IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UHR SG March April 2023 teleconference minutes | | | | |
| Date: 2023-03-25 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Ross Jian Yu | Huawei | Building F3, Huawei Industrial Base, Shenzhen, Guangdong, China |  | ross.yujian@huawei.com |
| Shimi Shilo | Huawei |  |  |  |
|  |  |  |  |  |

Abstract

This document contains the minutes for UHR SG March April 2023 teleconference.

Revision history:

* Rev0: initial version.
* Rev1: add the minutes for the 2nd and 3rd call
* Rev2: add the minutes for the 4th call, add the attendance list for the 2nd and 3rd call

Abbreviations:

* A: Answer
* C: Comment

# 1st Conf. Call: Mar 27th Monday (10:00–12:00 ET)

* The Chair, Laurent Cariou (Intel), calls the meeting to order.
* IEEE 802 and 802.11 IPR policy and procedure
  + Patent Policy: Ways to inform IEEE:
    - Cause an LOA to be submitted to the IEEE-SA ([patcom@ieee.org](mailto:patcom@ieee.org)); or
    - Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or
    - Speak up now and respond to this Call for Potentially Essential Patents

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair. **Nobody speaks/writes up**.

* + Copyright Policy: Participants are advised that
    - IEEE SA’s copyright policy is described in [Clause 7](https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7) of the IEEE SA Standards Board Bylaws and [Clause 6.1](https://standards.ieee.org/about/policies/opman/sect6.html) of the IEEE SA Standards Board Operations Manual;
    - Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy

**Copyright Policy was presented.**

* + **Patent, Participation, Copyright and policy related subclause:** Please refer to Patent And Procedures**。**
* Attendance reminder.
  + Participation slide: <https://mentor.ieee.org/802-ec/dcn/16/ec-16-0180-05-00EC-ieee-802-participation-slide.pptx>
  + Please record your attendance during the conference call by using the IMAT system:
    - 1) login to [imat](https://imat.ieee.org/attendance), 2) select “802.11 Telecons (<Month>)” entry, 3) select “C/LM/WG802.11 Attendance” entry, 4) click “<UHR SG > conference call that you are attending.
  + If you are unable to record your attendance contact Laurent Cariou ([laurent.cariou@intel.com](mailto:laurent.cariou@intel.com)) and Ross Jian Yu ([ross.yujian@huawei.com](mailto:ross.yujian@huawei.com)) for assistance
  + Please ensure that the following information is listed correctly when joining the call:
    - "[voter status] First Name Last Name (Affiliation)"
* Agenda
  + Chair reviews proposed agenda found in [11-23-0531r](https://mentor.ieee.org/802.11/dcn/23/11-23-0531-00-0uhr-uhr-sg-march-april-2023-teleconference-agendas.docx)0
  + Discussion:
    - Agenda approved with unanimous consent.
* Announcements:
  + None
* Submissions
  + [11-23/0060r1](https://mentor.ieee.org/802.11/dcn/23/11-23-0060-01-0uhr-layered-qos-and-multi-layer-transmission-follow-up.pptx) Layered QoS and multi-layer transmission follow-up Ross Jian Yu (Huawei)
    - C: slide #4 – results for unequal power and equal power here?
    - A: 2nd and 3rd are equal power
    - C: I would expect unequal to be at least as good as equal power
    - A: equal power has better performance here
    - C: Unequal could converge to equal power, so I’m surprised that it’s much worse
    - A: we simply compare all cases, for unequal power case we balance the effective post-SNR of each stream
    - C: which channel (LOS/NLOS) did you simulate?
    - A: I think it was channel B
    - C: do you have a corresponding channel condition statistic? Looks like on the left side there are more benefits
    - A: I can double-check the condition number, for NLOS scenario the SNR is very small so there is some loss, but with SNR big enough there are gains
    - C: but with good choice you should recover the performance
    - C: here you’re prosposing MC-MIMO, did you consider unequal modulation (11n style)?
    - A: not so far, we’ve given some thoughts to that, we can further evaluate that, but we prefer this method, similar as MU-MIMO but with single receiver, easy for link adaptation. That’s our current study
    - C: for the second scheme, how is the interference generated? Is it a 20MHz waveform?
    - A: I need to double-check
    - C: is it a real 20MHz waveform with Tx power leakage on other bands, or a purely frequency-domain interference
    - A: I will check and get back to you
    - C: related to interference, in last slide you mention multi-layer gain in interference scenario, is there still gain when there is no interference?
    - A: when there is no interference, it depends on the channel selectivity; when channel selectivity is large there may be gain, but if the channel is flat, there may be some loss due to loss of the interleaver across different RUs.
    - C: but do you assume you know the interference level across frequency?
    - A: we assume there is some prior knowledge of the interference environment.
    - C: in your simulations did you consider AGC on receiver side?
    - A: we do consider it and we do consider that strong stream may lead to clipping, so we will lose some power to stream with lower SNR.
    - C: so what is dynamic range for AGC?
    - A: we have a model for that but I don’t remember.
    - C: but you do include the quantization noise for the weaker RUs?
    - A: we may double-check this offline, not sure quantization is here.
  + [11-23/0069r1](https://mentor.ieee.org/802.11/dcn/23/11-23-0069-01-0uhr-considerations-on-latency-improvement.pptx) Considerations on Latency Improvement Insun Jang (LG Electronics)
    - C: Changing traffic from one AC queue to another, the spec already allows to use that TXOP for lower AC if the higher AC is empty.
    - A: I intend to consider the case where TXOP sharing or multi-TID transmission cannot be used.
    - C: My other question is about SN. This BA is not only about per TID, but also per sub-ID?
    - C: For slide 5, I agree with what you observe. Because similar issues are also for 11be spec. Should address it in 11be than UHR.
    - C: Let us not discuss 11be here.
    - C: do you think we should have LL TID in the A-MPDU?
    - A: yes
    - C: Prefer to have offline discussion as there are many questions.
  + [11-23/0075r1](https://mentor.ieee.org/802.11/dcn/23/11-23-0075-01-0uhr-more-discussions-on-deep-learning-for-wlan.pptx) More Discussions on Deep learning for WLAN Ziyang Guo (Huawei)
    - C: The station uses this channel to access the channel. The decision will be yes or no?
    - A: The binary decission, transmit or wait.
    - C: slide 8, all these AI # are AI STAs. Only consider AI STAs have traffic? Do non-AI STAs have traffic or not?
    - A: we assume all STAs are AI STAs.
    - C: the traffic models are for AI enabled STAs?
    - A: if you want to use them for legacy STAs, it is ok.
    - C: another question, slide 10, you are saying for different features, as you list here, some models may be used, especially the input. Are they sharing the same parameters used for NN model?
    - A: I do not check whetheter they use the same model. But it is possible to reuse part of the model, e.g., use the same number of layers.
    - C: that’s from Ref [6]?
    - A: we also do some simulation, AI based channel access and AI based link adaptation can share some paraeters.
    - C: The filter action, slide 12, I try to see this decisison filter is highly implementation specific. How do you think this will impact the standardization?
    - A: this needs to have some further discussion. We need to discuss whether we need to stdanardize this filter.
  + [11-23/0092r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0092-00-0uhr-preemption.pptx) Preemption Juan Fang (Intel)
    - C: Slide 5, you may already mention that some problems need to be further solved. The STA2 has certain packet to transmit, how does AP1 know that?
    - A: We need to use different iFS for LL packet and the next DL PPDU.
    - C: The STA whichever has the LL traffic can access the channel?
    - C: What is the boundary of dividing the PPDUs?
    - A: PPDU level.
    - C: We kind of enabling doing this already by different EDCA parameters. What is xIFS you use for your simulation.
    - A: we use SIFS for the simulation. Need to define different iFS. For true value, we need further consideration.
    - C: Slide 5, on the left, the AP sends the first DL PPDU to STA, but there is no immediate BA.
    - A: very good question. We can do different scheme. We can do BA together at the end. For the DL LL PPDU, we need immediate BA from STA2.
    - C: for legacy STA, how can you control the PPDU length?
    - A: cannot control the PPDU length, but can control TXOP length for legacy STAs, not support burst transmission.
    - C: I think legacy and next generation, different generations share the same TXOP length. It hurts the Tput.
    - A: You mean it is not fair for the legacy mode?
    - C: you only control the new STA or the AP?
    - A: this new proposed soluation can only apply to the new Wi-Fi 8 STAs. We cannot do anything unless we set lmit to the TXOP length or the TXOP without burst transmission.
    - C: you mention the collision issue. It is natural we have multiple STAs have LL traffic.
    - A: we need to consider that. STA2 and STA3 may have collision. We are working on the solution.
    - C: If it is a fixed length, it seems a little bit hard, we can further discuss. This is an important issue we need to solve.
    - C: I have similar question as the previous commenter. You don’t put immediate BA. There may be retransmission for LL data.
    - A: sorry about that. There should be one immediate BA.
    - C: do you condier for LL traffic, you use low MCS?
    - A: need to consider that. For time critical packet, we have different PER setting.
    - C: do you have evaluation there are multiple LL STAs? The collision will degrade the performance.
    - A: in this simulation, both the AP and the STA have LL traffic. We did see some effect due to the collision.
  + [11-23/0042r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0042-00-0uhr-thought-for-range-extension-in-uhr.pptx) Thought for Range Extension in UHR Dongguk Lim (LG Electronics)
    - C: Is 802.11ah a baseline?
    - A: You mean the relay STA has an AP function. We can consider the relay STA has an AP function, but it requires many complicated operation. For simplicity, we can consider relay STA has a non-AP STA controlled by the AP.
    - C: Have you considered security related issue?
    - A: Thanks for your question. It is a good one. For security, we need to think more about that.
* AoB:
  + None
* Adjourned at 11:59 ET

# 2nd Conf. Call: Apr 10th Monday (10:00–12:00 ET)

* The Chair, Laurent Cariou (Intel), calls the meeting to order.
* IEEE 802 and 802.11 IPR policy and procedure
  + Patent Policy: Ways to inform IEEE:
    - Cause an LOA to be submitted to the IEEE-SA ([patcom@ieee.org](mailto:patcom@ieee.org)); or
    - Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or
    - Speak up now and respond to this Call for Potentially Essential Patents

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair. **Nobody speaks/writes up**.

* + Copyright Policy: Participants are advised that
    - IEEE SA’s copyright policy is described in [Clause 7](https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7) of the IEEE SA Standards Board Bylaws and [Clause 6.1](https://standards.ieee.org/about/policies/opman/sect6.html) of the IEEE SA Standards Board Operations Manual;
    - Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy

**Copyright Policy was presented.**

* + **Patent, Participation, Copyright and policy related subclause:** Please refer to Patent And Procedures
* Attendance reminder.
  + Participation slide: <https://mentor.ieee.org/802-ec/dcn/16/ec-16-0180-05-00EC-ieee-802-participation-slide.pptx>
  + Please record your attendance during the conference call by using the IMAT system:
    - 1) login to [imat](https://imat.ieee.org/attendance), 2) select “802.11 Telecons (<Month>)” entry, 3) select “C/LM/WG802.11 Attendance” entry, 4) click “<UHR SG > conference call that you are attending.
  + If you are unable to record your attendance contact Laurent Cariou ([laurent.cariou@intel.com](mailto:laurent.cariou@intel.com)) and Ross Jian Yu ([ross.yujian@huawei.com](mailto:ross.yujian@huawei.com)) for assistance
  + Please ensure that the following information is listed correctly when joining the call:
    - "[voter status] First Name Last Name (Affiliation)"
* Agenda
  + Chair reviews proposed agenda found in [11-23-0531r](https://mentor.ieee.org/802.11/dcn/23/11-23-0531-01-0uhr-uhr-sg-march-april-2023-teleconference-agendas.docx)1
  + Discussion:
    - Agenda approved with unanimous consent.
* Announcements:
  + None
* Submissions
  + [11-23/0298r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0298-00-0uhr-improved-reliability-in-presence-of-interference.pptx) Improved reliability in presence of interference Laurent Cariou (Intel)
    - C: if there is interference, the rate will be dropped. This will be double punishment. This is the desire behavior. Has to drop the rate because of the interference.
    - A: For sure, if the interference will follow in the TXOP, you should drop the rate. But for infrequent interference, then you would not want the rate to be dropped.
    - C: This makes Wi-Fi slower. Because of in-device coexistence. Are you making similar presentation in BLE?
    - A: The idea is what we fix what we can do in Wi-Fi side. They fix what they can. There can be some liason.
  + [11-23/0226r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0226-00-0uhr-coordination-of-r-twt-for-multi-ap-deployment.pptx) Coordination of R-TWT for Multi-AP Deployment Abdel Karim Ajami (Qualcomm Inc.)
    - C: Make sense to me. Slide 8, Opt1, do you mean by clock or TSF?
    - A: Since you want to communicate SP start time of another AP. That’s why preserve the current case. Need to have the same TSF.
    - C: We need both options. Opt 1 is safe for enterprise. Opt 2 is for devices in different domain.
    - C: slide 5, not only AP2 end the TXOP, but also all the STAs should end the TXOP before AP1’s R-TWT.
    - A: This depends on how it progresses in the group. There could be two levels. It is just the AP. The AP can utilize some tools to manage its BSS. Level 2, both AP and STAs will end the TXOP.
    - C: you assume level 2 will also work?
    - A: basically there is always a tradefoff. This depends on the discussion.
    - C: For the simulation on slide 7, for coordinated medium access, all the latency value are the same?
    - A: All the downlink from all APs get chance to transmit. It explains the good latency.
    - C: Slide 5, could you explain the left figure and second bullet. Why the transmission delay happens?
    - A: it assumes 11be R-TWT. The TXOP ends per BSS. BSS3 does not follow any R-TWT period. The medium is occupied. So when time comes for BSS-1 and BSS-2, the transmission is delayed.
    - C: Very interesting idea. Slide 8, as Brian mentioned, we need both options. Opt 2 may be much more scalable. We need Opt 1 on top, for example within ESS.
    - A: thanks for the comments. Will consider these and follow-up.
  + [11-23/0285r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0226-00-0uhr-coordination-of-r-twt-for-multi-ap-deployment.pptx) TXOP Protection of Non-Primary Channel Kiseon Ryu (NXP)
    - C: Slide 6, the trigger frame on 80 MHz, is transmitted per 20 MHz for example. P20 is only to STA1 S20 goes to STA2. There are 3 trigger frames?
    - A: The trigger frame is non-HT duplicate. The RU can be allocated to STA1 using P20 RU, STA2 using S20 RU, STA3 using S40 RU.
    - C: The AP transmits non-HT duplicate. The STA2 cannot read P20. So she just transmited CTS to S20 channel, right?
    - A: The trigger frame ban be received on P20 channel.
    - C: why transmits CTS on S20?
    - A: the AP can allocate RU on S20.
    - C: What is the difference compared with current MU-RTS? How does it work with legacy STAs for CTS on S20?
    - A: the baseline, MU-RTS allocates the RU to STA only P20, P40, P80 etc. The STA should respond CTS including P20/40/80 etc. That is the current one. The legacy STA, can just be allocated using existing definitions. We can coexistence with legacy STA and UHR STA.
    - C: Slide 6, I try to connect slide 6 and 8. For Opt 1 on slide 6, STA2 and STA3, they do not send CTS on P20 but only on secondary channels. But STA1 also sends on P20. The AP can still initiate the transmission. When you say pro and con, all the STAs only send CTS on secondary channels.
    - A: STA 1 may have busy channels. The trigger frame transmits on 80 MHz, to support non-primary channel access, trigger frames may only send on secondary channels.
    - C: the presentation is not related to the protection of non-primary channels. Enabling CTS to transmit within different punctured channels, not neccesarily including P20. The part you try to achieve, as an AP, you know which STAs are aviailable on which channels? Because it is not bandwidth, it is going to affect STA’s transmission and reception based on the punctured pattern.
    - A: using the TXOP, the AP needs to know which subchannel is busy or idle for each scheduled STA, we can use MU-RTS and CTS exchange. We need this proposal to figure out without BQRP.
    - C: if you don’t have extra capability, it does not bring benefits. It will bring mutl-channel hidden node. There may no PPDU which keeps the channel busy.
    - A: we may need to define new rules to use this option.
  + [11-23/0286r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0285-00-0uhr-txop-protection-of-non-primary-channel.pptx) Trigger frame protection Po-Kai Huang (Intel)
    - C: why protection this time, trigger frame has been widely used.
    - A: From our understanding, the main reason, we start to use this extensively. Extend it a little bit for SMPS and eMLSR. Because of these extended usage, the trigger, it is the time to solve this problem. Another reason, it involes some changes in the trigger frame. Better to provide in the early stage of a group.
    - C: 11bi is the better place, why in UHR?
    - A: 11bi is mianly for privacy. This is not about privacy. This is to waste power.
    - C: if you look at the PAR, it also mentions this part.
    - A: We can further discuss. 11bi is about privacy. We cannot solve every security problem in 11bi.
    - C: these 3 scenarios, if the trigger frame is transmitted frame without protection, it is about to protect the further data?
    - A: security is related to security attack model. The most important threat model is this specific use case that is similar to WUR. It is ok that everybody brings different threat models.
    - C: Are you intended in 11ax trigger frame or only for next generation trigger frame?
    - A: we want to ensure the trigger frame is backward compatible. We don’t have 11be or 11ax trigger frame, we call it HE user field, EHT user field. Protection may begin with UHR. For the new generation, promote the MIC.
    - C: you are trying to avoid power consumption?
    - A: main use case is because of the attack model. There may be other things related to other attack. I am not trying to boil the water.
    - C: I would expect a lot of attacks would have impact on control frames. Do you have any thouhgts which is the most important attack?
    - A: We already see this attack model discussed in 11ba.
  + [11-23/0297r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0297-00-0uhr-rtwt-for-multi-ap.pptx) rTWT for Multi-AP Laurent Cariou (Intel)
    - C: I agree for unmanaged BSSs, allow or tolerate drift, feels like a more robust solution.
    - A: yes, depend on the scenario. May need multiple solutions.
    - C: did you consider two hop?
    - A: I haven’t touched the two hop cases. Happy to hear some thoughts.
* AoB:.
  + C: it would be beneficial if the contributions can be uploaded 24 hours before hand.
  + A: Will do that and send an email.
* Adjourned at 12:00 ET

# 3rd Conf. Call: Apr 17th Monday (10:00–12:00 ET)

* The Chair, Laurent Cariou (Intel), calls the meeting to order.
* IEEE 802 and 802.11 IPR policy and procedure
  + Patent Policy: Ways to inform IEEE:
    - Cause an LOA to be submitted to the IEEE-SA ([patcom@ieee.org](mailto:patcom@ieee.org)); or
    - Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or
    - Speak up now and respond to this Call for Potentially Essential Patents

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair. **Nobody speaks/writes up**.

* + Copyright Policy: Participants are advised that
    - IEEE SA’s copyright policy is described in [Clause 7](https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7) of the IEEE SA Standards Board Bylaws and [Clause 6.1](https://standards.ieee.org/about/policies/opman/sect6.html) of the IEEE SA Standards Board Operations Manual;
    - Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy

**Copyright Policy was presented.**

* + **Patent, Participation, Copyright and policy related subclause:** Please refer to Patent And Procedures
* Attendance reminder.
  + Participation slide: <https://mentor.ieee.org/802-ec/dcn/16/ec-16-0180-05-00EC-ieee-802-participation-slide.pptx>
  + Please record your attendance during the conference call by using the IMAT system:
    - 1) login to [imat](https://imat.ieee.org/attendance), 2) select “802.11 Telecons (<Month>)” entry, 3) select “C/LM/WG802.11 Attendance” entry, 4) click “<UHR SG > conference call that you are attending.
  + If you are unable to record your attendance contact Laurent Cariou ([laurent.cariou@intel.com](mailto:laurent.cariou@intel.com)) and Ross Jian Yu ([ross.yujian@huawei.com](mailto:ross.yujian@huawei.com)) for assistance
  + Please ensure that the following information is listed correctly when joining the call:
    - "[voter status] First Name Last Name (Affiliation)"
* Agenda
  + Chair reviews proposed agenda found in [11-23-0531r](https://mentor.ieee.org/802.11/dcn/23/11-23-0531-01-0uhr-uhr-sg-march-april-2023-teleconference-agendas.docx)1
  + Discussion:
    - 11/23-0058r0 has been presented in March meeting.
    - The chair added 11/23-0263r0 into today’s agenda
* Announcements:
  + None
* Submissions
  + [11-23/0279r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0279-00-0uhr-considerations-on-seamless-roaming.pptx) Considerations on Seamless Roaming, Insun Jang (LG Electronics)
    - C: slide 8, the bottom figure, AP1 and AP4 transmit data to STA1. AP2 and AP5 transmit to STA2. What is the mechanism of data sharing?
    - A: It doesn’t have details. I expect, next slide, if you have a common upper MAC layer, I think the two APs, AP1 and AP4. We could touch the current spec to support this procedure.
    - C: How does legacy work with this AP MLD? You have this two additional group. This AP group 1 itself should be an AP MLD.
    - A: The termonoligy, we can change the name. To support legacy STA, EHT STA see only the AP group.
    - C: to clarify, 11be only identifies MLD, not group.
    - A: yes.
    - C: you mention there is some parameter for the common MAC. There is only one common SAP to the DS, right?
    - A: UHR AP MLD only has one MAC SAP.
    - C: what kind of parameters we can separate on two entities? The AP group is dynamic formed or fixed dynamic formed?
    - A: we can have further discussion, it depends on MLD parameter we defined in 11be.
    - C: the figure in slide 9, there are two upper common MAC sublayer, what are the relationship between the top and middle one? What’s the component in each sublayer?
    - A: similar question to the previous commenter. Eventulaly we should decide what context need to be maintained in which level.
    - C: how to design the architecture according to current 11be framework.
    - A: most of the information can be transmit from the middle to the upper MAC sublayer.
  + [11-23/0170r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0170-00-0uhr-smooth-roaming-discussion.pptx) smooth roaming discussion, Liwen Chu (NXP)
    - C: Slide 2, you mention two potential directions. Do you have any preference?
    - A: Yes, all the discussion is for AP MLD method.
    - C: Do you think it is possible multiple roaming AP MLD? One roaming AP MLD is a bottleneck.
    - A: for ESS, yes, we may have multiple roaming AP MLD.
    - C: I have another presentation on roaming. Could you group them together?
    - A: starting from next F2F, we will group contributions by topic.
    - C: AID space is too small. It is basically link level roaming with data loading. Why optional for roaming AP MLD?
    - A: In some use case, we only need one AP MLD, we never need roaming. We may need to define new ML element, new RNR. Need to define a bunch of new things. If you don’t support, you don’t need to implement all these tihngs.
    - C: For a camera, the AP may die, the client does not moving, or the AP may move. We have the attitude in 11be, we have association between AP MLD. That kind of logic can work here again. It can be leaved for future discussion.
  + [11-23/0281r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0170-00-0uhr-smooth-roaming-discussion.pptx) Considerations on RU / MRU Designs for UHR, Eunsung Park (LG Electronics)
    - C: slide 16, you mention the pilot tones may be not enough. It is true. It is a little complex to add the pilot tones.
    - A: I am not sure the current number of pilot is enough. We need futher study.
    - C to Chair: This kind of contribution is kind of detail. I want to ask whether we will have some agreement for each item.
    - Chair: We definitely need to agree on some high level directions. We can make early agreement, at least SPs. The first agreement should be what high level features.
    - C to Chair: will those carry to TGs?
    - Chair: that’s the expection. But as we are SG here, we should not assume the agreement must carry on.
  + [11-23/0261r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0261-00-0uhr-tdma-for-wifi-8.pptx) TDMA for wifi-8, Dibakar Das (Intel)
    - C: slide 7, when AP allocate a part of TXOP to the second AP. The second AP will have to do some carrier sense. I assume no matter CTS will transmit or not.
    - A: Yes. That’s true.
    - C: A high level question. I see some members have presentation to use R-TWT to do the coordination. Here, this is another way. Do you have any comments about these two methods, we’d better choose one of them? Or research on both of them.
    - A: Looking at 11be, we have two ways. You can give semi-static allocation. The trigger allows you to do more dynamic allocation. I think we need both.
    - C: Slide 7, you say only the first AP sends CTS, what’s the problem of simultaneous CTS by multiple APs.
    - A: this is for the case of sequential allocation.
    - C: Nice presentation. Agree with the direction of trying to use MU-RTS TXS framework. Also the signaling, agree in general. Probably limit the number of shared APs. How we make use of the spectrum if one AP does not send CTS.
    - A: Having a single AP is what we prefer for now.
  + [11-23/263r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0263-00-0uhr-triggered-beamforming-in-uhr.pptx) Triggered Beamforming in UHR, Shimi Shilo (Huawei)
    - C: For OFDMA, we do use Tx power control, MU-MIMO as well. In order to increase SNR, we can just increase the power. The AP can inform as well. I wonder what is the actual benefit for OFDMA.
    - A: You can not always increase the power. Triggered beamforming does not only increase SNR at Rx, also reduce interference.
    - C: OFDMA+MU-MIMO? How to reduce the interference?
    - A: You can concentrate your energy for your intended Rx. You are not spreadaing your energy to the uninteded Rx, the 3rd-party Rx.
    - C: your intention is for every TB PPDU, the AP is going to initiate UL souding?
    - A: The intention is not to apply everytime, leave AP to determine. We have the trigger frame, we have the sounding protocol. We trigger the STA to send sounding PPDUs. How often to do that leaves to AP to decide.
    - C: for UL sounding, it can already be done with non-TB UL sounding. STA can have the information. Optimistically, the AP can already do UL sounding.
    - A: theoretically, probably yes. You were assuming the STA initiated sounding, it may be far before the triggered transmission. Furhtermore, you assume the STA is beamforming which the AP does not care. Channel estimation. In practice, it is quite problemalitical.
    - C: A STA has two antennas, or you assume more?
    - A: majority, it two. But there is STAs with more.
    - C: you mention it helps reduce interference for 3rd party STA. If you do nulling, I agree. If you only maximize throughput, you increase interference for the STA at the same eigendirection.
    - A: in average, it would reduce interference.
    - C: I can add more clarification. This trigger based UL beamforming. This is not limited by the number of antennas by each non-AP STA.
* AoB:.
  + Chair: may add another teleconference call.
  + C: Can try May 4th evening..
  + C: A 10-day notice is needed.
* Adjourned at 11:56 ET

# 4th Conf. Call: May 8th Monday (10:00–12:00 ET)

* The Chair, Laurent Cariou (Intel), calls the meeting to order.
* IEEE 802 and 802.11 IPR policy and procedure
  + Patent Policy: Ways to inform IEEE:
    - Cause an LOA to be submitted to the IEEE-SA ([patcom@ieee.org](mailto:patcom@ieee.org)); or
    - Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or
    - Speak up now and respond to this Call for Potentially Essential Patents

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair. **Nobody speaks/writes up**.

* + Copyright Policy: Participants are advised that
    - IEEE SA’s copyright policy is described in [Clause 7](https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7) of the IEEE SA Standards Board Bylaws and [Clause 6.1](https://standards.ieee.org/about/policies/opman/sect6.html) of the IEEE SA Standards Board Operations Manual;
    - Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy

**Copyright Policy was presented.**

* + **Patent, Participation, Copyright and policy related subclause:** Please refer to Patent And Procedures
* Attendance reminder.
  + Participation slide: <https://mentor.ieee.org/802-ec/dcn/16/ec-16-0180-05-00EC-ieee-802-participation-slide.pptx>
  + Please record your attendance during the conference call by using the IMAT system:
    - 1) login to [imat](https://imat.ieee.org/attendance), 2) select “802.11 Telecons (<Month>)” entry, 3) select “C/LM/WG802.11 Attendance” entry, 4) click “<UHR SG > conference call that you are attending.
  + If you are unable to record your attendance contact Laurent Cariou ([laurent.cariou@intel.com](mailto:laurent.cariou@intel.com)) and Ross Jian Yu ([ross.yujian@huawei.com](mailto:ross.yujian@huawei.com)) for assistance
  + Please ensure that the following information is listed correctly when joining the call:
    - "[voter status] First Name Last Name (Affiliation)"
* Agenda
  + Chair reviews proposed agenda found in [11-23-0531r](https://mentor.ieee.org/802.11/dcn/23/11-23-0531-02-0uhr-uhr-sg-march-april-2023-teleconference-agendas.docx)2
    - 11-23/0262r0 is postphoned.
    - 11-23/0250r0 is added to the end of today’s agenda.
* Announcements:
  + None
* Submissions
  + [11-23/0249r1](https://mentor.ieee.org/802.11/dcn/23/11-23-0249-01-0uhr-extended-txop-sharing.pptx) extended TXOP sharing Liwen Chu (NXP)
    - C: Slide 10, the idea is one time if MU-RTS TX is sending out, only call for one shared AP? For Opt 1, in 2nd service period, you have two AP working simultaneously?
    - A: Yes, for 2nd service period, the starting and ending time may be the same. The first one is the simpler. For the second one, need alignment, kind of complicated. At least need to support the first one.
    - C: Opt 2, as you show in slide 11, do they share the same bandwidth?
    - A: Yes.
    - C: in different time?
    - A: yes
    - C: one MU-RTS allocates those multiple periods?
    - A: yes.
  + [11-23/0291r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0291-00-0uhr-r-twt-multi-ap-coordination.pptx) R-TWT Multi-AP Coordination Muhammad Kumail Haider (Meta)
    - C: Slide 7, I agree that OBSS TWT can be considered by a non-AP STA. Like STA1,2 in the figure. The BA does not consider virtual carrier sensing. Are you proposing to change the current rule?
    - A: Don’t propose specifically. May consider some enhanced spatial reuse. The key idea to we may have scearnio that can be exploited.
  + [11-23/0243r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0243-00-0uhr-joint-transmission-for-uhr-additional-results.pptx) Joint Transmission for UHR - Additional Results Ron Porat (Broadcom)
    - C: you baseline is single AP with TDMA? How could it compare with coordinated spatial reuse?
    - A: the CSR will be very competitive if X is high. Slide 3, if SNR-X is close to 0, it will not cause interference to STA. We can show some results in the future.
    - C: for the baseline, maximum of these two. What does this mean?
    - A: In our case, AP1 and AP2 are symmetric to the same SNR. The STAs belong to AP1 has a certain SNR and certain interference.
    - C: You have two STAs, one communicates with AP1, the other with AP2?
    - A: The baseline is single AP, it doesn’t matter which AP.
  + [11-23/0293r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0293-00-0uhr-follow-up-on-twt-based-multi-ap-coordination.pptx) Follow-up on TWT-based Multi-AP Coordination Rubayet Shafin (Samsung Research America)
    - C: Slide 5, neighboring AP are OBSS APs? What do you mean here?
    - A: AP1 and AP2 use the same channel.
    - C: slide 4, you have mode 1 and mode 2. Suggest to consider mode 3, everyone understands the interference and reduces MCS.
    - A: It is similar to CSR.
    - C: indeed. Within TWT, use CSR.
    - A: it still falls into mode 2.
    - C: reducing interference is one approach, redcuding MCS is another approach.
  + [11-23/0250r0](https://mentor.ieee.org/802.11/dcn/23/11-23-0250-00-0uhr-ap-coordination-with-r-twt.pptx) AP coordination with R-TWT Liwen Chu (NXP)
    - C: Slide 7, another option is to reduce MCS.
    - A: yes. This is only one example.
    - C: Your last slide, which client in an OBSS should defer. This is an interesting idea. How would you provde a little insurance here.
    - A: One STA may detect OBSS’s beacon. If there STA doesn’t detect OBSS’s beacon, then will not use this scheme.
    - C: who decides these thresholds?
    - A: neighnor APs can do some information exchange. Need to do some coordination.
* AoB:.
  + None
* Adjourned at 11:52 ET

# Appendix

* + Attendee List for 1st Conf. Call:

|  |  |  |  |
| --- | --- | --- | --- |
| Breakout | Timestamp | Name | Affiliation |
| UHR SG | 3/27 | Aio, Kosuke | Sony Corporation |
| UHR SG | 3/27 | Ajami, Abdel Karim | Qualcomm Technologies, Inc |
| UHR SG | 3/27 | Andersdotter, Amelia | Sky Group/Comcast |
| UHR SG | 3/27 | Anwyl, Gary | MediaTek Inc. |
| UHR SG | 3/27 | Asterjadhi, Alfred | Qualcomm Technologies, Inc |
| UHR SG | 3/27 | Baek, SunHee | LG ELECTRONICS |
| UHR SG | 3/27 | baron, stephane | Canon Research Centre France |
| UHR SG | 3/27 | Cao, Rui | NXP Semiconductors |
| UHR SG | 3/27 | Carney, William | Sony Group Corporation |
| UHR SG | 3/27 | CHENG, yajun | Xiaomi Communications Co., Ltd. |
| UHR SG | 3/27 | Chng, Shi Baw | BAWMAN LLC |
| UHR SG | 3/27 | Choi, Jinsoo | LG ELECTRONICS |
| UHR SG | 3/27 | Chu, Liwen | NXP Semiconductors |
| UHR SG | 3/27 | CHUN, JINYOUNG | LG ELECTRONICS |
| UHR SG | 3/27 | Chung, Chulho | SAMSUNG |
| UHR SG | 3/27 | DeLaOlivaDelgado, Antonio | InterDigital, Inc. |
| UHR SG | 3/27 | Dong, Xiandong | Xiaomi Communications Co., Ltd. |
| UHR SG | 3/27 | Erkucuk, Serhat | Ofinno |
| UHR SG | 3/27 | Fan, Shuang | Sanechips Technology Co., Ltd. |
| UHR SG | 3/27 | Fang, Juan | Intel |
| UHR SG | 3/27 | Fujimori, Yuki | Canon Research Centre France |
| UHR SG | 3/27 | Gu, Xiangxin | Unisoc |
| UHR SG | 3/27 | GUIGNARD, Romain | Canon Research Centre France |
| UHR SG | 3/27 | Guo, Ziyang | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Gupta, Binita | Meta Platforms, Inc. |
| UHR SG | 3/27 | Haider, Muhammad Kumail | Meta Platforms Inc. |
| UHR SG | 3/27 | Handte, Thomas | Sony Group Corporation |
| UHR SG | 3/27 | Henry, Jerome | Cisco Systems, Inc. |
| UHR SG | 3/27 | Hervieu, Lili | Cable Television Laboratories Inc. (CableLabs) |
| UHR SG | 3/27 | Hsu, Ostrovsky | Xiaomi Communications Co., Ltd. |
| UHR SG | 3/27 | HUANG, CHIHAN | MediaTek Inc. |
| UHR SG | 3/27 | Huang, Lei | Huawei International Pte Ltd |
| UHR SG | 3/27 | Huq, Kazi Mohammed Saidul | Ofinno |
| UHR SG | 3/27 | Jang, Insun | LG ELECTRONICS |
| UHR SG | 3/27 | Jeon, Eunsung | SAMSUNG ELECTRONICS |
| UHR SG | 3/27 | Jung, Insik | LG ELECTRONICS |
| UHR SG | 3/27 | Jungnickel, Volker | Fraunhofer Heinrich Hertz Institute |
| UHR SG | 3/27 | kamath, Manoj | Broadcom Corporation |
| UHR SG | 3/27 | Kim, Geon Hwan | LG ELECTRONICS |
| UHR SG | 3/27 | Kim, Jeongki | Ofinno |
| UHR SG | 3/27 | Kim, Myeong-Jin | SAMSUNG |
| UHR SG | 3/27 | Kim, Sanghyun | WILUS Inc. |
| UHR SG | 3/27 | Kim, Youhan | Qualcomm Technologies, Inc. |
| UHR SG | 3/27 | Kishida, Akira | Nippon Telegraph and Telephone Corporation (NTT) |
| UHR SG | 3/27 | Klein, Arik | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Koundourakis, Michail | Samsung Cambridge Solution Center |
| UHR SG | 3/27 | Kuo, Chih-Chun | MediaTek Inc. |
| UHR SG | 3/27 | Lalam, Massinissa | SAGEMCOM SAS |
| UHR SG | 3/27 | Lanante, Leonardo | Ofinno |
| UHR SG | 3/27 | Li, Weiyi | Spreadtrum |
| UHR SG | 3/27 | Li, Yapu | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 3/27 | Lim, Dong Guk | LG ELECTRONICS |
| UHR SG | 3/27 | Lin, Wei | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Liu, Peng | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Lorgeoux, Mikael | Canon Research Centre France |
| UHR SG | 3/27 | Lou, Hanqing | InterDigital, Inc. |
| UHR SG | 3/27 | Lovison, Federico | Cisco Systems, Inc. |
| UHR SG | 3/27 | Lu, Liuming | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 3/27 | Ma, Yunsi | HiSilicon (Shanghai) Technologies Co., LTD. |
| UHR SG | 3/27 | Maguluri, Anilkumar | Synaptics |
| UHR SG | 3/27 | Mantha, Abhishek | Broadcom Corporation |
| UHR SG | 3/27 | MAO, ZHI | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Martinez Vazquez, Marcos | MaxLinear Corp |
| UHR SG | 3/27 | McCann, Stephen | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Miwa, Shinya | Canon Research Centre France |
| UHR SG | 3/27 | Montemurro, Michael | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Mutgan, Okan | Nokia |
| UHR SG | 3/27 | Nayak, Peshal | Samsung Research America |
| UHR SG | 3/27 | Nezou, Patrice | Canon Research Centre France |
| UHR SG | 3/27 | Ng, Boon Loong | Samsung Research America |
| UHR SG | 3/27 | Noh, Si-Chan | Newracom Inc. |
| UHR SG | 3/27 | Park, Eunsung | LG ELECTRONICS |
| UHR SG | 3/27 | Park, Minyoung | Intel |
| UHR SG | 3/27 | Park, Sungjin | Senscomm |
| UHR SG | 3/27 | Patil, Abhishek | Qualcomm Incorporated |
| UHR SG | 3/27 | Patwardhan, Gaurav | Hewlett Packard Enterprise |
| UHR SG | 3/27 | Pettersson, Charlie | Ericsson AB |
| UHR SG | 3/27 | Qi, Yue | Samsung Research America |
| UHR SG | 3/27 | Quan, Yingqiao | Unisoc |
| UHR SG | 3/27 | RISON, Mark | Samsung Cambridge Solution Centre |
| UHR SG | 3/27 | Ryu, Kiseon | NXP Semiconductors |
| UHR SG | 3/27 | Sato, Takuhiro | SHARP CORPORATION |
| UHR SG | 3/27 | Schelstraete, Sigurd | MaxLinear |
| UHR SG | 3/27 | Serizawa, Kazunobu | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 3/27 | Shafin, Rubayet | Samsung Research America |
| UHR SG | 3/27 | Shilo, Shimi | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Son, Ju-Hyung | WILUS Inc. |
| UHR SG | 3/27 | Song, Hao | Intel |
| UHR SG | 3/27 | SUH, JUNG HOON | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Sun, Bo | Sanechips |
| UHR SG | 3/27 | Tsodik, Genadiy | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Tsujimaru, Yuki | Canon Inc. |
| UHR SG | 3/27 | Uln, Kiran | Infineon Technologies |
| UHR SG | 3/27 | Urabe, Yoshio | Panasonic Holdings Corporation |
| UHR SG | 3/27 | Vaidya, Maulik | Charter Communications |
| UHR SG | 3/27 | Val, Inaki | MaxLinear, Inc. |
| UHR SG | 3/27 | Vermani, Sameer | Qualcomm Incorporated |
| UHR SG | 3/27 | Wang, Qi | Apple, Inc. |
| UHR SG | 3/27 | Wu, Kanke | Qualcomm Incorporated |
| UHR SG | 3/27 | Wu, Tianyu | Apple, Inc. |
| UHR SG | 3/27 | Xia, Qing | Sony Corporation |
| UHR SG | 3/27 | Xin, Yan | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Yang, Jay | Nokia |
| UHR SG | 3/27 | Yano, Kazuto | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 3/27 | Yi, Yongjiang | Spreadtrum Communication USA, Inc |
| UHR SG | 3/27 | Yoon, Yelin | LG ELECTRONICS |
| UHR SG | 3/27 | Yu, Jian | Huawei Technologies Co., Ltd |
| UHR SG | 3/27 | Zhang, Jiayi | Ofinno |
| UHR SG | 3/27 | Zhang, Yan | NXP Semiconductors |
| UHR SG | 3/27 | Zhao, Yue | Huawei Technologies Co., Ltd; |

* + Attendee List for 2nd Conf. Call:

|  |  |  |  |
| --- | --- | --- | --- |
| Breakout | Timestamp | Name | Affiliation |
| UHR SG | 4/10 | Aboulmagd, Osama | Huawei Technologies Co., Ltd |
| UHR SG | 4/10 | Aio, Kosuke | Sony Corporation |
| UHR SG | 4/10 | Ajami, Abdel Karim | Qualcomm Technologies, Inc |
| UHR SG | 4/10 | Alayedi, Mohanad | Istanbul Medipol University, Vestel |
| UHR SG | 4/10 | Ali, Sawaira | Istanbul Medipol University, Vestel |
| UHR SG | 4/10 | Ansley, Carol | Cox Communications Inc. |
| UHR SG | 4/10 | Asai, Yusuke | NTT |
| UHR SG | 4/10 | Aygul, Mehmet | Vestel |
| UHR SG | 4/10 | Baek, SunHee | LG ELECTRONICS |
| UHR SG | 4/10 | baron, stephane | Canon Research Centre France |
| UHR SG | 4/10 | Baykas, Tuncer | Ofinno |
| UHR SG | 4/10 | Cao, Rui | NXP Semiconductors |
| UHR SG | 4/10 | Carney, William | Sony Group Corporation |
| UHR SG | 4/10 | Chen, You-Wei | MediaTek Inc. |
| UHR SG | 4/10 | CHENG, yajun | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/10 | Cho, Hangyu | LG ELECTRONICS |
| UHR SG | 4/10 | Choi, Jinsoo | LG ELECTRONICS |
| UHR SG | 4/10 | Chu, Liwen | NXP Semiconductors |
| UHR SG | 4/10 | CHUN, JINYOUNG | LG ELECTRONICS |
| UHR SG | 4/10 | Costa, D.Nelson | Peraso Technologies Incorporated |
| UHR SG | 4/10 | da Silva, Claudio | Meta Platforms Inc. |
| UHR SG | 4/10 | Dong, Xiandong | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/10 | Eren, Tuncay | Istanbul Medipol University, Vestel |
| UHR SG | 4/10 | Erkucuk, Serhat | Ofinno |
| UHR SG | 4/10 | Fan, Shuang | Sanechips Technology Co., Ltd. |
| UHR SG | 4/10 | feng, Shuling | MediaTek Inc. |
| UHR SG | 4/10 | Fischer, Matthew | Broadcom Corporation |
| UHR SG | 4/10 | Gao, Ning | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/10 | Gidvani, Ravi | SAMSUNG ELECTRONICS |
| UHR SG | 4/10 | Gu, Xiangxin | Unisoc |
| UHR SG | 4/10 | Guo, Ziyang | Huawei Technologies Co., Ltd |
| UHR SG | 4/10 | Gupta, Binita | Meta Platforms, Inc. |
| UHR SG | 4/10 | Halasz, David | Morse Micro |
| UHR SG | 4/10 | Hervieu, Lili | Cable Television Laboratories Inc. (CableLabs) |
| UHR SG | 4/10 | Ho, Duncan | Qualcomm Incorporated |
| UHR SG | 4/10 | Hsu, Ostrovsky | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/10 | Hu, Shengquan | MediaTek Inc. |
| UHR SG | 4/10 | HUANG, CHIHAN | MediaTek Inc. |
| UHR SG | 4/10 | Huq, Kazi Mohammed Saidul | Ofinno |
| UHR SG | 4/10 | Inohiza, Hirohiko | Canon |
| UHR SG | 4/10 | Jeon, Eunsung | SAMSUNG ELECTRONICS |
| UHR SG | 4/10 | Kamel, Mahmoud | InterDigital, Inc. |
| UHR SG | 4/10 | Kim, Geon Hwan | LG ELECTRONICS |
| UHR SG | 4/10 | Kim, Jeongki | Ofinno |
| UHR SG | 4/10 | Kim, Sang Gook | LG ELECTRONICS |
| UHR SG | 4/10 | Kim, Sanghyun | WILUS Inc. |
| UHR SG | 4/10 | Kishida, Akira | Nippon Telegraph and Telephone Corporation (NTT) |
| UHR SG | 4/10 | Kneckt, Jarkko | Apple, Inc. |
| UHR SG | 4/10 | Kreishan, Loay | Charter Communications |
| UHR SG | 4/10 | Lanante, Leonardo | Ofinno |
| UHR SG | 4/10 | Levy, Joseph | InterDigital, Inc. |
| UHR SG | 4/10 | Li, Yapu | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/10 | Lim, Dong Guk | LG ELECTRONICS |
| UHR SG | 4/10 | Lu, kaiying | MediaTek Inc. |
| UHR SG | 4/10 | Lu, Liuming | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/10 | Luo, Chaoming | Beijing OPPO telecommunications corp., ltd. |
| UHR SG | 4/10 | Ma, Yongsen | SAMSUNG ELECTRONICS |
| UHR SG | 4/10 | Maguluri, Anilkumar | Synaptics |
| UHR SG | 4/10 | MAO, ZHI | Huawei Technologies Co., Ltd |
| UHR SG | 4/10 | Motozuka, Hiroyuki | Panasonic Holdings Corporation |
| UHR SG | 4/10 | Mutgan, Okan | Nokia |
| UHR SG | 4/10 | Namvar, Nima | Charter Communications |
| UHR SG | 4/10 | Nayak, Peshal | Samsung Research America |
| UHR SG | 4/10 | Ng, Boon Loong | Samsung Research America |
| UHR SG | 4/10 | Noh, Si-Chan | Newracom Inc. |
| UHR SG | 4/10 | Ozbakis, Basak | VESTEL Electronics Corp. |
| UHR SG | 4/10 | Park, Minyoung | Intel |
| UHR SG | 4/10 | Park, Sungjin | Senscomm |
| UHR SG | 4/10 | Patil, Abhishek | Qualcomm Incorporated |
| UHR SG | 4/10 | Patwardhan, Gaurav | Hewlett Packard Enterprise |
| UHR SG | 4/10 | Qi, Yue | Samsung Research America |
| UHR SG | 4/10 | Quan, Yingqiao | Unisoc |
| UHR SG | 4/10 | Ratnam, Vishnu | Samsung Research America |
| UHR SG | 4/10 | Ryu, Kiseon | NXP Semiconductors |
| UHR SG | 4/10 | Schelstraete, Sigurd | MaxLinear |
| UHR SG | 4/10 | Seo, Sangho | Broadcom Corporation |
| UHR SG | 4/10 | Serizawa, Kazunobu | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 4/10 | Shen, Andy | Futurewei Technologies |
| UHR SG | 4/10 | Shirakawa, Atsushi | SHARP CORPORATION |
| UHR SG | 4/10 | Song, Hao | Intel |
| UHR SG | 4/10 | Sosack, Robert | Molex Incorporated |
| UHR SG | 4/10 | SUH, JUNG HOON | Huawei Technologies Co., Ltd |
| UHR SG | 4/10 | Tanaka, Yusuke | Sony Group Corporation |
| UHR SG | 4/10 | Taori, Rakesh | Infineon Technologies |
| UHR SG | 4/10 | Tsujimaru, Yuki | Canon Inc. |
| UHR SG | 4/10 | Urabe, Yoshio | Panasonic Holdings Corporation |
| UHR SG | 4/10 | Wang, Chao Chun | MediaTek Inc. |
| UHR SG | 4/10 | Wang, Hao | Tencent |
| UHR SG | 4/10 | Wang, Lei | Futurewei Technologies |
| UHR SG | 4/10 | Wang, Qi | Apple, Inc. |
| UHR SG | 4/10 | Wei, Dong | NXP Semiconductors |
| UHR SG | 4/10 | Yang, Jay | Nokia |
| UHR SG | 4/10 | YANG, RUI | InterDigital, Inc. |
| UHR SG | 4/10 | Yano, Kazuto | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 4/10 | Yee, James | MediaTek Inc. |
| UHR SG | 4/10 | Yi, Yongjiang | Spreadtrum Communication USA, Inc |
| UHR SG | 4/10 | Yoon, Yelin | LG ELECTRONICS |
| UHR SG | 4/10 | Yu, Jian | Huawei Technologies Co., Ltd |
| UHR SG | 4/10 | Zhang, Yan | NXP Semiconductors |
| UHR SG | 4/10 | Zhao, Yue | Huawei Technologies Co., Ltd; |
| UHR SG | 4/10 | Zhou, Pei | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/10 | Zhu, Minchen | XGIMI |

* + Attendee List for 3rd Conf. Call:

|  |  |  |  |
| --- | --- | --- | --- |
| Breakout | Timestamp | Name | Affiliation |
| UHR SG | 4/17 | Aboulmagd, Osama | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Aio, Kosuke | Sony Corporation |
| UHR SG | 4/17 | Ajami, Abdel Karim | Qualcomm Technologies, Inc |
| UHR SG | 4/17 | Ali, Sawaira | Istanbul Medipol University, Vestel |
| UHR SG | 4/17 | Ansley, Carol | Cox Communications Inc. |
| UHR SG | 4/17 | Anwyl, Gary | MediaTek Inc. |
| UHR SG | 4/17 | Asai, Yusuke | NTT |
| UHR SG | 4/17 | Baek, SunHee | LG ELECTRONICS |
| UHR SG | 4/17 | Baykas, Tuncer | Ofinno |
| UHR SG | 4/17 | Bredewoud, Albert | Broadcom Corporation |
| UHR SG | 4/17 | Cao, Rui | NXP Semiconductors |
| UHR SG | 4/17 | Chen, You-Wei | MediaTek Inc. |
| UHR SG | 4/17 | CHENG, yajun | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/17 | Chiang, James | MediaTek Inc. |
| UHR SG | 4/17 | Chng, Baw | BAWMAN LLC |
| UHR SG | 4/17 | Cho, Hangyu | LG ELECTRONICS |
| UHR SG | 4/17 | CHUN, JINYOUNG | LG ELECTRONICS |
| UHR SG | 4/17 | Coffey, John | Realtek Semiconductor Corp. |
| UHR SG | 4/17 | Costa, D.Nelson | Peraso Technologies Incorporated |
| UHR SG | 4/17 | da Silva, Claudio | Meta Platforms Inc. |
| UHR SG | 4/17 | Dong, Xiandong | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/17 | ElSherif, Ahmed | Qualcomm Incorporated |
| UHR SG | 4/17 | Erkucuk, Serhat | Ofinno |
| UHR SG | 4/17 | Fan, Shuang | Sanechips Technology Co., Ltd. |
| UHR SG | 4/17 | feng, Shuling | MediaTek Inc. |
| UHR SG | 4/17 | Fischer, Matthew | Broadcom Corporation |
| UHR SG | 4/17 | Gao, Ning | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/17 | Gu, Xiangxin | Unisoc |
| UHR SG | 4/17 | GUIGNARD, Romain | Canon Research Centre France |
| UHR SG | 4/17 | Guo, Yuchen | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Guo, Ziyang | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Gupta, Binita | Meta Platforms, Inc. |
| UHR SG | 4/17 | Handte, Thomas | Sony Group Corporation |
| UHR SG | 4/17 | Hervieu, Lili | Cable Television Laboratories Inc. (CableLabs) |
| UHR SG | 4/17 | Hsu, Ostrovsky | Xiaomi Communications Co., Ltd. |
| UHR SG | 4/17 | Hu, Chunyu | Facebook |
| UHR SG | 4/17 | HUANG, CHIHAN | MediaTek Inc. |
| UHR SG | 4/17 | Huang, Po-Kai | Intel |
| UHR SG | 4/17 | Inohiza, Hirohiko | Canon |
| UHR SG | 4/17 | Jang, Insun | LG ELECTRONICS |
| UHR SG | 4/17 | Jung, Insik | LG ELECTRONICS |
| UHR SG | 4/17 | Kim, Geon Hwan | LG ELECTRONICS |
| UHR SG | 4/17 | Kim, Sang Gook | LG ELECTRONICS |
| UHR SG | 4/17 | Kim, Sanghyun | WILUS Inc. |
| UHR SG | 4/17 | Kishida, Akira | Nippon Telegraph and Telephone Corporation (NTT) |
| UHR SG | 4/17 | Klein, Arik | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Koundourakis, Michail | Samsung Cambridge Solution Center |
| UHR SG | 4/17 | Lanante, Leonardo | Ofinno |
| UHR SG | 4/17 | Lee, Wookbong | Apple Inc. |
| UHR SG | 4/17 | Levy, Joseph | InterDigital, Inc. |
| UHR SG | 4/17 | Li, Jialing | Qualcomm Technologies, Inc. |
| UHR SG | 4/17 | Li, Weiyi | Spreadtrum |
| UHR SG | 4/17 | li, yan | ZTE Corporation |
| UHR SG | 4/17 | Li, Yapu | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/17 | Lim, Dong Guk | LG ELECTRONICS |
| UHR SG | 4/17 | Lu, Liuming | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/17 | Lumbatis, Kurt | CommScope, Inc. |
| UHR SG | 4/17 | Luo, Chaoming | Beijing OPPO telecommunications corp., ltd. |
| UHR SG | 4/17 | Luo, Yuanqiu | Futurewei Technologies |
| UHR SG | 4/17 | Ma, Yongsen | SAMSUNG ELECTRONICS |
| UHR SG | 4/17 | Ma, Yunsi | HiSilicon (Shanghai) Technologies Co., LTD. |
| UHR SG | 4/17 | MAO, ZHI | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Max, Sebastian | Ericsson AB |
| UHR SG | 4/17 | Miwa, Shinya | Canon Research Centre France |
| UHR SG | 4/17 | Montemurro, Michael | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Motozuka, Hiroyuki | Panasonic Holdings Corporation |
| UHR SG | 4/17 | Namvar, Nima | Charter Communications |
| UHR SG | 4/17 | Noh, Si-Chan | Newracom Inc. |
| UHR SG | 4/17 | Park, Eunsung | LG ELECTRONICS |
| UHR SG | 4/17 | Park, Minyoung | Intel |
| UHR SG | 4/17 | Park, Sungjin | Senscomm |
| UHR SG | 4/17 | Patil, Abhishek | Qualcomm Incorporated |
| UHR SG | 4/17 | Pettersson, Charlie | Ericsson AB |
| UHR SG | 4/17 | Quan, Yingqiao | Unisoc |
| UHR SG | 4/17 | Ratnam, Vishnu | Samsung Research America |
| UHR SG | 4/17 | Serizawa, Kazunobu | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 4/17 | Shen, Andy | Futurewei Technologies |
| UHR SG | 4/17 | Smith, Luther | Cable Television Laboratories Inc. (CableLabs) |
| UHR SG | 4/17 | Song, Hao | Intel |
| UHR SG | 4/17 | Strobel, Rainer | MaxLinear |
| UHR SG | 4/17 | SUH, JUNG HOON | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Sun, Bo | Sanechips |
| UHR SG | 4/17 | Tsodik, Genadiy | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Urabe, Yoshio | Panasonic Holdings Corporation |
| UHR SG | 4/17 | Val, Inaki | MaxLinear, Inc. |
| UHR SG | 4/17 | VIGER, Pascal | Canon Research Centre France |
| UHR SG | 4/17 | Wang, Chao Chun | MediaTek Inc. |
| UHR SG | 4/17 | Wang, Lei | Futurewei Technologies |
| UHR SG | 4/17 | Wang, Qi | Apple, Inc. |
| UHR SG | 4/17 | Wei, Dong | NXP Semiconductors |
| UHR SG | 4/17 | Wentink, Menzo | Qualcomm Technologies, Inc |
| UHR SG | 4/17 | Yamada, Ryota | SHARP CORPORATION |
| UHR SG | 4/17 | Yang, Jay | Nokia |
| UHR SG | 4/17 | YANG, RUI | InterDigital, Inc. |
| UHR SG | 4/17 | Yano, Kazuto | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 4/17 | Yee, James | MediaTek Inc. |
| UHR SG | 4/17 | Yi, Yongjiang | Spreadtrum Communication USA, Inc |
| UHR SG | 4/17 | Yoon, Yelin | LG ELECTRONICS |
| UHR SG | 4/17 | Yu, Jian | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Zhang, Jiayi | Ofinno |
| UHR SG | 4/17 | Zhang, Yan | NXP Semiconductors |
| UHR SG | 4/17 | Zhao, Yue | Huawei Technologies Co., Ltd |
| UHR SG | 4/17 | Zhou, Pei | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 4/17 | Zhu, Minchen | XGIMI |

* + Attendee List for 4th Conf. Call:

|  |  |  |  |
| --- | --- | --- | --- |
| Breakout | Timestamp | Name | Affiliation |
| UHR SG | 5/8 | Aboulmagd, Osama | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Ajami, Abdel Karim | Qualcomm Technologies, Inc |
| UHR SG | 5/8 | Ansley, Carol | Cox Communications Inc. |
| UHR SG | 5/8 | Asai, Yusuke | NTT |
| UHR SG | 5/8 | Asterjadhi, Alfred | Qualcomm Technologies, Inc |
| UHR SG | 5/8 | Baek, SunHee | LG ELECTRONICS |
| UHR SG | 5/8 | Baykas, Tuncer | Ofinno |
| UHR SG | 5/8 | Bredewoud, Albert | Broadcom Corporation |
| UHR SG | 5/8 | Carney, William | Sony Group Corporation |
| UHR SG | 5/8 | Chen, You-Wei | MediaTek Inc. |
| UHR SG | 5/8 | CHENG, yajun | Xiaomi Communications Co., Ltd. |
| UHR SG | 5/8 | Chng, Baw | BAWMAN LLC |
| UHR SG | 5/8 | Cho, Hangyu | LG ELECTRONICS |
| UHR SG | 5/8 | Choi, Jinsoo | LG ELECTRONICS |
| UHR SG | 5/8 | CHUN, JINYOUNG | LG ELECTRONICS |
| UHR SG | 5/8 | Chung, Chulho | SAMSUNG |
| UHR SG | 5/8 | Coffey, John | Realtek Semiconductor Corp. |
| UHR SG | 5/8 | Erkucuk, Serhat | Ofinno |
| UHR SG | 5/8 | Fang, Yonggang | MediaTek Inc. |
| UHR SG | 5/8 | Fischer, Matthew | Broadcom Corporation |
| UHR SG | 5/8 | Ghosh, Chittabrata | Apple Inc. |
| UHR SG | 5/8 | Gidvani, Ravi | SAMSUNG ELECTRONICS |
| UHR SG | 5/8 | Haider, Muhammad Kumail | Meta Platforms Inc. |
| UHR SG | 5/8 | Halasz, David | Morse Micro |
| UHR SG | 5/8 | Hervieu, Lili | Cable Television Laboratories Inc. (CableLabs) |
| UHR SG | 5/8 | Hsu, Ostrovsky | Xiaomi Communications Co., Ltd. |
| UHR SG | 5/8 | Hu, Chunyu | Facebook |
| UHR SG | 5/8 | Hu, Shengquan | MediaTek Inc. |
| UHR SG | 5/8 | HUANG, CHIHAN | MediaTek Inc. |
| UHR SG | 5/8 | Huang, Po-Kai | Intel |
| UHR SG | 5/8 | Inohiza, Hirohiko | Canon |
| UHR SG | 5/8 | Jang, Insun | LG ELECTRONICS |
| UHR SG | 5/8 | Jung, Insik | LG ELECTRONICS |
| UHR SG | 5/8 | Kim, Geon Hwan | LG ELECTRONICS |
| UHR SG | 5/8 | Kim, Myeong-Jin | SAMSUNG |
| UHR SG | 5/8 | Kim, Sanghyun | WILUS Inc. |
| UHR SG | 5/8 | Kishida, Akira | Nippon Telegraph and Telephone Corporation (NTT) |
| UHR SG | 5/8 | Klein, Arik | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Kuo, Chih-Chun | MediaTek Inc. |
| UHR SG | 5/8 | Lalam, Massinissa | SAGEMCOM SAS |
| UHR SG | 5/8 | Lanante, Leonardo | Ofinno |
| UHR SG | 5/8 | Lee, Wookbong | Apple Inc. |
| UHR SG | 5/8 | Li, Weiyi | Spreadtrum |
| UHR SG | 5/8 | Li, Yapu | Guangdong OPPO Mobile Telecommunications Corp.,Ltd |
| UHR SG | 5/8 | Lim, Dong Guk | LG ELECTRONICS |
| UHR SG | 5/8 | Lin, Zinan | InterDigital, Inc. |
| UHR SG | 5/8 | Lu, kaiying | MediaTek Inc. |
| UHR SG | 5/8 | Luo, Yuanqiu | Futurewei Technologies |
| UHR SG | 5/8 | Ma, Yongsen | SAMSUNG ELECTRONICS |
| UHR SG | 5/8 | Ma, Yunsi | HiSilicon (Shanghai) Technologies Co., LTD. |
| UHR SG | 5/8 | Maguluri, Anilkumar | Synaptics |
| UHR SG | 5/8 | MAO, ZHI | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Martinez Vazquez, Marcos | MaxLinear Corp |
| UHR SG | 5/8 | Max, Sebastian | Ericsson AB |
| UHR SG | 5/8 | Monajemi, Pooya | Apple Inc. |
| UHR SG | 5/8 | Motozuka, Hiroyuki | Panasonic Holdings Corporation |
| UHR SG | 5/8 | Namvar, Nima | Charter Communications |
| UHR SG | 5/8 | Nayak, Peshal | Samsung Research America |
| UHR SG | 5/8 | Nezou, Patrice | Canon Research Centre France |
| UHR SG | 5/8 | Ng, Boon Loong | Samsung Research America |
| UHR SG | 5/8 | Noh, Si-Chan | Newracom Inc. |
| UHR SG | 5/8 | Ozbakis, Basak | VESTEL Electronics Corp. |
| UHR SG | 5/8 | Park, Sungjin | Senscomm |
| UHR SG | 5/8 | Patil, Abhishek | Qualcomm Incorporated |
| UHR SG | 5/8 | Patwardhan, Gaurav | Hewlett Packard Enterprise |
| UHR SG | 5/8 | Pettersson, Charlie | Ericsson AB |
| UHR SG | 5/8 | Ptasinski, Henry | Element78 Communications LLC |
| UHR SG | 5/8 | Quan, Yingqiao | Unisoc |
| UHR SG | 5/8 | Rosdahl, Jon | Qualcomm Technologies, Inc. |
| UHR SG | 5/8 | Ryu, Kiseon | NXP Semiconductors |
| UHR SG | 5/8 | Schelstraete, Sigurd | MaxLinear |
| UHR SG | 5/8 | Serizawa, Kazunobu | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 5/8 | Sosack, Robert | Molex Incorporated |
| UHR SG | 5/8 | SUH, JUNG HOON | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Sun, Bo | Sanechips |
| UHR SG | 5/8 | Tanaka, Yusuke | Sony Group Corporation |
| UHR SG | 5/8 | Tsujimaru, Yuki | Canon Inc. |
| UHR SG | 5/8 | Urabe, Yoshio | Panasonic Holdings Corporation |
| UHR SG | 5/8 | Val, Inaki | MaxLinear, Inc. |
| UHR SG | 5/8 | Verma, Lochan | Apple Inc. |
| UHR SG | 5/8 | Wang, Chao Chun | MediaTek Inc. |
| UHR SG | 5/8 | Wang, Lei | Futurewei Technologies |
| UHR SG | 5/8 | Wang, Qi | Apple, Inc. |
| UHR SG | 5/8 | Wu, Kanke | Qualcomm Incorporated |
| UHR SG | 5/8 | Yang, Jay | Nokia |
| UHR SG | 5/8 | Yang, Jimmy | Moxa Inc. |
| UHR SG | 5/8 | Yano, Kazuto | Advanced Telecommunications Research Institute International (ATR) |
| UHR SG | 5/8 | Yee, James | MediaTek Inc. |
| UHR SG | 5/8 | Yi, Yongjiang | Spreadtrum Communication USA, Inc |
| UHR SG | 5/8 | Yoon, Kangjin | Meta Platforms Inc. |
| UHR SG | 5/8 | Yoon, Yelin | LG ELECTRONICS |
| UHR SG | 5/8 | Yu, Jian | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Zhang, Jiayi | Ofinno |
| UHR SG | 5/8 | Zhang, Yan | Apple Inc |
| UHR SG | 5/8 | Zhao, Yue | Huawei Technologies Co., Ltd |
| UHR SG | 5/8 | Zhou, Lei | H3C Technologies Co., Limited |