IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGax  November 2014 San Antonio Meeting Minutes | | | | |
| Date: 2014-11-21 | | | | |
| 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 |
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Abstract

TGax meeting minutes from the IEEE 802.11 San Antonio session, November 3rd – 7th, 2014.

**IEEE 802.11 Task Group ax**

**November 2014 San Antonio Meeting**

**Grand Hyatt, San Antonio, TX**

**November 3rd – 7th, 2014**

**Monday, November 3rd, 2014, AM1 TGax Ad Hoc Session (8:30-10:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chair of the TGax, @8:30
   1. About 190 people are in the room.
2. Announcement
   1. This is a TGax ad hoc session. No motions will be conducted during this session.
   2. Agenda Doc.11-14/1319r2 on the server. Rev 3 is the working document.
   3. Meeting Protocol: Chair asked to state name and affiliation when speaking for the first time.
   4. Attendance reminder.
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 meeting and Teleconference minutes since September meeting.
   2. Continue to advance task group documents.
      1. Simulation Scenarios
      2. Evaluation Methodology
      3. Channel Model
      4. Function Requirements
   3. Continue discussion on Ad hoc structure and start time
   4. Technical Presentations
   5. Schedule Teleconference times.
5. General Flow of the meeting
   1. Slides 13 and 14 of the 14/1319r2 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  (Ad Hoc) |  |  | TGax |
| AM2 |  | TGax |  |  |
| PM1 |  | TGax | TGax | TGax |
| PM2 | TGax | TGax |  |  |
| PM3 |  | TGax |  |  |

1. Agenda for Monday, November 3rd, AM1 (8:30 – 10:30).
   1. Proposed Agenda
      1. Call meeting to order
      2. Patent policy, etc.
      3. Call for submissions
      4. Set and approve agenda for this Ad Hoc meeting
      5. Presentations
      6. Adjourn.
   2. Chair asked if there are any other items – No items proposed. Meeting will be conducted based on this order.
2. Call for submissions
   1. Evaluation Methodology
      1. 11-14/1388, “Consideration on PER prediction for PHY abstruction”, Bo Sun (ZTE Corp)
      2. 11-14/1418, “Further Study of Time Varying Interference and PHY Abstraction” Yakun Sun (Marvell)
      3. 11-14/1420, “The Impact of Preamble Error on MAC System Performance”, Po-Kai Huang (Intel)
      4. 11-14/1424, “Proposed Changes to Evaluation Methodology and Simulation Scenario”, Yuichi Morioka (Sony)
      5. 11-14/1440, “A Few Corrections to Video Traffic Model in Evaluation Methodology Document”, Guoqing Li (Apple)
   2. Simulation Scenarios and Calibration
      1. 11-14/1392, “Simulation results for Box-5 calibration”, Suhwook Kim (LG Electronics)
      2. 11-14/1402, “Box1 and Box3 calibration results”, Masahito Mori (Sony)
      3. 11-14/1342, “MAC Calibration Results”, Igor Kim (ETRI)
      4. 11-14/1343, “Multicast Scenarios for MAC Calibration”, Igor Kim (ETRI)
      5. 11-14/1419, “SLS Box5 Calibration Results and Discussions” Yakun Sun (Marvell)
      6. 11-14/1434, “SLS Box4 Calibration Results”, Russell Huang (MediaTek Inc.)
      7. 11-14/1441, “Simulation Setting of Box5 Calibration”, Jiyong Pang (Huawei)
      8. 11-14/1177, “Box5 Calibration Discussion”, Jiyong Pang (Huawei)
      9. 11-14/1444, “Energy Efficiency Evaluation and Simulation Model”, Chinghwa Yu (MediaTek)
      10. 11-14/1449, “MAC Calibration Results”, Newracom
      11. 11-14/1450,” box 0 calibration results”, Hongsup Lee (Newracom)
      12. 11-14/1451, “box 1 and box 2 calibration results”, Jaehyun Ahn (Newracom)
   3. Technology
      1. 11-14/1380, “Efficiency Measurement for RTS CTS”, Katsuo Yunoki (KDDI R&D Laboratories)
      2. 11-14/1381, “Novel RTS CTS”, Katsuo Yunoki (KDDI R&D Laboratories)
      3. 11-14/1382, “Responses to the comments on doc1169”, Katsuo Yunoki (KDDI R&D Laboratories)
      4. 11-14/1397, “Discussion on Frame Structure for Future WLAN Systems with OFDMA”, Myeong-Jin Kim (Korea University)
      5. 11-14/1403, “Performance Analysis of BSS Color and DSC”, Masahito Mori (Sony)
      6. 11-14/1404, “11aa GCR-BA Performance in OBSS”, Yuichi Morioka (Sony)
      7. 11-14/1416, “Observed Protocol Violations Caused by DSC for Roaming STAs”, Chuck Lukaszewski (Aruba Networks)
      8. 11-14/1417, “HEW PPDU Transmission Discussion” Yongho Seok (NEWRACOM)
      9. 11-14/1426, “DSC and legacy coexistence”, Gustav Wikstrom et al. (Ericsson)
      10. 11-14/1427, “DSC Performance”, Gustav Wikstrom et al. (Ericsson)
      11. 11-14/1428, “Clear Channel Assessment for OFDMA PHY”, K. C. Chen (NTU) and D. J. Deng (NCUE)
      12. 11-14/1431, “Issues on UL-OFDMA”, Young Hoon Kwon (Newracom)
      13. 11-14/1433, “Protocol and signaling framework for OFDMA”, Sigurd Schelstraete (Quantenna)
      14. 11-14/1435, “Considerations on OBSS Spatial Reuse”, Jianhan Liu (Mediatek Inc.)
      15. 11-14/1436, “Overhead Analysis for Simultaneous Downlink Transmissions”, Pengfei Xia (interdigita)
      16. 11-14/1437, “Efficient Wider Bandwidth Operation in IEEE 802.11a”, Jinsoo Ahn (Yonsei Univ)
      17. 11-14/1439, “Preamble Considerations in Large Channel Delay Spread Scenarios”, Daewon Lee (Newracom)
      18. 11-14//1442, “Considerations on DL OFDMA control mechanism”, Woojin Ahn (Yonsei Univ.)
      19. 11-14/1443, “Adapting CCA and Receiver Sensitivity”, Esa Tuomaala (Nokia)
      20. 11-14/1446, “Analysis of frequency and power requirements for UL-OFDM”, Leif Wilhelmsson
      21. 11-12/1448, “Considerations for Adaptive CCA”, Reza Hedayat (Newracom)
      22. 11-14/1452, “Frequency selective scheduling in OFDMA”, Leif Wilhelmsson (Ericsson)
      23. 11-14/1228, “Issues on 256-FFT per 20MHz”, Heejung Yu (NEWRACOM/YU)
   4. Specification Framework
      1. 11-14/1429, “Proposed 802.11ax specification framework document”, Minho Cheong (Newracom)
      2. 11-14/1432, “Proposed 802.11ax specification framework – background”, Minho Cheong (Newracom)
      3. 11-14/1453, “Spec Framework Proposa” Robert Stacey (Intel)
      4. 11-14/1447, “Proposed Spec Framework Document for 11ax considering potential tech features”, John Son (WILUS Institute), Young Doo Kim (SK Telecom)
3. Presentations
   1. Guoqin Li (Intel) presented “” based on the submission 14/1440r0.
      1. Summary
         1. Description of the traffic model modified.
      2. Discussions - No discussion.
      3. Next Step
         1. Chair suggested motion to apply the changes into the Evaluation Methodology document.
   2. Katsuo Yunoki (KDDI) presented “Efficiency Measurement for RTS/CTS” based on the submission 14/1380r0.
      1. Summary
         1. Efficiency of using RTS/CTS is evaluated based actual measurements in dense WLAN area in Tokyo.
         2. Results show that the benefit of RTS/CTS in throughput outweighs the incurred overhead in the weak signal case.
      2. Discussions
         1. Benefit for client devices to use or not to use the RTS/CTS is discussed.
         2. Effect of frame aggregation. 🡪 Three or four MSDUs are aggregated.
         3. The measurement condition discussed and clarified.
   3. Katsuo Yunoki (KDDI) presented “” based on the submission 14/1381r1.
      1. Summary
         1. A novel RTS/CTS procedure to alleviate the exposed terminal problem proposed while handling the hidden terminal issue.
      2. Discussions
         1. Not sure the second RTS/CTS frames can be successfully exchanged without affecting the reception of existing data transmission.
         2. Tx time of the second data frame may not be finished at the same time with the first data frame.
   4. Katsuo Yunoki (KDDI) presented “Responses to the comments on doc.1169r0” based on the submission 14/1382r0.
      1. Summary
         1. A follow-up presentation of “IEEE 11-14/1169r0, DL-FDMA considerations” which was presented at September 2014 meeting.
         2. Comparing with OFDMA, the proposed access method may not have better efficiency.
         3. However it doesn’t require any negotiation processes before data frame transmissions. It will have advantages to deliver short packets to multiple destinations.
      2. Discussions
         1. Some members asked the difference between the proposed scheme and a case of four independent APs are operating on channels in a non-overlapping manner.
   5. Masahito Mori (Sony) presented “Performance Analysis of BSS Color and DSC” based on the submission 14/1403r0.
      1. Summary
         1. Performance of DSC vs. BSS Coloring has been compared.
      2. Discussions
         1. Consideration for fairness questioned. 🡪 Not considered.
         2. Asked a question on the throughput performance in slide 7 – if it the average throughput contains all STAs (legacy and 802.11ax). 🡪 The graph contains all of the STAs.
         3. A member commented that the environment is very complicated and he is not sure if it works in an actual environment.
   6. Yuichi Morioka (Sony) presented “” based on the submission 14/1404r0.
      1. Summary
         1. 802.11aa (GCR-BA) performance in OBSS with the existence of 11b/g STAs is shown in this submission.
         2. Inefficient data re/transmission and overhead of BAR/BA exchange make throughput worse as the number of BAR received STAs increases.
         3. It is difficult to improve multicast by utilizing GCR-BA in a co-ex environment with 802.11b/g.
      2. Discussions
         1. A member commented about the generic point of multicast enhancement such as Tx data rate. For GCR, the AP needs some intelligence.
         2. Chair commented that this can be resolved in another TG.
   7. Jiyong Pang (Huawei) presented “Simulation Setting of Box 5 Calibration” based on the submission 14/1441r0.
      1. Summary
         1. Box5 calibration parameters used by several interested companies are listed for reference.
         2. Different realizations of certain MAC/PHY details among individual simulators are introduced for further.
      2. Discussions
         1. A member commented that some aspects listed here have already considered in PHY level calibrations. For PHY abstraction, Box 0 covers it.
         2. Some members suggested offline discussions for this issue.
4. TGax ad hoc meeting adjourned @ 10:28 AM..

**Monday, November 3rd, 2014, PM2 TGax Session (16:00-18:00)**

1. Meeting called to order @ 16:00
   1. The agenda is contained in 11-14/1319r4
      1. Rev 3 is the working document.
   2. There were more than 190+ people in the room.
2. Proposed agenda for this session
   1. Call meeting to order
   2. Patent policy, etc.
   3. Set and approve agenda
   4. Summary from September 2014 meeting
   5. TG motions
      1. Approve TG meeting and Teleconference minutes since September meeting.
   6. Presentations
      1. Evaluation Methodology related submissions.
      2. Simulation Scenarios and Calibration related submissions.
   7. Recess
3. Administrative Items
   1. Chair went through the IEEE 802 and IEEE 802.11 Policy and Procedure.
      1. Chair asked if anyone is aware of any potentially essential patents. 🡪 No response.
   2. Chair asked people to state name and affiliation when addressing for the first time in the session.
   3. Chair also reminded attendance.
4. Setting and approval of the agenda
   1. Proposed agenda for Monday PM2
      1. Call meeting to order
      2. Patent policy, etc.
      3. Set and approve agenda
      4. Summary from September 2014 meeting
      5. TG motions
         1. Approve TG meeting and Teleconference minutes since September meeting.
      6. Presentations
         1. Evaluation Methodology related submissions.
         2. Simulation Scenarios and Calibration related submissions.
   2. Recess
      1. Chair asked for comments for the agenda. – No response.
   3. Chair asked for approval of the proposed agenda. – Agenda approved.
5. Summary from the September 2014 Meeting
   1. Elected TG vice chairs as scheduled.
      1. Simone Merlin (Qualcomm)
      2. Ron Porat (Broadcom)
   2. Approved the first revision of the functional Requirements document
   3. Generated new revision of the TG documents based on motions passed during the meeting.
   4. Technical presentations
   5. Started a discussion on ad hoc groups
6. Task Group Motion
   1. **Motion:** **Approve TGax TG minutes of meetings and teleconferences from September 2014 interim meeting to today:** 
      1. <https://mentor.ieee.org/802.11/dcn/14/11-14-1159-02-00ax-tgax-september-2014-meeting-minutes.docx>
      2. <https://mentor.ieee.org/802.11/dcn/14/11-14-1344-00-00ax-tgax-teleconference-minutes-2014-10-09.docx>
      3. **Move: Simone Merlin (Qualcomm), Second: Al Petrick (J&P Associates)**
      4. Discussion – No discussion
      5. **Result: Motion approved with no objection.**
7. Presentation – Evaluation Methodology/Simulation Scenario/Calibration
   1. Bo Sun (ZTE) presented “Consideration on PER Prediction for PHY Abstraction” based on the submission 14/1388r1.
      1. Summary
         1. RBIR based PHY abstraction has been introduced in evaluation methodology document.
         2. Two issues:
            1. For an A-MPDU with multiple subframes aggregated, the PER of each subframe, instead of the whole PPDU should be estimated. How to estimate the PER of each subframe is not defined.
            2. How to reflect the impact of preamble detection error is not defined.
         3. Proposed the A-MPDU PER prediction process, and several options for preamble decoding error modeling are discussed.
      2. Discussion
         1. We have several proposals for this issue. How do we proceed?
         2. This proposal is not a part of EM/SS.
         3. Offline discussion suggested.
   2. Yakun Sun (Marvell) presented “Further Study of Time Varying Interference and PHY Abstraction” based on the submission 14/1418r1.
      1. Summary
         1. Basic procedure of PHY abstraction in the previous discussion is open to how to model time-varying interference.
         2. Different models have been studied among which a block-wise PER model has been shown to be more accurate.
         3. Some further studies on the time-varying interference presented.
      2. Discussion
         1. CCA level in the OBSS environment discussed.
   3. Yakun Sun (Marvell) presented “SLS Box5 Calibration Results and Discussions” based on the submission 14/1419r0.
      1. Summary
         1. Box5 calibration results have been collected using 11ac scenario 6.
         2. Further simulated one BSS results and suggest to use as the first step box5 calibration.
         3. Motivated by the observation of frequent packet collision and offline discussions, proposed a preamble model for collision.
      2. Discussion
         1. Error model for preamble discussed.
         2. Simulation model and parameters discussed.
   4. Suhwook Kim (LG Electronics) presented Simulation results for Box 5 calibration “” based on the submission 14/1392r1r.
      1. Summary
         1. Simulation results for Box 5 calibration presented.
         2. Based on simulation results, alignment of collision model suggest as for the first step of Box 5 calibration.
      2. Discussion
         1. A member asked if BSS Color is considered in the simulation. 🡪 The answer was no, but the partial AID just like the one defined in 802.11ac is considered.
         2. Possibility of incorporating the calibration scenario into the SS discussed.
   5. Po-Kai Huang (Intel) presented “The Impact of Preamble Error on MAC System Performance” based on the submission 14/1420r1.
      1. Summary
         1. It has been shown that with or without preamble error model, the deferral behavior is different for the stations.
         2. This contribution focuses on the impact on system performance of MAC system simulation with preamble error model.
         3. Preamble Error Model shall be adopted in the MAC simulator to observe the correct OBSS behaviors in dense environment.
      2. Discussion
         1. Formula in slide 7 – not clear if it is okay.
         2. Again, use of BSS Color bits discussed.
      3. **Straw Poll #1: Do you agree to define a preamble error model in MAC simulations and integrated system simulations in evaluation methodology?**
         1. **Discussion**
            1. **For MAC calibration, a model is defined and not sure what additional features are required for that. 🡪 Model.**
            2. **Definition of preamble error questioned.**
         2. **Result: Y/N/A = 58/12/55**

Chair asked if there is objection to recess until evening session. 🡪 No objection.

1. Recess @ 18:00 until AM2 (10:30) Tuesday.

**Tuesday, November 4th, 2014, AM2 TGax Session (10:30-12:30)**

1. Meeting called to order by Osama Aboul-Magd (Huawei Technologies) at 10:30 AM.
   1. The agenda is contained in 11-14/1319r4 which is on the server.
      1. Rev 5 is the working document.
   2. There were 190+ people in the room.
2. Administrative Items
   * + 1. Chair reminded that we are still operating under the IEEE 802 and IEEE 802.11 Policy and Procedure.
       2. Chair asked to address himself/herself when speaking for the first time.
       3. Chair also reminded to do attendance.
3. Set and approve agenda
   1. Proposed agenda for Tuesday AM1:
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
         1. 11-14/1402, “Box1 and Box3 calibration results”, Masahito Mori (Sony)
         2. 11-14/1342, “MAC Calibration Results”, Igor Kim (ETRI) 🡪 cancelled.
         3. 11-14/1343, “Multicast Scenarios for MAC Calibration”, Igor Kim (ETRI) 🡪 cancelled.
         4. 11-14/1434, “SLS Box4 Calibration Results”, Russell Huang (MediaTek Inc.)
         5. 11-14/1444, “Energy Efficiency Evaluation and Simulation Model”, Chinghwa Yu (MediaTek)
         6. 11-14/1449, “MAC Calibration Results”, Newracom
         7. 11-14/1450,” box 0 calibration results”, Hongsup Lee (Newracom)
         8. 11-14/1451, “box 1 and box 2 calibration results”, Jaehyun Ahn (Newracom)
      4. Recess
   2. Chair asked for comments for the agenda. – No response.
   3. Chair asked for approval of the proposed agenda. – Agenda approved.
4. Presentation
   1. Russell Huang (MediaTek) presented “TGax SLS Box4 Calibration Results” based on the submission 14/1434r1.
      1. Summary
         1. Box 4 calibration results presented.
         2. Definition of “Per-STA Throughput” proposed.
         3. Conclusions:
            1. Throughput curves can give future calibration a baseline.
            2. MCS selection makes SINR look different than Box 2.
            3. Granularity of LUT (lookup) table can have some effect on curves.
      2. Discussions
         1. No discussion.
   2. Chinghwa Yu (MediaTek) presented “Energy Efficiency Evaluation and Simulation Model” based on the submission 14/1444r1.
      1. Summary
         1. An ideal power and battery source model to evaluate power efficiency for generic power supply and battery-operated devices proposed.
         2. Average energy per bit calculation method also proposed.
         3. Two MAC power states (TX / RX) for power efficiency evaluation introduced.
      2. Discussions
         1. A member suggested power save mode to be considered.
         2. Consideration for MAC and PHY state discussed. 🡪 PHY should be abstracted.
   3. Yarkko Kneckt (Nokia) presented “802.11ax Power Save Discussion” based on the submission 14/1454r1.
      1. Summary
         1. The submission discusses on the power save requirements in 802.11ax use scenarios, and the traditional power save mechanisms and the microsleep (PSMP, Partial AID) mechanisms are introduced.
      2. Discussions
         1. There was a question asking if enhancement to the existing power save mechanism can be considered. The answer was the presenter is open for it.
         2. A member commented that modules other than the WLAN consume power more and we need to understand how much improvement in UX can be expected by this. Improvement in idle state needs to be considered.
         3. Another member asked the impact of power save on latency.
   4. Chuck Lukaszewski (Aruba Networks) presented “Observed protocol violations caused by DSC with roaming STAs” based on the submission 14/1416r1.
      1. Summary
         1. It is probably impossible to choose a single margin value that works for all clients 🡪 Fixed margins are problematic.
         2. Any DSC implementation in TGax needs to be roam-aware.
         3. SNR fluctuations and MIMO effects create non-deterministic TX openings after crossing DSC edge
      2. Discussions
         1. A member asked if the presenter has any performance comparison with and without DSC. The answer was no.
         2. There was a question asking if there are any limits on rate configuration. 🡪 There are some limits coming from the high margin.
         3. Another member commented that this is not the DSC. No STA will start to roam having -62 dBm of signal level.
         4. There was a question on transmit power control. 🡪 The answer was currently no. It could be a part of solution.
   5. Zhou Lan (Huawei Technologies) presented “MAC calibration results comparison” based on the submission 14/1192r5.
      1. Summary
         1. The results are very much aligned within 5% difference.
         2. Ready to go to the next steps, i.e. Box 4 and Box 5 simulations.
      2. Discussions
         1. No discussions.
   6. Straw Poll on 14/1419r1 by Chuck (Aruba Networks)
      1. **Straw Poll #1: Should any DSC specification adopted by TGax include mechanism(s) to ensure graceful roaming and eliminate unnecessary transmissions?**
         1. **Discussions**
            1. **Maybe we need to do something in designing the DSC mechanism.**
         2. **Amendment to the straw poll: Should TGax consider roaming in designing DSC specification to ensure graceful roaming and eliminate**
         3. **Result: Y/N/A = 60/3/58**
   7. Leif Wilhelmsson (Ericsson AB) presented “Analysis of frequency and power requirements for UL-OFDMA” based on the submission 14/1446r0.
      1. Summary
         1. UL-OFDMA sets requirements on frequency synchronization and power alignment for the signals sent by the STAs.
         2. Comparing degradation due to MUI and self interference is one means to set requirements on power differences, in addition to e.g. dynamic range in the ADC.
      2. Discussions
         1. No discussions.

We have 4 minutes to recess.

Chair asked if there is any objection to recess until PM1. – No objection.

1. Recess @ 12:28 until PM1 (13:30) today.

**Tuesday, November 4th, 2014, PM1 TGax Session (13:30-15:30)**

1. Meeting called to order by Osama Aboul-Magd (Huawei Technologies), chair of TGax, @ 13:35.
   1. The agenda document 11-14/1319r4 is on the server.
      1. Rev 5 still is the working document.
      2. There were 190+ people in the room.
2. Reminder
   1. Chair asked people to state name and affiliation when addressing for the first time.
   2. Chair reminded that we are still operating under the IEEE 802 and IEEE 802.11 Policy and Procedures.
   3. Chair also reminded people to do attendance.
3. Agenda setting
   1. Proposed agenda for this session:
      1. Call Meeting to order
      2. Presentations
         1. 11-14/1426, “DSC and legacy coexistence”, Gustav Wikstrom et al. (Ericsson)
         2. 11-14/1427, “DSC Performance”, Gustav Wikstrom et al. (Ericsson)
         3. 11-14/1428, “Clear Channel Assessment for OFDMA PHY”, K. C. Chen (NTU) and D. J. Deng (NCUE)
         4. 11-14/1435, “Considerations on OBSS Spatial Reuse”, Jianhan Liu (Mediatek Inc.)
         5. 11-14/1443, “Adapting CCA and Receiver Sensitivity”, Esa Tuomaala (Nokia)
         6. 11-12/1448, “Considerations for Adaptive CCA”, Reza Hedayat (Newracom)
      3. Recess
   2. Chair asked if there is any objection to proceed with this agenda. No objection.
      1. The agenda for Tuesday PM1 was approved.
4. Presentations – DSC and CCA related submissions
   1. Filip Mestanov (Ericsson AB) presented “DSC and legacy coexistence” based on the submission 14/1426r1.
      1. Summary
         1. Studied the situation of legacy STAs coexisting with 802.11ax STAs that use increased CCA Threshold.
         2. Increasing the CCA threshold from -82 to -62 provides about 20-25% gain in average and 5th percentile user throughputs.
         3. Improved performance is also observed for the legacy STAs in a file transfer scenario.
      2. Discussions
         1. A member asked about the traffic generation in this evaluation.
         2. Another member questioned about the use of scenario 2 if it is realistic.
   2. Filip Mestanov (Ericsson AB) presented “DSC Performance” based on the submission 14/1427r1.
      1. Summary
         1. Increasing the CCA threshold provides throughput gains in the order of 20-40% (depending on the load levels) in all simulation scenarios except for S4.
         2. For S2 no significant gains can be seen from using more advanced DSC algorithms.
         3. For S2 the achievable gains are in the order of 25%.
      2. Discussions
         1. Detailed simulation conditions such as PHY model and traffic model discussed. 🡪 To be included in the next version.
         2. A member asked if the presenter had conducted any analysis of increased air time and decreased SINR. 🡪 There will be a follow up presentation in the next meeting.
         3. Another member asked about the simulation conditions.
   3. Kwang-Cheng Chen (Taiwan National University) presented “Clear Channel Assessment for OFDMA PHY” based on the submission 14/1428r0.
      1. Summary
         1. CCA and CSMA/CA might face new challenges if OFDMA PHY is adopted.
         2. Reliable CCA to deploy CSMA/CA in WLANs is still an open problem.
      2. Discussions
         1. A member asked clarification on this presentation if the OFDMA scheme discussed here is a generic one. 🡪 The answer was only uplink OFDMA is considered.
   4. Esa Tuomaala (Nokia) presented “Adapting CCA and Receiver Sensitivity” based on the submission 14/1443r0.
      1. Summary
         1. Scenario 1 simulations shown with varying receiver sensitivities.
         2. Demonstrating the unfairness in per-floor throughput.
         3. Impact of local adaptation of thresholds (per-floor basis) discussed.
      2. Discussions
         1. There was a discussion on the “fairmess”.
         2. Another member commented this is the problem we should address.
   5. Reza Hedayat (NEWRACOM) presented “Considerations for Adaptive CCA” based on the submission 14/1448r1.
      1. Summary
         1. The basic principle of this proposal is that each STA gradually gathers the information that identifies its neighborhood.
         2. After the status of the neighborhood list reaches some confidence, the STA applies adaptive CCA approach.
         3. This approach could deal with large presence of legacy STAs to keep it fair to legacy devices.
      2. Discussions
         1. There was a discussion about the adaptability to the topology changes.
         2. Network type discussed - infrastructure network or IBSS?
   6. Jianhan Liu (MediaTek) presented “Consideration on OBSS Spatial Reuse” based on the submission 14/1435r0.
      1. Summary
         1. Spatial reuse capability is a parameter that can be used to maximize network throughput.
         2. Maximizing network throughput by enhancing spatial reuse.
      2. Discussions
         1. A member commented that detailed design still early to discuss.
         2. Another member commented setting appropriate CCA threshold can maximize the throughput.
         3. There was a question whether the spatial reuse can be initiated by an AP or a STA? 🡪 Could be either.

Chair asked if there is any objection to recess until PM2. 🡪 No objection.

1. Recess at 15:15 until Tuesday PM2 (16:00) today.

**Tuesday, November 4th 2014, PM2 Session (16:00-18:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chair of TGax, @16:00
   1. Agenda 11-14/1319r4 is on the server. Rev 5 is working document.
   2. There were 200+ people in the room.
2. Reminder
   1. Chair asked people to state name and affiliation when addressing for the first time in the session.
   2. Chair reminded that this meeting is operated under the IEEE 802 and IEEE 802.11 P&P.
   3. Attendance!
3. Agenda Setting
   1. Proposed agenda for this session - Tuesday PM2
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure.
      3. Presentations
         1. 11-14/1397, “Discussion on Frame Structure for Future WLAN Systems with OFDMA”, Myeong-Jin Kim (Korea University)
         2. 11-14/1428, “Clear Channel Assessment for OFDMA PHY”, K. C. Chen (NTU) and D. J. Deng (NCUE)
         3. 11-14/1431, “Issues on UL-OFDMA”, Young Hoon Kwon (Newracom)
         4. 11-14/1433, “Protocol and signaling framework for OFDMA”, Sigurd Schelstraete (Quantenna)
         5. 11-14//1442, “Considerations on DL OFDMA control mechanism”, Woojin Ahn (Yonsei Univ.)
         6. 11-14/1452, “Frequency selective scheduling in OFDMA”, Leif Wilhelmsson (Ericsson)
      4. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
4. Presentations – related to OFDMA
   1. Yong Hoon Kwon (NEWRACOM) presented “Issues on UL-OFDMA Transmission” based on the submission 14/1431r1.
      1. Summary
         1. Compared to DL-OFDMA, UL-OFDMA has some issues to be resolved. On the top of that, following items are discussed.
            1. Protection for UL MU transmissions
            2. Need for UL request frame
      2. Discussions
         1. There was a discussion about the request frame if it can be piggybacked. 🡪 Piggybacking is not preferred for the short frames.
         2. A member commented that overhead can be reduced by combining the UL & DL sequences.
         3. Another member commented that protection mechanism is desired for the OFDMA scheme to improve the cell edge performance.
         4. There was a suggestion on UL request frame to use it for UL MU-MIMO.
   2. Young-Chai Ko (Korea University) presented “Discussion on Frame Structure for Future WLAN Systems with OFDMA” based on the submission 14/1397r1.
      1. Summary
         1. In order to serve users having different link quality and support UL MU transmission, we need to discuss frame structure of OFDMA.
         2. An example of OFDMA frame structure introduced.
      2. Discussions
         1. No discussion.
   3. Sigurd Schelstraete (Quantenna Communications) presented “Protocol and signaling framework for OFDMA” based on the submission 14/1433r0.
      1. Summary
         1. For practical implementation of OFDMA, many of the necessary concepts already exist in MU-MIMO.
         2. The existing framework as the basis for OFDMA. Specifically:
            1. Grouping/group ID
            2. Identify users by group and user position
            3. Per-user signaling in preamble fields (similar to 11ac)
            4. ACK mechanism using combination of immediate and BAR
      2. Discussions
         1. Comparing the Group ID and AID, the group ID is more efficienct.
         2. There was a discussion whether the group can be commonly used for both OFDMA and MU-MIMO.
         3. Some members asked questions about the resource assignment. However, it is implementation issue and will be out of scope of the standard.
         4. Some members prefer to go beyond what was specified in the 802.11ac. However, there was a comment that the objectives of having those technologies are not the same and need to be careful.
   4. Lief Wilhelmsson (Ericsson) presented “Frequency selective scheduling in OFDMA” based on the submission 14/1452r0.
      1. Summary
         1. OFDMA allows for frequency selective scheduling. To achieve the scheduling gain requires accurate channel knowledge at the AP without extensive sounding.
         2. Initial simulation results for a simple set-up concerning possible gain achieved by frequency selective scheduling presented.
         3. Possible ways to obtain channel knowledge at the AP are also discussed.
      2. Discussions
         1. There was a discussion about the channel model.
   5. Woojin Ahn (Yonsei University) presented “Considerations on DL OFDMA control mechanism” based on the submission 14/1xxxry.
      1. Summary
         1. The gain of DL-OFDMA analyzed.
         2. Limitation of basic access and RTS/CTS for DL-OFDMA in dense OBSS environment discussed, and necessity of additional coordination mechanism for DL-OFDMA suggested.
      2. Discussions
         1. A member commented that 20 MHz channel is used in high density areas and not clear how to differentiate from the existing deployment.

Chair asked if there is any objection to recess. 🡪 No objection.

1. Recessed at 15:22 until PM2 (16:00) today.

**Tuesday, November 4th 2014, PM3 Session (19:30-21:30)**

TGax session Tuesday PM3 was cancelled because the rest of the agenda items will be able to be covered in the other 3 meeting slots on Wednesday and Thursday.

**Wednesday, November 5th 2014, PM1 Session (13:30-15:50)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of TGax, @13:30
   1. Agenda 11-14/1319r5 is on the server. Rev 6 is working document.
   2. There were about 190+ people in the room.
2. Reminder and Announcements
   1. Chair reminded that this meeting is operated under 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 PM1
      1. Call Meeting to order
      2. IEEE 802 and 802.11 IPR Policy and procedure
      3. Presentations
         1. 11-14/1417, “HEW PPDU Transmission Discussion” Yongho Seok (NEWRACOM)
         2. 11-14/1436, “Overhead Analysis for Simultaneous Downlink Transmissions”, Pengfei Xia (interdigita)
         3. 11-14/1437, “Efficient Wider Bandwidth Operation in IEEE 802.11a”, Jinsoo Ahn (Yonsei Univ)
         4. 11-14/1439, “Preamble Considerations in Large Channel Delay Spread Scenarios”, Daewon Lee (Newracom)
         5. 11-14/1228, “Issues on 256-FFT per 20MHz”, Heejung Yu (NEWRACOM/YU)
         6. 11-14/1531, “Empirical open-air VHT client scaling results for use in validating MAC simulators” Chuck Lukaszewski (Aruba Networks)
         7. 11-14/1496, “Power-Save-Calibration-Scenario”, Jarkko Kneckt (Nokia)
      4. Recess
   2. Chair asked if there are any objections to proceed with this agenda – no objections.
      1. The agenda approved.
4. Presentations – Chair asked to limit the time for each presentation to 20 min including Q&A.
   1. Yongho Seok (NEWRACOM) presented “HEW PPDU Transmission Discussion” based on the submission 14/1417r0.
      1. Summary
         * 1. Previous discussions in IEEE 802.11ax are favoring on the enhanced MU-MIMO and OFDMA technologies.
           2. In order to fully utilize the MU-MIMO and OFDMA technical advantage, the HEW PPDU protocol design should consider heterogeneous users operated in the different operating mode.
      2. Discussions
         1. No discussion.
   2. Pengfei Xia (InterDigital) presented “Overhead Analysis for Simultaneous Downlink Transmissions” based on the submission 14/1436r0.
      1. Summary
         * 1. DL MU-MIMO: Suitable for large packets and high SNR. May suffer from a large feedback overhead.
           2. DL OFDMA: Potential efficiency improvement over single user transmissions. Potential efficiency improvement over single user transmissions. Suitable for small packet transmissions.
           3. ACK: Simultaneous ACK may reduce overhead and improve throughput substantially.
      2. Discussions
         1. No discussion.
   3. Jinsoo Ahn (Yonsei University) presented “Efficient Wider Bandwidth Operation in IEEE 802.11ax” based on the submission 14/1437r1.
      1. Summary
         * 1. Alternative Primary Channel would increase Channel Usage and would sustain legacy channel expansion rule, and APCH would contend with other Primary Channel
           2. APCH based transmission without Primary Channel has much more gain. APCH based wider bandwidth operation might control OBSS fairness on wider bandwidth operation
      2. Discussions
         1. There was a discussion whether the secondary channel should be fixed or dynamic. The presenter does not have specific idea on that and more analysis will be needed.
   4. Daewon Lee (Newracom) presented “Preamble Considerations in Large Channel Delay Spread Scenarios” based on the submission 14/1439r0.
      1. Summary
         * 1. Control information decoding in the preamble can be problematic when the channel delay spread is larger than 800ns, especially for existing PPDU formats.
           2. Support of large channel delay scenarios not only should support reliable reception of data packets but also control information (e.g. information in the preamble) as well.
      2. Discussions
         1. No discussion.
   5. Heejung Yu (Yeungnam University/ NEWRACOM) presented “Issues on 256-FFT per 20MHz” based on the submission 14/1228r2.
      1. Summary
         * 1. To change the OFDM symbol structure, issues such as PAPR, mid-packet CCA and phase tracking need to be addressed.
           2. To fully evaluate impact of the changes in the FFT size, PHY simulation results including PAPR effects, CFO, SFO, phase noise, and system level evaluation regarding mid-packet CCA need to be evaluated.
      2. Discussions
         1. A member asked for suggestion to model the phase noise.
   6. Chuck Lukaszewski (Aruba Networks) presented “Empirical open-air VHT client scaling results for use in validating MAC simulators” based on the submission 14/1513r0.
      1. Summary
         * 1. Presented actual lab TCP data taken in open air with 50 STAs each of 1SS, 2SS and 3SS over 20, 40 and 80 MHz channels.
           2. The goal is to help vendors further validate the accuracy of their MAC & PHY simulators by sharing our data set.
           3. Suggestions: Adapt Box 3 simulators to create a special case of SS#2 that reflects our VHD lab setup and test sequence and compare simulation results against empirical data.
      2. Discussions
         1. A member asked for a question about the unique performance of 1 SS phone of VHT80 TCP bidirectional data.
         2. Clarification on the traffic model discussed.
   7. Jarkko Kneckt (Nokia) presented “TGax Power Save Calibration Scenario” based on the submission 14/1496r1.
      1. Summary
         * 1. The calibration scenario for power save and power save related operation parameters proposed.
      2. Discussions
         1. Some members asked for questions on the simulation conditions such as value of CWmin, voltages for Power State parameter.
   8. Jarkko Kneckt (Nokia) presented “Power Save Calibration Results” based on the submission 14/1495r0.
      1. Summary
         * 1. The power save calibration ensures the correct implementation of the power save mechanisms.
           2. The PS mechanisms need to be implemented similarly to produce the same results.
           3. Calibration scenario as discussed in the previous presentation proposed.
      2. Discussions
         1. No discussion.
5. Discussion on the agenda for tomorrow
   1. We will have discussions on Spec Framework and Ad Hocs.
6. Recessed at 15:21 until AM1 (8:00) Thursday.

**Thursday, November 6th, 2014, AM1 Session (8:00-10:00)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @8:00 AM
   1. About 200+ people are in the room.
   2. Agenda 14/1319r6 is on the server. Rev. 7 is the working document.
2. Reminder and Announcements
   1. Chair asked people to state name and affiliation when addressing for the first time in the session.
   2. Chair reminded IEEE 802 and 802.11 IPR P&P.
   3. Chair reminded people to do attendance.
3. Agenda for this session
   1. Thursday AM1
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Attendance
      3. Agenda Setting
      4. Presentations
         1. 11-14/1429, “Proposed 802.11ax specification framework document”, Minho Cheong (Newracom)
         2. 11-14/1432, “Proposed 802.11ax specification framework – background”, Minho Cheong (Newracom)
         3. 11-14/1447, “Proposed Spec Framework Document for 11ax considering potential tech features”, John Son (WILUS Institute), Young Doo Kim (SK Telecom)
         4. 11-14/1453, “Spec Framework Proposal” Robert Stacey (Intel)
      5. Straw Polls and Motins
      6. Discussion on ad hoc groups (if we still have a time).
      7. Recess
   2. Chair asked if there are any modifications to the agenda.
   3. Agenda approved without objections.
4. Presentations
   1. Minho Cheong (NEWRACOM) presented “Proposed 802.11ax specification framework document - Background”, based on the submission 14/1432r1, and “Proposed 802.11ax specification framework document”, based on the submission 14/1429r1.
      1. Summary
         1. It is good to start with simple structure as P802.11ah.
         2. Propose the above skeleton document could be an initial starting point for moving forward.
      2. Discussions
         1. Why not mention UL/DL MU transmissions explicitly? 🡪Not sure UL is feasible nor agreed in the group.
         2. Chair suggested the straw poll being conducted after the series of presentations.
   2. John Son (WILUS Institute) presented “Proposed Spec Framework Document for 11ax considering potential tech features”, based on the submission 14/1447r1.
      1. Summary
         1. It is important to establish a systematic skeleton in 11ax SFD in order to contain the current technical agreements properly.
         2. Based on the analysis of previous technical discussions, we proposed the 11ax SFD skeleton as follows:
            1. HE Physical Layer
            2. Multi User Support
            3. Coexistence
            4. MAC Layer
      2. Discussions
         1. No discussions.
   3. Robert Stacy (Intel) presented “Proposed Spec Framework Document for 11ax considering potential tech features”, based on the submission 14/1453r2.
      1. Summary
         1. Reviewed history of SFD referring doc.11-09-0992, the SFD for 802.11ac.
      2. Discussions
         1. The only difference between this document and the one presented by Minho is description of UL and DL MU features. Need more discussions to state UL MU features in the SFD.
         2. Current descriptions in the SFD are the place holders. Good to start with very simplified contents.
         3. A member suggested not having UL/DL description from MU features.
         4. Coexistence can be a part of MAC features.
         5. Suggested energy efficiency/power saving features to be mentioned.
         6. “Features for operation in dense environment” implies OBSS issues to be handled and can be a top level section.
         7. The Power Save feature can be under the MAC section.
5. Straw Polls on the Specification Framework Document
   1. **Straw Poll by Minho Cheong (NEWRACOM)**
      * 1. **Straw Poll: Do you support to adopt document 11-14/1429r1 as the initial revision of the TG Specification Framework document?**
        2. Discussions
           1. Minho explained that this document is the simplest one.
        3. **Result: Y/N/A = 47/66/32**
   2. **Straw Poll by Robert Stacy (Intel)**
      1. **Straw Poll: Do you support taking the contents of 11-14/1453r2, adding a “6.1 Power Save” subclause and adopting it as the TG spec framework doc?**
      2. 1. Discussions
         2. **Result: Y/N/A = 114/40/30**
   3. **Motion by Robert Stacy (Intel)** 
      1. **Motion: Move to take the contents of 11-14/1453r2, adding a “6.1 Power Save” subclause and adopting it as the TG spec framework doc?**
         1. **Moved by Robert Stacy (Intel), Second by Lei Wang (Marvell)**
         2. Discussions
         3. **Result: Y/N/A = 109/25/15, motion passes.**
6. Discussions on the ad hoc group
   1. Vinko Erceg (Broadcom) presented “TGax Ad Hoc Structure Discussion”, based on the submission 14/1184r2.
      1. Summary
         1. The document is almost the same as the previous version except for the last slide which contains the motion to approve the proposed structure.
         2. The structure is 4 ad hocs and 3 co-chairs for each.
      2. Discussions
         1. Start time of the ad hoc discussed. Will have chair election in January. Start time of ad hoc needs to be decided.
            1. Chair suggested election in January and start of the ad hoc in March.
         2. A member mentioned that he is confused by the names of ad hoc groups and the section titles in the SFD.
      3. **Motion #1: Move to have the following 4 Ad Hoc Groups in TGax:** 
         1. **MAC**
         2. **PHY**
         3. **Multiuser**
         4. **Spatial Reuse**
         5. **Moved by Al Petrick (J. P. and Associates), Seconded by Eldad Perahia (Intel)**
         6. **Discussions**
         7. **Result: Motion accepted by unanimous consent.**
      4. **Motion #2: Move to have 3 co-chairs per Ad Hoc Group in TGax:** 
         1. **Moved by Eldad Perahia (Intel), Seconded by Sean Coffey (RealTek)**
         2. Discussions
            1. Why each ad hoc should have the same number of chairs? Suggested the ad hoc group to decide it. 🡪 Historically 2 or 3 co-chairs worked very well. Need someone to take the minutes, needs someone to take care of the database.
         3. **Result: Motion accepted unanimously.**
7. Recess @ 9:59 AM until PM1 (13:30) today.

**Thursday, September 18th, 2014, PM1 Session (13:30-15:30)**

1. The meeting called to order by Osama Aboul-Magd (Huawei Technologies), the chairperson of the TGax, @ 13:35.
   1. About people are in the room at the beginning of the session.
   2. Agenda Doc.11-14/1319r5 is on the server. Rev 6 is the working document
2. Reminder and Announcements
   1. Chairperson reminded IEEE 802 and 802.11 IPR P&P.
   2. Chair asked people to announce name and affiliation when addressing for the first time in the session.
   3. Chairperson reminded attendance.
3. Agenda for this session
   1. Proposed agenda for Thursday PM1
      1. Call Meeting to order
      2. Reminder
         1. IEEE 802 and 802.11 IPR Policy and procedure.
         2. Chair asked people to state name and affiliation when speaking for the first time in the session.
         3. Attendance!
      3. Agenda Settings
      4. Discussions on the Ad Hoc Chair Election
         1. Election will be on Tuesday during January meeting.
      5. Start Time for the Ad Hoc group
         1. Ad hoc group meetings to start on March.
      6. Editor appointment (Robert Stacy)
      7. 11-14/1523r1, “Offline Discussion Minutes of SLS Calibration,” Jiyong Pang (Huawei)
      8. TG Motions
      9. Goals for January 2015
      10. Teleconference Schedule
      11. Adjourn
   2. Chair asked if there are any objections to proceed with this agenda – no objections. The agenda was approved.
4. Discussion on the Ad Hoc Chair Election
   1. Will have election in January 2015 session.
   2. It is nice if the TG comes up with 12 names for the ad hoc chairs. But will have an election if more than 12 people are nominated.
   3. A member suggested Tuesday to have the election in order for people to negotiate/coordinate the candidates on Monday. Chair agreed with the suggestion.
5. Start Time for the Ad Hoc group
   1. Simone suggested March to start the ad hoc groups. Many people supported the idea.
   2. A member asked for clarification how the discussions about simulation scenario, evaluation methodology and calibrations will be handled. The answer was those topics will be discussed in the whole TG.
      1. Maximum number of two ad hocs will be run at any time.
   3. Another member asked the operating rules for the ad hoc groups.
6. Editor appointment (Robert Stacy)
   1. We have Robert Stacy willing to volunteer the editor.
   2. Robert was the editor of 802.11ac and his experience will be valuable for TGax.
   3. Robert mentioned his is happy to serve as the editor.
   4. Chair asked if there is any objection to accept Rober Stacy as the technical editor of TGax. There was no objection. Robert Stacy accepted as the technical editor of TGax.
7. Presentation by Jiyong Pang (Huawei) on SLS calibration
   1. Jiyong presented results of discussion on the system level simulation calibration based on the submission 11/1523r2.
   2. Summary
      1. Topics covered are Preamble model, Preamble detection metric, RBIR PHY abstraction, Receiving procedure and CCA status, Control frame detection, Box5 calibration scenario, etc.
   3. Discussions – no discussion.
8. TG Motions
   1. Motion by Ron Porat on Evaluation Methodology (11-14-0571-06)
      1. Ron mentioned that the video traffic model presented by Guotiq Li (Intel) is the only changes.
      2. Discussions
      3. **Motion: Move to accept the document 11-14-0571-06** 
         1. **Moved by Ron Porat (Broadcom), Seconded by Al Petrick**
         2. Discussion
            1. No discussion.
         3. **Result: Motion accepted with no objection.**
   2. Motion by Jarkko Kneckt (Nokia) on Power Save Calibration Scenario (14/1496r5).
      1. Jarkko had gone through the document.
         1. Discussions:
      2. **Motion: Move to accept changes in document 11-14/1496r5 and include them in the TG Simulation Scenario document 11-14/0980.**
         1. **Moved byJarkko Kneckt (Nokia), Seconded by Stuart Kerry (OK-Brit).**
         2. Discussions
            1. A member asked for a time for review.
         3. **Result: Y/N/A = 58/10/46, motion passes.**
   3. Motion by Simone Merlin (Qualcomm) on Simulation Scenario document (14/0980r5).
      1. Simone explained the changes made to the document.
         1. Discussions:
      2. **Motion: Move to accept document 11-14/0980r5 as the new revision of the Simulation Scenario document.**
         1. **Moved by Simone Merlin (Qualcomm), Seconded by Yasu (NTT).**
         2. Discussions – No discussion.
         3. **Result: Motion accepted with no objection.**
9. Goals for January 2015 session
   1. Chair suggested two items
      1. Continue to advance the TG documents based on submissions.
      2. Technical Presentations.
10. Teleconference Planning
    1. Chair one teleconference between now and January 2015 meeting.
       1. Thursday, December 4th, 10:00 – 12:00 ET proposed by Chair.
    2. Discussions
       1. Chair mentioned our history so far was to have one conference call.
    3. Chair asked if there is any objection to proceed with this plan. 🡪 No objection.
11. AOB
    1. No other businesses.
    2. Chairperson asked if there is any objection to adjourn at this time. No objections.
12. TGax has adjourned@14:44.