IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGax  May 2014 Waikoloa Meeting Minutes | | | | |
| Date: 2014-05-30 | | | | |
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Abstract

HEW SG meeting minutes from the IEEE 802.11 Waikoloa session, May 12th – 16th, 2014.

**IEEE 802.11 Task Group ax**

**May 2014 Waikoloa Meeting**

**Hilton Waikoloa Village, Big Island, HI, USA**

**May 12th – 16th, 2014**

**Monday, May 12th, 2014, AM2 Session (10:30-12:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei), the chair pro-tem of the TGax, @10:30
   1. About 200 people are in the room.
2. Agenda Doc.11-14/478r0 on the server.
   1. Rev 1 is the working document
   2. Chair asked to state name and affiliation when speaking for the first time.
   3. Chair reminded attendance.
3. The chair reviewed the mandatory 5 slides of P&P.
   1. Call for potentially essential patents
      1. Chair asked if anyone is aware of potentially essential patents.
      2. No potentially essential patents reported.
4. Agenda items for the week
   1. Approve HEW SG minutes from May meeting.
   2. TG officers elections
   3. TG Timeline
   4. TG Documents
   5. Presentations and consolidation of documents
   6. Schedule Teleconference times.
5. General Flow of the meeting
   1. Slide 13 of the 14/219r1 contains general flow of the meetings this week.
   2. There are nine meeting slots for TGax as contained in slide 14 of 14/219r1.

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| --- | --- | --- | --- | --- |
|  | Monday | Tuesday | Wednesday | Thursday |
| AM1 |  |  | TGax | TGax |
| AM2 | TGax | TGax |  |  |
| PM1 |  |  |  | TGax |
| PM2 | TGax | TGax |  |  |
| PM3 | TGax | TGax |  |  |

1. Tentative Agenda for Monday, May 12th, AM2 (10:30 – 12:30).
   1. Proposed Agenda
      1. Call meeting to order
      2. Patent policy, etc.
      3. Call for submissions
      4. Set and approve agenda
      5. Summary from March 2014 meeting
      6. SG motions
      7. Approve SG minutes from the May meeting.
      8. TG Timeline
      9. TG Documents
      10. Elections
      11. Presentations
      12. 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 about 40 submissions.
   1. 11-14/0527, “PHY Abstraction for TGax System Level Simulations”, Ron Murias (InterDigital)
   2. 11-14/0546, “Packet traffic measurements around Boulder Colorado”, Jim Lansford (CSR) - TM
   3. 11-14/0567, “Proposed TGax Functional Requirements”, Lei Wang (Marvell)
   4. 11-14/0571, “Evaluation Methodologies”, Ron Porat (Broadcom)
   5. 11-14/0577, “Path Loss Model for Scenario 1”, Nihar Jindal (Broadcom)
   6. 11-14/0578, “Residential Scenario CCA/TPC Simulation Discussion”, Joseph Levy (InterDigital)
   7. 11-14/0581, “Further Discussions on PHY Abstraction”, Yakun Sun (Marvell) - EM
   8. 11-14/0582, “Calibrating MAC Simulator Through Function Test”, Jinjing Jiang (Marvell) - SS
   9. 11-14/0583, “Further Discussions on Instantaneous SINR Calibration for System Simulation”, Yakun Sun (Marvell)
   10. 11-14/0584, “System Level Simulations on Beamforming and Link Adaptation”, Yan Zhang (Marvell)
   11. 11-14/0585, “PHY Abstractions Types For and IEEE 11ax System Level Simulation”, Jianhan Liu (Mediatek)
   12. 11-14/0586, “Automotive Considerations for the Simulation Scenarios”, Igal Kotzer (General Motors)
   13. 11-14/0594, “Insert Virtual Desktop Infrastructure (VDI) Traffic Model Content for HEW Simulation Scenarios”, Yingpei Lin (Huawei)
   14. 11-14/0595, “Edits on Some Traffic Content for HEW SG Simulation Scenarios”, Yingpei Lin (Huawei)
   15. 11-14/0598, “Uplink multi-user MAC protocol for 11ax”, Tran Thi Thao Nguyen (Kyushu Inst. of Tech.)
   16. 11-14/0600, “MAC simulator calibration”, gwen barriac ( qualcomm)
   17. 11-14/0603, “Evaluating-TGax-network-with video-traffic” Chao-Chen Wang (Mediatek)
   18. 11-14/0604, “Evaluating-TGax-network-with video-traffic-text-update”, Chao-Chen Wang (Mediatek)
   19. 11-14/612, “Calibration Procedures towards Integrated System Level Simulation”, Jiayin Zhang (Huawei)
   20. 11-14/0613, “Discussions on adaptive frame length in MAC based on block ACK”, Ningbo Zhang (BUPT)
   21. 11-14/0614, “Joint Coding and Modulation Diversity with LRA MMSE VP by QR precoding MIMO”, Ningbo Zhang (BUPT)
   22. 11-14/0616, “CSMA/CA enhancements”, Yonggang Fang (ZTE)
   23. 11-14/0617, “Discussion on timeline for 802.11ax”, Laurnet Cariou (Orange)
   24. 11-14/0620, “link adaptation for PHY SLS calibration”, Jinyoung Chun (LG Electronics)
   25. 11-14/0621, “Simulation Scenarios”, Simone Merlin (Qualcomm)
   26. 11-14/0624, “Investigation on 1024 QAM feasibility in 11ax”, Eunsung Park (LG Electronics)
   27. 11-14/0625, “Multi-channel operation in Simulation scenarios”, Suhwook Kim (LG Electronics)
   28. 11-14/0626, “IEEE 802.11ax Functional Requirements”, SangHyun Chang (Samsung)
   29. 11-14/0627, “Outdoor Channel Models for System Level Simulations”, Kaushik Josiam (Samsung)
   30. 11-14/0628, “Measurements on CCA Thresholds in OBSS Environments”, John Son (WILUS Institute), Young Doo Kim (SK Telecom)
   31. 11-14/0634, “Discussion on MAC system calibration”, Zhou Lan (Huawei)
   32. 11-14/0635, “DSC Implementation”, Graham Smith (DSP Group)
   33. 11-14/0636, “Discussion on functional requirement”, Zhou Lan (Huawei)
   34. 11-14/0637, “Spatial Reuse and Coexistence with Legacy Devices”, James Wang (mediaTek)
   35. 11-14/0647, “PHY abstraction comparison”, Tianyu Wu (MediaTek)
   36. 11-14/0648, “Performance of a Dense Campus Network”, Chinghwa Yu (MediaTek Inc)
   37. 11-14/0649, “802.11ax Timeline Scenarios”, Rolf de Vegt (Qualcomm)
   38. 11-14/0656, “How to Describe 802.11ax Functional Requirements”, Minho Cheong
   39. 11-14/0660, “802.11ax Timeline”, Minho Cheong
   40. 11-14/0677, “MAC Simulation Calibration Methodology Comparison”, Chinghwa Yu (MediaTek Inc)
   41. 11-14/0682, “In Situ Spectrum Reuse Measurements in Indoor 20,000 Seat Arena”, Chuck Lukaszewski (Aruba Networks)
3. Summary from March 2014
   1. Reviewed and updated the PAR and the CSD based on comments received from individuals and other IEEE 802 WGs
      1. <https://mentor.ieee.org/802.11/dcn/14/11-14-0165-01-0hew-802-11-hew-sg-proposed-par.docx>
      2. <https://mentor.ieee.org/802.11/dcn/14/11-14-0169-01-0hew-ieee-802-11-hew-sg-proposed-csd.docx>
      3. PAR and CSD were approved by the IEEE 802 EC and Nescom
      4. IEEE Standard board approved IEEE 802.11ax TG.
   2. Presentations
      1. Number of submissions related to simulation scenarios, calibration, evaluation methodologies, channels models, PHY abstraction, and technologies
4. Approval of SG/TG minutes (March 2014 Meeting Minutes and Teleconferences Minutes)
   1. **Motion: Approve HEW SG/TGax minutes of meetings and teleconferences from March 2014 plenary meeting to today:**
      1. [**https://mentor.ieee.org/802.11/dcn/14/11-14-0380-01-0hew-march-2014-beijing-meeting-minutes.docx**](https://mentor.ieee.org/802.11/dcn/14/11-14-0380-01-0hew-march-2014-beijing-meeting-minutes.docx)
      2. [**https://mentor.ieee.org/802.11/dcn/14/11-14-0530-00-00ax-tgax-teleconference-minutes-2014-04-17.doc**](https://mentor.ieee.org/802.11/dcn/14/11-14-0530-00-00ax-tgax-teleconference-minutes-2014-04-17.doc)
      3. **Moved by Edward Au (Huawei Technologies), seconded by Al Petrick (Jones-Petrick and Associates)**
      4. **No Discussion on this motion.**
      5. **Chair asked if there are any objections to accept those minutes.**

**Motion accepted with no objections**

1. Presentations:
   1. Jim Lansford (CSR) presented “IEEE 802.11ax High Efficiency WLAN Packet measurements around Boulder, CO” based on 14/0564r1
      1. Summary
         1. Captured packets using NetworkMonitor + Wireshark around Boulder, CO.
         2. Heavily congested areas have mostly low rates and small packets.
         3. Lots of big packets in residential (video?).
         4. Lots of small, low rate packets (beacons?) in a managed environment
      2. Discussions
         1. Some members pointed out some issues related to the tool.
         2. A member commented that it was surprising to see so many short and low rate packets in a managed environment.
         3. A member asked for the clarification of measurement method and dependency on the location.
   2. Graham Smith (DSP Group) presented “Dynamic Sensitivity Control Implementation”, based on 14/0635r1.
      1. Summary
         1. Intended to help with those interested in using DSC for simulations:
            1. The default mandatory CCA levels are maintained.
            2. DSC is basically setting the RX Sensitivity according to the strength of received signal from AP.
         2. DSC is designed for relatively small network coverage areas so as to improve channel re-use and overall throughput in a total coverage area.
      2. Discussions
         1. A member commented that it would be good for STAs to have this capability.
         2. Another member asked for clarification on relationship between CCA threshold and sensitivity..
   3. Pengfei Xia (InterDigital) presented “PHY Abstraction for TGax System Level Simulations”, based on 14/0527r1.
      1. Summary
         1. RBIR is an excellent candidate for PHY abstraction..
      2. Discussions
         1. No questions or comments.

No other presentations ready for this session.

Chair asked if there is any objection to recess until PM2 today. No one objected.

1. Recess at 12:28 until Tuesday PM2 (16:00) today.

**Monday, May 12th 2014, PM2 Session (16:00-18:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chair pro-tem of TGax, @16:00
   1. Agenda 11-14/0478r1 is on the server. Rev 2 is working document.
   2. There were 200 people in the room.
   3. Chair reminded that this meeting is operated under the IEEE 802 and IEEE 802.11 P&P.
   4. Chair asked to limit presentation time
2. Proposed agenda for this session
   1. Monday PM2
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance.
      3. Chair and Secretary election
      4. Presentations
      5. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
3. Elections – the Chairperson and Secretary of TGax.
   1. TGax Chair Election
      1. Adrian Stephens (Intel), the chairperson of 802.11 WG, runs this part of the session.
      2. Adrian asked if there is other candidate. No response and nomination closed.
      3. Adrian asked to affirm Osama Aboul-Magd as the chair of the TGax.
      4. Osama Aboul-Magd (Huawei Technologies) is affirmed as the chairperson of the TGax.
   2. Secretary Election
      1. Now, the chair-elect, Osama Aboul-Magd (Huawei Technologies), runs the session.
      2. Chair asked if there is any other nomination. There was no response and nomination was closed.
      3. Chairperson asked to affirm Yasuhiko Inoue (NTT) as the secretary of TGax..
      4. Yasuhiko Inoue (NTT) was affirmed as the secretary of the TGax.
4. Presentations
   1. Yingpei Lin (Huawei Technologies) presented “Insert Virtual Desktop Infrastructure (VDI) Traffic Model Content for HEW Simulation Scenarios” based on 14/0594r0.
      1. Summary
         1. VDI traffic models proposed for simulation scenarios document.
      2. Discussions
         * 1. A member asked if this is consistent with the previous submission of VDI traffic models. The answer was yes.
           2. A member asked for a clarification on parameter of the traffic model.
   2. Yingpei Lin (Huawei Technologies) presented “Edits on Some Traffic Content for HEW SG Simulation Scenarios” based on 14/0595r0.
      1. Summary
         1. Proposed modifications to the traffic models specified in the simulation scenario document.
            1. Video rate in Annex 2.
            2. Gaming traffic model in Annex 1 and Annex 2.
      2. Discussions
         * 1. A member suggested dependency of video rate on the CODEC.
           2. The member also asked a question on the relationship between the bi-directional video traffic model and VDI traffic model in the previous presentation. There will be offline discussion.
   3. Gwen Barriac (Qualcomm) presented “Proposed Calibration For MAC simulator” based on 14/0600r0.
      1. Summary
         1. A calibration plan for MAC simulator together with MAC & PHY parameters, traffic model and configurations proposed.
      2. Discussions
         1. Q: A member asked for the intention of this presentation. The answer was that every company doing MAC and integrated simulations to have the same result.
         2. C: Another member commented about the configuration – especially for the frame aggregations.
         3. Q: A member asked for the way to derive PER. The presenter need to check about that point.
         4. Q: A member asked if test cases multiple cells environment and non-Wi-Fi interference have been considered. The answer was no. The intention here is to keep the calibration scenario simple.
         5. Q: Some members asked for details of simulation parameters.
   4. Kaushik Josiam (Samsung) presented “Outdoor Channel Models for System Level Simulations” based on 14/0627r0.
      1. Summary
         1. ITU-R UMi model agreed for outdoor channel model between AP and STAs.
         2. Need AP to AP and STA to STA channel models for evaluations.
         3. The above channel models and modifications on parameters proposed..
      2. Discussions
         1. A member asked for the intention of proposing ITU-Modified channel model. The answer was personal recommendation.
         2. Some members commented about the system configuration for the ITU channel model.
   5. Jinjing Jiang (Marvell) presented “Calibrating MAC Simulator Through Function Test” based on 14/0582r0.
      1. Summary
         1. Suggestion 1: test MAC functionalities before testing system performance for MAC calibration.
         2. Suggestion 2: MAC functionalities calibration via testing the MAC FSM states (and transitions).
         3. Open to discussions on the idea and invite inputs on the test case design.
      2. Discussions
         1. C: A member commented that simple calibration is good enough.
         2. Q: A member asked if the presenter is suggesting every company to implement the state machine in slide 7. The answer was that it is just an example.
         3. For a question asked by a member, the presenter answered that the intention is to make this process short so that people can concentrate on the new features.
5. Recessed at 12:31 until PM2 (16:00) today.

**Monday, May 12th 2014, PM3 Session (19:30-:21:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @19:35
   1. Agenda 11-14/0478r1 is on the server. Rev 2 is working document.
   2. There were 150 people in the room.
   3. Chair reminded that this meeting is operated under the IEEE 802 and IEEE 802.11 P&P.
   4. Chair asked to limit presentation time
2. Proposed agenda for this session
   1. Monday PM3
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
      4. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
3. Presentations
   1. Zhou Lan (Huawei Technologies) presented “Consideration on MAC system calibration” based on 14/0634r0
      1. Summary
         1. A hybrid approach for MAC calibration is proposed.
         2. Examining simulation log is a straightforward way to verify deterministic MAC behaviors, it is also useful to verify nondeterministic behavior under some scenarios.
         3. Performance comparison is commonly used for simulation system calibration, however it consumes simulation time and requires efforts for deciding scenarios and common parameter setting.
         4. It is suggested to leverage simulation log and conduct performance test only if necessary.
      2. Discussions
         1. C: Some members mentioned that we should make sure that the results are comparable. It will not make sense if different company had different results.
   2. Suhwook Kim (LG Electronics) presented “Multi-channel operation in simulation scenario” based on 14/0625r1.
      1. Summary
         1. Revised description on the channelization parameters such as center frequency, channel bandwidth, and primary channels for each simulation scenario in the current simulation scenario document.
         2. Mandatory (baseline) and optional channelization methods per each simulation scenario proposed.
      2. Discussions
         1. C: A member mentioned that channel allocation in 802.11ac is not random.
         2. C: Another member commented the intention seems to be considering the adjacent channel interference.
         3. C: Another member mentioned that we should consider all relevant frequency bands not limited to the 5 GHz band.
         4. C: Another member commented that P2P channels.
   3. Tran Thi Thao Nguyen (Kyushu Institute of Technology) presented “Uplink Multi-User MAC protocol for 11ax”, based on 14/0598r0.
      1. Summary
         1. Uplink Multi-User MAC protocol applicable for both frequency and spatial domains proposed.
         2. Concept of user group for UL transmissions which is similar to that of DL MU-MIMO in 802.11ac proposed
      2. Discussions
         1. Q: A member asked about the effect of hidden terminal. The answer was use of RTS/CTS handshake could be used to mitigate that eefect.
         2. C: Another member expressed a concern on addressing rule in the proposed scheme.
         3. C: Some members asked for the clarifications on basic ideas and assumptions.
      3. **Straw Poll #1: Do you agree that TGax should support a mode of uplink multi-user transmission?**
         1. **Result: Y/N/A = 36/0/62**
      4. **Straw Poll #2: Do you agree that any proposal for uplink multi-user transmission protocol for TGax should be a distributed type of protocol?**
         1. **Result: 0/4/83**
4. Recessed at 21:13 until AM2 (10:30) tomorrow.

**Tuesday, May 13th 2014, AM2 Session (10:30-12:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @10:30
   1. Agenda 11-14/0478r2 is on the server. Rev 3 is working document.
   2. There were 180 people in the room at the beginning of the session. More people came in later.
   3. Chair reminded that this meeting is operated under the IEEE 802 and IEEE 802.11 P&P.
   4. Chair asked people to address himself/herself when speaking for the first time.
   5. We have about 30 presentations to hear. The chair asked each presentation to be done in 20 minutes including Q&A.
2. Agenda for this session
   1. Tuesday AM2
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance.
      3. TG Issues – start discussions on following items.
         1. Timeline (11-14/649, 11-14/617, Minho) – PM2
         2. TG Documents
         3. TG Structure
      4. Presentations
      5. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
3. TG Issues
   1. TG Document – based on slide 27 of the agenda file
      1. Simulation Scenarios (11-14/0621r0)
      2. Evaluation Methodology (11-14/0571r0)
      3. Channel Models
      4. Functional Requirements
      5. Process
      6. Specification Framework (down the road)
      7. Discussions
         1. Channel Model document:
            1. Should we have the channel model separated from simulation scenarios?
            2. The preference of the group is to have a separate documents of channel model.
            3. Jianhan will coordinate the channel model document.
         2. Functional Requirements
            1. ???
         3. Process – may include creation of specification framework
      8. Approve the initial revisions of each document by motions.
      9. Motion to accept any changes.
   2. TG Structure – based on slide 28 of the agenda file
      1. Proposed TG Structure
         1. 2 vice chairs: Responsibilities include running the TG meeting if the chair is unavailable.
         2. Create 4 ad hoc groups (MAC, PHY and others)
            1. Number of chairs per ad hoc is TBD.
            2. Responsibilities include running ad hoc meeting, developing spec framework document (SFD), draft development, maintain comment database.
         3. An Editor
            1. Creating the SFD and adding text as it is approved by the task group.
            2. Edit the draft amendment.
         4. Discussions
            1. Chair recommended offline discussions on these topics and come back with a proposal in the future sessions.
4. Presentations

We have 30 presentations to hear and the chair asked to limit the time for each presentation to 20 minutes.

* 1. Jiyong Pang (Huawei Technologies) presented “Calibration Procedures towards Integrated System Level Simulation” based on 14/0612r0.
     1. Summary
        1. The calibration procedures contributing to an integrated system level simulation are described
        2. Some preliminary results on Instantaneous SINR, PHY SLS and Integrated SLS are shown.
     2. Discussions
        1. C(slide 6): A member mentioned that we have not agreed anything about PHY System Simulations.
        2. C: Another member commented about the impact of frame aggregation to SNR and SINR.
  2. Chao-Chun Wang (MediaTek) presented “Modeling and Evaluating Variable Bit rate Video Steaming for 802.11ax” based on 14/0604r1.
     1. Summary
        1. Video streaming is a critical traffic type for future wireless networks including 802.11ax.
        2. Practical video streaming runs at variable bit rate due to many factors in the E2E path.
        3. It is critical to model the video streaming in a realistic manner to reflect the true user experience.
        4. Suggested that inclusion a modeling methodology in the simulation scenario for the variable bit rate video streaming based on existing video traffic model
     2. Discussions
        1. No discussion.
     3. **Straw Poll: Do you support including he variable bit rate video streaming (described in page 9) into Annex of evaluation methodology document?**
        1. **Discussion/Clarification**
        2. **Vote: Y/N/A = 25/1/86**
  3. Eunsung Park (LG Electronics) presented “Investigation on 1024 QAM feasibility in 11ax” based on 14/0624r0.
     1. Summary
        1. In indoor scenarios, 1024 QAM provides system-level gain of 10 ~ 20 % even in 2 by 2 MIMO with SM. The gain is increasing in SISO and STBC.
        2. It is also important that from the user perspective, 1024 QAM provides 25% peak data rate increase as well as average throughput enhancement.
        3. Proposed to check hardware feasibility to meet the lower EVM requirement.
     2. Discussions
        1. Q: A member asked about the simulation condition – whether impairments are considered. The answer was it is AWGN simulation.
        2. C: Some members commented the impact on EVM impact and impact of channel estimation error should be evaluated.
        3. C: Another member suggested reconsideration of constellation mapping.
  4. Yakun Sun (Marvell) presented “Further Discussions on PHY Abstraction” based on 14/0581r0.
     1. Summary
        1. MIESM-based PHY abstraction is independent to channel types/interference scenarios.
        2. AWGN-based SNR vs. PER lookup table can accurately predict PER for various channel types.
     2. Discussions
        1. Q (slide 13): A member asked about the PER conversion.
        2. C: Another member commented that he would like to see the way to reduce complexity.
        3. C: Another member mentioned that the simulation is based on an ideal condition and need to consider implementation loss which the system level simulation should capture.

1. Recessed at 12:31 until PM2 (16:00) today.

**Tuesday, May 13th, 2014, PM2 Session (16:00-18:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei), the chair of TGax, @16:01
   1. About xxx people are in the room at the beginning of the session.
   2. Chair reminded IEEE 802 and 802.11 IPR P&P.
   3. Agenda Doc.11-14/0478r2 is on the server. Rev 3 is the working document
2. Agenda for this session
   1. Tuesday PM2
      1. Call the meeting to order
      2. Reminder:
         1. IEEE 802 and 802.11 IPR Policy & Procedure.
         2. Attendance
      3. TG Issues
         1. Timeline
            1. 14/617r0 - Laurent
            2. 14/ - Minho
            3. 14/649 - Rolf
      4. Presentations
      5. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
   3. Agenda approved.
3. Timeline discussion
   1. Presentation by Laurent Cariou (Orange) - “Discussion on timeline for 802.11ax”, based on 14/0617r0.
      1. Summary
         1. Discussed the risk of a long timeline for 802.11ax with regards to the early needs of densification
         2. Some ways to speed up the improvement of user experience in dense environments discussed.
         3. We also believe that 11ax brings improvements to Wi-Fi experience that will be needed earlier than 2018-19
      2. Discussions
         1. C: A member suggested basic features as for the first focus, and then to think about the advanced features.
         2. C: Some members agreed to speed up the process, but there also is a opinion that we should not be too optimistic to change the process.
         3. C: Some members mentioned that we need actual plan to accelerate the process.
         4. C: Another member would like to understand market need to think about the timeline.
      3. **Straw Poll: Would you like to see investigations on the way to create 2 waves for the specification of 802.11ax?**
         1. **Y/N/A = 39/18/62**
   2. Presentation by Minho Cheong (NEWRACOM) - “802.11ax Timeline”, based on 14/0660r0.
      1. Summary
         1. Discussed the risk of the timing to create ad hoc groups in TGax.
         2. The formation of TGac ad hoc groups reviewed.
         3. The process for TGax proposed.
      2. Discussions
         1. No discussions.
   3. Presentation by Rolf De Vegt (Qualcomm) – “802.11ax Timeline Scenarios”, based on 14/0649r0.
      1. Summary
         1. Timeline benchmarks from 802.11ac presented.
         2. Discussion of .11ax timeline relative to .11ac timeline
         3. Two scenarios for preliminary projection of .11ax timeline presented.
      2. Discussions
         1. C: Some members mentioned the scenario A in the slide 5 is too aggressive.
         2. C: A member pointed out selection of the new features is a key to determine the timeline.
         3. C: Another member mentioned that the scenario B in the slide 6 is still aggressive.
         4. C: A member mentioned that it is too early to start working on the SFD in September 2014.
      3. **Straw Poll: What scenario should be reflected in the 802.11ax timeline estimate:**
         1. **A: Scenario A (D1.0 in Jan 2016)**
         2. **B: Scenario B (D1.0 in July 2016)**
         3. **C: Scenario C (D1.0 in Jan 2017)**
         4. **D: Other timeline**
         5. **E: Don’t know / Abstain**
         6. **Discussions:**
            1. **Can be voted for many? 🡪 Vote for one.**
         7. **Result: A/B/C/D/E = 48/54/12/6/7**
4. Presentations
   1. Igal Kotzer (GM) presented “Automotive Considerations for the Simulation Scenarios”, based on 14/0586r0.
      1. Summary
         1. Changes to the Simulation Scenario proposed:
            1. Both of the presented automotive scenarios have similar simulation characteristics.
            2. Simulation scenario 3 - Allow unmanaged operation as well as managed operation.
      2. Discussions
         1. Q: A member asked for clarification about the unmanaged condition on the slide 6 – what exactly is unmanaged? The answer was channel selection/frequency planning.
         2. C: Another member mentioned that additional scenario could introduce a potential risk of extending the timeline.
         3. C: A member pointed out that the relative speed of the vehicle is very slow.
   2. Yan Zhang (Marvell) presented “System Level Simulations on Beamforming and Link Adaptation”, based on 14/0584r0.
      1. Summary
         1. TxBF significantly improves throughput, especially 5%-tile STA throughput.
         2. 11ac single user TxBF should be adopted as the baseline system level simulation evaluation for 11ax.
         3. BSS throughput employing ideal link adaptation is about 4 times higher than that of employing ACK-based link adaptation.
         4. There are a small amount of STAs are not able to associate with APs in current large outdoor scenario.
      2. Discussions
         1. Q: A member asked for a clarification of assumption on the feedback mechanism.
         2. Q (slide 15): A member asked about the reason why big SINR advantage of 10 dB can be expected. The answer was not only the TxBF but also the other features affect the result.
         3. Q: A member asked for a question on link adaptation.
         4. Q: A member asked about the detail of assumed TxBF technique.
         5. Q: Some members asked about the assumed link adaptation scheme in this presentation.
5. Recess @ 18:00 until PM3 (19:30) this evening.

**Tuesday, May 13th, 2014, PM3 Session (19:30-21:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei), the chair of TGax, @19:33
   1. About 150 people are in the room.
   2. Chair reminded IEEE 802 and 802.11 IPR P&P.
   3. Agenda Doc.11-14/0478r2 is on the server. Rev 3 is the working document.
   4. We still have 20 presentations to hear.
2. Agenda for this session
   1. Tuesday PM3
      1. Meeting call to order
      2. Reminder
         1. IEEE 802 and IEEE 802.11 Policy and Procedure
         2. Attendance
      3. Presentations
      4. Recess
   2. Agenda approved without objections.
3. Presentations
   1. Tianyu Wu (MediaTek) presented “PHY abstraction method comparison” based on 14/0647r2
      1. Summary
         1. The results shows that RBIR-CM, RBIR-BICM and MMIB provide similar accuracy on instantaneous PER prediction.
         2. RBIR can provide quite accurate prediction for average performance.
         3. A channel irrelevant curve fitting method can be used to further improve the accuracy.
         4. Instantaneous PER is hard to be precisely predicted.
      2. Discussions
         1. Q (slide 16): A member asked how the authors created these graphs. The answer was that the first three graphs are created from simulation results.
         2. Q: The member also asked which one is more accurate.
         3. C (slide 15): Another member made a comment on the channelization.
   2. John Son (WILUS Institute) presented “Measurements on CCA Thresholds in OBSS Environment” based on 14/0628r0.
      1. Summary
         1. The previous works have addressed the benefits of increased CCA threshold resulting greater spatial reuse in OBSS environment.
         2. This contribution focuses on performance of the increased CCA threshold in OBSS environment where non-overlapping channels are utilized.
         3. Performance degradations in dense OBSS deployments observed even though APs are utilizing non-overlapping channels due to Adjacent Channel Interferences.
         4. Presented preliminary experiment results showing performance improvements with the increased receive threshold on target AP.
      2. Discussions
         1. C: A member mentioned this could be the solution for the 4 times improvement stated in the PAR and commented that the impact of out-of-band emission should be considered.
         2. C: Another member mentioned that the near-far problem will be more severe for the HEW scenarios and CCA on the secondary channels will be important.
         3. Q: A member asked about the traffic condition.
   3. Yakun Sun (Marvell) presented “Further Discussions on Instantaneous SINR Calibration for System Simulation” based on 14/0583r0.
      1. Summary
         1. Two suggestions for instantaneous SINR calibration
            1. Suggestion1: Use SINR per tone given its convenience and readiness.
            2. Suggestion 2: Use simple MAC for channel access - open to discussion on CSMA or CCA-only
      2. Discussions
         1. C: A member mentioned that (1) SINR calibration per tone may not be enough, (2) CCA-only MAC does not simulate the actual behavior of the MAC.
         2. C: Another member commented that integrated simulation is carried out in an event driven manner unlike the one in this presentation.
   4. Nihar Jindal (Broadcom) presented “Path Loss Model for Scenario I” based on 14/0577r1.
      1. Summary
         1. Proposed path loss model for scenario I:
            1. Option A: 11nB PL with 5 dB/wall and 18.3 dB per floor (non-linear summation), and 4 dB shadow for all links
            2. Option B: 3GPP indoor femto model with 0.3 \* d term, and 4 dB shadow for all links
            3. Numbers are for fc = 2.4 GHz; apply normal fc^2 scaling if fc changed.
      2. Discussions
         1. C: A member commented that issues in actual deployments should be considered.
         2. C: Another member mentioned that keep simple.
      3. **Straw Poll: Do you agree to use the11nB path loss model, as modified below, for all links in simulation scenario 1?**
         1. **11nB PL with 5 dB/wall and 18.3 dB per floor (non-linear summation), and 4 dB shadow for all links**
            1. **PL(d) = 40.05 + 20\*log10(min(d,5)) + (d>5) \* 35\*log10(d/5) + 18.3\*F^((F+2)/(F+1)-0.46) + 5\*W**
         2. **Discussion**
         3. **Result: Y/N/A = 49/4/48**
   5. James Yee (MediaTek) presented “Performance Observation of a Dense Campus Network” based on 14/0648r0.
      1. Summary
         1. Initial results from a survey of the performance and traffic pattern of a large scale dense campus WLAN network at the National Taiwan University presented.
         2. In a dense managed campus network, WLAN is the bottleneck, video traffic is significant, and apps are bursty in activity.
         3. Low average per STA throughput due to low likelihood of Channel Access, not link quality.
         4. Dynamic Tx Power Control may improve overall area throughput but lowers average per STA throughput.
         5. CCK Management frames heavily impact 2.4GHz WLAN.
         6. Further observations and solution validation expected via NTU collaboration.
      2. Discussions
         1. Q: Asked about the impact of soft APs – number, ratio, airtime, etc.
         2. C: Some members commented that he/she would like to understand the traffic conditions.
         3. Q: Asked about the way of observing the network. 🡪 Just passively monitored the network.
         4. C: Another member mentioned that the impact of the legacy (CCK) transmissions will be of interest of the group.
4. Chair asked if there are other submissions ready to present. 🡪 No response.
5. Recess @ 21:21 until AM1 (8:00) tomorrow morning.

**Wednesday, May 14th, 2014, AM1 Session (8:00-10:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @8:02 AM
   1. About 180 people are in the room.
   2. Chair reminded IEEE 802 and 802.11 IPR P&P.
   3. Agenda Doc.11-14/0478r3 is on the server. Rev 4 is the working document
2. Agenda for this session
   1. Tentative Agenda
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance
      3. Simulation Scenarios and Evaluation Methodologies – discussion and related Motions
         1. 11-14/0621
         2. 11-14/0571
      4. Functional Requirements
         1. 11-14/0572
         2. 11-14/0626
         3. 11-14/0636
         4. 11-14/0656
      5. Recess
   2. Chair asked if there are any modifications to the agenda.
   3. Agenda approved without objections.
3. Simulation Scenarios and Evaluation Methodologies
   1. Simone Merlin (Qualcomm) presented “TGax Simulation Scenarios”, based on 14/0621r1
      1. Status
         1. Simone uploaded rev 0 yesterday and rev 1 last night.
         2. Simone explained current status of the document highlighting the changes and TBDs.
      2. Summary
         1. Annex 2 - Traffic model was moved to Evaluation Methodologies document.
         2. Proposed path loss model is included in the current version of this document.
         3. There still are TBDs – such as traffic models and channel models for some scenarios – further contributions encouraged.
      3. Discussions
         1. Q: A member asked whether the fast rate adaptation was considered. The answer was it was one of the TBD items.
         2. Q: Another member asked about the process of making a modification. The chair answered that it need a motion with more than 75% approval.
         3. C: A member commented that the channel model agreed in the HEW SG is not reflected. 🡪 Simone confirmed the concensus of the group.
      4. **Straw Poll on Calibration Scenario:**

**Do you support including the calibration tests (section title: MAC calibration) in the first version of the simulation scenarios document?**

* + - 1. **Result: Y/N/A = 37/25/31**
      2. **Suggested removing the section.**
    1. Further Discussions
       1. Some suggestion on the path loss model, frequency adjustment, etc.
    2. **Motion (11-14/0621r2):**

**Move to adopt document 14/0621r2 as the initial version the Simulation Scenarios Document for the 802.11ax TG, enacting the changes:**

* + - 1. **Moved by Stuart Kerry (OK-Brit), Seconded by Simone Merlin (Qualcomm).**
      2. **Discussions – No discussion.**
      3. **Chair asked if any objection to accept the motion – no objection.**
      4. **Result: Motion approved.**
  1. Ron Porat (Broadcom) presented “11ax Evaluation Methodology”, based on 14/0571r0.
     1. Status
        1. Ron explained the changes made from the previous document.
     2. Discussions
        1. C: A member mentioned that evaluation methodology should not specify how the simulation is conducted. It should be described in the Annex.
        2. C: A member suggested text for box 3 of the system level simulation (page 11).
     3. **Straw Poll: Which option do you prefer?**
        1. **Option #1: Delete the first bullet on page 18**
        2. **Option #2: Delete the first and the second bullet on page 18**
        3. **Option #3: Delete the reference only in the first line of the first bullet on page 18**
        4. **Result: Option #1/#2/#3 = 0/25/40**
     4. Discussions
        1. Ron suggested removing all text in Box 3 on the page 18.
     5. **Motion:**

**Move to adopt document 11-14/0571r1**

* + - 1. **Moved by Ron Porat (Broadcom), Seconded by Allan Jones (Activision).**
      2. **Discussions – Vote count requested.**
      3. **Result: Y/N/A = 102/1/4, motion passed.**

1. Functional Requirements
   1. Minho Cheong (NEWRACOM) presented, “How to Describe 802.11ax Functional Requirements”, based on 14/0656r1.
      1. Summary
         1. PAR and Functional Requirements of the previous projects reviewed.
         2. Relation between PAR and FR summarized in the table on slide 14.
      2. Discussions
         1. Q (slide 7): A member asked what was new in FR. 🡪 The answer was very small difference between PAR and FR in the case of 802.11ac. It is not the case for 802.11ax because of ambiguity of the description/definition in the PAR.
         2. C: Another member mentioned that we definitely need the FR.
   2. Lei Wang (Marvell) presented, “Proposed 802.11ax Functional Requirements”, based on 14/0567r2.
      1. Status
         1. This is joint contribution from Marvell, Huawei and Samsung.
         2. The intention of this presentation is to stimulate the discussions on functional requirements.
      2. Summary – current structure of the functional requirements
         1. System Performance
            1. Average throughput per station measured at MAC SAP
            2. The 5th percentile of per station throughput
         2. System Efficiency
            1. Spectrum efficiency
            2. Power efficiency
         3. System Deployment
            1. Operation band
            2. Dense deployment
            3. Outdoor deployment
         4. Backward compatibility and coexistence
         5. Compliance to the PAR
      3. Discussions
         1. Q: A member asked about the relationship between PAR and FR.
         2. C: Another member suggested more discussions.
         3. Chair suggested offline discussions.
2. Recess until AM1 (8:00 AM) tomorrow morning.

**Thrsday, May 15th, 2014, AM1 Session (8:00-10:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @ 8:0.
   1. About 180 people are in the room at the beginning of the session.
   2. Agenda Doc.11-14/0478r4 is on the server. Rev 5 is the working document
   3. Chair reminded IEEE 802 and 802.11 IPR P&P.
   4. Attendance reminder.
2. Administrative Items
   1. Announcement
      1. We still have 7 presentations to hear.
      2. Chair asked to limit time for each presentation to 20 minutes.
   2. Agenda for this session
      1. Tentative Agenda for this session
         1. Call Meeting to order
         2. Reminder
            1. IEEE 802 and 802.11 IPR Policy and procedure.
            2. Attendance
         3. Presentations
         4. Recess
      2. Chair asked if there are any comments or objections – no objections. The agenda approved.
3. Presentations
   1. James Wang (MediaTek) presented “Spatial Reuse and Coexistence with Legacy Devices”, based on 14/0637r0.
      1. Summary
         1. Discussed the issue of legacy device starvation due to spatial re-use as observed from previous contributions.
         2. Proposed mechanisms to achieve fairness for co-existence with legacy STAs by using TPC for spatial reuse (802.11ax) STAs.
      2. Discussions
         1. C (slide 6): Some members commented that the effect of channel allocation and spatial reuse should be taken into account.
   2. Jinyoung Chun (LG Electronics) presented “Link Adaptation for PHY SLS calibration”, based on 14/0620r0.
      1. Summary
         1. In evaluation methodology document, some parameters related to link adaptation have not been decided yet.
         2. Some descriptions on link adaptation for MCS selection in evaluation methodology document proposed.
      2. Discussions
         1. Q: Asked if this is a proposal of LA with feedback information. The answer was no.
         2. C: Not sure Link Adaptation with feedback works in a fast fading environment.
         3. We have adopted initial EM document yesterday and the chairperson suggested offline discussion before making a motion to adopt the proposed text in the EM document.
   3. Frank LaSita (InterDigital) presented “Residential Scenario CCA/TPC Simulation Discussion”, based on 14/0578r0.
      1. Summary
         1. Results of simulations with varying CCA threshold and transmit power adjustments in the Residential Scenario.
         2. Data throughput and delay are shown as a result of the applied power and threshold values.
         3. Calibration efforts to refine assumptions are needed before technology evaluations are made.
      2. Discussions
         1. Q: A member asked for clarification if this is PHY or MAC simulation. 🡪 MAC simulation.
         2. Q: Another member asked for the assumed MCS selection scheme.
         3. Q: Some members asked for clarification – what is the difference between reuse 1 and reuse 3 conditions since they look very close to each other.
         4. Q: Another member asked for a clarification on the definition of throughput.
   4. Yonggang Fang (ZTE) presented “CSMA Enhancement Suggestion”, based on 14/0616r0.
      1. Summary
         1. CSMA/CA mechanism used in 802.11 is good for low density WLAN deployment, but the intent of TGax is to address the issues of high density deployment.
         2. Instead of contention on the wireless medium in time domain, contention in the code domain is proposed for a high density environment.
      2. Discussions
         1. Q: Some members asked about the use of AP coordination and code assignment.
         2. Q: Another member asked a question about collision with a legacy STA. 🡪 The answer was that we need more study.
         3. C: A member pointed out that use of code will require synchronization between AP and STA.
   5. Jianhan Liu (MediaTek) presented “PHY Abstraction for and IEEE 11ax PHY System Simulation and Integrated System Level Simulation”, based on 14/0585r5.
      1. Summary – PHY Abstraction:
         1. ESM should not be correlated with channel types.
         2. ESM Accuracy
         3. Implementation complexity.
      2. Discussions
         1. Q: A member asked which document should include the LUT 🡪 Evaluation Methodology.
      3. Straw Poll: Do you agree to use RBIR ESM as the PHY abstraction for PHY system simulation and integrated system level simulation for 11ax?
         1. Discussion
         2. Result: Y/N/A = 68/0/57
   6. Chuck Lukaszewski (Aruba Networks) presented “In Situ Spectrum Reuse Measurements in Indoor 20,000 Seat Arena”, based on 14/0682r0.
      1. Summary
         1. Very high-density (VHD) environments such as outdoor stadiums and indoor arenas are poorly characterized.
         2. 802.11hew SG has done some work on modelling.
         3. This contribution presents recent in situ reuse measurements at large indoor basketball arena in USA.
      2. Discussions
         1. Q: A member asked for the reason of throughput degradation in the actual very high density environment. 🡪 Cannot estimate the reason.
         2. C: Some members suggested that CCA optimization/Dynamic Sensitivity Control can be the solution.
         3. Q: Another member asked for the expected throughput.
         4. C: Another member commented that use of directional antenna causes less interference.
         5. Q: There was a question asking for the assumed traffic conditions/scenarios. 🡪 The measurement was conducted by using xChariot.
         6. Q: A member asked for the distribution of the MCS. 🡪 The presenter has no data on that.

* Chair explained the plans for the afternoon session:
  + Presentation – 11-14/0677
  + Straw Poll – Kaushik Josiam
  + Update on Simulation Scenarios document – Simone Merlin
  + Update on Evaluation Methodology document – Ron Porat
  + Timeline discussions
  + Teleconference planning

1. Recess @9:55 AM until PM1 (13:30) today.

**Thursday, May 15th, 2014, PM1 Session (13:30-15:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @ 13:30.
   1. About 170 people are in the room at the beginning of the session.
   2. Chairperson reminded IEEE 802 and 802.11 IPR P&P.
   3. Chairperson reminded attendance.
   4. Agenda Doc.11-14/0478r4 is on the server. Rev 5 is the working document
2. Agenda for this session
   1. Thursday PM1
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance
      3. Presentations
         1. 11-14-0677, “Comparison of Calibration Methodology for MAC Simulation” Chinghwa Yu (MediaTek) – 20 min.
      4. Straw Poll (kaushik) – 10 min.
      5. Motion (Chao-Chun) – 10 min.
      6. Simulation Scenario (Simone) – 10 min.
      7. Evaluation Methodology (Ron) – 10 min.
      8. Timeline (All)
      9. Goals for July 2014
      10. Teleconference Schedule
      11. Adjourn
   2. Chair asked if there are any objections to proceed with this agenda – no objections. The agenda was approved.
3. Presentations
   1. Chinghwa Yu (MediaTek) presented “Comparison of Calibration Methodology for MAC Simulation”, based 14/0677r0.
      1. Summary
         1. MAC simulation calibration using the ns3 based platform.
         2. Compared different proposals of calibration methodology for MAC simulation presented in TGax.
         3. A bottom up calibration methodology for MAC simulation proposed to validate essential MAC features for integrated MAC PHY system level simulation, including identification of the importance and priority of MAC calibration cases.
      2. Discussions
         1. Q: A member asked a question about the details of proposed bottom up calibration method.
         2. C: A member commented that step-by-step calibration is good enough.
4. Straw Poll by Kaushik Josiam (Samsun) wrt Channel Models discussed in 14/0695r1.
   1. **Straw Poll #1:**

**In scenario IV, for simulating channels needing UMi channels, do you agree to incorporate the following in the simulation scenarios document.**

* **The path loss equation with the proposed height modification as listed in slide 3.**
  + 1. **Discussion on the straw poll – no discussion**
    2. **Result: Y/N/A = 55/9/43**
  1. **Straw Poll #2:**

**In scenario IV, for simulating channels needing UMi channels, do you agree to incorporate the following in the simulation scenarios document**

* **the shadow fading model as mentioned in Slide 5**
  + 1. **Discussion on the straw poll – no discussion**
    2. **Result: Y/N/A = 19/11/79**

1. Motion by Chao-Chun Wang (MediaTek) wrt Channel Models discussed in 14/0604r1.
   * 1. Chao-Chun summarized the proposal.

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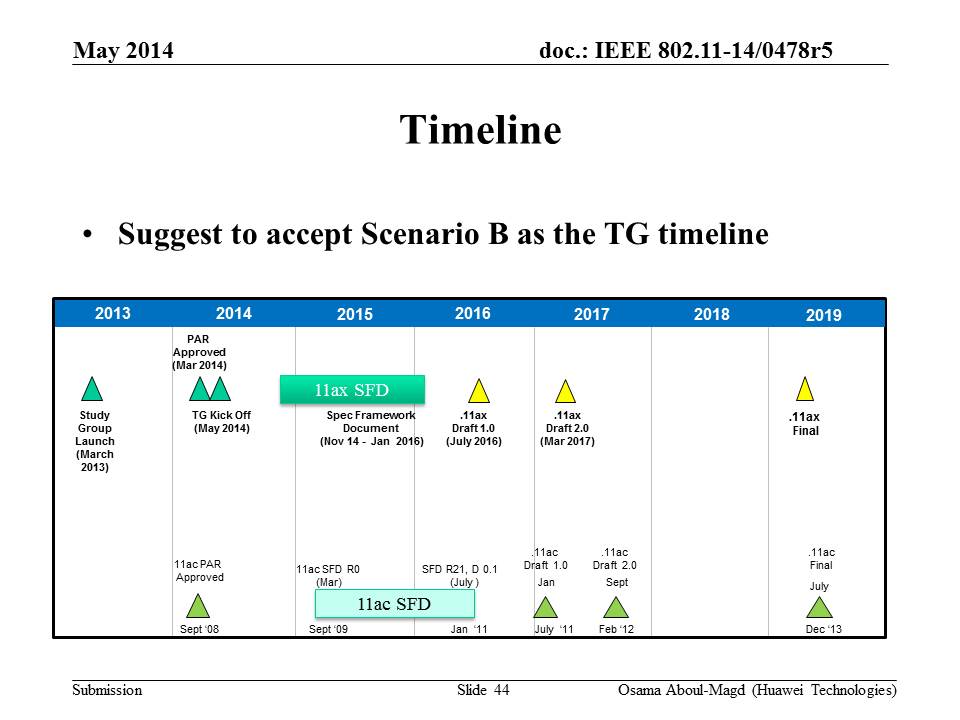
* + 1. **Move to accept including the variable bit rate video streaming into the Annex of the Evaluation Methodology document**
    2. **Discussions**
       1. **There will be something we need to work out. More offline discussions suggested.**
       2. **What is added? – Just head line.**
    3. **Moved by Chao-Chun Wang, Seconded by Guq**
    4. **Chair asked if there is objection to accept this motion. No objection.**
    5. **Motion accepted.**

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1. Simulation Scenario update
   1. Simone Merlin (Qualcomm) presented “TGax Simulation Scenario”, based 14/0621r3.
      1. Simone explained the updated TGax Simulation Scenario document.
         1. Removed PHY abstraction
         2. Added MAC Calibration scenario
      2. Discussions
         1. Q: Should we have separate Simulation Scenario, Evaluation Methodology and Channel Model documents?
         2. Q: Asked if the path loss model in a current scenario can be applied to other scenario.
   2. **Motion (11-14/0621r4)**
      1. **Move to accept the document document 11-14/0621r4 as the baseline document for the TGax Simulation Scenarios document.**
      2. **Moved by Simone Merlin (Qualcomm), Seconded by Kaushik Josiam (Samsung)**
      3. **Discussion on the motion – no discussion**
      4. **Result: Y/N/A = 76/3/7**
2. Evaluation Methodology update
   1. Ron Porat (Broadcom) presented “11ax Evaluation Methodology”, based 14/0571r2.
      1. Ron summarized the document highlighting the changes.
      2. Discussions
         1. No question nor discussion
      3. **Motion (11-14/0571r2)**

* **Move to accept document 11-14/0571r2 as the baseline document for the TGax Evaluation Methodology.**
  + - 1. **Discussion on the motion – no discussion**
      2. **Moved by Ron Porat (Broadcom), Seconded by Kaushik Josiam (Samsung)**
      3. **Result: Motion accepted without objection.**

1. Timeline discussion
   1. The chairperson reviewed results of the discussions yesterday.
   2. The chairperson suggested option B in 11-14/0478r5



* 1. Discussion
     1. Acceleration the process suggested.
     2. Asked if this discussion can be deferred to July 2014 session 🡪 The chairperson needs timeline.
     3. More time to think about timeline and how to accelerate the process suggested.
     4. One more straw poll suggested.
  2. Chairperson asked if there are any objections about the time line in slide of 11-14/0478r5
  3. **Motion: Move to accept Scenario B timeline on slide # 44 of this presentation as TGax timeline.** 
     1. **Moved by Sean Coffey (RealTek) , Seconded by Allan Jones (Activision)**
     2. **Result: Y/N/A = 65/11/30**
     3. **Motion passed.**

1. Goals for July 2014

* Continue to advance simulation scenario and evaluation methodology
* Approve an initial FR
* Approve an initial Channel Model
* Discuss and approve TG structure and process
* Technical Presentations

1. Teleconference Planning
   1. Chair three teleconferences between now and July meeting.
      1. Wednesday June 4, 10:00 – 12:00 ET
      2. Wednesday June 18, 20:00 – 22:00 ET
      3. Wednesday July 2, 10:00 – 12:00 ET
2. AOB
   1. No other businesses.
   2. Chairperson asked if there is any objection to adjourn at this time. No objections.
3. TGax adjourned@15:02.