IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGax  January 2016 Atlanta Meeting Minutes | | | | |
| Date: 2016-02-02 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Yasuhiko Inoue | NTT | 1-1 Hikari-no-oka, Yokosuka, Kanagawa 239-0847 Japan | +81 46 859 5097 | inoue.yasuhiko@lab.ntt.co.jp |
|  |  |  |  |  |

Abstract

TGax meeting minutes from the IEEE 802.11 Atlanta session, January 18th – 22nd, 2016.

Minutes from the ad hoc groups are contained in the following documents:

* PHY
  + <https://mentor.ieee.org/802.11/dcn/16/11-16-0119-00-00ax-ieee-802-11-tgax-january-2016-atlanta-phy-ad-hoc-meeting-minutes.docx>
* MAC
  + <https://mentor.ieee.org/802.11/dcn/16/11-16-0110-00-00ax-jan-2016-atlanta-tgax-mac-ad-hoc-meeting-minutes.docx>
* MU Ad Hoc
  + <https://mentor.ieee.org/802.11/dcn/16/11-16-0147-00-00ax-tgax-mu-ad-hoc-january-2016-agenda.pptx>

The submission for SR ad hoc was considered in the MAC ad hoc due to the number of submissions.

(No minutes provided by the SR ad hoc for the January 2016 meeting.)

**IEEE 802.11 Task Group ax**

**January 2016 Atlanta Meeting**

**Hyatt Regency Atlanta, Atlanta, GA**

**January 18th – 22nd, 2016**

**TGax Chair Osama Aboul-Magd (Huawei Technologies)**

**Vice Chair Simone Merlin (Qualcomm)**

**Vice Chair Ron Porat (Broadcom)**

**TGax Secretary Yasuhiko Inoue (NTT)**

**TGax Technical Editor Robert Stacy (Intel)**

**Monday, January 18th, 2016, AM2 TGax Session (10:30-12:30)**

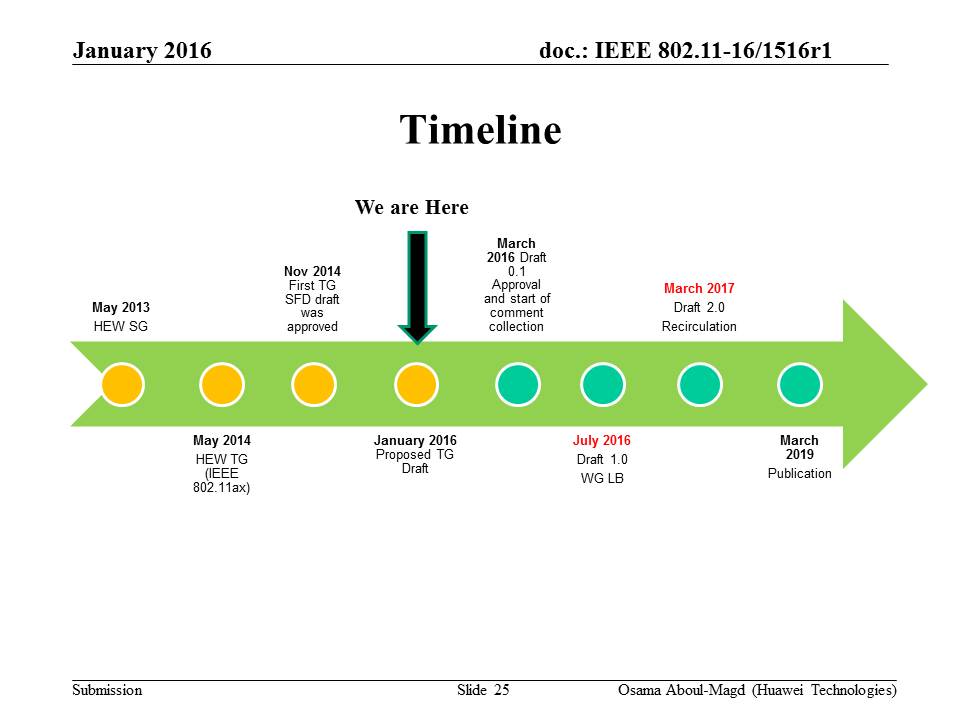
1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chair of the TGax, @10:30
   1. About 190 people are in the room.
2. **Announcement**
   1. Agenda Doc.11-15/1516r0 on the server. Rev. 1 is the working document.
   2. Meeting Protocol: Chair asked to state name and affiliation when speaking for the first time.
   3. Attendance reminder.
      1. The attendance server: https://imat.ieee.org/
      2. See 11-09-0517r0 for more information.
3. **The chair reviewed the mandatory 5 slides of P&P.**
   1. Instructions for the WG Chair.
   2. Participants, Patents, and Duty to Inform.
   3. Patent Related Links.
   4. Call for potentially essential patents.
      1. Chair asked if anyone is aware of potentially essential patents.
      2. No potentially essential patents reported.
   5. Other Guidelines for IEEE WG Meetings.
4. **Agenda items for the week**
   1. Approve TG and Teleconference minutes since November 2015 meeting.
   2. Continue to advance task group documents.
      1. Simulation Scenarios
      2. Evaluation Methodology
      3. Channel Model
      4. Function Requirements
      5. Specification Framework
   3. Ad Hoc meetings
   4. Technical Presentations
   5. Schedule Teleconference times.
5. **General Flow of the meeting**
   1. Slides 13 and 14 of the 15/1516r0 contain general flow of the meeting.
   2. There are eight meeting slots planed for TGax.

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Monday | | Tuesday | | Wednesday | | Thursday |
| AM1 |  | |  | | TGax | |  |
| AM2 | TGax | | TGax  (Ad Hoc) | TGax  (Ad Hoc) |  | | TGax |
| PM1 |  | | TGax  (Ad Hoc) | TGax  (Ad Hoc) | TGax  (Ad Hoc) | TGax  (Ad Hoc) |  |
| PM2 | TGax  (Ad Hoc) | TGax  (Ad Hoc) |  | | TGax  (Ad Hoc) | TGax  (Ad Hoc) | TGax |
| PM3 |  | | TGax  (Ad Hoc) | TGax  (Ad Hoc) |  | |  |

1. **Agenda for Monday, January 18th, AM2 (10:30 – 12:30).**
   1. Proposed Agenda for Monday AM2:
      1. Call meeting to order
      2. Patent policy, etc.
      3. Call for submissions
      4. Set Ad Hoc Groups schedule and approve agenda
      5. Summary from November 2015 meeting
      6. SFD review – Editor
      7. TG motions
         1. Approve TG meeting and Telecon minutes since November meeting.
         2. Approve the latest SFD revision
      8. Timeline
      9. Ad Hoc group Rules
      10. Presentations
      11. Recess
   2. Chair asked if there are any other items – No items proposed. Meeting will be conducted based on this order.
2. **Call for submissions – we have 48 submissions**
   1. PHY – 22 submissions
      1. 11-16/0030 “Maximum Tone Grouping Size for 802.11ax Feedback with MU-MIMO,” Kome Oteri (InterDigital)
      2. 11-16/0033 “1x HE-LTF for ULMUMIMO,” Hongyuan Zhang (Marvell)
      3. 11-16/0034 “Beamforming with HE-LTF Compression,” Hongyuan Zhang (Marvell)
      4. 11-16/0036 “CRC Generation for HE-SIG,” Yakun Sun (Marvell)
      5. 11-16/0037 “Continuous Puncturing for HE-SIGB Encoding,” Yakun Sun (Marvell)
      6. 11-16/0038 “Sequence for 1x LTF,” Daewon Lee (Newracom)
      7. 11-16/0039 “RU Allocation in SIG-B,” Daewon Lee (Newracom)
      8. 11-16/0040 “Issues with Compressed SIG-B Mode,” Yujin Noh (Newracom)
      9. 11-16/0041 “Link Adaptation for HE WLAN,” Yujin Noh (Newracom)
      10. 11-16/0044 “MCS Levels and TX EVM Requirement for 1024 QAM,” Eunsung Park (LG Electronics)
      11. 11-16/0045 “Flexible Wider Bandwidth Transmission,” John Son (WILUS)
      12. 11-16/0046 “Content for the extra tones in LSIG and RLSIG,” Jiayin Zhang (Huawei)
      13. 11-16/0047 “Discussion on the HE Extended Range SU PPDU,” Jiayin Zhang (Huawei)
      14. 11-16/0052 “Remaining HE-LTF Sequence Design,” Le Liu (Huawei)
      15. 11-16/0053 “Requirements for UL MU Transmissions,” Arjun Bharadwaj (Qualcomm)
      16. 11-16/0056 “On QPSK DCM Modulation and LDPC Tone Mapper for DCM,” Jianhan Liu (MediaTek)
      17. 11-16/0071 “Packet Extension Follow Up,” Ron Porat (Broadcom)
      18. 11-16/0079 “Allocation sizes for BCC in OFDMA,” Ken Taniguchi (Toshiba)
      19. 11-16/0080 “1x/2x/4x OFDM Symbol in HE SU PPDU with BCC,” Heejung Yu (Yeungnam Univ./NEWRACOM)
      20. 11-16/0088 “Ng for Compressed Beamforming feedback,” Sriram Venkateswaran (Broadcom)
      21. 11-16/0089 “Single Stream Pilots in UL MU MIMO,” Sriram Venkateswaran (Broadcom)
      22. 11-16/0104 “Rate Matching for HE-SIG-B,” Daewon Lee (Newracom)
   2. MAC – 12 submissions
      1. 11-16/0015 “Explicit Block Ack Request in DL MU PPDU,” Yongho Seok (Newracom)
      2. 11-16/0017 “Beacon Collision Avoidance,” Evgeny Khorov (IITP)
      3. 11-16/0018 “TDMA for Eliminating Hidden Station Effect in Dense Networks,” Evgeny Khorov (IITP)
      4. 11-16/0028 “Follow Up for Multi-STA BA for SU Transmissions,” Xiaofei Wang (InterDigital)
      5. 11-16/0029 “TXOP Truncation Enhancement,” Xiaofei Wang (InterDigital)
      6. 11-16/0042 “BSS Color Settings for a Multiple BSSID Set,” Geonjung Ko (WILUS)
      7. 11-16/0050 “Fragmentation for MU frames-Follow up on acks,” Alfred Asterjadhi (Qualcomm)
      8. 11-16/0051 “Response Give Trigger Type,” David Xun Yang (Huawei)
      9. 11-16/0068 “BSS Color and Multiple BSSID,” Liwen Chu (Marvell)
      10. 11-16/0069 “Multi-TID A-MPDU in MU Transmission,” Liwen Chu (Marvell)
      11. 11-16/0087 “NAV cancellation issues on MU protection,” Jinsoo Ahn (Yonsei Univ.)
      12. 11-16/0102 “High Efficiency Medium Access via Rosters,” Sean Coffey (RealTek)
   3. MU – 9 submissions
      1. 11-16/0031 “Proposed UL MU CS Rules,” Lei Wang (Marvell)
      2. 11-16/0048 “Protection using MU RTS/CTS,” Young Hoon Kwon (Newracom)
      3. 11-16/0054 “UL MU CCA Response,” Kaiying Lv (ZTE)
      4. 11-16/0057 “Indication for UL MU Carrier Sensing,” Kiseon Ryu (LG Electronics)
      5. 11-16/0065 “Duration/ID field in UL-MU,” Tomo Adachi (Toshiba)
      6. 11-16/0066 “Views on UL-MU Features,” Joonsuk Kim (Apple)
      7. 11-16/0067 “MAC Padding in Trigger Frame,” Liwen Chu (Marvell)
      8. 11-16/0085 “Congestion control for UL MU random access,” Woojin Ahn (Yonsei Univ.)
      9. 11-16/0091 “Regarding HE NDPA frame for DL Sounding Sequence,” Narendar Madhavan (Toshiba)
   4. Spatial Reuse – 1 submission 🡪 to be covered in the MAC Ad Hoc
      1. 11-16/0060 “Recipient-aware Spatial Reuse,” Reza Hedayat (Newracom)
   5. TG – 4 submissions
      1. 11-15/1095 “OFDMA Performance in 11ax,” Suhwook Kim (LG Electronics)
      2. 11-16/0024 “Proposed draft specification,” Robert Stacy (Intel)
      3. 11-16/0043 “Clarification of SFD Texts,” John Son (WILUS)
      4. 11-16/0059 “Non-contiguous Channel Bonding in 11ax,” Yunbo Li (Huawei)
   6. **Ad Hoc meeting scheduling**
      1. Chair asked if there are any objections to approve the TGax schedule as follow.
         1. There are no objections. The TGax schedule is approved.

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Monday | | Tuesday | | Wednesday | | Thursday |
| AM1 |  | |  | | TGax  (full) | |  |
| AM2 | TGax  (full) | | TGax  (PHY) | TGax  (MAC/SR) |  | | TGax  (full) |
| PM1 |  | | TGax  (PHY) | TGax  (MAC) | TGax  (PHY) | TGax  (MU) |  |
| PM2 | TGax  (PHY) | TGax  (MAC) |  | | TGax  (PHY) | TGax  (???) | TGax  (full) |
| PM3 |  | | TGax  (MU) | TGax  (???) |  | |  |

1. **Summary from November 2015 Meeting**
   1. Over 30 PHY motions passed addressing power boost, CP for SIG-B, LTF sequences, MCS values for SIG-B, SIG-B common part, etc.
   2. 16 MAC motions passes addressing DL MU operation, Multi-STA BA in OFDMA, fragmentation negotiation, Trigger frame contenets, etc.
   3. 12 MU motions passed addressing UL MU operation, MU BAR frame, MU RTS/CTS use during a TXOP, MU-RTS format, etc.
   4. One SR motion passed related to NAV setting when intra-BSS or OBBS frames.
   5. A new revision of the Specification Framework document was produced by the Editor. It is available at: <https://mentor.ieee.org/802.11/dcn/15/11-15-0132-13-00ax-spec-framework.docx>
2. **TG Motions**
   1. **Motion: Approve TGax minutes of meetings and teleconferences from November 2015 plenary meeting to today:** 
      * [**https://mentor.ieee.org/802.11/dcn/15/11-15-1368-01-00ax-tgax-november-2015-dallas-meeting-minutes.docx**](https://mentor.ieee.org/802.11/dcn/15/11-15-1368-01-00ax-tgax-november-2015-dallas-meeting-minutes.docx)
      * [**https://mentor.ieee.org/802.11/dcn/15/11-15-1421-01-00ax-nov-2015-spatial-reuse-ad-hoc-meeting-minutes.docx**](https://mentor.ieee.org/802.11/dcn/15/11-15-1421-01-00ax-nov-2015-spatial-reuse-ad-hoc-meeting-minutes.docx)
      * [**https://mentor.ieee.org/802.11/dcn/15/11-15-1423-01-00ax-tgax-mu-ad-hoc-meeting-minutes-november-2015.docx**](https://mentor.ieee.org/802.11/dcn/15/11-15-1423-01-00ax-tgax-mu-ad-hoc-meeting-minutes-november-2015.docx)
      * [**https://mentor.ieee.org/802.11/dcn/15/11-15-1442-00-00ax-nov-2015-phy-ad-hoc-meeting-minutes.docx**](https://mentor.ieee.org/802.11/dcn/15/11-15-1442-00-00ax-nov-2015-phy-ad-hoc-meeting-minutes.docx)
      * [**https://mentor.ieee.org/802.11/dcn/15/11-15-1414-00-00ax-nov-2015-mac-ad-hoc-meeting-minutes.docx**](https://mentor.ieee.org/802.11/dcn/15/11-15-1414-00-00ax-nov-2015-mac-ad-hoc-meeting-minutes.docx)
      1. **Moved: Brian Hart, Second: David Xun Yang**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
   2. **SFD Motion**
      1. **Move to accept document 11-15/0132r13 as the current revision of the TG Specification Framework document.**
      2. **Moved by Robert Stacy, Seconded by Al Petrick.**
      3. Discussion: No discussion.
      4. **Result: The motion was accepted with no objection.**
3. **Timeline**
   1. Slide 25 of the agenda document



* 1. Plan is;
     1. To review the current proposed draft until March 2016.
     2. To start comment collection process if the proposed draft is accepted in March 2016.
     3. Spend 4 months to resolve comments and create draft 1.0 in July 2016.
  2. Discussion
     1. Q: Any plans to finalize TGax SFD? There are many TBDs.
     2. A: During the 802.11ac standardization, SFD was not changed after the 802.11ac draft 0.1 was approved. Any modifications and new proposals are incorporated into the draft directly. We will follow the same process as we did during 802.11ac standardization.
     3. Q: What will be the process to add new things into the draft?
     4. A: Chair asked members to submit text to be incorporated into the draft.

1. **Ad Hoc Group Rules**
   1. A straw poll needs to achieves at least 75% at the ad-hoc level to be converted to a motion at the TG level.
   2. In the case a consensus can not be reached within an Ad Hoc group (a stalemate that prohibits further progress), the subject is moved to the Task group, if an Ad Hoc straw poll vote to move the subject to the Taskgroup achieves > 50% approval.
   3. A straw poll affecting the Spec Framework has to start with,
      1. Do you agree to add to the TG Specification Frame work document?
         1. x.y.z. <feature description>
   4. For further details, please see 11-15-0075r0
   5. Minutes of the Ad Hoc group meetings will be available on mentor.
2. **Plans for Wednesday AM1 session**
   1. Call Meeting to order
   2. IEEE 802 and 802.11 IPR Policy and procedure.
   3. Presentations
      1. 11-16-0024, Proposed Draft Specification
   4. Recess
3. **Presentations**
   1. **Suhwook Kim (LG Electronics) presented “OFDMA Performance in 11ax” based on the submission 15/1095r5..**
      1. Summary:
         1. Updated OFDMA Simulations Results considering following points;
            1. MU-RTS/CTS
            2. CCA for UL OFDMA
         2. OFDMA shows better throughput in most cases while throughput gain of RTS/CTS is more larger in legacy case.
         3. Next step is to include more features being discussed in TGax.
      2. Discussions:
         1. Clarification requested for the scheduling scheme.
         2. Details of MU-RTS/CTS exchange procedure discussed to maximize the throughput.
         3. A member commented that only the energy detection will be capable for the CCA within 4 s. 🡪 Assumed frame detection as well.
         4. Some members asked question on the simulations results.
   2. **John Son (Willus Insititute) presented “title” based on the submission 16/0043r0.**
      1. Summary:
         1. Several clarifications on TGax SFD texts proposed.
            1. Texts for L\_LENGTH mod 3, HE-SIG-A, HE-SIG-B, HE-LTF, Cascading and Fragmentation proposed.
      2. Discussions:
      3. **Straw Poll: Do you agree to change the texts in 11ax SFD as proposed in pages 3~10 in this slide ?**
         * **(page 3) 1. L\_LENGTH mod 3**
         * **(page 4) 2. HE-SIG-A (number of tones)**
         * **(page 5) 3. HE-SIG-A (location)**
         * **(page 6) 4. HE-SIG-A (repetition mode)**
         * **(page 7) 5. HE-SIG-B (CRC/Tail)**
         * **(page 8) 6. HE LTF (in SP1)**
         * **(page 9) 7. Cascading**
         * **(page 10) 8. Fragmentation (TB)**
         1. Discussion:
            1. A member suggested to make motion covering all of the proposed changes.
            2. Chair suggested page by page review.

Slide 3: 1. L\_LENGTH - no comment

Slide 4: 2. HE-SIG-A (number of tones) - no comment

Slide 5: 3. HE-SIG-A (location) - no comment

Slide 6: 4. HE-SIG-A (repetition mode) - no comment

Slide 7: 5. HE-SIG-B (CRC/Tail) - no comment

Slide 8: 6. HE LTE (in SP1) - no comment

Slide 9: 7. Cascading – need discussion

Slide 10: 8. Fragmentation - TB means trigger based. No need to change.

* + 1. **Modified Straw Poll: Do you agree to change the texts in 11ax SFD as proposed in pages 3~10 in this slide ?**
       - **(page 3) 1. L\_LENGTH mod 3**
       - **(page 4) 2. HE-SIG-A (number of tones)**
       - **(page 5) 3. HE-SIG-A (location)**
       - **(page 6) 4. HE-SIG-A (repetition mode)**
       - **(page 7) 5. HE-SIG-B (CRC/Tail)**
       - **(page 8) 6. HE LTF (in SP1)**
       1. **Result: No objection.**
    2. **Motion: Move to change the texts in 11ax SFD as proposed in pages 3~10 in this slide.**
       1. **(page 3) 1. L\_LENGTH mod 3**
       2. **(page 4) 2. HE-SIG-A (number of tones)**
       3. **(page 5) 3. HE-SIG-A (location)**
       4. **(page 6) 4. HE-SIG-A (repetition mode)**
       5. **(page 7) 5. HE-SIG-B (CRC/Tail)**
       6. **(page 8) 6. HE LTF (in SP1)**
       7. **Moved by John Son, Seconded by Yong Hoon Kwon**
       8. Discussion: No discussion.
       9. **Result: The motion was accepted with no objection.**

1. **AoB**
   1. PM1 is ad hoc sessions
      1. PHY – Centennial I
      2. MAC – Regency VII
2. **TGax meeting recessed @ 12:22 AM until PM1 (13:30) today.**

**Monday, January 18th, 2016, PM1 TGax Ad Hoc Sessions (13:30-15:30)**

* PHY Ad hoc – CENTENNIAL I
  + Agenda: 11-16-0108
* MAC Ad hoc – REGENCY VII
  + Agenda: 11-16-0109

**Tuesday, January 19th, 2016, AM2 TGax Ad Hoc Sessions (10:30-12:30)**

* PHY Ad hoc – CENTENNIAL I
  + Agenda: 11-16-0108
* MAC Ad hoc – REGENCY VII
  + Agenda: 11-16-0109

**Tuesday, January 19th, 2016, PM1 TGax Ad Hoc Sessions (1330-15:30)**

* PHY Ad hoc – CENTENNIAL I
  + Agenda: 11-16-0108
* MAC Ad hoc – REGENCY VII
  + Agenda: 11-16-0109

**Tuesday, January 19th 2016, PM3 TGax Ad Hoc Session (19:30-21:30)**

* MU Ad hoc – CENTENNIAL I
  + Agenda: 11-16-0147

**Wednesday, January 20th 2016, AM1 Session (8:00-10:00)**

1. **The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @8:02.**
   1. Agenda 11-15/1516r1 is on the server. Rev 2 is working document.
2. **Administrative Items**
   1. Chair reminded the IEEE 802 and IEEE 802.11 P&P.
   2. Chair asked people to address himself/herself when speaking for the first time.
   3. Attendance
3. **Agenda for this session**
   1. Wednesday AM1
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure
      3. Agenda Setting
      4. Progress Review
      5. Presentations
         1. 11-16-0024, Proposed Draft Specification – Robert Stacy
         2. 11-16-0059, Non-contiguous Channel Bonding in 11ax – Yunbo Li
      6. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
4. **Progress Review**
   1. MAC
      1. Completed all submissions including an SR submission.
   2. PHY
      1. Had three sessions and completed most presentations except five.
      2. Suggested cancellation of one of the PHY ad hoc sessions.
   3. MU
      1. One out of nine submissions withdrawn.
      2. Heard 5 presentations and three remaining.
   4. Discussion
      1. As a result of the discussions, PM Sessions today will be TGax full sessions.
5. **Presentations**
   1. **Robert Stacy (Intel), the TGax technical editor, presented “Proposed IEEE 802.11ax Draft” based on the submission 16/0024r0.**
      1. Summary
         1. Robert explained the 16/0024r0 which is written in the draft style.
            1. HE PHY (Clause 25)

Followed the style of 802.11ac.

* + - * 1. MAC

New features in clause 9.

* + 1. Discussions
       1. A member mentioned he would like to edit some text for DSC and asked how to work with people who volunteered to craft the draft.
          1. After passing a motion to include something into SFD, someone needs to create some text.
          2. Chair suggested use of conference calls between January and March meetings.
    2. Plan for advancing the draft
       1. Approve the draft during the March 2016 meeting.
          1. Draft 0.1
       2. Start a comment collection (CC) for 30 days on draft 0.1 – Ends some time in April.
       3. Comment resolution (May and July)
       4. Draft 1.0 in July 2016 and start WG LB.
  1. **Yunbo Li (Huawei) presented “Non-contiguous Channel Bonding in 11ax” based on the submission 16/0059r0.**
     1. Summary
        1. Non-contiguous channel bonding is proposed in 11ax to increase the system efficiency.
        2. With minor changed to current spec, non-contiguous channel bonding can be implemented;
           1. Implemented by nulling the tones of non-available channel(s)
           2. Only MU transmission will be supported in non-contiguous channel bonding
     2. Discussions
        1. A member mentioned he understood that no resource is allocated for the 20 MHz channel which was sensed busy and asked about if the preamble part is transmitted. 🡪 We need to discuss about it, but current assumption is not to transmit the preamble part.
        2. Another member asked why this technique is discussed in conjunction with MU techniques.
     3. **Straw Poll**
        1. **Do you agree to add to the TG SFD;**

**The non-contiguous channel bonding will be supported in 802.11ax by:**

* + - * 1. **Transmitting using OFDMA PPDU format by nulling the tones of one or more secondary channels in 80MHz and 160 (80+80)MHz;**
        2. **Modes for non-contiguous channel bonding are TBD;**
        3. **Non-contiguous channels within primary or secondary 80MHz only exists at AP side.**
      1. Discussions
         1. The spec allows specific allocation of secondary 20, secondary 40 and secondary 80 channels. The wording is not good. 🡪 The term of “secondary channel” is strictly defined in the spec and is not appropriate to explain the intension of this straw poll.
         2. Another member asked relation of sub-band, RU and tones.
         3. This straw poll will affect the SFD and amendment to the text proposed.
      2. **Result: Y/N/A = 75/1/39, the straw poll will be converted to a motion.**

1. **Presentation – left over presentations from PHY and MU ad hocs**
   1. **Sriram Venkateswaran (Broadcom) presented “Single Stream Pilots in UL MU MIMO,” based on the submission 16/0089r0.**
      1. Sumary
         1. The current SFD supports single stream pilots for SU, DL/UL OFDMA and DL MU-MIMO transmissions
         2. Support for single stream pilots for UL MU-MIMO transmissions proposed.
      2. Discussion
         1. C (Slide 12): In single stream transmissions, we may not have two LTFs 🡪 We have them.
      3. **Straw Poll: Do you support the following change/additions to the SFD:**
         1. **For UL MU MIMO transmissions, support of single stream pilots and masking the LTF sequence of each spatial stream by a distinct orthogonal code is mandatory at the transmitter side (non AP STA).**
         2. **The trigger frame shall use 1 bit to indicate whether the UL MU MIMO transmission following it uses single stream pilots or a mask on each spatial stream of the LTF sequence by a distinct orthogonal code.**
      4. Discussion: No question.
      5. **Result: Y/N/A = 80/0/32, this straw poll will be converted to a motion.**
   2. **Ron Porat (Broadcom) presented “Packet Extension Follow Up,” based on the submission 16/0071r0.**
      1. Summary
         1. Proposed to change the current text in the SFD:
            1. “When ≥ 80MHz is supported, no thresholds are defined for RU size less than or equal to 242 tones (20MHz); otherwise, thresholds are defined down to a TBD RU size”

to

* + - * 1. “Packet extension device capability thresholds are defined for all RU sizes greater than or equal to 242 tones. No packet extension permitted and no thresholds defined for an RU size less than 242 tones”
    1. Discussion – No questions
    2. **Straw Poll: Do you support changing the current text in the TG Specification Framework:**

**When ≥ 80MHz is supported, no thresholds are defined for RU size less than or equal to 242 tones (20MHz); otherwise, thresholds are defined down to a TBD RU size**

**with:**

**Packet extension device capability thresholds are defined for all RU sizes greater than or equal to 242 tones. No thresholds defined for an RU size less than 242 tones**

* + - 1. Discussion
         1. A member asked for clarification on the last sentence of the straw poll.
      2. **Result: Y/N/A = 80/0/22, this motion will be converted to a motion.**

1. AoB
   1. 10 minutes left.
   2. For the afternoon session, 3 PHY and 3 MU presentations will be presented.
2. Recessed at 9:50 until PM1 (13:30) today.

**Wednesday, January 20th 2016, PM1 TGax Full Session (13:30-15:30)**

1. **Meeting called to order at 13:33 by Osama Aboul-Magd (Huawei Technologies), the TGax** **chairperson.**
   1. Agenda: 11-15-1516-01 is on the server. R2 still is the working document.
2. **Announcement/Reminder**
   1. Chair reminded that we are still operating under the IEEE 802 and 802.11 P&P
   2. Chair asked people to address himself/herself when speaking for the first time.
   3. Attendance
3. **Agenda Setting**
   1. For this afternoon (PM1 and PM2)
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
         1. MU submissions
         2. PHY submissions
         3. 16/0060r2 revised SP presentation by Reza
      4. AoB
      5. Recess
   2. Chair asked if there is any objection to accept this agenda 🡪 no objection.
4. **Presentations**
   1. **Joonsuk Kim (Apple) presented “Views on UL-MU features,” based on the submission 16/0066r2.**
      1. Summary
         1. Views on UL MU features, especially UL MU-MIMO, were presented.
         2. One useful scenario of UL MU-MIMO will be a response for DL MU-MIMO.
         3. UL MU Tx capable devices should meet more complex HW requirements.
         4. Suggested that spec defines two MU capabilities under MIMO, i.e. DL-MU and UL-MU.
      2. Discussion
         1. C (slide 10): Number of LTFs depends on the total number of streams which depends on the total number of STAs. In this case, not sure how to do the TxBF. 🡪 Single User Beamforming protocol is already there.
         2. C: A member discussed about the overhead.
         3. C: 11ax supports cascading structure. Sounding could be more efficient. Would like to see simulation results before deciding anything.
         4. C: Any analysis about using DL sounding result? 🡪 It depends on how fast the channel changes. Also relates to implementation.
         5. C (slide 12): Supported features may differ from STA to STA. Not sure we can mix them.
         6. C: Target of 802.11ax is to improve the average throughput. Looks strange
         7. C: UL MU-MIMO is effective where there are many STAs and AP is equipped with many antenna elements.
         8. C: Q matrix may not accurate.
      3. **Straw Poll**
         1. **Straw Poll #1: Do you agree to add following text in SFD?**

**NDP shall only be in SU PPDU format and sent by the same STA transmitting NDP-A, for CSI measurement for beamforming**

* + - * 1. Discussion

A member asked for deferral of straw polls to check the previous presentations. 🡪 If we want more time to think about this, all straw polls can be postponed.

* + - * 1. **All straw polls postponed.**
      1. Straw Poll #2: Do you agree that UL MU-MIMO capable non-AP devices shall also support DL MU-MIMO?
         1. i.e., In order to be UL-MU-MIMO Tx capable, non-AP STAs need to be DL-MU-MIMO Rx capable
      2. Straw Poll #3: Do you agree that UL MU-OFDMA capable non-AP devices shall also support DL MU-OFDMA?
         1. i.e., In order to be UL-MU-OFDMA Tx capable, non-AP STAs need to be DL-MU-OFDMA Rx capable
  1. **Wojin Ahn (Yonsei Univ.) presented “Congestion control for UL MU random access,” based on the submission 16/0085r1.**
     1. Summary
        1. Performance limit of UL MU random access discussed.
        2. Proposed the use of transmit probability as a congestion control parameter.
        3. Simulation results presented.
     2. Discussion
        1. A member asked how to calculate the congestion window 🡪 Estimation based on the measurement result assumed.
        2. Another member asked retransmission policy. Not sure if we need additional information for congestion control.
     3. **Straw Poll: Do you agree to add to the TG Specification Frame work document?**

**4.5 UL OFDMA-based random access**

* **An HE AP is allowed to broadcast transmission probability, *pt,*, in the trigger frame to the STAs so that STAs can initiate the random access process after the trigger frames.**
* **After OBO decrement, each STA with zero OBO value chooses a random number [0, 1]. If the chosen number is smaller than *pt*, the STA transmits its frame. Otherwise, the STA shall not transmit its frame, and the STA shall reselect its OBO.**
  + - 1. Discussion – No discussion.
      2. **Result: Y/N/A = 7/21/many, this straw poll will not be converted to a motion.**
  1. **Narendar Madhavan (Toshiba) presented “Regarding HE NDPA frame for DL Sounding Sequence,” based on the submission 16/0091r2.**
     1. Summary
        1. The need for an HE AP to notify certain parameters to solicit STAs (or beamformees) to generate beamforming feedback matrices discussed.
        2. Parameters include sub-carrier grouping , Codebook, channel width etc.
        3. These parameters notified before the reception of HE NDP frame is preferred
     2. Discussion
        1. No discussion.
     3. **Straw Poll: Do you agree to add to the TG Specification Frame work document?**

**x.y.z. An HE AP indicates the necessary TBD parameters so that multiple HE STAs can start generate compressed beamforming feedback matrix immediately after receiving the HE NDP frame.**

* + - 1. Discussion
         1. When and how AP indicates the parameters?
         2. The straw poll text is not clear.
         3. Any issues if those parameters are transmitted in the MIMO control field? 🡪 Parameters differ from STA to STA.
         4. Amendment to the straw poll text suggested.
      2. **Result: Y/N/A = 39/0/many, this straw poll will be converted to the motion.**
  1. **Kentatou Taniguchi (Toshiba) presented “Allocation sizes for BCC in OFDMA,” based on the submission 16/0079r2.**
     1. Summary
        1. The coding scheme under multiple RU allocation scenarios discussed.
        2. Some concerns if we allow multiple RU allocation to a user.
     2. Discussion – No discussion
     3. Straw Polls
        1. **Straw Poll #1: Do you agree to add the following text into 11ax SFD?**
* **Multiple RU allocation for one STA shall not be allowed in 11ax.**
  + - * 1. Discussion - No discussion.
        2. **Result: Y/N/A = 28/2/many**
      1. Straw Poll #2: **Do you agree the following text?**
* LDPC is the only coding scheme in the HE PPDU Data field for allocation sizes more than 242 tones when multiple RU allocation is allowed to a user.
  + - * 1. Discussion

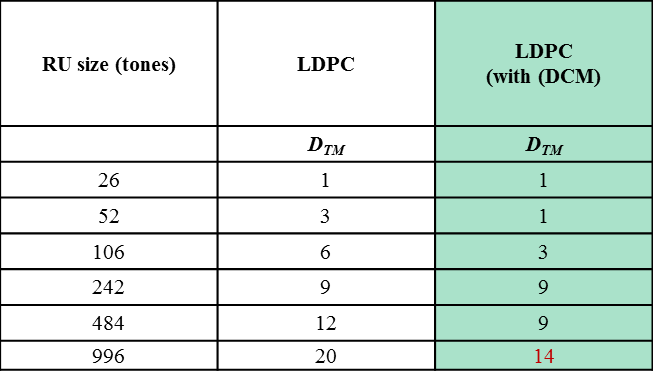
Since the SP#1 passed, this straw poll was withdrawn.

* 1. **Jianhan Liu (MediaTek) presented “On QPSK DCM Modulation and LDPC Tone Mapper for DCM,” based on the submission 16/0056r0.**
     1. Summary
        1. DCM Modulation schemes and LDPC tone mapping parameters have not yet been defined in 11ax SFD.
        2. QPSK DCM modulation scheme and LDPC tone mapper in this contribution proposed.
     2. Discussion – No discussion.
     3. **Straw Poll**
        1. **Straw Poll #1: Do you agree to add the following QPSK DCM modulation scheme to the IEEE802.11ax SFD?**

**The coded/interleaved bits are modulated as QPSK and mapped to the lower half frequency segment: [d1, d2, … dN\_SD/2];**

**The modulated symbols of the lower half frequency segment are repeated and conjugated and then mapped to the upper half frequency segment: [dN\_SD/2+1, dN\_SD/2+2, … dN\_SD] = conj([d1, d2, … dN\_SD/2])**

* + - * 1. **Discussion – No discussion.**
        2. **Result: Y/N/A = 71/0/16, this straw poll will be converted to a motion.**
      1. **Straw Poll #2: Do you agree to add the following LDPC Tone Mapping parameters *DTM*  for DCM modulations to the IEEE802.11ax SFD?**



* + - * 1. **Discussion – No discussions.**
        2. **Result: Y/N/A = 76/0/21, this straw poll will be converted to a motion.**

1. **AOB**
   1. PM2: One presentation by Reza
2. **Recess until PM2 (16:00) today.**

**Wednesday, January 20th 2016, PM2 TGax Full Session (16:00-18:00)**

1. Meeting called to order at 16:00 by Osama Aboul-Magd (Huawei Technologies), the TGax chairperson.
2. Announcement/Reminder
   1. Chair reminded that we are still operating under the IEEE 802 and 802.11 P&P
   2. Chair asked people to address himself/herself when speaking for the first time.
   3. Attendance
3. Agenda Setting
   1. For this afternoon (PM1 and PM2)
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
         1. MU submissions - completed
         2. PHY submissions - completed
         3. 16/0060r2 revised SP presentation by Reza
      4. AoB
      5. Recess
   2. Chair asked if there is any objection to accept this agenda 🡪 no objection.
4. **Presentation**
   1. **Reza Hedayat (Newracom) presented “Recipient-aware Spatial Reuse,” based on the submission 16/0060r3.**
      1. Summary
         1. Straw poll updated based on the feedback after yesterday’
      2. Discussion – No discussion.
      3. **Straw Poll: Do you agree that the following text in 11ax SFD to be modified?**

**5.1: Features for operation in dense environments**

**The specification to consider a procedure that may revise the NAV depending on TBD conditions at the recipient of the ongoing OBSS frame.**

* **A HE STA that receives an inter-BSS RTS frame with RSSI more than OBSS PD threshold and receives the response inter-BSS CTS frame less than a TBD threshold (e.g. OBSS PD) may set back the NAV to the value before receiving the inter-BSS RTS frame. The PPDU format of the RTS/CTS frames is TBD. When HE format is used, adjustments to TX power based on the Spatial Reuse field in HE SIG-A is applied.**
  + - 1. **Discussion**
      2. Result: Y/N/A = 13/13/many, this motion will not converted to a motion.

1. **AoB**
   1. Plans for tomorrow
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
         1. ETSI Update, by Andrew Myles
      4. TG Motions
      5. Goals for September 2015
      6. Telecon Schedule
      7. Adjourn
2. **Recess @ 16:20 until AM2 tomorrow (Thursday).**

**Thursday, January 21st, 2016, AM2 TGax full Session (10:30-12:30)**

1. **The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @10:30 AM**
   1. Agenda 15/1516r2 is on the server. Rev. 3 is the working document.
2. **Announcement/Reminder**
   1. Chair reminded IEEE 802 and 802.11 IPR P&P.
   2. Chair asked people to state name and affiliation when addressing for the first time in the session.
   3. Chair reminded people to do attendance.
3. **Agenda for this session**
   1. Thursday AM2 and PM2
      1. Call Meeting to order
      2. Announcement/Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance
      3. Agenda Setting
      4. Presentations
         1. Andrew Myles – ETSI BRAN update (20 min)
      5. TG Motions
      6. Goals for March 2016
      7. Conference Calls Schedule
      8. Adjourn
   2. Chair asked if there are any modifications to the agenda.
   3. Agenda approved without objections.
4. **Presentations**
   1. **Andrew Myles (Cisco Systems) presented “What is the status of the ETSI BRAN work on a revised version of EN 301 893?”, based on the submission 16/0163r0.**
      1. Summary
         1. European frequency regulation relevant to the wireless LAN EN 301 893 is under revision.
         2. Three open issues:
            1. Receiver requirement – ED threshold
            2. Max. TXOP duration
            3. Multi-channel access
         3. More participation by Wi-Fi folk to the ETSI BRAN meeting is encouraged.
      2. Discussions
         1. C: A member mentioned that the 10 ms TXOP will be important for 802.11ac devices (for channel sounding).
         2. Q: A member asked for the risk assessment on the two-step process. --> Evidence based seems to be agreeable. The point is right balance of efficiency and fairness.
         3. Consideration for 802.11ax system 🡪 Can be in the second step.
         4. C: Another member discussed about the relationship between the multi-channel requirements and OFDMA technique. 🡪 The important thing is to think about the regulations for the 802.11ax.
5. **Motions – TG documents**
   1. **PHY Motions**
      1. **PHY Motion #101: Move to add the following to Section 7.3 of the TGax SFD.**

**802.11ax spec shall support Ng = 4 and 16 for sounding feedback with SU/MU-MIMO-OFDM(A).**

***- NOTE—The tone grouping factor, Ng is defined with respect to data tones of the HE PPDU.***

* + - 1. **Moved by Kome Oteri, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #102: Move to add to the TG Specification Framework:**

**In the MU Exclusive Beamforming Report for the delta SNR, the locations of the feedback tones shall be identical to the tone locations of the compressed V matrices fed back**

* + - 1. **Moved by Sriram Venkateswaran, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #103: Move to add the following text in SFD**

**- 11ax allows 1xLTF as an optional mode in the following cases:**

* **SU, with GI = 0.8us only**
* **Full-BW UL-MUMIMO, with GI=1.6us only**
* **Full BW DL-MUMIMO, with GI=0.8us TBD**
  + - 1. **Moved by Sriram Venkateswaran, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #104: Move to add the following text in SFD**
  + ***When 1x/2x HE-LTF is transmitted, it is recommended that the spatial mapping matrix applied to HE-STF and beyond is chosen such that it preserves the smoothness of the physical channel, achieved by limiting the variation of each element’s real and imaginary values in the spatial mapping matrix across successive tones.*** 
    - 1. **Moved by Hungyuan Zhang, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #105: Move to add the following in the current SFD:**
* **The CRC bits of HE-SIG-A and each coding group of HE-SIG-B are generated as 4 LSB of HT CRC generator output**
  + - 1. **Moved by Yakun Sun, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: M\The motion was accepted with no objection.**
    1. **PHY Motion #106: Move to add the following to the current SFD:**
* **SIGB bits for each SIGB content channel are continuously encoded with 1 BCC encoder**
  + - 1. **Moved by Yakun Sun, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #107: Move to add to the TG SFD:**
* **4x HE-LTF160MHz(-1012:1:1012) =[ 4x LTF80MHz\_primary , zeros(1,23), 4x LTF80MHz\_secondary ]**
* **4x LTF80MHz\_primary = [L-LTF80M, 0, R-LTF80M] as agreed for 80MHz 4x HE-LTF;**
* **4x LTF80MHz\_secondary = [L-LTF80M, 0, (-1)\* R-LTF80M]**
* **4x HE-LTF80+80MHz = [4x LTF80MHz\_primary , 4x LTF80MHz\_secondary]**
  + - 1. **Moved by Le Liu, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #108: Move to add to the TG SFD:**
* **2x HE-LTF160MHz(-1012:2:1012) =[ 2x LTF80MHz\_primary , zeros(1,11), 2x LTF80MHz\_secondary ]** 
  + **2x LTF80MHz\_primary  as agreed for 80MHz 2x HE-LTF  
    = [{1st 242-RU}, {2nd 242-RU}, {central 26-RU}, {3rd 242-RU}, {4th 242-RU}];**
  + **2x LTF80MHz\_secondary   
    = [{1st 242-RU}, (-1)\*{2nd 242-RU}, {central 26-RU}, {3rd 242-RU}, (-1)\*{4th 242-RU} ];**
* **2x HE-LTF80+80MHz = [2x LTF80MHz\_primary , 2x LTF80MHz\_secondary]**
  + - 1. **Moved by Le Liu, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #109: Move to add to the TG SFD:**
* **use the 20/40/80/160/80+80MHz 1x HE-LTF sequences in slide 21-24 of 11-16/0053r0**
  + - 1. **Moved by Le Liu, Seconded by Ron Porat.**
      2. Discussion: Chair asked the members to include necessary material in the motion text, not just refer to the document.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #110: Move to include the following text to SFD:**
* **At least 1 state is reserved in the 8 bit RU allocation subfield of the HE-SIG-B common field for “no STA-specific information field assigned by the RU allocation subfield’.**
  + **Details are TBD**
    - 1. **Moved by Daewon Lee, Seconded by Young Hoon Kwok**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #111: Move to include the following text to TGax SFD:**
    - **In MU PPDU, the SIG-A shall indicate the number of STAs when compressed SIG-B mode is indicated (i.e. full bandwidth MU-MIMO indicated).**
      * **Details are TBD**
      1. **Moved by Yujin, Seconded by Ron Porat.**
      2. Discussion
         1. A member mentioned it might not be clear and amendment was proposed.
      3. **Motion to amend PHY Motion #111: Amend the PHY motion #111**

**From**

**Move to include the following text to TGax SFD:**

* + - * **In MU PPDU, the SIG-A shall indicate the number of STAs when compressed SIG-B mode is indicated (i.e. full bandwidth MU-MIMO indicated).**
        + **Details are TBD**

**to**

**Move to include the following text to TGax SFD:**

* + - * **In MU PPDU, the SIG-A shall indicate the number of STAs when full bandwidth MU-MIMO compressed SIG-B mode is indicated.**
        + **Details are TBD**
        1. **Motion to amend accepted with no objection.**
        2. **PHY Motion #111 was amended.**
      1. **Discussion: No discussion. PHY Motion #111 was amended.**
      2. **Result: Y/N/A = 63/10/27, motion passes.**
    1. **PHY Motion #112: Move to add the following new MCS levels as an optional feature to the 11ax SFD:**
       - **MCS10: 1024 QAM with 3/4 code rate**
       - **MCS11: 1024 QAM with 5/6 code rate**
       1. **Moved by HanGyu Cho, Seconded by Ron Porat.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    2. **PHY Motion #113: Move to add the following new MCS levels as an optional feature to the 11ax SFD:**
       - **TX EVM requirement of -35dB is used for MCS 10 and MCS 11**
       1. **Moved by HanGyu Cho, Seconded by Ron Porat.**
       2. Discussion
          1. A member mentioned that it is unusual that EVM requirements for two different MCSs have the same value. 🡪 This is based on the simulation results as discussed in the PHY ad hoc session.
       3. **Result: The motion was accepted with no objection.**
    3. **PHY Motion #114: Move to add the SFD:**
       - **The content of 4 extra tones [-28,-27,27,28] of L-SIG and RL-SIG in 20MHz HE PPDU is [-1,-1,-1,1]**
       1. **Moved by Jiayin Zhang, Seconded by Ron Porat.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    4. **PHY Motion #115: Move to modify the SFD as the red text:**
       - ***There are only three pre-HE-STF preamble formats defined:*** 
         * ***SU format (mandatory) / Trigger based UL***
         * ***MU format (mandatory)***
         * ***Extended range SU format (mandatory)***

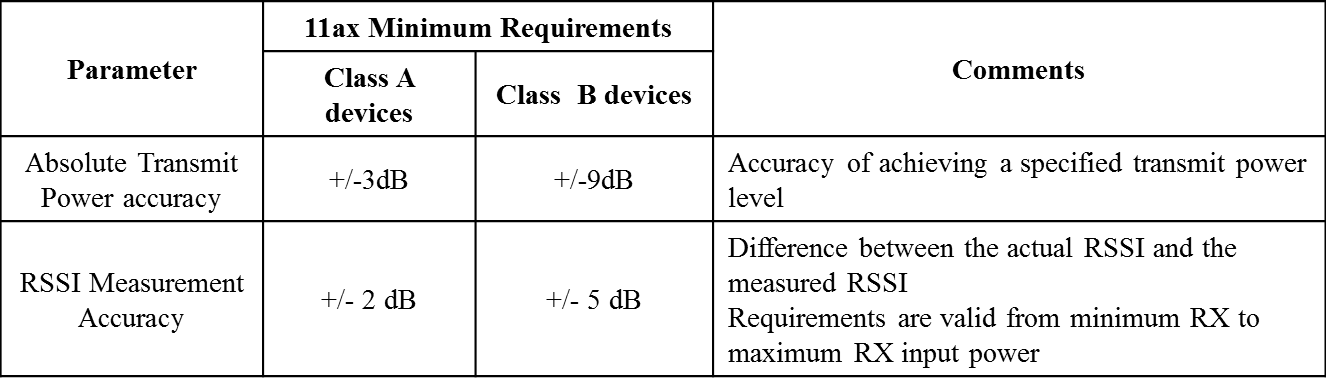
***[PHY Motion 68, November 2015, see [6]]***

* + - 1. **Moved by Jiayin Zhang, Seconded by Ron Porat.**
      2. Discussion
         1. (Against): Not sure how effective it is and how much complexity will be added.
         2. (For) PHY Ad Hoc agreed that it is necessary for the outdoor use cases.
         3. (Against) Should not be mandatory for all cases.
         4. (For) This is only for the preamble which should be understood by all HE devices.
         5. C: This is important for coexistence.
      3. **Motion to amend: mandatory 🡪 mandatory on receive**
         1. Discussion

(Against) This does not address anything.

(Against) The original intension is not only for the reception but also for the transmission.

* + - * 1. **Result: Y/N/A = 27/36/20, motion to amend fails.**
      1. **Back to original motion**
      2. **Result: Y/N/A = 64/23/15, motion fails.**
    1. **PHY Motion #116: Move to add to SFD:**
       - **The HE Extended Range SU PPDU is transmitted only on the primary 20Mhz.**
       1. **Moved by Jiayin Zhang, Seconded by Ron Porat.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    2. **PHY Motion #117: Move to add to SFD:**
       - **The HE Extended Range SU PPDU can only be transmitted with MCS0, MCS1, MCS2 and only with 1 spatial stream.**
       1. **Moved by Jiayin Zhang, Seconded by Ron Porat.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    3. **PHY Motion #118: Move to add the following text in SFD:**
       - **There are two STA classes that support HE trigger-based PPDU with information exchanged as part of the device capability**
         * **Class A: STAs that are high capability devices and**
         * **Class B: STAs that are low capability devices.**
       1. **Moved by Arjun Bharadwaj, Seconded by Simone Merlin.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    4. **PHY Motion #119: Move to add the following text in SFD:**
       - * **STAs that participate in HE trigger-based PPDU shall support per chain max(P-32,-10dBm) as the min Tx power, with P the max power the STA can transmit at the antenna connector of that chain using MCS0 while meeting the TX EVM and spectral mask requirements. A STA transmitting at and above the min power shall support the EVM requirements for TBD MCS (but at least MCS7)**
       1. **Moved by Arjun Bharadwaj, Seconded by Simone Merlin.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    5. **PHY Motion #120: Move to add the following text in SFD:**
       - * **STAs that participate in HE trigger-based PPDU shall support the following absolute Tx power requirements and the RSSI measurement accuracy requirements for the two device classes**

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* + - 1. **Moved by Arjun Bharadwaj, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #121: Move to add the following text in SFD:**
    - **STAs that participate in HE trigger-based PPDU shall pre-compensate for carrier frequency offset (CFO) error and timing drift.  After  compensation, the absolute value of residual CFO error with respect to the corresponding Trigger frame shall not exceed 350Hz for data subcarriers when measured as the 10% point of CCDF of CFO errors in AWGN at a received power of -60dBm in the primary 20MHz. The residual CFO error measurement shall be made on the HE trigger-based PPDU packet after HE-SIGA.**
      1. **Moved by Arjun Bharadwaj, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #122: Move to add the following text in SFD:**
    - **STA that participate in HE Trigger based PPDU transmission shall have timing accuracy of +/-0.4µs relative to the Trigger frame. This requirement does not include round trip delay.**
      1. **Moved by Arjun Bharadwaj, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #123: Move to add the following text in SFD:**
    - **The following TX LO leakage requirements are supported for all transmission modes in 11ax:**
      * **The power measured at the location of the RF LO using resolution BW 78.125 kHz shall not exceed the maximum of –32 dB relative to the total transmit power and -20 dBm, or equivalently max(P-32,-20), where *P* is the transmit power per antenna in dBm. The transmit center frequency leakage is specified per antenna.**
      1. **Moved by Arjun Bharadwaj, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #124: Move to add the following text in SFD:**
    - **Transmit center frequency and the symbol clock frequency for all transmit antennas and frequency segments shall be derived from the same reference oscillator.**
      1. **Moved by Arjun Bharadwaj, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #125: Move to add to the TGax SFD:**
    - **The non-contiguous channel bonding will be supported in 802.11ax by:**
      * **Transmitting using OFDMA PPDU format by nulling the tones of one or more secondary channels in 80MHz and 160 (80+80)MHz;**
      * **Modes for non-contiguous channel bonding are TBD;**
      * **Non-contiguous channels within primary or secondary 80MHz only exists at AP side.**
      1. **Moved by Yanchun Li, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #126: Move to add the following change/additions to the SFD:**
       - **For UL MU MIMO transmissions, support of single stream pilots and masking the LTF sequence of each spatial stream by a distinct orthogonal code is mandatory at the transmitter side (non AP STA). When single stream pilot is used, no masking is applied to the HE LTF**
       - **The trigger frame shall use 1 bit to indicate whether the UL MU MIMO transmission following it uses single stream pilots or a mask on each spatial stream of the LTF sequence by a distinct orthogonal code.**
       1. **Moved by Sriram Venkateswaran, Seconded by Ron Porat.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    2. **PHY Motion #127: Move to change the current text in the TG Specification Framework:**
       - **When ≥ 80MHz is supported, no thresholds are defined for RU size less than or equal to 242 tones (20MHz); otherwise, thresholds are defined down to a TBD RU size.**

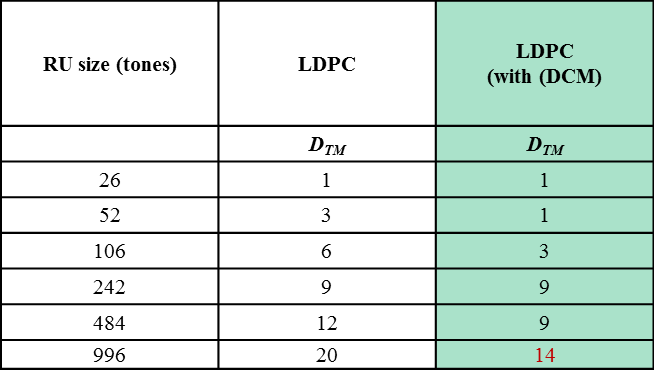
**with**

* + - * **Packet extension device capability thresholds are defined for all RU sizes greater than or equal to 242 tones. No thresholds defined for an RU size less than 242 tones**
      1. **Moved by Ron Porat, Seconded by Yasu Inoue.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #128: Move to add the following text into 11ax SFD:**
       - **Multiple RU allocation for one STA shall not be allowed in 11ax.**
       1. **Moved by Ken Taniguchi, Seconded by Young Hoon Kwon.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    2. **PHY Motion #129: Move to add the following QPSK DCM modulation scheme to the IEEE 802.11ax SFD:**

**The coded/interleaved bits are modulated as QPSK and mapped to the lower half frequency segment: [d1, d2, … dN\_SD/2];**

**The modulated symbols of the lower half frequency segment are repeated and conjugated and then mapped to the upper half frequency segment: [dN\_SD/2+1, dN\_SD/2+2, … dN\_SD] = conj([d1, d2, … dN\_SD/2]).**

* + - 1. **Moved by Jianhan Liu, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #130: Move to add the following LDPC Tone mapping parameters DTM  for DCM modulations to the IEEE802.11ax SFD**

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* + - 1. **Moved by Jianhan Liu, Seconded by Ron Porat.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **PHY Motion #131: Move to add to SFD**
       - **HE-LTF/HE-STF power is boosted 3dB for BPSK and QPSK including DCM in the HE Extended Range SU PPDU preamble.**
       1. **Moved by Jiayin Zhang, Seconded by Jianhan Liu.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
  1. **MAC Motions**
     1. **MAC Motion #58: Move to add to the TGax SFD:**
* **6.2.1 Trigger frame**

**A recipient of a MU-BAR frame can transmit other data or management frame in addition to BA/ACK frame if it does not exceed the indicated UL MU duration.**

* + - 1. **Moved by Yongho Seok, Seconded by Young Hoon Kwon.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MAC Motion #59: Move to add the TGax SFD:**
       - **If the trigger frame requests a specific frame type as response, the response to this trigger frame shall contain at least the frame with the required type if the required type is available at the STA side; if the STA has no frame with the required type, the STA should transmit QoS Null frame to AP.**
       1. **Moved by David Xun Yang, Seconded by Ross Jianyu.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    2. **MAC Motion #60: Move to add the TGax SFD:**
       - **5.y.z AP and STAs in one BSS of a Multiple BSSID set shall consider a frame from another BSS of the same Multiple BSSID set as an intra-BSS frame (Signaling for a Multiple BSSID set is TBD).**
       1. **Moved by Geonjung Ko, Seconded by John Son.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    3. **MAC Motion #61: Move to add the TGax SFD:**
       - **A same BSS Color shall be used for the virtual APs which are defined by TBD Multiple BSSID element.**
       1. **Moved by Liwen Chu, Seconded by Lei Wang.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    4. **MAC Motion #62: Move to add the TGax SFD:**
       - **11ax STAs shall use the baseline (de-)fragmentation for signaling 11ax fragmentation within an A-MPDU**
         * **The SN identifies the MSDU/MMPDU, and the FN identifies the fragment of an MSDU/MMPDU**
       1. **Moved by Alfred Asterjadhi, Seconded by Simone Merlin.**
       2. Discussion: No discussion.
       3. **Result: The motion was accepted with no objection.**
    5. **MAC Motion #63: Move to add the TGax SFD:**
       - **Under 11ax fragmentation, the following acknowledgement rules apply:**
         * **Fragmentation – Level I**

**Recipient shall respond with an Ack to a fragment carried in a “VHT” single MPDU soliciting immediate response**

* + - * + **Fragmentation – Level II**

**Recipient shall respond with:**

**Ack frame to a fragment carried in a “VHT” single MPDU soliciting immediate response**

**C-BA frame to an A-MPDU soliciting immediate response**

**Each bit in BlockAck Bitmap indicates successful reception of the carried fragment or of the full MSDU**

* + - 1. **Moved by Alfred Asterjadhi, Seconded by Simone Merlin.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MAC Motion #64: Move to add the TGax SFD:**
       - **Under 11ax fragmentation, the following acknowledgement rules apply:**
         * **Fragmentation – Level III**

**Recipient shall respond with:**

**Ack frame to a fragment carried in a “VHT” single MPDU soliciting immediate response**

**C-BA frame to an A-MPDU that does not carry fragments and soliciting immediate response**

**“Dedicated” C-BA frame to an A-MPDU carrying fragments and soliciting immediate response**

* **Each bit in BlockAck Bitmap indicates successful reception of each of the carried fragments**
* **The max number of fragments for which the BA frame signals the receive status is contained in a nonzero value of the FN subfield of the BA frame**
* **Maximum number of fragments per MSDU in the eliciting A-MPDU transmitted by the originator shall be 4**
  + - 1. **Moved by Alfred Asterjadhi, Seconded by Simone Merlin.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**

1. **Recess until start of PM2 session (16:00) today.**

**Thursday, January 21st, 2016, PM2 TGax full Session (16:00-18:00)**

1. **The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @16:00.**
   1. Agenda 15/1516r2 is on the server. Rev. 3 is the working document.
2. **Announcement/Reminder**
   1. Chair reminded IEEE 802 and 802.11 IPR P&P.
   2. Chair asked people to state name and affiliation when addressing for the first time in the session.
   3. Chair reminded people to do attendance.
3. **Agenda for this session**
   1. Thursday AM2 and PM2
      1. Call Meeting to order
      2. Announcement/Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance
      3. Agenda Setting
      4. Presentations
         1. Andrew Myles – ETSI BRAN update (20 min)
      5. TG Motions (continued)
      6. Goals for March 2016
      7. Conference Calls Schedule
      8. Adjourn
   2. Chair asked if there are any modifications to the agenda.
   3. Agenda approved without objections.
4. **TG Motions (continued)**
   1. **MAC Motions (Continued)**
      1. **MAC Motion #65: Move to add the TGax SFD:**

**4.2 DL MU Operation:**

* + - * + **The spec shall allow UL MU transmission of Multi-STA Block ACK frame in response to multi-TID A-MPDU of DL MU transmission. The value of the AID field in M-BA is TBD.**
      1. **Moved by Liwen Chu, Seconded by Lei Wang.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MAC Motion #66: Move to add the TGax SFD:**

**4.2 DL MU Operation:**

* + - * + **The spec shall allow UL MU transmission of Multi-STA Block ACK frame in response to multi-TID A-MPDU of DL MU transmission. The value of the AID field in M-BA is TBD.**
      1. **Moved by Liwen Chu, Seconded by Lei Wang.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
  1. **MU Motions**
     1. **MU Motion #40: Move to add the following text into Section 4.3 of the SFD:**
        + - **When a STA is required to sense the medium before its UL MU transmission in response to a trigger frame,  it senses the medium using ED after receiving the PPDU that contains the trigger frame (i.e. during the TBD IFS time).**
        1. **Moved by Lei Wang, Seconded by Kiseon Ryu.**
        2. Discussion: No discussion.
        3. **Result: The motion was accepted with no objection.**
     2. **MU Motion #41: Move to add the following text into Section 4.3 of the SFD:**
        + - **When a STA needs to perform the energy-detect (ED) before its UL MU transmission in response to a trigger frame, it shall perform the energy-detect (ED) at least in the subchannel that contains the STA’s UL allocation, where the sensed subchannel consists of either a single 20MHz channel or multiple of  20MHz channels.**
        1. **Moved by Lei Wang, Seconded by Kiseon Ryu.**
        2. Discussion: No discussion.
        3. **Result: The motion was accepted with no objection.**
     3. **MU Motion #42: Move to add the following text into Section 4.3 of the SFD:**

**When required to sense the medium before its UL MU transmission in response to a trigger frame, if a STA detects the 20MHz channels containing the allocated UL RU are not all idle, then the STA shall not transmit anything in the allocated UL RU.**

* + - 1. **Moved by Sean Coffey, Seconded by Kiseon Ryu.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MU Motion #43: Move to change the SFD text in the clause 4.3 as below:**
* **~~A STA shall consider CCA status to respond to a Trigger frame under a non-null TBD set of conditions.~~**
* **Trigger frame carries an indication of whether or not the carrier sensing is required for the STA to transmit a UL MU PPDU in response to a Trigger frame. If a Trigger frame indicates that the carrier sensing is required, the STA shall consider the channel status of the physical channel sensing (meaning ED) and virtual carrier sense (NAV) before UL MU transmission in response to the Trigger Frame. Otherwise, the STA may transmit a UL MU PPDU without the carrier sensing. The AP shall require the carrier sensing except under TBD conditions.**
  + - 1. **Moved by Kiseon Ryu, Seconded by Kaushik Josium.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MU Motion #44: Move to add the following text in Section 4.3 of the SFD:**

**The inter frame space between a PPDU that contains a trigger frame and its triggered UL MU PPDU is SIFS**

* + - 1. **Moved by Liwen Chu, Seconded by Lei Wang.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MU Motion #45: Move to add the following text to the SFD:**
* **The spec shall define a MAC padding scheme (TBD) for trigger frame sent in Non-HT PPDUs**
  + - 1. **Moved by Liwen Chu, Seconded by Lei Wang.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**
    1. **MU Motion #46: Move to add to the TG Specification Frame work document:**
* **x.y.z An HE AP indicates the necessary TBD parameters so that multiple HE STAs can construct the compressed beamforming feedback matrix immediately after receiving the HE NDP frame**
  + - 1. **Moved by Narendar Madhavan, Seconded by Daewon Lee.**
      2. Discussion: No discussion.
      3. **Result: The motion was accepted with no objection.**

1. **Plans for the March 2016**
   1. Discuss Proposals affecting the TG Specification Framework document
   2. Approve D0.1 of the TG Draft
   3. Approve a 30-day Comment Collection Process.
2. **Teleconference planning**
   1. Chair suggested three conference call.
      1. Thursday, February 4th, 2016, 1:00-12:00 (ET)
      2. Thursday, February 18th, 2016, 2:00-22:00 (ET)
      3. Thursday, March 3rd, 2016, 1:00-12:00 (ET)
   2. Chair asked if there is any objection to this plan. 🡪 No objection.
3. **AOB**
   1. Coexistence Assurance document: TG leadership will review the CA document of 802.11ac and discuss necessary changes for 802.11ax.
   2. Volunteers welcomed.
4. **Adjournment**
   1. TGax adjourned for the week @ 16:40.