| TGbe (PHY) | 4/13 | Xin, Yan | Huawei Technologies Co., Ltd |
| TGbe (PHY) | 4/13 | Yan, Aiguo | Oppo |
| TGbe (PHY) | 4/13 | YANG, RUI | InterDigital, Inc. |
| TGbe (PHY) | 4/13 | Yang, Steve TS | MediaTek Inc. |
| TGbe (PHY) | 4/13 | Young, Christopher | Broadcom Corporation |
| TGbe (PHY) | 4/13 | Yu, Jian | Huawei Technologies Co., Ltd |
| TGbe (PHY) | 4/13 | Yu, Mao | NXP Semiconductors |
| TGbe (PHY) | 4/13 | Yuan, Fangchao | HUAWEI |
| TGbe (PHY) | 4/13 | Zhang, Yan | NXP Semiconductors |

**Straw Polls**

1. **SPs from 1495r2 –** Wook Bong Lee (Samsung)

SP#1: SP1 in 1495r2

* **Do you support to define a compressed beamforming feedback in 11be for following cases?**
  + **Number of streams: 1-16**
  + **Number of antennas: 2-16**
  + **Note: Compressed beamforming feedback is the same as defined in 11ax except for the new parameter values of Nc and Nr. ~~Compressed beamforming feedback is defined in 19.3.12.3.6 of 802.11-2016. Number of streams is Nc in equation 19-79 of 802.11-2016. Number of antennas is Nr in equation 19-79 of 802.11-2016.~~**

**Discussion for SP:**

C: This is reuse legacy compressed beamforming method right?

A: Yes.

C: Can you clarify that this is same as 11ax, just extend the parameters.

A: ok. Updated SP text.

C: If there are other compressed beamforming with less overhead there will be multiple modes for compressed beamforming?

A: Yes, I am thinking legacy method is good for SU beamforming case and we have another SP for mechanism for MU case.

SP result: Y/N/A: 51/ 1/10

(Included 2 yes votes from email.)

SP#2: SP2 in 1495r2

* **Do you support to define a mechanism to reduce the explicit beamforming feedback overhead for 9-16 antennas in 11be compared to the compressed beamforming feedback defined in 19.3.12.3.6 of 802.11-2016?**
  + **Focusing on MU-MIMO feedback with maximum 4 streams**
  + **SU case TBD**

**Discussion for SP:**

C: Why exclude SU feedback?

A: This is focusing on MU based feedback. Later if we want to use it for SU case, that’s fine. Fine to add SU case TBD in SP. For SU case, the simulation shows no big difference comparing to the baseline scheme.

C: What is “**with maximum 4 streams**”, is it per STA or total?

A: This is stream number per STA.

C: Are you SP your proposed scheme or a general direction?

A: It’s on the general direction.

C: My vote will depend on whether there will be a good scheme. I will be hesitate if there is no good scheme on the table.

C: This SP is for SFD or for information collection.

A: It’s for SFD. There are several cases we already voted for general direction without detailed scheme.

C: Do you think there is no benefit for >4ss per user?

A: I think most of the STA will be limited to 4ss. So I just want to focus on <=4ss case in this SP but we are not saying >4ss cases will be excluded.

SP result: Y/N/A: 22/ 23/18

(Included 1 yes vote from email.)

1. **SPs from 65r3 –** Lily Lyu (Huawei)

SP#3: SP1 from 65r3

**Do you support to ~~introduce~~ investigate implicit sounding as an optional mode in TGbe (for R2)?**

**Discussion for SP:**

C: There are a lot of uncertainty as well as potential in implicit sounding. Whether to enable it now may need more time to determine. Can you defer the SP? I think these features shall be discussed in R2. I want to be open to the feature but need more time to study.

A: Any specific problem in your mind?

C: A lot of product trying to bring up this feature but meet a lot of implementation difficulties. Not sure whether calibration accuracy can be sufficient for MU.

C: If you want to run the SP, maybe you can add “investigate” and not include in SFD.

A: Ok. Updated the SP text.

C: What do you need to standardize for implicit sounding?

A: Sounding procedure.

C: If STA want to explicit sounding, should AP follow? Is it STA side optional or AP side optional?

A: STA can be optional to choose the feature.

C: STA need to send NDP to help AP calibration, right? You need to rely on STA at least once? Do you need some over the air signal?

A: Only need AP no need for STA side support.

C: Then the accuracy may have some problem.

SP result: Y/N/A: 47/8/10

(Included 1 yes vote and 1 abstain vote from email.)

Other SPs in 65r3 are on detailed protocols and is deferred for further study.

1. **SPs from 0019r3 –** Dongguk Lim (LG)

SP#4: SP1 from 0019r3

* **Do you agree to add the following into the 11be SFD?**
  + **The following subfields exist in U-SIG and/or EHT-SIG of an EHT PPDU sent to single user:**
    - **LDPC Extra symbol**
    - **~~STBC~~**
    - **Beamformed**
    - **Pre-FEC padding factor**
    - **PE Disambiguity**

**Discussion for SP:**

C: I have question on STBC. We may not need it anymore in 11be. Suggest to discuss this field separately.

A: I will delete STBC from the SP.

C: Do you mean all these field has same meaning as in 11ax?

A: Yes, we think same or similar meaning for these fields as in 11ax. Details of these fields can be further discussed.

C: We do not know whether we need these fields since the functions are not clear.

C: Add “factor” after Pre-FEC padding.

SP result: Y/N/A: 41/5/11

(Included 1 additional no vote from bridge)

SP#5: SP2 from 0019r3

* **Do you agree to add the following into the 11be SFD?**
  + **The EHT PPDU sent to a single user has the EHT-SIG field.** 
    - **~~EHT-SIG field has a common field (TBD for user-specific field)~~** 
      * **A subfield that indicates preamble puncturing pattern can be present in the U-SIG/EHT-SIG field.**

**Discussion for SP:**

C: Why need a common field for PPDU to single user.

A: Common field is for overflowed information of U-SIG.

C: Whether there is overflow information is case by case. Our proposal shows no overflow information. Suggest to delete the sentence with common field.

A: ok. Updated the SP text.

C: What do you think of just have unified to MU PPDU format.

A: The SP include EHT-SIG field already.

C: This may be too early to determine SU format is derived from MU with compressed format.

A: U-SIG/EHT-SIG do you mean or or and?

A: We think both are ok. You want to change to U-SIG and/or EHT-SIG?

C: We also have a contribution on this topic, can you defer the SP?

A: Ok, we can defer the SP.

SP deferred.

SP3 in 0019r3 also deferred.

1. **SPs from 0020r3 –** Dongguk Lim (LG)

SP#6: SP1 from 0020r3

* **Do you agree that in BW ≤ 160MHz, the EHT-SIG content channel for Multiple user transmission is configured as following?**
  + **A EHT-SIG content channel is composed of a 20 MHz frequency segment.**
  + **EHT-SIG content channels carry EHT-SIG common information and the user-specific information.**
  + **The EHT-SIG field ~~of MU PPDU~~ consists of the two EHT-SIG content channels in each 80MHz**
  + **~~In 80MHz and 160MHz, EHT-SIG content channel can be configured as below, respectively.~~**
  + **The content channels (i.e., CC1 and CC2) per each 80MHz may carry different information.**
    - **Where, SST operation using TWT is one potential applicable scenario, other scenarios are TBD**
* **~~Note:~~** ~~in example 2, each STA still only needs to decode the CC in one 80MHz segment to get its assigned information~~

**Discussion for SP:**

C: In your SP, you limited to <=160MHz case but leave 240 and 320MHz case open. Do you want to include these cases as well?

A: These cases are in SP2.

C: You have two plots, one figure includes cc1, cc2, cc3 and cc4. It may be misleading to people that STA need to decode 160MHz to get all cc1 to cc4. Better to add some clarification. For example: Add “in example two, each STA still only need to decode the content channel in one 80MHz segment to get its assigned information”

A: We are fine to update the SP text.

C: The figure in the SP is not needed. Comment to remove the figure and the note to avoid confusing.

C: Some editorial updates for SP text.

SP result: Y/N/A: 42/3/6

(Included 1 yes vote from bridge and 1 yes vote from email)

SP#7: SP3 from 0020r3

* **Do you agree that 11be STA can recognize the ~~full~~ preamble puncturing pattern it needs by using the BW field and puncturing information of U-SIG and EHT-SIG field in Multiple user transmission?**
  + **Details for how to convey the puncturing information is TBD.**

**Discussion for SP:**

C: Comment to remove “full”. STA only need its own information not the full information of all STAs.

A: Ok. Updated SP text.

C: Does it exclude any other options?

A: This is general concept. Other than U-SIG and EHT-SIG we do not have plan.

C: Does this also include SU?

A: No, only for MU. SU case already run.

C: Change and to “and/or”.

C: “11be STA” do you mean only intended 11be STA or any 11be STA that received the PPDU?

A: We don’t think we need to differentiate the cases here.

C: The question is if a STA don’t know where is the primary channel, can they find out the puncture pattern?

A: Need further discussion.

SP result: Y/N/A: 33/2/24

(Included 1 yes vote from bridge)

**New Submissions**

1. **11-20-0479r0 – 240MHz channelization –** Sigurd Schelstraete (Quantenna/ON)

**Summary:** Proposed 3 options for 240MHz channelization: Opt1: Non-overlapping 240MHz; Opt2: Any three consecutive 80MHz; Opt3: Any 3 consecutive 80MHz channels within 320MHz channel.

**Discussion:**

C: We should first discuss the 320MHz channelization. If any two 160MHz can form a 320MHz channel, then opt 2 and opt3 become the same.

A: I didn’t consider that option for 320MHz yet.

C: Do we want to enable non-contiguous 160+80 and non-contiguous 160+160.

A: I think we already have conclusion for these modes.

C: What is the benefit to allow overlapped 320MHz?

A: You can define more 320MHz channels. And can make use of the last 160MHz in US.

C: In opt3, all listed are contiguous 240MHz, do you consider non-contiguous 240MHz?

A: There are still many questions for non-contiguous 240MHz. For example does it need to limit to 320MHz etc. Need more discussion.

C: In opt1, if 320MHz BSS the primary channel is on the last 80MHz of channel 47, then it’s not possible to use 240MHz PPDU in the BSS.

A: Same for 160MHz case.

C: There are several cases where the channels are overlapped. This will bring some problems. The primary 20MHz channel and BW will not tell you the actual channel.

SP1 deferred.

SP#8: SP2 from 0479r0

**In 160+80 MHz BSS, should the 160 and 80 MHz be non-adjacent?**

SP result: Y/N/A: 25/5/24

1. **11-20-0456r0 – Rx EVM requirement for 4K QAM –** Qinghua Li (Intel)

**Summary:** Show simulation results for EVM requirements for 4KQAM.

**Discussion:**

C: You mentioned results not sensitive the phase noise. What PN model you are using?

A: There are some model in IEEE for ay etc. We are using some proprietary PN model and crosschecked with others.

C: I suggest you share the model.

C: Do we have agreement on TX EVM model?

A: We are showing the worst-case scenario.

C: Do you include the distortions (PA distortion etc) at Tx side?

A: Yes. We do include.

C: You model TX distortion as AWGN and add AWGN channel again?

A: Yes.

C: Everyone should use recommended model for IEEE in simulation.

C: I see ~5dB EVM requirement between results from different party. Can you explain where is the gap comes from? All simulation show results for beamforming case but results are different. Some show ~43dB EVM requirement but your results is 38.

A: You may refer to Ron’s simulation before. His simulation is real EVM where Qinghua is simulation on measured EVM in spec. Ron’s simulation does not say you have to work with 43dB EVM. In Ron’s simulation, -40dB also works. 256QAM to 1k QAM, simulation shows 3dB EVM gap, it’s reasonable to have another 3dB EVM gap to achieve 4K QAM.

SP#9: SP1 from 0456r0

* **Do you support -38 dB as the Tx EVM requirement for 11be 4k QAM?**

SP result: Y/N/A: 27/ 12/18

(Included 1 yes vote from bridge)

**Adjourn**

The meeting is adjourned at 21:53 ET