

**IEEE P802.11
Wireless LANs**

IEEE 802.11 TGax				
May 2016 Waikoloa Meeting Minutes				
Date: 2016-05-31				
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Abstract

TGax meeting minutes from the IEEE 802.11 Waikoloa session, May 16th – 20th, 2016.

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

- PHY
 - <https://mentor.ieee.org/802.11/dcn/16/11-16-0755-00-00ax-tgax-may-2016-waikoloa-phy-ad-hoc-meeting-minutes.docx>
- MAC/SR ad hoc
 - <https://mentor.ieee.org/802.11/dcn/16/11-16-0698-04-00ax-tgax-mac-and-spatial-reuse-ad-hoc-agenda.pptx>
- MU Ad Hoc
 - <https://mentor.ieee.org/802.11/dcn/16/11-16-0716-00-00ax-mu-ad-hoc-meeting-minutes-may-2016.docx>

**IEEE 802.11 Task Group ax
May 2016 Waikoloa Meeting
Hilton Waikoloa Village, Waikoloa, HI
May 16th – 20th, 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, May 16th, 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
 - 1.1. Agenda Doc.11-16/0512r0 on the server. Rev. 1 is the working document.
2. **Announcement**
 - 2.1. Meeting Protocol: Chair asked to state name and affiliation when speaking for the first time.
 - 2.2. Attendance reminder.
 - 2.2.1. The attendance server: <https://imat.ieee.org/>
 - 2.2.2. See 11-09-0517r0 for more information.
 - 2.2.3. Contact the WG 1st vice chair, if having any issue.
3. **The chair reviewed the mandatory 5 slides of P&P.**
 - 3.1. Instructions for the WG Chair.
 - 3.2. Participants, Patents, and Duty to Inform.
 - 3.3. Patent Related Links.
 - 3.4. Call for potentially essential patents.
 - 3.4.1. Chair asked if anyone is aware of potentially essential patents.
 - 3.4.2. No potentially essential patents reported.
 - 3.5. Other Guidelines for IEEE WG Meetings.
4. **Agenda items for the week**
 - 4.1. Approve TG and Teleconference minutes since March 2016 meeting.
 - 4.2. Confirmation of the TG leadership.
 - 4.3. Resolution of comments received on draft D0.1.
 - 4.4. Ad Hoc meetings
 - 4.5. Technical Presentations
 - 4.6. Schedule Teleconference times.
5. **General Flow of the meeting**
 - 5.1. Slides 13 and 14 of the 16/0512r1 contain general flow of the meeting.
 - 5.2. There are eight meeting slots planed for TGax.

	Monday	Tuesday	Wednesday	Thursday
AM1				
AM2	TGax	TGax (Ad Hoc)	TGax (Ad Hoc)	TGax
PM1		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)	TGax			

6. Agenda for Monday, May 16th, AM2 (10:30 – 12:30).

6.1. Proposed Agenda for Monday AM2:

- 6.1.1. Call meeting to order
- 6.1.2. Patent policy, etc.
- 6.1.3. Call for submissions
- 6.1.4. Set Ad Hoc Groups schedule and approve agenda
- 6.1.5. Affirmation vote for the TG leadership
- 6.1.6. TG motions
 - 6.1.6.1. Approve TG meeting and Telecon minutes since March meeting.
 - 6.1.6.2. Approve resolutions of comments, if needed.
- 6.1.7. Comment Resolution Status – Robert Stacy
- 6.1.8. Summary from March 2016 meeting
- 6.1.9. Timeline
- 6.1.10. The End of the SFD process
- 6.1.11. PAR Reminder
- 6.1.12. Presentations and Comment Resolution
 - 6.1.12.1. 11-16/0571, Yu Wang
 - 6.1.12.2. 11-16/0597, Graham Smith
 - 6.1.12.3. 11-16/0604, Tanguy Ropitault
- 6.1.13. Recess

- 6.2. Chair asked if there are any other items – No items proposed. Meeting will be conducted based on this order.

7. Call for submissions – we have about 70 submissions

7.1. PHY – 33 submissions

- 7.1.1. 11-16/0608, “Beamforming Feedback Report Structure,” Sameer Vermani (Qualcomm)
- 7.1.2. 11-16/0610, “CR HE-SIG-A Part I,” Ross Jian Yu (Huawei Technologies)
- 7.1.3. 11-16/0611, “Remaining Issues in Trigger Frame Design,” Sameer Vermani (Qualcomm)
- 7.1.4. 11-16/0613, “SIG-B Related Issues,” Lochan Verma (Qualcomm)
- 7.1.5. 11-16/0614, “Comment Resolution on Clause 26.1.1 Part 1,” Lochan Verma (Qualcomm)
- 7.1.6. 11-16/0615, “Comment Resolution on Clause 26.3.12 Part 1,” Lochan Verma (Qualcomm)
- 7.1.7. 11-16/0617, “Remaining Topics in Power Control,” Bin Tian (Qualcomm)
- 7.1.8. 11-16/0618, “11ax CSD Design,” Bin Tian (Qualcomm)
- 7.1.9. 11-16/0619, “PAPR Reduction of HE-SIGB,” Bin Tian (Qualcomm)
- 7.1.10. 11-16/0620, “DCM PHY Parameters,” Hongyuan Zhang (Marvell)
- 7.1.11. 11-16/0621, “DCM Interleaver,” Tianyu Wu (MediaTek)
- 7.1.12. 11-16/0622, “16 QAM Napping for DCM,” Sudhir Srinivasa (Marvell)
- 7.1.13. 11-16/0623, “CR on Section 26.3.10.12,” Bin Tian (Qualcomm)
- 7.1.14. 11-16/0625, “CR on Section 26.3.6,” Bin Tian (Qualcomm)
- 7.1.15. 11-16/0626, “Feedback Element Compression for 802.11ax,” Kome Oteri (InterDigital Communications)
- 7.1.16. 11-16/0633, “Left over Issues in RU Signaling for HE-SIGB,” Yan Zhang (Marvell)
- 7.1.17. 11-16/0634, “11ax Comment Resolutions for Clauses 26.3.2,” Yan Zhang (Marvell)
- 7.1.18. 11-16/0635, “BW indication for Non-contiguous Channel Bonding,” Yunbo Li (Huawei Technologies)
- 7.1.19. 11-16/0636, “TXOP Duration field in HE-SIG-A,” Jeongki Kim (LG Electronics)
- 7.1.20. 11-16/0637, “Load balancing indication for MU-MIMO over 484-tone and larger RU in OFDMA,” Ming Gan (Huawei Technologies)

- 7.1.21. 11-16/0638, “Discussions for Non-contiguous Channel Bonding,” John Son (Wilus)
- 7.1.22. 11-16/0639, “Follow-up on HE-SIG-B user-specific field,” Jinsoo Choi (LG Electronics)
- 7.1.23. 11-16/0649, “Feedback Tone Map and Quantization,” Sriram Venkateswaran (Broadcom)
- 7.1.24. 11-16/0652, “Power scaling of 4 extra tones,” Xiaogang Chen (Intel)
- 7.1.25. 11-16/0653, “CR on section 26.3.3,” Xiaogang Chen (Intel)
- 7.1.26. 11-16/0654, “CP and LTF Options and Signaling,” Ron Porat (Broadcom)
- 7.1.27. 11-16/0655, “On MCS0 DCM Modulation and DCM Capability,” Jianhan Liu (MediaTek)
- 7.1.28. 11-16/0656, “1024QAM Modulation,” Jianhan Liu (MediaTek)
- 7.1.29. 11-16/0658, “CR on 26.3.7.1,” Jinsoo Choi (LG Electronics)
- 7.1.30. 11-16/0659, “CR on 26.3.9.9 and 26.3.5,” Eunsung Park (LG Electronics)
- 7.1.31. 11-16/0663, “CR on Section 26.2.2,” Ke Yao (ZTE)
- 7.1.32. 11-16/0681, “Comment Resolution CID 215 2486,” Daewon Lee (Newracom)
- 7.1.33. 11-16/0682, “CR CID on PHY data field other,” Daewon Lee (Newracom)

7.2. MAC – 18 submissions

- 7.2.1. 11-16/0583, “Backoff Procedure Handling Upon TF Reception,” Yu Wang (Ericsson)
- 7.2.2. 11-16/0584, “Need of SDU Fragmentation to Reduce Padding Ratio in UL-OFDMA Transmission,” Yu Wang (Ericsson)
- 7.2.3. 11-16/0588, “Channel State Estimation based Bidirectional Initialized Random Access,” Bo Li (Northwestern Polytechnical Univ.)
- 7.2.4. 11-16/0590, “Multi-BSS Association for Edge Users’ Throughput Improvements,” Mao Yang (Northwestern Polytechnical Univ.)
- 7.2.5. 11-16/0616, “BlockAck generation and selection rules,” Alfred Asterjadhi (Qualcomm)
- 7.2.6. 11-16/0627, “ROM Recovery Rules,” Jayh Hyunhee Park (LG Electronics)
- 7.2.7. 11-16/0628, “Buffer Status Report in HE Control field,” Jayh Hyunhee Park (LG Electronics)
- 7.2.8. 11-16/0640, “BSS Color Collision,” Geonjung Ko (Wilus Institute)
- 7.2.9. 11-16/0641, “Regarding HE fragmentation,” Woojin Ahn (Yonsei Univ.)
- 7.2.10. 11-16/0643, “HE Control Scheduling,” Liwen Chu (Marvell)
- 7.2.11. 11-16/0644, “SS Allocation in Trigger,” Liwen Chu (Marvell)
- 7.2.12. 11-16/0645, “MU Minimum MPDU Start Spacing,” Liwen Chu (Marvell)
- 7.2.13. 11-16/0646, “HE Beamforming Feedback,” Liwen Chu (Marvell)
- 7.2.14. 11-16/0657, “In-device Multi-radio Coexistence and UL MU operation,” Robert Stacy (Intel)
- 7.2.15. 11-16/0673, “Multi-User EDCA,” Jinsoo Ahn (Yonsei Univ.)
- 7.2.16. 11-16/0674, “EIFS excess problem of Acknowledgement for UL MU procedure,” Hanseul Hon (Yonsei Univ.)
- 7.2.17. 11-16/0675, “comment resolution for CID2383,” Yonggang Fang (ZTE)
- 7.2.18. 11-16/0684, “Channel Access Efficiency,” Evgeny Khorov (IITP)

7.3. MU – 9 submissions

- 7.3.1. 11-16/0582, “Random Access RU Allocation in the Trigger Frame,” Evgeny Khorov (IITP)
- 7.3.2. 11-16/0591, “Issues related to OCW management,” Patrice Nezou (Canon)
- 7.3.3. 11-16/0592, “Follow up on Issue related to unused UL OFDMA RUs,” Stephane Baron (Canon)
- 7.3.4. 11-16/0648, “MU-RTS/CTS PHY Format,” Po-Kai Huang (Intel)
- 7.3.5. 11-16/0661, “Adaptive Random Access UL OFDMA,” Leonardo Lanante (Kyushu Institute of Technology)
- 7.3.6. 11-16/0662, “Further consideration on channel access rule to facilitate MU transmission opportunity,” Jing Ma (NICT)
- 7.3.7. 11-16/0664, “Consideration on backoff procedure for UL MU transmission,” Jing Ma (NICT)
- 7.3.8. 11-16/0665, “Some Notes on Interference Alignment for Downlink Multi-User MIMO,” Dzevdan Kapetanovic (Ericsson)
- 7.3.9. 11-16/0667, “Signaling of Multi-TID Aggregation Limit,” Chittabrata Ghosh (Intel)

7.4. Spatial Reuse – 3 submission

- 7.4.1. 11-16/0581, “Proposed changes to SR clause,” Soma Tayamon (Ericsson)

- 7.4.2. 11-16/0589, “Fractional-Backoff Procedure and Dynamic CCA,” Bo Li (Northwestern Polytechnical University)
- 7.4.3. 11-16/0647, “Consideration of Spatial Reuse for Trigger Frame,” Po-Kai Huang (Intel)

7.5. TG – 6 submissions

- 7.5.1. 11-16/0571, “QoS Handling of Trigger Frame,” Yu Wang (Ericsson)
- 7.5.2. 11-16/0597, “TG ax Indoor Enterprise Scenarios, Color, DSC and TPC,” Graham Smith (SR Technologies)
- 7.5.3. 11-16/0604, “Simulation-based evaluation of DSC in enterprise scenario,” Tanguy Ropitault (NIST)
- 7.5.4. 11-16/0609, “HE NDPA frame format,” Ross Jian Yu (Huawei)
- 7.5.5. 11-16/0612, “Mandatory/Optional Issues for 802.11ax,” Sameer Vermani (Qualcomm)
- 7.5.6. 11-16/0629, “Box 5 Calibration Results,” Marik Hsiao (MediaTek)

8. Ad Hoc meeting scheduling

- 8.1.1. Chair asked if there are any objections to approve the TGax schedule as follow.
 - 8.1.1.1. Ad hoc slots:
 - 8.1.1.1.1. MU → 2 slots.
 - 8.1.1.1.2. PHY → Every ad hoc (6 slots)
 - 8.1.1.1.3. SR is merged into MAC (31 submissions).
 - 8.1.1.1.4. MAC/SR → 4 slots.
 - 8.1.1.2. There are no objections. The TGax schedule is approved.

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

9. Affirmation of the TG Leadership

- 9.1. Confirmation of the TG Leadership
 - 9.1.1. Confirmation of the TG Chairs will be done by the WG Chair on Friday.
 - 9.1.2. The TG need to confirm the Vice Chairs, Secretary, and Technical Editor.
- 9.2. Confirmation of Vice Chairs, Secretary, and Technical Editor:
 - 9.2.1. 1st Vice Chair: Simone Merlin
 - 9.2.2. 2nd Vice Chair: Ron Porat
 - 9.2.3. Secretary: Yasuhiko Inoue
 - 9.2.4. Technical Editor: Robert Stacy.

9.3. Motion: Move to confirm Simone Merlin, Ron Porat, Yasuhiko Inoue, and Robert Stacey for the positions of 1st Vice Chair, 2nd Vice Chair, Secretary, and Technical Editor respectively.

9.3.1. Moved by Al Petrick, Seconded by Bin Tian

9.3.2. Result: Motion was approved with no objection.

9.4. Ad Hoc Group Chairs

MAC	PHY	MU	SR
Eric Wong (Apple)	Bo Sun (ZTE)	Sigurd Schelstraete (Quantenna)	Laurent Cariou (Intel)
Reza Hedayat (Newracom)	Jianhan Liu (MediaTek)	Kiseon Ryu (LG Electronics)	Guido R. Hiertz (Ericsson)
Brian Hart (Cisco)	Hongyuan Zhang (Marvell)	Kaushik Josiam (Samsung)	Jae Seung Lee (ETRI)

9.4.1. Ad hoc leaderships were approved.

10. Summary from March 2016 Meeting

- 10.1. Approved TG draft D0.1 and started a 21-day comment collection period.
- 10.2. The comment collection period closed on April 11. 2919 comments were received.
- 10.3. Held a three of Telecons (April 14 and April 21, May 5). All comments are assigned.

11. TG Motions

11.1. Motion: Approve TGax minutes of meetings and teleconferences from March 2016 plenary meeting to today:

- <https://mentor.ieee.org/802.11/dcn/16/11-16-0415-01-00ax-tgax-march-2016-macau-meeting-minutes.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0536-02-00ax-tgax-teleconference-minutes-april-14th-2016.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0568-01-00ax-tgax-teleconference-minutes-april-21st-2016.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0575-01-00ax-tgax-teleconference-minutes-may-5th-2016.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0537-00-00ax-spatial-reuse-ad-hoc-group-march-2016-minutes.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0509-00-00ax-tgax-march-2016-macau-phy-ad-hoc-meeting-minutes.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0439-01-00ax-mar-2016-macau-tgax-mac-ad-hoc-meeting-minutes.docx>
- <https://mentor.ieee.org/802.11/dcn/16/11-16-0466-00-00ax-tgax-mu-ad-hoc-meeting-minutes-march-2016.docx>

11.1.1. Moved by: Simone Merlin, Seconded by: Al Petrick

11.1.2. Discussion: No discussion.

11.1.3. Result: The motion was accepted with no objection.

12. Timeline

- 12.1. Slide 30 of the agenda document (11-16/512r1)
- 12.2. Current Plan:
 - 12.2.1. May 2014: start of the TG
 - 12.2.2. Nov. 2014: First draft of the TG SFD was approved
 - 12.2.3. Jan. 2016: proposed TG draft
 - 12.2.4. March 2016: Draft D0.1 was approved and CC started

12.2.5. July 2016: Draft 1.0 and WG letter ballot

12.2.6. March 2017: Draft 2.0 and recirculation

12.2.7. Jan 2018: Sponsor Ballot

12.3. Proposed Timeline:

12.3.1. May 2014: start of the TG

12.3.2. Nov. 2014: First draft of the TG SFD was approved

12.3.3. Jan. 2016: proposed TG draft

12.3.4. March 2016: Draft D0.1 was approved and CC started

12.3.5. September 2016: Draft 1.0 and WG letter ballot

12.3.6. March 2017: Draft 2.0 and recirculation

12.3.7. July 2017: MDR (Mandatory Document Review)

12.3.8. November 2017: Formation of SB pool

12.3.9. March 2018: Sponsor Ballot

12.3.10. December 2018: RevCom

12.4. Summary

12.4.1. The only change is move the Draft 1.0 to be available in September 2016.

13. SFD Process

13.1. Proposal by the chair:

13.1.1. This meeting is the last meeting where we consider changes to SFD.

13.1.2. Going forward all submission should target the TG draft.

13.2. Discussion

13.2.1. A proposal to change the draft should come with relevant text.

14. PAR Reminder

14.1. **This amendment defines standardized modifications to both the IEEE 802.11 physical layers (PHY) and the IEEE 802.11 Medium Access Control layer (MAC) that enable at least one mode of operation capable of supporting at least four times improvement in the average throughput per station (measured at the MAC data service access point) in a dense deployment scenario, while maintaining or improving the power efficiency per station.**

14.2. **This amendment defines operations in frequency bands between 1 GHz and 6 GHz. The new amendment shall enable backward compatibility and coexistence with legacy IEEE 802.11 devices operating in the same band.**

14.3. This is something that we need to think about.

14.3.1. An example will be to do system level simulation to show the improvement.

15. Presentations

15.1. **Guido R. Hiertz (Ericsson) presented “QoS Handling of Trigger Frames” based on the submission 16/0571r1..**

15.1.1. Summary:

15.1.1.1. Follow up the presentation given in the last conference call.

15.1.1.2. Two options are identified to configure EDCA parameters for TF – fixed or variable EDCA parameters.

15.1.1.3. Two options are identified to configure EDCA parameters for TF – In or out of the 802.11e framework.

15.1.2. Discussions:

- 15.1.2.1. The priority (access category) for the trigger frame is discussed and some members expressed a concern to use the highest AC in a dense environment.
- 15.1.2.2. A member commented that consideration for the legacy devices will be necessary if the TFs are sent in the highest priority.
- 15.1.2.3. There was a comment that the AP can determine the EDCA parameters of its own BSS, but such a function is not really implemented in the products.

15.1.3. Straw Polls

- 15.1.3.1. Straw Poll #1: Do you prefer Trigger Frames to be sent with**
- a) fixed EDCA AC_VO parameters, or
 - b) EDCA parameters depending on the AC of solicited data, or
 - c) don't you have an opinion?

15.1.3.1.1. Result: a/b/c = 2/15/31

- 15.1.3.2. Straw Poll #2: Do you believe a separate backoff process should be applied to TF besides the per AC processes?**

15.1.3.2.1. Result: Y/N/A = 13/19/19

15.2. Graham Smith (SR Technologies) presented "TG ax Indoor Enterprise Scenarios, Color, DSC and TPC," based on the submission 16/0597r1.

- 15.2.1. Summary:
 - 15.2.1.1.1. The Indoor Enterprise scenario is examined for two rooms with the 4CH case and the 9 channel case.
 - 15.2.1.1.2. Legacy, Legacy/TPC, Color, Color/TPC, DSC, DSC/TPC and DSC/"TPC one" are all examined.
 - 15.2.1.1.3. Results show blocking and sharing and a 'figure of merit' is used for comparison
- 15.2.2. Discussions:
 - 15.2.2.1. A member asked a question whether the results shown in the slides are simulation results or calculation result. The answer was calculation.
 - 15.2.2.2. Another member asked for simulation results.

15.2.3. Straw Poll: DSC text should be incorporated into the Draft 11ax Amendment

Note: 16/0310 may be used as a basis.

- 15.2.3.1. Discussion
- 15.2.3.2. Result: This straw poll will be conducted later this week.

16. AoB

- 16.1. PM1 is ad hoc sessions
 - 16.1.1. PHY – Centennial I
 - 16.1.2. MAC – Regency VII

17. TGax meeting recessed @ 12:31 PM..

Monday, May 16th, 2016, PM2 TGax Ad Hoc Sessions (16:00-18:00)

- PHY Ad hoc – Room: KONA 4&5
 - Agenda: 11-16-0693

- MAC & SR Ad hoc – Room: Queens 4
 - Agenda: 11-16-0698

Monday, May 16th, 2016, PM3 TGax Ad Hoc Sessions (16:00-18:00)

- PHY Ad hoc – Room: KONA 4&5
 - Agenda: 11-16-0693

- MU Ad hoc – Room: Queens 4
 - Agenda: 11-16-0697

Tuesday, May 17th, 2016, AM2 TGax Ad Hoc Sessions (10:30-12:30)

- PHY Ad hoc – Room: KONA 4 & 5
 - Agenda: 11-16-0693
- MAC and SR Ad hoc – Room: Queens 4
 - Agenda: 11-16-698

Tuesday, May 17th, 2016, PM1 TGax Ad Hoc Sessions (13:30-15:30)

- PHY Ad hoc – Room: KONA 4&5
 - Agenda: 11-16-0693
- MU Ad hoc – Room: Queens 4
 - Agenda: 11-16-0697

Tuesday, May 17th 2016, PM3 (EVE) TGax full Session (19:30-21:30)

1. **The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @19:32.**
 - 1.1. Agenda 11-16/0512r2 is on the server. Rev 3 is working document.
2. **Administrative Items**
 - 2.1. Chair reminded the IEEE 802 and IEEE 802.11 P&P.
 - 2.2. Chair asked people to address himself/herself when speaking for the first time.
 - 2.3. Attendance
3. **Agenda for this session**
 - 3.1. Tuesday PM3 (EVE)
 - 3.1.1. Call Meeting to order
 - 3.1.2. IEEE 802 and 802.11 IPR Policy and procedure
 - 3.1.3. Agenda Setting
 - 3.1.4. Progress Review
 - 3.1.5. Presentations
 - 3.1.5.1. 11-16-0604 Simulation based evaluation of DSC
 - 3.1.5.2. Straw Poll from 11-16-0597
 - 3.1.5.3. 11-16-0609 NDPA frame format
 - 3.1.5.4. 11-16-0612 Mandatory and Optional Support for 11ax
 - 3.1.5.5. 11-16-0629 Box 5 calibration
 - 3.1.5.6. 11-16-0665 Notes on Interference Alignment
 - 3.1.6. Recess
 - 3.2. Chair asked if there are any objections to proceed with this agenda – no objections.
 - 3.2.1. The agenda approved.
4. **Progress Review**
 - 4.1. MU – completed all presentations.
 - 4.2. PHY
 - 4.2.1. All the submission affecting SFD have been presented.
 - 4.2.2. Comment resolution started.
 - 4.3. MAC and SR
 - 4.3.1. 10 presentations left..

- 4.4. Discussion
 - 4.4.1. Chair asked people if we need to request additional meeting slot. There is no request for the additional meeting slot.
 - 4.4.2. Chair asked if there is any objection to proceed with this agenda. There was no objection.

5. Presentations

5.1. Tanguy Ropitault (NIST) presented “Simulation-based evaluation of DSC in enterprise scenario” based on the submission 16/0604r2.

5.1.1. Summary

- 5.1.1.1. Performance of DSC in **enterprise** scenario and recommend DSC parameters investigated by computer simulations.
- 5.1.1.2. Highlight the importance of fairness study while analyzing mechanisms supposed to increase spatial reuse.

5.1.2. Discussions

- 5.1.2.1. 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.
 - 5.1.2.1.1. After passing a motion to include something into SFD, someone needs to create some text.
 - 5.1.2.1.2. Chair suggested use of conference calls between January and March meetings.

5.1.3. Plan for advancing the draft

- 5.1.3.1. Approve the draft during the March 2016 meeting.
 - 5.1.3.1.1. Draft 0.1
- 5.1.3.2. Start a comment collection (CC) for 30 days on draft 0.1 – Ends some time in April.
- 5.1.3.3. Comment resolution (May and July)
- 5.1.3.4. Draft 1.0 in July 2016 and start WG LB.

5.2. Straw Poll from 11-16-0597-01 by Graham Smith (SR technologies).

5.2.1. Straw Poll: DSC text should be incorporated into the Draft 11ax Amendment.

Note: 16/0310 may be used as a basis.

5.2.1.1. Discussion.

5.2.1.1.1. The point of the straw poll is inclusion of DSC into the draft.

5.2.1.1.2. A member commented that 16/310 amends clause 18, 19 and 20. Graham responded that there is no reason that those devices cannot use this feature.

5.2.1.2. Result: Y/N/A = 12/28/38

5.3. Ross Jian Yu (Huawei Technologies) presented “HE NDPA frame format,” based on the submission 11-16-0609-00.

5.3.1. Summary

5.3.1.1. HE NDPA frame format proposed based on the VHT NDPA

5.3.2. Discussions – No discussion.

5.3.2.1. Straw Poll: Do you agree to add to the SFD the HE NDPA frame format as shown in slide 15 and 16 of 0609r1?

5.3.2.1.1. Discussion – No discussion.

5.3.2.2. Result: The straw poll was accepted with no objection.

5.4. Sameer Vermani (Qualcomm) presented “Mandatory/Optional Issues for 802.11ax” based on the submission 11-16-0612-01.

5.4.1. Summary

- 5.4.1.1. OFDMA: mandatory for both DL and UL
- 5.4.1.2. Multiple streams and STBC: Support for $N_{ss} > 1$ is still optional. STBC still optional.
- 5.4.1.3. MCS Support: HE MCSs from 0 to 7 are mandatory. HE-MCSs 8 and 9 are optional.
- 5.4.1.4. DL MU-MIMO:
 - 5.4.1.4.1. Support for the full BW DL MU-MIMO defined in 802.11ac is mandatory for a high end AP.
 - 5.4.1.4.2. Support for the reception of full BW DL MU-MIMO at a non-AP STA

5.4.2. Discussion

- 5.4.2.1. Q: A member asked the purpose of this discussion. The answer was it is for the differentiation of the features from legacy systems.
- 5.4.2.2. C: In single stream transmissions, we may not have two LTFs → We have them.
- 5.4.2.3. There was a discussion on the reception capability of full BW DL MU-MIMO signal at non-AP STAs.

5.4.3. Straw Poll: Do you support the following change/additions to the SFD:

5.4.3.1. 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).

5.4.3.2. 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.

5.4.4. Discussion: No question.

5.4.5. Result: Y/N/A = 80/0/32, this straw poll will be converted to a motion.

5.5. Andrew Tan (MediaTek) presented “Box 5 Calibration Results” based on the submission 16/0629r2.

5.5.1. Summary

- 5.5.1.1. Results from 1 BSS test cases and 2 BSS DL test case align with prior efforts from other companies
- 5.5.1.2. Lack of alignment in other 2BSS test cases and all 3BSS test cases due to sparseness of test results submitted and divergence among submitted results
- 5.5.1.3. More results for the 2BSS and 3BSS DL test cases needed as the next step to analyze and to come up with convergent results

5.5.2. Discussion – No questions

5.6. Dzevdan Kapetanovic (Ericsson) presented “Some Notes on Interference Alignment for Downlink Multi-User MIMO,” based on the submission 11-16-0665-00.

5.6.1. Summary

- 5.6.1.1. The standard DL MU-MIMO precoding for BPSK is severely suboptimal.
- 5.6.1.2. An improved way of precoding and decoding BPSK symbols.
- 5.6.1.3. Similar ideas are applied to complex-valued alphabets and simulation results show the improvements.

5.6.2. Discussion

5.6.2.1.

5.6.3. Straw Poll:

5.6.3.1. Straw Poll #1: Do you support that 802.11ax implements a selection mechanism in conjunction with improved receiver capabilities for BPSK?

5.6.3.1.1. Discussion

5.6.3.1.1.1.

5.6.3.1.2. Result: Y/N/A = 1/5/many

5.6.3.2. Straw Poll #2: Do you support that 802.11ax implements a selection mechanism for reduced rank transmission with complex-valued symbols?

5.6.3.2.1. Discussion

5.6.3.2.1.1.

5.6.3.2.2. Result: Y/N/A = 1/6/many

6. AoB

6.1. No other business to conduct.

7. Recessed at 21:31 until Wednesday PM1 (13:30) for the PHY and MAC/SR ad hoc sessions.

Wednesday, May 18th 2016, PM1 TGax ad hoc sessions (13:30-15:30)

- PHY Ad Hoc @ Kona 4 & 5
 - Agenda: 11-16/0693

- MAC/SR Ad Hoc @ Queens 4
 - Agenda: 11-16/0698

Wednesday, May 18th 2016, PM2 TGax ad hoc sessions (16:00-18:00)

- PHY Ad Hoc @ Kona 4 & 5
 - Agenda: 11-16/0693

- MAC/SR Ad Hoc @ Queens 4
 - Agenda: 11-16/0698

Thursday, May 19st, 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, @10:31 AM**

1.1 Agenda 16/0512r3 is on the server. Rev.v4 is the working document.

2 Announcement/Reminder

2.1 Chair reminded IEEE 802 and 802.11 IPR P&P.

2.2 Chair asked people to state name and affiliation when addressing for the first time in the session.

2.3 Chair reminded people to do attendance.

3 Agenda for this session

3.1 Thursday AM2 & PM2

3.1.1 Call Meeting to order

3.1.2 Announcement/Reminder

3.1.2.1 IEEE 802 and 802.11 IPR Policy and procedure.

3.1.2.2 Attendance

3.1.3 Agenda Setting

3.1.4 Presentations (if any)

3.1.5 TG Motions

3.1.5.1 Timeline motion

3.1.5.2 PHY, MAC, MU, SR motions

3.1.5.3 Comment resolution motions

3.1.6 Goals for July 2016

3.1.7 Conference Calls Schedule

3.1.8 AOB

3.1.9 Adjourn

3.2 Chair asked if there are any additions and/or modifications to the agenda. No response.

3.3 Agenda approved without objections.

4 Presentation

4.1 No presentation.

5 Motions

5.1 Timeline Motion: Move to accept the proposed timeline in slide #30 as the official TG timeline.

5.1.1 Moved by Simone Merlin, Seconded by Rolf DeVegt.

5.1.2 Discussion – No discussion.

5.1.3 Result: Motion accepted with no objection.

5.2 PHY, MAC, MU, SR Motions

5.2.1 PHY Motion #156: Move to modify the TG specification framework as in slide 44 to slide 80.

5.2.1.1 Moved by Ron Porat, Seconded by Bin Tian.

5.2.1.2 Discussion – No discussion

5.2.1.3 Result: The motion was accepted with no objection.

5.2.2 PHY Motion #157: Move to change TG draft D0.1 as in document 11-16/0736r0.

5.2.2.1 Moved by Bin Tian, Seconded by Jianhan Liu.

5.2.2.2 Discussion – No discussion

5.2.2.3 Result: The motion was accepted with no objection.

5.2.3 MAC Motion #84: Move to modify the TG specification framework as in slide 83 to slide 99.

5.2.3.1 Moved by Simone Merlin, Seconded by Reza Hedayat.

5.2.3.2 Discussion – No discussion

5.2.3.3 Result: The motion was accepted with no objection.

5.2.4 MU Motion #56: Move to modify the TG specification framework as in slide 101 to slide 105.

5.2.4.1 Moved by Evgeny Khorov, Seconded by Chittabrata Ghosh.

5.2.4.2 Discussion – No discussion

5.2.4.3 Result: The motion was accepted with no objection.

5.2.5 SR Motion #8: Move to modify the TG specification framework as in slide 107 to slide 111.

5.2.5.1 Moved by James Wang, Seconded by Yasuhiko Inoue.

5.2.5.2 Discussion – No discussion

5.2.5.3 Result: The motion was accepted with no objection.

5.3 Comment Resolution Motions

5.3.1 Comment Resolution Motion #1: Move to accept the resolution of comment CID 2383 in document 11-16/0675r1.

5.3.1.1 Moved by Reza Hedayat, Seconded by Bo Sun.

5.3.1.2 Discussion – No discussion

5.3.1.3 Result: The motion was accepted with no objection.

5.3.2 Comment Resolution Motion #2: Move to accept resolutions of comments

5.3.2.1 1682, 474, 1196, 1455, 2003, 844, 2122, 1197, 356, 2006, 2533, 2285, 1456, 1457, 1678, 1677, 912, 913, 1686, 1687, 1846, 2002, 843, 2121, 845, 296, 1007, 541, 2538, 2124, 524, 540, 2168, 2004

5.3.2.2 In document 11-16/0610r3.

5.3.2.3 Moved by Ross Jian Yu, Seconded by Bo Sun.

5.3.2.4 Discussion – No discussion

5.3.2.5 Result: The motion was accepted with no objection.

5.3.3 Comment Resolution Motion #3: Move to accept resolutions to CIDs

5.3.3.1 2129, 2286, 2539, 2537, 2128, 2013, 2009, 2167, 2169, 865, 2127, 2125, 2534, 2008, 2014, 2015, 2018 in 11-16/0610r4.

5.3.3.2 Moved by Ross Jian Yu, Seconded by Bo Sun.

5.3.3.3 Discussion – No discussion

5.3.3.4 Result: The motion was accepted with no objection.

5.3.4 Comment Resolution Motion #4: Move to accept resolutions for the following CIDs in 11-16/0614r1:

5.3.4.1 348, 351, 466, 467, 877, 878, 879, 1030, 1185, 1451, 1605, 1606, 1607, 1757, 1922, 2352, 2507, 2511, 2512, 2513, 2514, 2515, 2516, 2828.

5.3.4.2 Moved by Lochan Verma, Seconded by Bo Sun.

5.3.4.3 Discussion – No discussion

5.3.4.4 Result: The motion was accepted with no objection.

5.3.5 Comment Resolution Motion #5: Move to accept resolutions for the following CIDs in 11-16/0615r1:

5.3.5.1 852, 853, 948, 1786, 1872, 1873, 2126.

5.3.5.2 Moved by Lochan Verma, Seconded by Bo Sun.

5.3.5.3 Discussion – No discussion

5.3.5.4 Result: The motion was accepted with no objection.

5.3.6 Comment Resolution Motion #6: Move to accept the resolutions for the following CIDs in 11-16/0623r1:

5.3.6.1 347, 531, 532, 533, 534, 535, 536, 850, 2093, 2094, 2095.

5.3.6.2 Moved by Bin Tian, Seconded by Bo Sun.

5.3.6.3 Discussion – No discussion

5.3.6.4 Result: The motion was accepted with no objection.

5.3.7 Comment Resolution Motion #7: Move to accept resolutions for the following CIDs in 11-16/0625r2:

5.3.7.1 279, 280, 282, 283, 839, 872, 1041, 1045, 1188, 1189, 1190, 1191, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 2345, 2364, 2520.

5.3.7.2 Moved by Bin Tian, Seconded by Bo Sun.

5.3.7.3 Discussion – No discussion

5.3.7.4 Result: The motion was accepted with no objection.

5.3.8 Comment Resolution Motion #8: Move to accept resolutions for the following CIDs in 11-16/0634r1:

5.3.8.1 542, 837, 881, 1186, 1032, 1612, 1613, 1614, 1615, 1844, 1929.

5.3.8.2 Moved by Yan Zhang, Seconded by Bo Sun.

5.3.8.3 Discussion – No discussion

5.3.8.4 Result: The motion was accepted with no objection.

5.3.9 Comment Resolution Motion #9: Move to accept resolutions for the following CIDs in 11-16/0658r2:

5.3.9.1 353, 354, 1953, 2527, 2528, 2725, 888, 889, 890, 891, 893, 894, 895, 896, 897, 1954, 1955, 1956, 2529, 2530, 1111, 1112, 1192, 1193, 1758, 1851, 1852, 2346, 1951, 1964, 1952, 2367, 1789.

- 5.3.9.2 Moved by Kiseon Ryu, Seconded by Bo Sun.
- 5.3.9.3 Discussion – No discussion
- 5.3.9.4 Result: The motion was accepted with no objection.

5.3.10 Comment Resolution Motion #10: Move to accept resolutions for the following CIDs in 11-16/0659r1:

- 5.3.10.1 313, 316, 529, 848, 530, 849
- 5.3.10.2 1933, 2518, 2154, 2155.

- 5.3.10.3 Moved by Kiseon Ryu, Seconded by Bo Sun.
- 5.3.10.4 Discussion – No discussion
- 5.3.10.5 Result: The motion was accepted with no objection.

5.3.11 Comment Resolution Motion #11: Move to accept resolutions for the following CIDs in 11-16/0663r4:

- 5.3.11.1 1925, 835, 870, 880, 1105, 1609, 2676, 2136, 2148, 2153, 2243, 2342, 2675.

- 5.3.11.2 Moved by Ke Yao, Seconded by Bo Sun.
- 5.3.11.3 Discussion – No discussion
- 5.3.11.4 Result: The motion was accepted with no objection.

5.3.12 Comment Resolution Motion #12: Move to accept resolutions for the following CIDs in 11-16/0681r3:

- 5.3.12.1 215, 2486.

- 5.3.12.2 Moved by Daewon Lee, Seconded by Bo Sun.
- 5.3.12.3 Discussion – No discussion
- 5.3.12.4 Result: The motion was accepted with no objection.

5.3.13 Comment Resolution Motion #13: Move to accept resolutions for the following CIDs in 11-16/0653r5:

- 5.3.13.1 277,519,521,838,886,1039,1187,1931, 2360, 2361, 2362, 2134.

- 5.3.13.2 Moved by Xiaogang Chen, Seconded by Bo Sun.
- 5.3.13.3 Discussion – No discussion
- 5.3.13.4 Result: The motion was accepted with no objection.

5.3.14 Comment Resolution Motion #14: Move to accept resolutions for the following CIDs in 11-16/0682r2:

- 5.3.14.1 2566, 2474, 2081, 2080, 2079, and 2078
- 5.3.14.2 1866, 2087, 2086, 2089, and 2092.

- 5.3.14.3 Moved by Daewon Lee, Seconded by Bo Sun.
- 5.3.14.4 Discussion – No discussion
- 5.3.14.5 Result: The motion was accepted with no objection.

6 Plans for the July 2016 session

- 6.1 Continue with the comment resolutions.

7 Teleconference planning

7.1 Chair suggested weekly conference calls.

7.1.1 Thursday, June 2nd, 16th, 30th, and July 14th, 2016, 10:00-12:00 (ET)

7.1.2 Thursday, June 23rd, July 7th, and August 4th, 2016, 20:00-22:00 (ET)

7.2 Chair asked if there is any objection to this plan. → No objection.

8 AOB

8.1 Coexistence Assurance document: TG leadership will review the CA document of 802.11ac and discuss necessary changes for 802.11ax.

8.2 Volunteers welcomed.

9 Adjournment

9.1 TGax adjourned for the week @ 11:41 AM.

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

TGax meeting was cancelled since TGax have already adjournment during the AM2 session.