IEEE P802.11
Wireless LANs

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| AMP SG meeting minutes for January 2024 Interim  |
| Date: 2024-1-30 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Hao Wang | Tencent |  |  | Harryhwang@tencent.com |

Abstract

This document includes minutes of AMP SG Sessions of IEEE January 2024 Interim.

Version Tracking:

R0: Creating the minutes.

# Monday 15 January 2024 @10:30-12:30 am ET

## Opening (IEEE 802.11-23/ 2170 r1)

* 1. Call to order 10:30 am ET.
	2. Chair, Bo Sun (Sanechips), instructed members to record attendance in IMAT.
	3. Chair introduced the patent policy and meeting rules (slides 2-8).
	4. No response to the call for patents.
	5. Chair introduced IEEE-SA COPYRIGHT POLICY (slides 9-10)
	6. Chair reviewed other Guidelines, Participation and Guideline for Straw Polls (slides 11-13).
	7. Chair reviewed Suggested Best Practices, Registration, Meeting plan, current AMP SG Session submission list (slides 14-19).
	8. Hao Wang (Tencent) is the secretary.
	9. Chair call for approval of the agenda of the AMP session.

## Agenda (IEEE 802.11-23/2170 r1)

* 1. Chair presented the agenda: https://mentor.ieee.org/802.11/dcn/23/11-23-2170-01-0amp-amp-sg-meeting-agenda-for-jan-interim-2024.pptx. (slide 22)
		+ Call meeting to order and remind the group to record attendance on imat.ieee.org
		+ IEEE-SA IPR policies and meeting rules
		+ Approve meeting agenda
		+ Approve past meeting minutes
		+ AMP SG timeline and progress review
		+ ITU-T SG20 Liaison Response (11-23/2203) discussion
		+ Contribution discussion
			- 11-23/0436r1, Updated Technical Report on support of AMP IoT devices in WLAN, Yinan Qi (OPPO)
			- 11-24/0047, AMP Station operation states, Solomon Trainin (Wiliot)
		+ Any other business?
		+ Recess
	2. No objection, Agenda approved.

## Approve AMP SG meeting minutes

* 1. Motion to approve the AMP SG meeting minutes since November 2023.

Approve the meeting minutes for AMP SG meetings during 802 Nov plenary session as below:

* + - https://mentor.ieee.org/802.11/dcn/23/11-23-2158-00-0amp-802-11-amp-sg-meeting-minutes-for-november-2023-plenary.docx

Moved: Harry Hao Wang

Seconded: Yinan Qi

Result: Approved with unanimous consensus

## AMP SG Timeline Plan (IEEE 802.11-23/2170 r1)

* 1. Chair reviewed the AMP SG time plan.

## ITU-T SG20 Liaison (11-23/2203) discussion

* 1. Review of IEEE 802.11-23/2203r0, AMP STA, Weijie Xu (OPPO)

C: PAR is not approved yet, should not be included in the response. But mentioning the progress and direction of the group is OK.

C: TIG report may be good to be included since it has been approved by the WG.

C: Update on the report during the SG phase should also be mentioned in the response.

C: ITU sends the similar liaison request to other SDO. For example, 3GPP responded already. It will be appreciated to send the response as early as possible.

C: It is suggested to consult with ITU Adhoc group for advices.

The document will be updated and presented on Tuesday session.

## Contribution discussion

* 1. Presentation of IEEE 802.11-23/0436r1, Updated Technical Report on support of AMP IoT devices in WLAN, Yinan Qi (OPPO)

No questions.

* 1. Presentation of IEEE 802.11-24/0047, AMP Station operation states, Solomon Trainin (Wiliot)

C: Idle state is already defined in the spec. It will need more granularity for AMP STA, for example, Idle from communication, or idle because of out of power.

Q: If AMP STA is out of power, how AP knows to what to do? This term is used for the AMP only STA?

A: AP doesn’t know the power state of the STA.

Q: There are also definitions for the states of a STA in the spec, e.g association state. I suggest to avoid the term of ‘STA operation state’ because it is too general and confusion. And we need to define the new term to fit in the existing standard context.

A: Agree. Operation means something and better add ‘energy’ in a way.

Q: Operation states and power may be related to the memory type. Some requires energy to keep the information. ‘Memory retention in active low state’ means what?

A: The assumption is not to have memory retention for the tag. The tag ID doesn’t require memory, it is a hardware attached to the tag. The memory retention is only for short time and for temporary information.

Q: The AMP tag can be active for short time, the typical case may require Trigger frame to transmit its ID. Is it necessary to define the gap between Tx and Rx?

A: Active high is required for transmission.

Q: Based on the description, the difference seems to be the memory retention. We need more work to define active low state. Memory retention is not a unique feature for active low Rx.

A: We are talking about the state where energy is used to keep the information and can’t transmit.

Q: The contribution is similar to our proposal of ‘energy limited operation’. The feature related to communication should be clarified. Some may impact the design of standard. In this figure, Idle state doesn’t consume power just do energy harvest. The efficiency of energy harvest has impact on the operation. In RFID case, the average harvest power equals to the average consumed power, so there is no active low state. To the previous commentor, the reader may estimate the time required to power the tag and send the trigger signal.

A: will discuss offline.

Q: What is the major difference between active low state and idle state?

A: Active low means smaller amount of energy but not enough. Idle state means the STA can’t do anything but harvest power.

Q: Should not mix states and energy harvest. It is not mandatory to use energy harvest for all AMP STAs. There could be multiple options for the AMP STA to gain energy.

A: There could be multiple energy supplies.

C: It is not necessary to communicate for the non-AP STA to associate first, examples are like 11bc.

Comment in the chat: Firstly, energy harvesting can be continuous, regardless of any state. Currently, it appears that the goal is to distinguish between two states: whether sta or tag is consuming energy; when collecting without consuming energy, it is an idle state; when low energy consuming, it is only storing memory related actions; when RX or TX is turned on, it is a high energy consuming state; My suggestion is to have a low energy state, not limited to storage. I am not sure, but it may be related to other behaviors such as clocks that do not transmit but still consume lower energy.

## Recess

* 1. The chair announced the session recessed at 12:22 pm ET.
	2. Next session will be on Jan 16th.

# Tuesday 16 January 2024 @ 10:30-12:30 pm ET

## Opening (IEEE 802.11-23/2170 r2)

* 1. Call to order 10:30 pm ET.
	2. Chair, Bo Sun (Sanechips), instructed members to record attendance in IMAT.
	3. Chair introduced the patent policy and meeting rules (slides 2-8).
	4. No response to the call for patents.
	5. Chair introduced IEEE-SA COPYRIGHT POLICY (slides 9-10)
	6. Chair reviewed other Guidelines, Participation and Guideline for Straw Polls (slides 11-13).
	7. Chair reviewed Suggested Best Practices, Registration, Meeting plan, current AMP TIG Session submission list (slides 14-19).
	8. Hao Wang (Tencent) is the secretary.
	9. Chair call for approval of the agenda of the AMP session.

## Agenda (IEEE 802.11-23/ 2170r2)

* 1. Chair presented the agenda:
		+ Call meeting to order and remind the group to record attendance on imat.ieee.org
		+ IEEE-SA IPR policies and meeting rules
		+ Approval of agenda
		+ Liaison Response to ITU-T SG20 discussion (11-23/2202)
		+ Contribution discussion
			- 11-24/0056, How 11ba Handled SNR, Steve Shellhammer (Qualcomm)
			- 11-24/0075, Follow Up on AMP Link Budgets, Wei Lin (Huawei)
		+ Any other business?
		+ Recess
	2. No objection, Agenda approved.

## - Liaison Response to ITU-T SG20 discussion (11-23/2202)

* 1. Review of IEEE 802.11-23/2202r6, Draft Response to ITU-T SG20 LS on the draft Technical Report ITU-T YSTR.Ambient IoT, Yinan Qi (OPPO)

C: Last reference, the TIG report is representing the group. The names of the editors could be removed.

## Contribution discussion

* 1. Presentation of IEEE 802.11-24/0056, How 11ba Handled SNR, Steve Shellhammer (Qualcomm)

Q: Slide 7, the antenna gain should be included but not for FCC. The power limit is affected by the antenna gain. But the relative comparison is OK. What is the purpose to include 4Mhz? The AMP STA may only transmit in low data rate.

A: MC-OOK using OFDM allows to use 20Mhz waveform with only a number of tones. The symbol rate is slow. It is a tradeoff of tx power limit and rx filter performance.

Q: In the table, 5.8 Ghz band is not available in Europe. There is no RLAN assignment for that band but there is Short Range Device (SRD) assignment for that band. Those devices can use up to 25mW power for transmission. Some in-vehicle devices use that band, refer to EN 300440.

A: The table means there is no PSD limit on that UNII-3 band.

Q: Slide 2, the method to detect the SNR. These two methods both are useful for AMP depending on the use case. If radio wave is used to provide power, the bottleneck of the coverage will be the power transfer. The threshold for RF transfer is -30dBm. The rx sensitivity should be close to that threshold. The SNR requirement will be relax. In another use case, the AMP STA should have the same high rx sensitivity as the legacy, e.g -40dBm, in order to use the existing infrastructure.

A: Agree. The energizer could be collocated with the radio part, the SNR could be high.

Q: Slide 3, the existing WUR design can support different kinds of architecture. The noise bandwidth could be different, so this issue should be discussed case by case.

A: Agree to use the band definition instead of the 20Mhz channel. More review on 11ba is needed. Generic model should be used in the simulation.

Q: Slide 5, WUR has 8dB higher noise figure than the legacy. The relax requirement is to support simplified receiver. In the future, we can support different architecture.

A: This 8dB comes from our implementation. Will discuss the details in March meeting.

Q: We support option 2 on slide 2. We think 20Mhz has advantage for the power limitation. The 8dB noise figure seems too low. Do you also consider sub-1Ghz band?

A: We consider two implementation scenarios, one is that energizer collocate with the transmitter, we don’t need to consider 11ba parameters. There will be no SNR problem. Two is with other power source and outdoor use cases. You need to consider the SNR problem. The number is open to discussion. In terms of the bandwidth, we lose 4dB in certain areas by the smaller bandwidth. If we get to close to 20Mhz, it will have adjacent channel problems. It is a tradeoff.

Q: Do you consider to use 11ba waveform in Sub-1Ghz?

A: We like the general methodology for both 2.4Ghz and Sub-1Ghz. It will be meaningful discussion to harmonize tech for both frequency band.

Q: 11ba uses 20Mhz legacy preamble followed by 4Mhz WUR frame. Does it follow 20Mhz legacy regulation or 4Mhz regulation?

A: Legacy preamble is short in time, most time is used for 4Mhz signal. WUR signal should comply with the regulatory requirement. Limited by 10dB/Mhz.

Q: Why define 4Mhz waveform for 11ba? There may multiple bandwidth for the AMP receiver.

A: There is tradeoff between power and receiver complexity.

* 1. Presentation of IEEE 802.11-24/0075, Follow Up on AMP Link Budgets, Wei Lin (Huawei)

Q: Slide 7, would it be accurate to say the distance for the mean received signal. Channel D doesn’t tell the received power of the link, only the mean path loss.

A: In simulation, the path loss for Channel D could be varied.

C: When you consider dynamic range for backscatter, some device may move the signal to different channel so that isolation may increase.

Q: Slide 2, please clarify the TX LNA component. Are you assume synchronization to be considered in the standard between reader and tag? Do you consider LoS channel between the reader and tag?

A: TX LNA follow the settings by previous contribution. We don’t discuss details here but there should be synchronization between the reader and tag. Certain deployment will ensure the LoS channel.

C: For the backscatter case, the coverage will be limited because of the dynamic range of the reader. But if we assume smartphone as the reader, there will be 20-30dB isolation and distance could be longer. In case 3, -45dBm is not the energy harvest threshold. There will be other source of power. The coverage of the power supply is not the bottleneck.

Q: Slide 8, the right column, what are the assumptions of the Tx power of the energizer?

A: We just consider the worst case. The Tx power is just enough to activate the tag.

C: The limit of Tx EVM could be 50dB. The standard definition is conservative. Further processing is needed to support the 50dB signal detection.

## Recess

* 1. The chair announced the session recessed at 12:25 pm ET.
	2. Next session will be on January 18th.

# Thursday 18 January 2024 @ 1:30-3:30 pm ET

## Opening (IEEE 802.11-23/ 2170 r3)

* 1. Call to order 1:30 pm ET.
	2. Chair, Bo Sun (Sanechips), instructed members to record attendance in IMAT.
	3. Chair introduced the patent policy and meeting rules (slides 2-8).
	4. No response to the call for patents.
	5. Chair introduced IEEE-SA COPYRIGHT POLICY (slides 9-10)
	6. Chair reviewed other Guidelines, Participation and Guideline for Straw Polls (slides 11-13).
	7. Chair reviewed Suggested Best Practices, Registration, Meeting plan, current AMP TIG Session submission list (slides 14-19).
	8. Hao Wang (Tencent) is the secretary.
	9. Chair call for approval of the agenda of the AMP session.

## Agenda (IEEE 802.11-23/ 2170 r3)

* 1. Chair presented the agenda:
		+ Call meeting to order and remind the group to record attendance on imat.ieee.org
		+ IEEE-SA IPR policies and meeting rules
		+ Approval of agenda
		+ Motion on Liaison Response to ITU-T SG20 (11-23/2202)
		+ Contribution discussion
			- 11-24/0112, Uplink Modulations Comparison for AMP Devices, Amichai Sanderovich (Wiliot)
			- 11-24/0163, Update on Dual-Band Operation, Joerg Robert (TU Ilmenau / Fraunhofer IIS)
			- 11-24/0178, Security Considerations in Ambient Power Communications, Hui Luo (Infineon Technologies)
		+ Teleconference Plan
		+ Any other business?
		+ Adjourn
	2. No objection, Agenda approved.

## Liaison Response Motion

* 1. Motion #1:

Move to submit the document 11-23/2202r6 to 802.11 WG for approval as the

IEEE 802.11 liaison response to ITU-T SG20 liaison on AMP tech report, allowing the WG chair editing privilege.

<https://mentor.ieee.org/802.11/den/23/11-23-2202-06-0amp-draft-response-to-itu-t-sg20-Is-on-the-draft-technical-report-itu-I-ystr-ambient-iot.dox>

Moved: Yinan Qi

Seconded: Sebastian Max

Result: 37Y/0N/5A, Passed

## Technical Contribution

* 1. Update of IEEE 802.11-24/0112, Uplink Modulations Comparison for AMP Devices, Amichai Sanderovich (Wiliot)

Q: I support FSK and BPSK for uplink, don’t like OOK. Question on power consumption on BPSK, why it is so high for BPSK.

A: Switching phase is not simple, it requires additional component to fine tune transceiver. The phase is not continuous.

Q: What do you think other required data rate for uplink?

A: It is a tradeoff between the channel and power consumption. We would like to see higher data rate.

Q: You don’t mention filtering. There will be out of band emission for FSK.

A: We’d like to avoid filtering regarding the low transmit power.

Q: You mention QPSK and high order FSK. Are u considering only binary modulation?

A: Open to high order modulation which can provide some benefit.

Q: Slide 5, OOK and FSK requires local oscillator? I think backscatter case doesn’t need it?

A: This is the analog front, not the actual system. Both backscatter and active mode will derive the system clock from the same clock.

Q: If the clock is to control the OOK, it will run in low frequency. The data rate is only several hundred kilo hertz. The power consumption for the oscillator will be low.

A: Agree, but this contribution doesn’t take the digital part into account.

C: There may be some other considerations for backscatter. The power could be generated by the infrastructure and the backscatter just flip bits. The PHY could be in low power and robust. The modulation listed here don’t offer multipath diversity. We consider to use BPSK together with DSSS.

Q: Slide 7, DC has impact to OOK. It seems that OOK works in high SNR region?

A: OOK is sensitive to energy out, it transmit nothing for bit zero. But other modulation needs to transmit signal for zero. So it is limited to high SNR.

* 1. Update of IEEE 802.11-24/0163, Update on Dual-Band Operation, Joerg Robert (TU Ilmenau / Fraunhofer IIS)

Q: Slide 12, the proposed operation is that the integrator transmits on Sub-1Ghz and passive AMP transmits on 2.4Ghz. It will need big SC shift which is difficult for AMP STA.

A: Agree. Backscatter doesn’t fit this situation, so active transmission is needed.

Q: Slide 11, you mention 2.4Ghz low rate communication with high power. In our analysis, backscatter only needs 0dB Tx power for close range communication.

A: Agree. But the range is limited.

Q: In existing devices, there are support for Sub-1Ghz. It is only for GPS kind of communication and Rx only.

A: Smartphones support these bands for cellular in US and EU.

Q: What is the target range for backscatter for AMP?

A: Not decided but 10m communication range is preferred.

Q: Slide 4, the backscatter is doing the full duplex with the frequency shift, how much cost will be added to the tag?

A: It is already done in RFID. It is not new. We show demos shifting 50Mhz. The main issue is the power, 1 micro watts for 1 mega hertz. But you need spectrum to do that.

Q: DL on 900Mhz band provides power to the STA, in addition, frequency clock can also use 900Mhz band. This could be a implementation for the receiver loop. It may require several micro watts.

A: No specific numbers yet.

Q: Suggest to have two modes, power supply can provided on both 2.4Ghz and Sub-1Ghz band.

A: Agree. It depends on the communication range.

Q: Slide 12, is the DL signal on Sub-1Ghz band?

A: It is an active transmitter, because backscatter only shift in mega hertz level. DL is on the Sub-1Ghz band. The data rate is low.

Q: The 2.4Ghz frequency is derived from the DL energizer?

A: It depends on implementation. But it is possible to derive from DL signal.

Q: DL and UL works on different frequency band. It may require major change on the standard.

A: Yes, but it is necessary.

Q: Slide 4 on backscatter, it would be better to reuse current WiFi, and the signal bandwidth is wider. The Sub-1Ghz signal may not be detected. The device has to work in the dynamic range, so the communication range is shorter.

A: Longer range can be achieved by freq shift. There are limitations for low complexity. The range has to be decided.

* 1. Update of IEEE 802.11-24/0178, Security Considerations in Ambient Power Communications, Hui Luo (Infineon Technologies)

No time for discussion.

## Teleconference Plan

The following teleconference plan is approved:

* + - Feb 6th, 9:00am, ET; 2 hours, webex
		- March 5th, 10:00am, ET; 2 hours, webex

## Adjourn

* 1. The group finished all the work.
	2. The chair announced the session adjourned at 3:30 pm ET.