IEEE P802.11
Wireless LANs

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| IEEE 802.11 TGbp Ambient Power CommunicationTeleconference Minutes August - September |
| Date: 2024-08-19 |
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Abstract

This document contains the IEEE 802.11 TGbp minutes for the teleconferences in August and September 2024.

Rev 0: Minutes for the IEEE 802.11 TGbp teleconference on 2024-08-06 added

Rev 1: Revised list of attendees on 2024-08-06

Rev 2: Fixed typo

Rev 3: Minutes for the IEEE 802.11 TGbp teleconference on 2024-09-03 added

TG Chair: Bo Sun (Sanechips)

TG Vice Chairs: Steve Shellhammer (Qualcomm)

 Rakesh Taori (Infineon)

TG Secretary: Sebastian Max (Ericsson)

TG Technical Editor: Yinan Qi (OPPO)

Abbrevations:

Q Question

A Answer

C Comment

SP Straw Poll

# Tuesday, August 06 2024, 09:00 - 11:00 (EDT)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1379r1).

* Chair calls the meeting to order at 09:00 EDT.
* Chair instructs members to record attendance in IMAT.
* Chair reviews the meeting rules and patent policy (slides 2-8).
* No response to the call for patents.
* Chair reviews IEEE-SA COPYRIGHT POLICY (slides 9-10)
* Chair reviews other Guidelines, Participation, Suggested Best Practices (slides 11-12).
* Chair reviews the current TGbp session submission list (slide 13), and the meeting agenda for the telephone conference (slide 16).

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1379r01 (slide 16).

* + 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
	+ Contribution discussion
		- 11-24/1214, Carrier PPDU Discussion for Long-range Backscatter Operation, Bin Qian (Huawei)
		- 11-24/1345, High-Level Requirements for Downlink PHY in 2.4 GHz, Steve Shellhammer (Qualcomm)
		- 11-24/1381, AMP Device Power Status, Yinan Qi (OPPO)
		- TBD
	+ Any other business?
	+ Recess

Chair calls for approval of the agenda of the TGbp session.

No discussion, no objection, agenda approved.

## Contributions

### Presentation of IEEE 802.11-24/1214r2, Carrier PPDU Discussion for Long-range Backscatter Operation, Bin Qian (Huawei)

Q: Is the proposal applicable in the 2.4GHz band?

A: Yes.

Q: Slide 9. Carrier Symbols, is that a narrowband carrier?

A: Could be existing Wi-Fi PPDU. May also use narrowband. It is open for now.

C: From the European Regulations, maximum transmit power is limited for a narrowband signal, limiting the distance to a few cm.

Q: Backscatter signal requires ~1ms charging according to a presentation in the past meeting for monostatic backscattering. Is this also needed here?

A: Yes. Although topology is different with bistatic backscatter, other procedures will be very similar. Activation of the tag will require energy.

Q: The tag should wait for a certain duration to reduce interference with the signal / the reference symbols. Why not add a wakeup-pattern in the PPDU to signal the tag when to start?

A: Yes, that is also possible. However, complexity is a concern. Tag needs to detect the pattern, increasing the complexity.

Q: Reference symbols – we can also use the Wi-Fi preamble? Why do we need the reference symbols?

A: Reference symbols are dedicated to measure the leaky channel / self-interference.

Q: There might also be a DL part in the PPDU. This can be used to synchronize the tag, then there's no need to use a timer.

A: The DL PPDU is send by the AMP reader, not by the carrier source. So there's a gap from the DL PPDU and the carrier PPDU.

Q: AMP tag can decode the DL PPDU, and then set its timing as given by the AMP reader. Then, the AMP reader controls the carrier source. So the carrier PPDU can be aligned.

A: The clock error of the AMP tag may be very high, 100k ppm. The time drift is significant.

Q: Time difference cause by the clock inaccuracy is ~1µs, it cannot be handled by the AMP reader?

A: Time drift can be up to 10%. So it can be up to ~4µs.

Q: What about charging at sub-1GHz for the bi-static apprach?

A: It could be charged at sub-1GHz. But the input carrier should be at 2.4GHz. Otherwise, a big frequency shift is needed, with high AMP tag complexity.

Q: Slide 6. It looks very similar to close-range (monostatic) backscatter. Can the design be harmonized for both approaches?

A: Yes.

### Presentation of IEEE 802.11-24/1345r0, High-Level Requirements for Downlink PHY in 2.4 GHz, Steve Shellhammer (Qualcomm)

Q: Slide 5. Energy is not harvested from the 2.4GHz radio?

A: Yes, it is not suggested here. No comment here in the presentation from where the energy is from.

Q: SP1. Does it make sense to include a "Legacy Preamble"?

A: Yes, I will update.

Q: SP3. Are there implications of a DL rate of 1Mb/s on the complexity?

A: Symbols are shorter with 1Mb/s, so sampling has to be faster. In a high SNR case, a 1-bit ADC is sufficient. Number of samples remains the same.

Q: But with a higher sampling rate the power consumption is increased?

A: Yes, but the duration decreases, so we'll save power. Total power consumption will be less.

Q: SP2. Is this targeting the integrated energizer case?

A: Yes. It targets all cases with a ~70dB link budget. Could also be the bistatic backscatter case.

Q: There might be scenarios where a longer sync field / lower rates are needed.

A: We already have the currently defined 11ba sync field with the lower rate in the standard, which can be re-used.

C: Suggestion to rephrase to not exclude longer sync fields / lower rates: "One of the ...".

C: SP2 and SP3: We are evaluating energy consumption of 11ba reception. We have an issue with higher rates. So, such a proposal will not be suitable for all solutions, especially with energy harvesting.

A: Very interesting, like to hear more about the experiments / evaluations.

C: Currently we don't have an SRD as mentioned in some of the SPs.

A: Some of the SPs are for the FRD, for the others we can discuss the timing or reword.

### Presentation of IEEE 802.11-24/1381r0, AMP Device Power Status, Yinan Qi (OPPO)

Q: Slide 4. AC\_BK is agreed. How can there be further sub-categories for AMP? Is that applicable to all device types?

A: Yes, it can be applied to all categories of devices. Might also consider a mixture of backscattering and active transmissions. Backscattering is always controlled by the AP due to the trigger-only mode. So, the AP can choose the device with a low power level. Otherwise, the AMP device might go to sleep.

Q: So, the scheduling is up to the AP? Is there a need to standardize this?

A: How to handle the power status is implementation specific. We need to specify the exchange of the power status information.

Q: Slide 5, regarding the energy storage draining rate. Is this from an AP perspective, can the AP compute the draining rate?

A: If the remaining power is reported frequently, it is no needed. But also the remaining power can be calculated from the current power and the draining rate, if reported to be AP.

Q: Energy storage may drain at a different rate depending on the device type. There are a lot of options.

A: Draining rate should be the base power consumption to keept the device alive.

Q: Some of the features are static, i.e., capabilities. Others are dynamic, for example the current power level, and can be reported. But what if the report of the dynamic values itself consumes energy.

A: Actual power after the report can be different as in the report due to the power consumpted for the reporting. However, details can be considered later. The goal is to optimize the power transmission to the AMP STAs and give the AP sufficient information.

C: Transmission of the report might consume a lot of energy, more than just transmitting the id.

C: Understand report of the energy harvesting rate. But not for the other reports – it will consume too much energy.

A: It depends on how often the report is done. Some reports can be done with a very long interval. For energy transfer the report is needed – otherwise, the energy transfer is done randomly, which is not efficient.

C: Slide 7, channel access priority. This is about the order of the AP triggering the AMP STA, not the channel access priority (which is AC\_BK). Access category is not the right word.

C: Suggest to come up with a "best case" calculation that shows a report as described in the presentation can provide a gain, although it consumes energy.

C: You consider only AP-triggered transmissions. There are use cases which are event-driven (e.g., a doorbell).

C: There might be use cases that use out-of-band methods or "onboarding" to send the capabilities to the AP. We should not mandate any form of reporting.

C: Drain rate may change quickly over time. The reports should be simple.

A: Agree that reporting does not have to be mandatory. In some scenarios there might be no need to report.

## Adjourn

The chair announced the session adjourned at 10:51 EDT.

Next session will be the teleconference on September 3rd.

Next hybrid (face to face & online) session will be the IEEE 802 wireless interim meeting starting from September 8th.

## List of Attendees

Amichai Sanderovich, Wiliot

Bin Qian, Huawei

Bo Sun, Sanechips

Clemens Korn, Fraunhofer IIS/TU Ilmenau

Hui Luo, Infineon

Ian Bajaj, Huawei

Jinho Choi, Samsung Electronics

Joerg Robert, TU Ilmenau / Fraunhofer IIS

Juan Fang, Intel

Junghoon Suh, Huawei

Lei Huang

Mahmoud Hasabelnaby, Huawei

Manideep Dunna, Qualcomm

Osama Aboul-Magd, Huawei

Ouzane Riadh, VESTEL, IMU

Panpan Li, Huawei

Pooria Pakrooh, Qualcomm

Rakesh Taori, Infineon Technologies

Rani Keren, Huawei

Riadh Ouzane, IMU, VESTEL

Rojan Chitrakar, Huawei

Rui Cao, NXP

Sebastian Max, Ericsson

Shimi Shilo, Huawei

Shuqiao Chen, Huawei

Solomon Trainin, Wiliot

Steve Shellhammer, Qualcomm

Taeyoung Ha, Samsung Electronics

Wei Lin, Huawei

Weijie, OPPO

Yaron

Yinan Qi, OPPO

Ying Wang, InterDigital

You-Wei Chen, Mediatek

Zhanjing Bao, TCL

Zhongjiang Yan, Northwestern Polytechnical University

# Tuesday, September 03 2024, 10:00 - 12:00 (EDT)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1379r2).

* Chair calls the meeting to order at 10:00 EDT.
* Chair instructs members to record attendance in IMAT.
* Chair reviews the meeting rules and patent policy (slides 2-8).
* No response to the call for patents.
* Chair reviews IEEE-SA COPYRIGHT POLICY (slides 9-10)
* Chair reviews other Guidelines, Participation, Suggested Best Practices (slides 11-12).
* Chair reviews the current TGbp session submission list (slide 13), and the meeting agenda for the telephone conference (slide 18).

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1379r2 (slide 18).

* + 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
	+ Contribution discussion
		- 11-24/1475, Discussion on ultra-low power timing clock, Weijie Xu (OPPO)
		- 11-24/1495, Draft of Specification Framework for TGbp, Yinan Qi (OPPO)
		- 11-24/1496, PPDUs in AMP, Bin Qian (Huawei)
	+ Any other business?
	+ Recess

Chair calls for approval of the agenda of the TGbp session.

No discussion, no objection, agenda approved.

## Contributions

### Presentation of IEEE 802.11-24/1475r0, Discussion on ultra-low power timing clock, Weijie Xu (OPPO)

Q: Table on slide 9. There are typically two clocks in a transceiver: One for PHY operation, that is active during rx/tx; one for sleep mode, a "real-time clock". For which one are the values?

A: PHY clock should be 1ppm. Example 1 (slide 8) discusses the accuracy of the "real-time clock" which controls the sleep durations. Example 2 (slide 8) is a "PHY clock", as the PHY is on during this time.

Q: 10^4ppm should be + or - 10^4ppm.

A: Yes, the clock error can be positive or negative.

A: The implementation can also be a single clock, but in different states, resulting in different accuracies.

Q: Slide 9. About "close range AMP IoT backscattering". How does it send anything if it has no energy storage?

A: It assumes a very short operation distance, few 10s of cm. The device can harvest power from the AP.

Q: But what does it do with the harvested power?

A: The operation is similar to RFID. See slide 5. Power storage enables accumulation of energy.

Q: Tx (and probably Rx operation) need ~1MHz clock. They consume ~1µW according to the literature. The table in slide 10 shows nW consumption, but the frequencies are much lower (kHz range). The power consumption is frequency dependent. It's hard to accept that a "PHY clock" with ~1MHz consumes less than 1µW.

A: Legacy operation clock consumption is several mW. It uses a crystal-based oscillator, with an accuarcy of 20ppm. Here, we need to relax the requirement of the clock to support also low-power clock. RFID devices also have a low-power clock. This can oscillate with 2MHz, consuming few µW, using a silicon-based clock.

C (from chat): RFID app 100nW @ 1.2MHz but 10% accurracy.

Q: Slide 10. What is the reference for "Table 2" and "Figure"?

A: Will be given in an updated revision.

Q: Slide 10, Table 2: Frequency row has "kHz" as unit. The middle ones have "Hz" as unit?

A: Yes.

Q: So this (including the power consumption) is not for the "PHY clock"?

A: Yes, this is at a very low frequency.

Q: And the PHY MHz clock has a much higher power consumption?

A: No, the MHz clock will be generated based on the lower frequency clock.

Q: If the baseband clock is derrived from the internal clock, what frequency can be generated?

A: Any kind of frequency range can be generated. The key is the accuracy.

Q: Then what's the power consumption of the derrived baseband clock?

A: Need to investigate.

### Presentation of IEEE 802.11-24/1495r0, Draft of Specification Framework for TGbp, Yinan Qi (OPPO)

C: There is a typo in the general description under MAC/PHY sections (to be fixed in rev 1).

Q: We've just talked about clock accuracy. Would this go in this document (SFD), or in the functional requirement document (FRD)?

A: This would go to the FRD; text for the draft of the spec would go into the specification framework document.

Q: Talking about frame formats. They don't belong in PHY or MAC and should have an individual section. TGbn has it done like this.

A: If the group agrees on that we can have a separate section.

C: The content of the SFD will be filled by editing instructions, coming out of motion texts. The editor may refine the structure, for example by ordering items. The editor should have the power to define the structure of the document.

C: Suggest to change the title of the document, remove "draft".

C: This should be decided in the meeting during next week with its own motion.

C: There might be an additional section on the architecture, for example to describe new type of nodes.

C: SFD vs. FRD. The FRD should include high-level statements, e.g., shall have a clock of x ppm accuracy. SFD should be on a feature level and describe methods to achieve the requirements.

Q: Will a document be ready for immediate changes (via motions) next week during the meeting?

A: Plan is to have a TG motion to approve the SFD baseline with almost empty content early in the meeting week. From then on, any motion may add text to the SFD.

A: A new revision of the document will be generated, with two additional sections (architecture and frame formats).

### Presentation of IEEE 802.11-24/1496r0, PPDUs in AMP, Bin Qian (Huawei)

Q: Slide 6. On the PPDU format, what are the assumptions? The energizer symbols will only be transmitted in 1GHz. Is the PPDU transmitted on multiple bands, with pieces in different bands?

A: This is for a sinlge band. The energizer symbols are in 2.4GHz. We're open to extend this to sub-1GHz, maybe with modifications.

Q: What do the energizer symbols carry?

A: They have two purposes. Wake-up AMP tag and signal reflection for backscatter. See Slide 5. DC-PPDU here is only consisting of energizer symbols, this is for the wake-up case. After that (Slide 6), the AP may transmit control data and based on the energizer symbols the tag can generate the backscatter signal.

Q: Are you assuming a co-located data transmitter & energizer?

A: For backscatter we consider two topologies, one of them is mono-static.

Q: Slide 7. Uplink PPDU, that is for active transmission. But what about the backscattering case?

A: Backscatter devices PPDU is not independent. But it might be similar to what is on slide 7 (without the preamble).

Q: Terminology should be different, in 2.4GHz the "Energizer Symbols" used for the backscattering should be named different to set them appart from the energizing function in sub-1GHz.

A: Agree, we may need better terminology.

Q: Why did you remove the "reference symbol" for interference calculation?

A: This is not removed, but part of the "Energizer Symbols".

Q: What is the length of the reference symbol?

A: Maybe 8µs.

C: Slide 7. Even for backscattering the reflected signal should be interpreted as uplink PPDU.

A: Active devices may use FSK modulation for the data field, backscattering OOK for simplicity. We need to look into aligning these; the device types will have different capabilities.

C: We should think if we shall use a different / more appropriate name for the "Wireless Power Transfer".

## Adjourn

The chair announced the session adjourned at 12:00 EDT.

Next session will be during the hybrid (face to face & online) session will be the IEEE 802 wireless interim meeting starting from September 8th.

## List of Attendees

Breakout Timestamp Name Affiliation

TGbp 2024-09-03 Qi, Yinan Guangdong OPPO Mobile Telecommunications Corp.,Ltd

TGbp 2024-09-03 Choi, JinHo SAMSUNG ELECTRONICS

TGbp 2024-09-03 Max, Sebastian Ericsson AB

TGbp 2024-09-03 QIAN, BIN Huawei Technologies Co., Ltd.

TGbp 2024-09-03 Kezys, Vytas HaiLa Technologies

TGbp 2024-09-03 Kain, Carl USDOT; Noblis

TGbp 2024-09-03 Costa, D.Nelson HaiLa Technologies

TGbp 2024-09-03 Bajaj, Ian Huawei International Pte. Ltd.

TGbp 2024-09-03 Bower, Patricia HaiLa Technologies, Inc

TGbp 2024-09-03 Wang, Ying InterDigital

TGbp 2024-09-03 Taori, Rakesh Infineon Technologies

TGbp 2024-09-03 Trainin, Solomon Wiliot

TGbp 2024-09-03 Amtmann, Franz NXP

TGbp 2024-09-03 Campiglio, Ugo Cisco Systems, Inc

TGbp 2024-09-03 Asterjadhi, Alfred Qualcomm, Inc

TGbp 2024-09-03 Shellhammer, Stephen Qualcomm Incorporated

TGbp 2024-09-03 Hasabelnaby, Mahmoud Huawei Technologies Canada; Huawei Technologies Co., Ltd

TGbp 2024-09-03 Sun, Bo Sanechips Technology Co., Ltd.

TGbp 2024-09-03 Dunna, Manideep Qualcomm

TGbp 2024-09-03 Huang, Lei Huawei International Pte Ltd

TGbp 2024-09-03 Xu, Weijie Beijing OPPO telecommunications corp., ltd.

TGbp 2024-09-03 Ha, Taeyoung Samsung Electronics Co., Ltd.

TGbp 2024-09-03 Regev, Dror Huawei

TGbp 2024-09-03 McCann, Stephen Huawei Technologies Co., Ltd