IEEE P802.11
Wireless LANs

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| IEEE 802.11 TGbp Ambient Power CommunicationSeptember 2024 Plenary Meeting MinutesWaikoloa Village, Hawaii, USA |
| Date: 2024-09-17 |
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Abstract

Rev 0: This document contains the IEEE 802.11 TGbp September 2024 Interim meeting minutes.

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

All times are given in local time of the meeting venue (i.e., HST / UTC-10)

# Monday AM2 (2024-09-09T10:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r3).

* Chair calls the meeting to order at 10:30.
* 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, and Registration (slides 11-14).
* Chair reviews the current TGbp session submission list (slides 15 to 18), the meeting agenda for the week (slide 19), and the distribution of submissions to the meeting slots.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r3 (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 TG minutes
* SFD skeleton discussion (11-24/1495) [15 mins]
* Contribution discussion (Functional Requirements) [25 mins for each w/o prior request]
	+ 11-24/1345, High-Level Requirements for Downlink PHY in 2.4 GHz, Steve Shellhammer (Qualcomm)
	+ 11-24/1475, Discussion on ultra-low power timing clock, Weijie Xu (OPPO)
	+ 11-24/1537, Wireless connectivity challenges for AMP only IoT devices under 802.11 specification, Solomon Trainin (Wiliot) [30 mins]
* Any other business?
* Recess

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

No discussion, no objection, agenda approved.

## Motion: Approve TGbp Meeting Minutes

Approve the meeting minutes for TGbp meetings during 802 Jul plenary session and TGbp TCs before Sep interim session as below:

https://mentor.ieee.org/802.11/dcn/24/11-24-1339-00-00bp-2024-07-plenary-meeting-minutes.docx

https://mentor.ieee.org/802.11/dcn/24/11-24-1390-03-00bp-teleconference-minutes-august-september-2024.docx

Moved: Sebastian Max

Seconded: Weijie Xu

Result: Approved with unanimous consent

## SFD skeleton discussion

Yinan Qi (OPPO) presents document IEEE802.11-24/1495r01, "Specification Framework for TGbp".

No discussion or questions. A motion to allow the editor to create a SFD based on this document will be run.

## Contributions

### Presentation of IEEE 802.11-24/1345r1, High-Level Requirements for Downlink PHY in 2.4 GHz, Steve Shellhammer (Qualcomm)

Q: SP1 context could be stand-alone thing. Is this only for the integrated energizer case? Could this be extended to the non-integrated energizer case as well?

A: SP1 does not say anything about integrated or non-integrated. It should not be tied to one implementation. The specification should be flexible to handle both cases. Fields should be similar structured; details might be different for the two cases.

Q: So, then the design might be similar, but for example the length of the fields may be different for a different link budget?

A: Might be, there could be differences for small vs. large link budget.

C: This SP1 does not preclude anything then? It is generic.

Q: SP1 2nd bullet. No need to talk about other different things than that will be defined. 1st bullet is sufficient. There will then be other SPs for backscatter STAs.

A: I go with what the group wants.

Q: Slide 7. "At least two AMP data fields," why is there the need for more than one?

A: We may alternate data fields with Excitation field. This is for harmonization with the backscatter case. In the active transmitter case there's no Excitation field, and thus only one data field.

Q: Slide 8. Is 1Mb/s assumed here? Why do we need to close in on the sync field duration before the data rate is agreed? Is there an option for multiple different length sync fields?

A: Previous presentation was on the data rates, but that's too early. However, the rate should be larger than with 11ba. So the sync field should can be smaller.

A: Less than 64µs lenght should be sufficient for the high-SNR case.

Q: SP1. No need to mix concerns and use cases. Is your intention to start with the 11ba design?

A: Yes, with a similar design. It is motivated by the 11ba structure, but with different details.

Q: Are you assuming a OFDM waveform?

A: No, it is silent on that topic. We are not deciding this here.

Q: Slide 8. Can there be mulitple AMP-Sync field with more than 64µs?

A: It's silent on these details. There may be two sync fields, it is not excluding possibilities.

C: SP1. Prefer to keep the second sub-point. Better to include all variations.

C: SP3. Need to decide the modulation first, then there might be different considerations for the coding.

Q: SP1. One or more AMP-Data fields, is that for UL or DL? This is for DL. "Excitation" was previously called "Energizer", but it shall be used to backscatter the UL data. Any field on the slide is a DL field.

Q: But there might be only the Excitation field, suggest changing "there may be one or more AMP-Data fields".

End of discussion, SPs will be run on Thursday PM2.

### Presentation of IEEE 802.11-24/1475r2, Discussion on ultra-low power timing clock, Weijie Xu (OPPO)

Q: 32.7kHz clock power consumption will be around 10nW, I agree that it is not the PHY clock. What is the motivation to clock the state? Let the device be ready when the trigger arrives?

A: Device needs an internal clock. If we want to have AMP devices better performance than RFID / lower energy for operation, we need to conserve the power. The AMP needs to wake up in time for the UL trigger.

C: Table for shows for low-range backscatter "no" for energy storage.

Q: Not sure if backscatter can support duty-cycle based operation. It has a very low energy storage unit. Backscatter can be trigger-based after being charged by the AP. No need to have a duty cycle.

A: AMP wants to support long distance. Thus, power storage is needed. However, harvesting power is very low, so a duty cycle operation is needed.

Q: Confused about SP1 and SP2. They have different values for the active transmitter.

A: The SPs are for different procedures. The different timings may be implemented by the same circuit, or by different circuits.

Q: Slide 11. Based on the accurarcy of the RTC clock, counting ms. It will round-off 0.7ms, so there can be errors.

A: First, we need requirements of the clock in ppm. Then, it can count the cycles. For 3ms it can count 2x32 and 1x33. There are implementation methods to adjust the rounding error.

Q: SP3. 1000ppm for duty cycle. But here it is 1000ppm to 10000ppm. This is a very large range, what value shall it be?

A: For DL we can support different implementations with relaxed DL clock. If there's only ED receiver it can be the larger, more relaxed value, 10000ppm should be ok.

C: Maybe pick a number before we run the SP?

### Presentation of IEEE 802.11-24/1537, Wireless connectivity challenges for AMP only IoT devices under 802.11 specification, Solomon Trainin (Wiliot)

C: Slide 11, our preference is #4. WUR frame might not be the right choice.

C: Slide 18. Makes a lot of sense, especially 1 and 2. Not sure about 3 and 4.

A: Want to enable things, not define. Concentrate only of AMP-only IoT STA part. Architecture needs to mention how to transport the data, transition to the DS needs to be specified.

Q: Change device to STA?

A: Agree.

Q: Architecture picture, Slide 18. Limit AMP-only STA to access the DS only via the non-AP STA?

A: Does not matter if its AP STA or not.

## Recess

The chair announced the session recessed at 12:30.

# Monday PM1 (2024-09-09T13:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r3).

* Chair calls the meeting to order at 13:30 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r3 (slide 25).

* 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
* TGbp SFD baseline motion [5 mins]
* Contribution discussion (PHY) [25 mins for each]
	+ 11-14/1497, Uplink Rates for Active Transmission, Amichai Sanderovich (Wiliot)
	+ 11-24/1513, Downlink link budget of passive receivers, Amichai Sanderovich (Wiliot)
	+ 11-24/1527, Analysis of Bandwidth Expansion in Backscatter Scenario, Bin Qian (Huawei)
	+ 11-24/1530, Discussion of AMP-SIG field, Bin Qian (Huawei)
* Any other business?
* Recess

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

No discussion, no objection, agenda approved.

## Motion #4: TGbp SFD baseline motion

Move to approve the baseline of TGbp Specification Framework Document (SFD) as included in 11-24/1613r0, for future development based on consensus.

Moved: Yinan Qi

Seconded: Sebastian Max

No discussion

Result: Approved with unanimous consent

Chair asks for future SPs to indicate if they intend to add text into the SFD or not.

## Contributions

### Presentation of IEEE 802.11-14/1497, Uplink Rates for Active Transmission, Amichai Sanderovich (Wiliot)

Q: Slide 5. Trigger by the reader contains the MCS. But the MCS depends on the distance - so is the reader aware of the distance?

A: The assumption is that the reader can decide the distance of the tags it wants to read. For example, start with 1m, and then enlarge the distance. If it searches a specific tag is has to use the lowest MCS. But there are other use cases.

Q: On the charge power of the active device - why is an active tag charged?

A: RF harvesting is used to energize active devices. There is no battery.

Q: There is -50dBm charging power?

A: The power for charging is 0.01µW, after all losses.

Q: Slide 4. Overall power efficiency 2%. Does that change with bandwidth?

A: It should be approximately the same. Most of the power comes from components not depending on the bandwidth.

Q: Minimum data rate for the uplink should be dependent on the DL. DL is the limiting factor for the devices.

A: Reception of the DL is completely different to the reception of the UL.

Q: Are there different rates for the DL, to reach tags in different distances?

A: Currently assume only one DL rate.

Q: Slide 7. What are the assumptions for the channel?

A: AWGN.

Q: What is the OOK bitrate?

A: 0.5Mb/s to 8Mb/s.

C: Maybe we need to look at Channel-D.

Q: What are the assumptions on feasibility to have multiple sync fields?

A: Trigger frame should contain the MCS of the UL to be returned. Hence, the receiver knows the MCS of the UL, and no sync field is required to get this information.

Q: What if the transmission is active, i.e. started by the AMP STA itself?

A: Either use an agreed MCS, or the most robust one.

### Presentation of IEEE 802.11-24/1513, Downlink link budget of passive receivers, Amichai Sanderovich (Wiliot)

Q: Slide 3, link budget. Why not communicate in sub-1GHz where the RF harvesting is done anyhow?

A: 2.4GHz provides wider bandwidth.

Q: Close range with integrated energizer is discussed, transmit with 30dBm. What about the full-duplex problem? The receiver will be saturated.

A: It's an active tag, so there's no full-duplex operation.

Q: Slide 10, SP. Sync field shall have high peak to side-lobe ratio. With Manchester the cross-correlation property will be broken.

A: According to our analysis this is not an issue, and it helps making the tag receiver simpler.

Q: How likely is a fading of the channel between transmissions?

A: Fading will occur even for stationary transmitters. Continuous reading of more and more tags will need several rounds. Reading of a specific tag may need retries.

Q: Slide 6. Does the AMP device need to select the receive frequency? There is no receiver filter, so the receiver bandwidth will be wide.

A: First, we have the (not very narrow) antenna filter. Second, the FIR/integrator filters interference.

Q: For longer ranges, how does the tag select the mode?

A: The reader will have all the information; the tag just responds. Passive reception allows the reader to configure the tag accordingly.

### Presentation of IEEE 802.11-24/1527r0, Analysis of Bandwidth Expansion in Backscatter Scenario, Bin Qian (Huawei)

Q: Frequency mask, is that from 11b or from regulations?

A: PSD mask is from 11b.

Q: What happens with a OFDM waveform?

A: It does not depend on the exact waveform, the key point are the shart transitions of OOK.

Q: Does the spectrum contain bow CW and the backscatter?

A: Just the backscatter.

Q: So, on top there's the CW, which is the original Wi-Fi transmission that complies with the PSD mask. The backscatter is usually 5dB less.

A: Yes, but still it will not satisfy the PSD mask.

Q: Did you take into account a transition time between on/off state?

A: That depends on the data rate, the symbol duration will be different. I assume ideal rect pulse for the transition time. A change will give a supression effect, but it will not be better than the SRRC-pulse. The results on slide 5 are the min/max boundaries.

Q: Transmitter will tx with 20dBm, backscatter will be at -30dBm. No one will recognize these transmissions.

A: Impact depends on the topology.

C: PSD mask for 11b depends on power of 11b device. Backscatter will be at -25dBm.

C: Here, carrier for 11b waveform is 22MHz. Backscatter signal depends on the carrier signal, it is the convolution of the carrier and the square form. For a narrowband signal CW it will be much better.

A: Yes, for a CW of 10MHz the bandwidth expansion will be much better.

Q: Slide 5, right figure. There should be a 5dB loss.

A: Did not consider input carrier. Plus, it's a relative PSD.

Q: Similar technology is used in RFID. How does RFID handle this?

A: Not familiar with RFID, but I think this problem is not discussed. RFID is in sub-1GHz.

C: For RFID no modulated CW is used.

C: 5dB or 7dB loss is only at the threshold of the tag for the reflection. If the input power is higher the loss gets much bigger. Can be 20dB, 25dB. So, the PSD curve goes down.

C: The RFID PSD is regulated for example in EN 302 208. The measurement to validate this is done at ~20cm, so it considers worst-case reflection.

### Presentation of IEEE 802.11-24/1530, Discussion of AMP-SIG field, Bin Qian (Huawei)

Q: SIG solves the complexity issue. How many rates do you expect for the DL?

A: No exact number. May need to support more than WUR. For non-integrated energizer case one rate might not be enough (different to the integrated energized case). For short distance to save airtime a high rate may be good.

C: DL data is expected only few bits. SIG field increases overhead, may be more than the data itself.

C: Still to early to discuss a SIG field.

A: Yes, might first be needed to identify how man data rates are needed.

Q: Slide 6. BSS coloring, is this an example, or shall this be supported in AMP?

A: Can be discussed.

Q: SP1. DL and excitation PPDU, are these two PPDU types?

A: Will be presented in a different contribution. It is a unified PPDU.

C: Don't think BSS color applies here.

C: Need to think if we need different DL PPDUs for integrated vs. non-integrated energizer case.

Q: What are the sampling rate requirements to decode this OOK data in the SIG?

A: Depends on the bandwidth of the SIG field.

Q: Can you clarify the complex implementation to identify the sync field?

A: For example, three data rates require three sync fields. Receiver will need to identify this.

Q: You are making assumptions on the content of the SIG field. At what point (how many data rates) makes is sense to have a SIG field vs. many sync fields?

A: Content is just some examples.

C: We need to keep in mind the overhead that is introduced.

A: Overhead may be reduced by combining sync field and SIG field.

C: Overhead may be very high, especially if 10dB difference between most robust and highes speed MCS is assumed. Costs 10x the bits.

## Recess

The chair announced the session recessed at 15:23 EDT.

# Tuesday AM1 (2024-09-10T08:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r3).

* Chair calls the meeting to order at 08:00.
* 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r3 (slide 27).

* 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
* Contribution discussion
	+ 11-24/1237, AMP Tag-STA Requirements for Close-Range Backscattering, Rui Cao (NXP)
	+ 11-24/1496, PPDUs in AMP, Bin Qian (Huawei)
	+ 11-24/1535, PPDU design for AMP Yinan Qi (OPPO)
	+ 11-24/1557, AMP DL PPDU design considerations, Rui Cao (NXP)
* 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 802.11-24/1237r0, AMP Tag-STA Requirements for Close-Range Backscattering, Rui Cao (NXP)

Q: Seems like Wake-up is about 22% overhead, have you considered wake-up in sub-1GHz?

A: We are focusing on everything in 2.4 GHz.

Q: Is it possible to complete data transaction with multiple PPDUs?

A: Yes, without a random access between PPDUs.

Q: Can we do all the data in several ms?

A: We can initially poll the number of tags, and then read specific tags.

Q: Since 10% clock error also applies to 2.4 GHz?

A: Yes.

Q: Clock error does not affect frequency offset?

A: No, since there is no mixer.

Q: Explain more about circuit restrictions on hardware wake-up time.

A: Settling time is 1 to 1.5 ms.

C: If you find out about capacitor size please send it on the reflector.

Q: One ms for wake-up is kind of large in 2.4 GHz, can it be made smaller?

A: For energizer and hardware settling 1 ms.

Q: Why 250 kb/s downlink rate?

A: Majority of the hardware is the same as in sub-1GHz, each half-bit needs four samples.

Q: If we increased the clock rate what would be the impact?

A: More power consumption.

Q: Does there need to be 1 ms before data exchange?

A: Yes. Every hardware component needs hardware settling time. Can share more off-line.

Q: The SP says at most, you want to put an upper limit on DL data rate?

A: Yes

### Presentation of IEEE 802.11-24/1496r1, PPDUs in AMP, Bin Qian (Huawei)

Q: On Slide 6 can you mix Data and Excitation fields?

A: Yes.

Q: One or more versions of the PPDU on Slide 6?

A: One.

Q: Do you think we need AMP-Preamble?

A: AMP-Sync and AMP-SIG are the preamble.

C: We should not be so focused on unified design, versus focusing on the required application.

A: For Downlink only one PPDU format. For Uplink we may need more than one PPDU format.

Q: Do we have a definition for Excitation field?

A: It is the downlink to be backscattered.

Q: What is your format for Slide 5 PPDU?

A: Can be used to.

Q: Can the PPDU on Slide 5 used for power harvesting or also excitation?

A: Both.

Q: For Backscatter would we specify an Uplink PPDU?

Q: SP#1, can there be multiple Sync fields?

A: No.

C: Let’s converge on the SP #1.

A: Yes.

Q: Any definition on Legacy Preamble?

A: OFDM several choices.

Q: Are you excluding DSSS preamble?

A: No.

Q: Any reason to state it is for 2.4 GHz?

A: In the PAR it says 2.4 GHz and sub-1GHz, currently we are focusing on 2.4 GHz. In sub-1GHz we may we have some differences.

### Presentation of IEEE 802.11-24/1535r0, PPDU design for AMP, Yinan Qi (OPPO)

Q: What is CW. Is it carrier wave or continuous wave?

A: It can be either.

Q: How we know the overall airtime, with multiple components, and it could be large?

A: By doing this we have a specific design for each use case, and it can be signaled in the SIG field, or different Sync field designs.

Q: Seems like this is to harmonizing difference use cases. Is to harmonize downlink and uplink?

A: Yes.

Q: What is the purpose of the Energizer field?

A: It is to provide signal for energy harvesting.

Q: For the active TX, is there a Legacy Preamble?

A: No. The AP can send a PPDU with a Legacy Preamble previously.

Q: Is this both 2.4 GHz and sub-1GHz?

A: These are for 2.4 GHz. we can extend these for sub-1GHz.

Q: In the straw poll, this seems to be triggered by the AP. What about STA-Initiated UL PPDU?

A: Want to avoid having a significant impact on legacy devices, we can start with AP polling communication, in the later cases, if we really need STA-Initiated UL PPDU, we can address them later.

Q: Is the concern including Legacy Preamble in UL?

A: Yes

C: There are MAC ways to protect legacy devices.

Q: You list Energizer symbols and CW symbols, what are the waveforms? Can we combine Energizer and CW symbols?

A: We can consider this.

Q: In the Straw Poll, my concern here there is no indication of active link communication. Maybe clarify this is for active uplink and not a legacy uplink.

A: That makes sense, and I can modify the straw poll.

C: Essentially you are proposing any combinations of these fields. Here it seems like there are many combinations, and that is hard to implement.

A: We define these components, and then based on the use case we can define the combinations.

### Presentation of IEEE 802.11-24/1557r0, AMP DL PPDU design considerations, Rui Cao (NXP)

Q: Is this for 2.4 GHz only?

A: Yes.

Q: In your multi-segment PPDU, what if one device transmits and one backscatter?

A: For backscatter, there needs to be a query frame and then polled later.

Q: How is the Sync field detected on the tag and what are power implementation?

A: Similar as WUR, can do either coherent or non-coherent. Coherent is low power.

Q: You mention that we may not need to standardize the excitation field?

A: The Tag backscatters everything in the band. And the TX and RX are implemented by the same company.

C: We need to specify for energy.

A: We need to meet regulatory requirements.

C: There may be some difference between the downlink and uplink in the OOK details.

A: For the active TX we need to specify the bandwidth so the RX can get the range.

Q: You mentioned you need RX filter bandwidth, is that needed?

A: For active TX Tags needs filtering.

C: For active you can have a wideband receiver.

Q: Can you elaborate more on excitation?

A: Provide energizer.

Q: The excitation field can be same or smaller BW than legacy preamble?

A: Active lower bandwidth, Backscatter same bandwidth.

Q: You show excitation before data, but if you have power how about data first?

A: We can consider that, based on different use cases.

## Recess

The chair announced the session recessed at 10:00 EDT.

# Wednesday AM2 (2024-09-11T10:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r4).

* Chair calls the meeting to order at 10:30 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r4 (slide 29).

* 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
* Contribution discussion
	+ 11-24/1543, Frequency translation backscatter, Manideep Dunna (Qualcomm)
	+ 11-24/1501, multiple access for AMP IoT, Weijie Xu (OPPO)
	+ 11-24/1533, Waveform for AMP IoT, Ke Wang (OPPO)
	+ 11-24/1520, Charging and Discharging Intervals in Passive AMP STAs, Dror Regev (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 802.11-24/1543r1, Frequency translation backscatter, Manideep Dunna (Qualcomm)

Q: Slide 7. Data-1 consists of "all off" symbols?

A: Yes. But the symbols can be altered.

Q: But the Data-1 should also consist of "on" symbols.

A: Yes. Continuous "off" should be avoided. There is a Miller state machine that makes sure there is no continuous "off". The data can also be changed using FM0.

Q: Is there any additional hardware needed?

A: No. RFID already has this functionality. There is a RF-switch and the clock needed to do the switch. This is already in the RFID tag. Only the clock rate needs to be increased, we need up to 2MHz. The hardware already exists in an RFID tag.

Q: Slide 8. Device needs to implement a local baseband oscillator. For 2MHz shift the osciallator needs to support 2MHz. For the RFID case (slide 6) the frequency offset is lower, 200kHz. We need to consider the higher power consumption for a 2MHz shift.

A: Current RFID tags support up to 600kHz shift. The RFID 600kHz clock is derived from a higher frequency clock. So, the power increase for 2MHz should not be too high.

Q: Switching will creater a lower and an upper sideband. The receiver will have to monitor this. As it is essentially a narrowband signal, doesn't this limit the data rate?

A: That is correct. Data rate is around 67.5kb/s. We could do single-sideband modulation, going to ~150kb/s.

Q: Single-sideband modulation will get much more complicated.

A: Correct. According to literature we need 4 RF-switches instead of a single one. Alternatively, shifting could be to RU2 / RU6 (larger shift).

C: Slide 12. Need to understand how -32dBm is achieved. Direct leakage has the same magnitude. Now the dynamic range gets ~40dB, that might be complicated.

C: Switch is 0 / 180°. There might be simpler switches, with lower losses. The serial switch has high losses, especially for the square wave. This is not for free.

A: Switch with open/short is better for the tag. A switch with open/50Ohm termination will need more circuits. In addition, the open/short the reflection coefficient will be 1/-1, not 1/0.

C: OFDMA RU separation on slide 11. Blue one is 2.5MHz. Shift to non-overlaping RU location, so clock rate is ~3MHz with some margin. Very tough for low-cost design, and might have a high power consumption, limiting the range.

C: With 11ax the symbold duration is 16µs. So the data rate is very low.

A: Yes, 67.5kb/s.

C: So 2ms for the data transmission. Maybe 1ms for the charging. That is a large duration.

A: There are ways to double / triple the 67.5kb/s. Translation to 2nd neighbor RU effectively doubles the rate, reducing the latency.

Q: How many bits do you expect from a tag, and how many tags are read? Maybe the data rate is not a real restriction.

A: 200b to 300b is the longest in RFID. RFID reads 10tag/s. We expect the same and match the existing functionality.

### Presentation of IEEE 802.11-24/1501, multiple access for AMP IoT, Weijie Xu (OPPO)

Q: Slide 9. A better clock accuracy could be a capability, but it should not be mandatory.

A: For TDM a poor clock accuracy is needed. We need to see how to address this.

C: It needs to be optional, I'm not ok to make it mandatory.

Q: Slide 10. Tx bandwidth is less than 10MHz. There are limits in China and Europe for the transmit power.

A: Yes, there is a PSD limit.

Q: Sub-1GHz there has been a lot of work. There is a mode for a large number of STAs, for long sleepers. There are mechanisms as RAW and TWT. They should be considered.

A: This is a general discussion. Many mechanisms from 11ah can be brought here, for example TWT.

Q: Slide 10. Is this for active transmit only?

A: For backscattering we need to consider if we can do that.

C: For backscattering it has been done.

Q: Slide 10. Is the tag responding on 10MHz? Is the center frequency of two tags on different frequencies?

A: Yes.

Q: So how is the trigger sent, is it duplicated on both 10MHz?

A: How to allocate the resources is still open.

C: There are a lot of design issues that we need to discuss.

Q: Slide 12. For active, FDM+CDM. Do you prefer this to TDM? CDM has a near/far issue, one tag is outpowering another one which is further away.

Q: For FDM, do you assume all tags support all frequencies? What is your assumption on the bandwidth? In 20MHz there is not a lot of space.

A: These are just examples. If FDM can be supported we can use it.

A: For the CDM case we compare to RFID. RFID cannot tolerate any collision.

C: Slide 12. TDM is the simplest. So, this should be supported in any case, and the rest is a capability.

### Presentation of IEEE 802.11-24/1533, Waveform for AMP IoT, Ke Wang (OPPO), presented by Yinan Qi (OPPO)

Q: Expect a DL-modulation, UL-backscatter-modulation, and UL-active-modulation. Is the "baseline" OOK for all three?

A: For the DL OOK should be the baseline. For UL, MSK could be applicable to active transmission if a higher data rate is needed and should be further studied. MSK shows benefits.

C: We should pick one for UL-active, OOK or MSK.

Q: On SP: "Baseline" for what: research, discussion, or SFD?

A: OOK should be mandatory.

C: SP should be modified accordingly.

### Presentation of IEEE 802.11-24/1520, Charging and Discharging Intervals in Passive AMP STAs, Dror Regev (Huawei)

C: Slide 4. Assumption is 20dBm for 900MHz and 2.4GHz. In 900MHz 30dBm is possible.

A: Yes, just need to adapt the numbers.

C: SP1. What is the intention?

A: There should be a minimum, similar to the minimum rx sensitivity. Good for deployment calculation. If it's better (similar to the noise figure) then it's good. But there should be a minimum number that is supported by every vendor.

Q: This is different for active vs. backscatter devices?

A: I don't think it is different. If the tag cannot be charged, then it does not matter if it's active or backscatter.

C: We need more definition, more precision. What is tested?

A: Sensitivity is the minimum power to charge a capacitor to 1V.

C: This is very hard to test, hard to certify.

A: Agree. Maybe minimum power to receive and transmit, i.e., to operate.

Q: Agree that some kind of definition is needed. What about efficiency?

A: Efficiency depends on the antenna; this is hard to define. Sensitivity is better.

Q: Rx and tx is controlled by the AP. Even if all circuit parameters are know, the AP does not know the distance. Will there be some kind of protocol?

A: AP does not know the status of the STA. Maybe the STA will report – but only if it is charged. AP does not know many parameters (distance, pathloss, connectivity). It can ask for reports, but even then we don't know how much information that adds.

Q: We care about the interoperability. How does this affect the interoperability? Why should we care as a standard?

A: If we want to ensure charging at 10m we need to have a definition for the minimum power to turn the tag into full functionality.

C: Maybe discuss duty cycle instead?

A: Good thought, we were thinking about a SP in this direction. Also, the duration of activity of the tag is important.

Q: Slide 5. This is one kind of implementation. If there is only one device this is possible. If there are many devices it depends on many parameters. I support a duty cycle definition.

A: This does not fit will with a triggered operation. If the tag is not charged, it will not answer / communicate. The tag is autonomous. There's no way the AP can force the tag to answer.

Q: What if the trigger is not for this device?

A: If there's not enough power in the air a tag can "die". It's an energy question, no idea how to provide energy to a tag that's not at the right level.

C: We might be looking at more than a single parameter. Minimum sensitivity to bring the tag to operation; minimum duty cycle for the AP to manage the tag.

## Recess

The chair announced the session recessed at 12:30 EDT.

# Wednesday PM2 (2024-09-11T16:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r5).

* Chair calls the meeting to order at 16:00 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r5 (slide 31).

* 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
* Contribution discussion
	+ 11-24/1500, Duty-cycle AMP operation, Weijie Xu (OPPO)
	+ 11-24/1534, Trigger based AMP communications, Chuanfeng He (OPPO)
	+ 11-24/1539, Energy-level status Reporting for AMP devices, Mahmoud Hasabelnaby (Huawei)
	+ 11-24/1549, Follow-up on AMP Channel access, Rojan Chitrakar (Huawei)
	+ 11-24/1560, Follow up on capability report and ID allocation for AMP STA, Zhanjing Bao (TCL)
* Any other business?
* Recess

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

Some discussion, slight change of the order of presentations (final order given above), no objection, agenda approved.

## Contributions

### Presentation of IEEE 802.11-24/1500r0, Duty-cycle AMP operation, Weijie Xu (OPPO)

Q: Slide 8. Do you assume the AP knows the identity of the tags? Or how is the assignment of the identity done?

A: For many scenarios the tag id is unknown. For some, there can be a prior assignment procedure.

C: If the identification is done over the air, it might get lost if a tag runs out of power and does not remember its id.

Q: Do you think all tags have the same duty cycle? Close tag with lots of power vs. far away tag with very limited power.

A: The AP does not know the distance of the tag. It needs to trigger all tags in the same way.

Q: All tags respond in unique spots to avoid collisions?

A: Yes.

C: So how to provision that? If there are 100 tags, and all show up in different (time) spots, the address space will be very limited. There might be collisions. However, there are schemes that allow collision resolution on the PHY. No large address space is needed.

C: Details are complicated. How do the STAs know when to wake up? How is the provisioning of the schedule done?

A: Agree.

C: There are many questions left for the details. There might be no chance to know which tags are in the vicinity. Tags may charge and wake-up at different times.

A: We might use similar grouping strategy as in RFID. Duty cycle is for the complete group, all devices in the same group have the same rx/tx window.

A: Furthermore, network can provide the timing and devices align to this.

C: SP is very vague. Need to specify more details, it is not clear what exactly is supported.

Q: Is duty cycle the right wording? Maybe rather "MAC activity".

### Presentation of IEEE 802.11-24/1534r0, Trigger based AMP communications, Chuanfeng He (OPPO)

C: Trigger is necessary and important, but the precondition is that the STA is charged. Otherwise, no duty cycle will work. Only STAs which are ready can be triggered.

A: Trigger is based on a duty-cycle operation. The transmission of the trigger follows a periodical schedule. If the STA gets the timing information, it can follow the trigger.

C: An AMP STA cannot follow a trigger if it has no energy.

A: It only needs to receive one trigger, then it can follow the duty cycle.

Q: For the MAC details it would be helpful to understand the capabilities of the AMP STA, in terms of storing information, storing its address, memory size. What are different possible cases? Likely they are different from regular Wi-Fi.

A: The duty cycle operation should be based on the AMP STA capability. It should be further studied.

C: Slide 7. I agree on the trigger frame, but there might be also different scenarios. This is tied to the duty cycle operation. In a simple scenario with just one AMP STA this might not be needed. I disagree on the "at least", we might not need all of that.

A: Next contribution will show more details.

Q: Slide 5. There will be preconditions / assumptions for such a scenario. Let's assumed that they are fulfilled. Is the response to the trigger comming only from a known AMP STA, or can any AMP STA respond?

A: The trigger provides the chance for an AMP STA to transmit, but it does not know which one will answer.

Q: Slide 5. Are the responding STAs pre-known to the AP?

A: For some use cases they are pre-known. For others they are not known.

C: What if it is even driven, like a smoke alarm? An arbitrary STA should be triggered to transmit.

### Presentation of IEEE 802.11-24/1539r0, Energy-level status Reporting for AMP devices, Mahmoud Hasabelnaby (Huawei)

Q: Agree that energy reporting can be beneficial. Slide 8. If an AMP STA has higher energy it can stay on longer. Maybe rather AMP STAs with lower energy should be prioritized, so the other way around as you show?

A: We like to allocate the resources that we have in a good way. So, it depends on the current situation, for some cases the priority should be given to the device with low energy.

Q: RFID already have a well-established system to schedule the transmissions. Are there studies that they have problems that would be solved by energy-level status reporting?

A: Before any trigger frame by the AP, the AMP STA shall send their energy level. Then, the AP can schedule according to their priority.

Q: What if the capacity the AMP STA is only sufficient for one frame exchange, and then again energy harvesting is needed?

A: We assume that the energy capacity is sufficient for multiple frame exchanges.

C: Suggest changing the "shall" of the SP.

Q: Number of AMP STAs, they are completely equal. They can only transmit if they are full, and cannot transmit more.

### Presentation of IEEE 802.11-24/1549r0, Follow-up on AMP Channel access, Rojan Chitrakar (Huawei)

Q: On selective retransmission. Does this depend on the detection of a collision? How reliable is this?

A: This is not assumed. The AP may detect that there is "something", but reception fails.

Q: But there may be a situation where the AP does not detect anything, so it does not know that there is a collision.

A: That might happen. This can also happen in RFID.

Q: You don't assume any ACK to the STA?

A: I am not assuming that there is an explicit ACK. This is rather an implicit ACK.

Q: This is then related to the first question. The STA assumes it was received (no NACK), but it was not.

A: This is just the first step, to get the id. Maybe we should consider explicit ACKs.

Q: Why is it split over multiple TXOPs?

A: That depends on the data rate. The TXOP duration is limited, and for a low data rates with 1ms per PPDU we might need multiple TXOPs. The increased number of slots decreases the probability for collisions.

Q: On the recap / time-slot based RA. If this is for backscattering the clock may drift very fast. So there is the need to add a trigger frame before every slot.

A: This will be similar to RFID. We need to consider the overhead of the downlink transmission.

Q: Is the trigger a broadcast poll?

A: Yes. There could be a filtering phase, like in RFID.

Q: How are the ids assigned to the devices?

A: This is a different problem, not discussed here.

## Recess

The chair announced the session recessed at 18:00 EDT.

# Thursday AM2 (2024-09-12T10:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r5).

* Chair calls the meeting to order at 10:30 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r5 (slide 33).

* 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
* Contribution discussion
	+ 11-24/1524, Follow-up on the AMP WPT protocol, Ian Bajaj (Huawei)
	+ 11-24/1536, Wireless Power Transfer for AMP, Yinan Qi (OPPO)
	+ 11-24/1551, WPT waveform discussion, Panpan Li (Huawei)
	+ 11-24/1561, AMP Power Budget Negotiation, Ugo Campiglio (Cisco)
* Any other business?
* Recess

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

Some discussion, switch of order, final order shown above. No objection, agenda approved.

## Contributions

### Presentation of IEEE 802.11-24/1524r2, Follow-up on the AMP WPT protocol, Ian Bajaj (Huawei)

Q: Slide 6. Not convinced that active energy reporting is neccessary, seems inefficienty. Why is the periodicity fixed for passive?

A: Because there is no control. If there is no feedback, then it is fixed during the deployment. Energizing control is only for non-integrated energizer.

Q: If an AP requests a tag, and it does not respond, the assumption must be that the tag has no power. That's already feedback. If now the tag is energized, and it responds, what can we assume?

A: It's a report of 0 or 1.

C: No, because the number of attempts to energize is an additional information.

A: There are many variables that can influence this assumption. Active reporting can help, it can make it more efficient. It does not preclude passive energy harvesting. WPT is an additional (supplement) source.

C: The AP only cares about if the tag responds or not. It's guessing (with additional information) vs. checking.

C: 15ms of TXOP duration. This is just a default value in the EDCA parameter set. If there are no regulatory / market requirements and AP could set this to higher values. I'm aware of two presentation in 802.11 where independent groups reported about 5GHz products in the market that transmitted much longer. For example, in 5GHz the maximum is 6ms, products transmit up to 20ms. The duration of course needs to balanced out, energy transmission vs. affecting other others.

Q: Slide 10. Relation tx power to consumed power; there is a factor of 10. To my knowledge this relation does not exist (or is not that linear).

A: These are our simulation assumptions.

Q: On the SP, what is the "existing 802.11 PHY".

A: We don't want to specify a new PHY for the communication between AP and the energizer.

Q: How long is the payload for the report?

A: See slide, we assume 100b, should be less than 60b.

Q: Inferred status can/may be obtained from the behavior of the device. Is there an advantage to explicit information? What do we get for explicit vs inferred in term of device complexity.

Chair closes the queue due to limited time.

### Presentation of IEEE 802.11-24/1536, Wireless Power Transfer for AMP, Yinan Qi (OPPO)

Q: We have not decided the operating frequency of the energizer. There are different regulatory domains / technologies. It's too early to discuss coexistence, we need to make sure the problem exists.

A: Correct. However, WPT will have to coexist with other systems. We should consider it from the beginning.

Q: What about the preamble, what are the details?

A: We are not clear yet, but it should be simple. It needs to be understood by the energizer.

Q: What is the point to define a new WPT PPDU?

A: We could also use the existing preamble, but it needs to indicate that it is WPT.

Q: Coexistence is important, especially in the sub-1GHz band. There are ways to use the spectrum efficiently. WPT does not need to take care if there is another WPT, this is an important point. We need to minimize the footprint on the spectrum.

C: Coexistence is important, good to consider it early. However, it can be tricky. Assume a scenario with three energizers; they could "hand over" their WPT signal to each other in an overlapping way, blocking the channel.

C: Multiple energizers could also block the channel in a much larger area. We should take a step back, create a set of requirements for the system, thinking about multiple energizers. Not so detailed SPs.

Q: Slide 3. Sounds like it is not done over Wi-Fi. Is there standardization work to be done?

A: Don't need to specifiy WPT frame / protocol. We might use out-of-band communication.

Q: Bluetooth has the option to transmit in specific channels. No sensing before transmission. This could minimze the interference, if only certain channels are used.

A: This would be perfect if there is an isolated channel for WPT. Not sure that this is the case everywhere.

C: Maybe we can minimize interference by selecting the right channel.

C: Many regulatory domains require coexistence; this is an important topic.

### Presentation of IEEE 802.11-24/1551, WPT waveform discussion, Panpan Li (Huawei)

Q: Slide Appendix A. Normally the tx power is very limited, for RFID it is higher. Why should WPT fall under the RFID regulation?

A: Because of the higher tx power.

Q: That's not convincing to me. If we want to apply RFID regulation, the device should also respond. Not sure we can apply RFID here.

C: In Europe 11ah directly overlaps with RFID spectrum. They interfere with each other.

Q: Some countries have minimum bandwidth requirements.

A: The slides show the maximum. For China / Europe there is not minimum requirement. For US, as on the slide, there are different regulations for different bandwidths.

C: In the US frequency hopping has to be used for a certain bandwidth.

C: We might need help from 802.18.

Q: Consideration DSSS and OFDM. Maybe also other waveforms, which are dedicated to energizing for better efficiency.

A: Any waveform can be used for WPT. DSSS and OFDM are currently used in Wi-Fi. Continuous wave is currently used. We follow the requirements given in the slides.

C: Efficiency of the energizer should be considered.

C: According to our PAR, at least one mode of WPT is defined. Hence, it should be mandatory.

C: In Europe multiple assignments for the same spectrum exists. E.g., shared between different services with different categories. You refer to RFID, with defined applications. Communication systems have a different assignment. HS 300 440 should be a better fit (this is where 11ah comes from).

### Presentation of IEEE 802.11-24/1561r1, AMP Power Budget Negotiation, Ugo Campiglio (Cisco)

Q: Slide 8. What if the STA is moving? Would reporting still help?

A: If it is going closer to the AP it can report that it gets more energy than before. If it goes out of range of the AP it's no longer useful to report.

Q: But the movement makes the reporting inprecise. Changing from close to far, for example, the AP will still assume it is close and send energy rarely. This only works if STAs are static.

A: AP should focus on the STAs with the least energy. If all are moving it is not useful.

Q: Received power is a good indication of the link budget. What is the AMP STA capability?

C: Please remove the "Cisco Confidential" on all slides.

A: Some AMP STAs may not support the mechanism / should not be obglided to.

C: We need to consider the price of sending a report, it consumes power.

C: Consider other use cases, e.g., identification. WPT can be stopped if identification has completed.

Q: Feedback on how much power is harvested from frame is useful. But how does the device measure this? Is is complex?

A: It should be possible.

C: Similar to measuring RSSI.

C: If voltage levels at the beginning and the end of the harvest intervals are known then the harvested energy can be calculated.

## Recess

The chair announced the session recessed at 12:15 EDT.

# Thursday PM2 (2024-09-12T16:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1380r6).

* Chair calls the meeting to order at 16:00 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, and Registration (slides 11-14).
* Chair reviews the agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 31).

* 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
* SPs and Motions (TG motions refer to 11-24/1322)
* Contribution discussion (Security&MAC) [available time t.b.d.]
	+ 11-24/1560, Follow up on capability report and ID allocation for AMP STA, Zhanjing Bao (TCL)
	+ 11-24/1548, Thoughts on Security for AMP, Rojan Chitrakar (Huawei)
	+ 11-24/1584, Ascon: the lightweight cryptography as a better cipher than AES for 802.11bp, Hui Luo (Infineon)
* Timeline review
* Teleconference plan
* Any other business?
* Adjourn

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

No discussion, no objection, agenda approved.

Chair explains the procedure and rules regarding SPs and Motions.

## Straw Polls

### SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 36)

Q: What is "non-data frame"

A: A new type of frame, i.e., not data-type. Similar to a WUR frame.

Q: Is the SP for the SFD or FRD just for information?

A: Currently not sure about the motion. The motion will not be run today.

Q: "non-data frame", will it be a MAC frame type or a PHY frame that does not contain MAC data?

A: The word frame refers to the MAC. It is a no-data-type frame.

Q: Is this for a specific MAC frame proposal?

A: It is in the presentation. We have not enough time.

SP is changed to say "non-data type frames".

Y / N / A: 7 / 38 / 32

### SP#2

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 37)

Q: Is this intended for SFD, FRD, or just for information?

Chair suggests indicating for every SP brought to the group the intention. As for this one it is not indicated, it is only for information.

Y / N / A: 34 / 17 / 25

### SP#3

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 38)

SP is changed to say "non-data type frames".

Y / N / A: 9 / 39 / 38

### SP#4

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 39)

Q: Why more than one Excitation field?

A: To support a kind of data exchange.

Q: Will vs. may in 2nd and 3rd bullet?

A: Yes, that's correct. There must be a single data field, but there may be more than one. It's not the same as the Excitation field.

Q: What is the expected length of the fields?

A: Not decided yet.

No objection to the SP.

### SP#5

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 40)

No objection to the SP.

### SP#6

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 41)

No objection to the SP.

### SP#7

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 42)

Q: Is this in addition to the AWGN channel model?

A: Yes. The question concerns simulations in addition to the AWGN channel model to evaluate multipath channels.

Q: So, this is only for longer ranges?

A: I want to get the feedback of the people. If they are not sure they should vote "Abstain".

Channel Model B: 12

Channel Model D: 18

Abstain: 45

Chair clarifies that only votes via Slido are valid.

### SP#8

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 43)

Text of the SP is changed to "Do you agree that 802.11bp amendment will define more than one uplink data rate for AMP-only active transmitters?".

Q: Is this for information only?

A: Yes.

C: I do not see the use case for multiple data rates.

Q: Suggest changing in the bullet "frame" to "PPDU"; "frame" is a MAC format.

Bullet point is changed to "TBD: how many rates and PPDU format".

Y / N / A: 41 / 8 / 20

### SP#9

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 44)

C: "AMP-trigger" is not defined.

C: Need to be careful on the terminology. Not sure if an "AMP-reader" will be defined, although I am sure we need an AMP trigger frame.

The SP is changed to be only for information.

Y / N / A: 20 / 26 / 29

### SP#10

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 45)

0.125Mbps: 19

0.25Mbps: 4

0.5Mbps: 3

1Mbps: 8

Abstain: 32

### SP#11

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 46)

1Mbps: 21

4Mbps: 4

8Mbps: 3

16Mbps: 8

Abstain: 39

### SP#12

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 47)

No objection to the SP.

### SP#13

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 48)

Q: We are not sure if this is achievable, can we defer the SP?

A: We have discussed this value a lot. It is feasible for active transmitters.

Y / N / A: 22 / 22 / 27

### SP#14

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 49)

Q: Is this for the FRD or SFD? FRD is high level guidance, SFD is detailed features, in my understanding.

A: That is correct.

Q: For which device types is that?

A: It is only about defining a function, which needs to be defined first. Then we can talk about limitations.

Q: 802.11 defines TSF as a local clock for the STA. Then, there is a requirement to synchronize to the AP. It is unclear what is intended here. In "regular" .11 a STA already has a local TSF before association. During association, the STA synchronizes to the AP's TSF. Is the SP the local TSF, or the latter, synchronized AP.

Y / N / A: 31 / 7 / 32

### SP#15

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 50)

No objection to the SP.

### SP#16

https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 51)

Q: Suggest removing "by the AP".

A: Agree, SP text is changed.

Q: Suggest changing "WiFi" to "802.11".

A: Agree, SP text is changed.

Q: Are all 802.11 devices included, even 11ba?

A: Yes.

Q: We did already SP more details on the clock accuracy. It is needed here?

A: Yes.

Q: Suggest to re-add "by the AP".

No objection to the SP.

## Motions

See document IEEE 802.11-24/1322r3.

### Motion #5

Move to include following content to sub-clause 2.1 of TGbp FRD:

“11bp defines at least one mode of MAC/PHY that supports close-range mono-static backscattering communication in 2.4 GHz.”

[DCN# 11-24/0798] SP: 37Y/6N/23A

Moved: Rui Cao

Seconded: Lei Huang

Result: Approved with unanimous consent

### Motion #6

Move to include following content to sub-clause 2.1 of TGbp FRD:

“11bp defines at least one mode of MAC/PHY that supports bi-static backscattering communication in 2.4 GHz.”

[DCN# 11-24/1215r1] SP: No objection

Moved: Bin Qian

Seconded: Hongyuan Zhang

Result: Approved with unanimous consent

### Motion #7

Move to include following content to TGbp SFD:

“11bp supports a mode to enable AMP devices to operate in legacy WLAN network by defining AMP DL and required control/signaling.”

[DCN# 11-24/1263r0] SP: 33Y/2N/6A

Moved: Pooria Pakrooh

Seconded: Bin Tian

Result: Approved with unanimous consent

### Motion #8

Move to include following content to sub-clause 4 of TGbp SFD:

“IEEE 802.11bp will specify, in 2.4 GHz, an AMP Downlink PPDU containing at least an 802.11 preamble field, an AMP-Sync field and an AMP-Data field. Inclusion of an AMP-SIG field is TBD.

The details of the 802.11 preamble field are TBD.

Additionally, for transmission to backscatter STAs there will be one or more Excitation fields

Additionally, for transmission to backscatter STAs there may be more than one AMP-Data field

Additionally, AMP-Sync and AMP-SIG field may precede each AMP-Data field

Name of this Downlink PPDU is TBD.

[DCN# 11-24/1345] SP: No objection

Moved: Steve Shellhammer

Seconded: Christian Berger

Result: Approved with unanimous consent

### Motion #9

Move to include following content to sub-clause 4 of TGbp SFD:

“The AMP Downlink PPDU AMP-Sync field and the AMP-Data field will use On-Off Keying (OOK) modulation.”

[DCN# 11-24/1345] SP: No objection.

Moved: Steve Shellhammer

Seconded: Weijie Xu

Result: Approved with unanimous consent

### Motion #10

Move to include following content to sub-clause 4 of TGbp SFD:

“The AMP Downlink PPDU AMP-Data field will use Manchester encoding for non-backscatter operation.

For the Backscatter case, the AMP-Data field encoding scheme is TBD.”

[DCN# 11-24/1345] SP: No objection.

Moved: Steve Shellhammer

Seconded: Bin Qian

Result: Approved with unanimous consent

### Motion #11

Move to include following content to sub-clause 4 of TGbp SFD:

“IEEE 802.11bp shall specify, in 2.4 GHz, an AMP uplink PPDU for AMP STA supporting active transmission that contains an AMP-Sync field and AMP-Data field. Inclusion of an AMP-SIG field in the AMP uplink PPDU is TBD.

The bandwidth of the AMP uplink PPDU is less than 20 MHz”

[DCN# 11-24/1496] SP: No Objection

Moved: Bin Qian

Seconded: Weijie Xu

Result: Approved with unanimous consent

### Motion #12

Move to include following content to sub-clause 2.1 of TGbp FRD:

“802.11bp defines AMP Timing Synchronization Function (AMP TSF)”

[DCN# 11-24/1475r3] SP: 31Y/7N/32A

Moved: Weijie Xu

Seconded: Yinan Qi

Result: Approved with unanimous consent

### Motion #13

Move to include following content to TGbp SFD:

“If AMP device is able to support AMP TSF, the maximum timing offset is ± 10^4 ppm”

[DCN# 11-24/1475r3] SP: No objection

Moved: Weijie Xu

Seconded: Lei Huang

Result: Approved with unanimous consent

### Motion #14

Move to include following content to TGbp SFD:

“11bp defines at least one mode of MAC/PHY that allows an AMP-only device with active uplink communication in 2.4GHz subject to the following requirements:

clock accuracy requirement is relaxed compared to legacy 802.11 devices;

the active uplink communication can only be sent in response to being polled by the AP”

[DCN# 11-24/1535r2] SP: No objection

Moved: Yinan Qi

Seconded:

Result: Approved with unanimous consent

### Motion #15

Move to include following content to sub-clause 4 of TGbp SFD:

“11bp defines at least one mode of MAC/PHY that supports close-range mono-static backscattering communication in 2.4 GHz.

11bp defines at least one mode of MAC/PHY that supports bi-static backscattering communication in 2.4 GHz.”

*[DCN# 11-24/0798r1, 11-24/1215r1]*

Moved: Rui Cao

Seconded: Bin Qian

Result: Approved with unanimous consent

## Current Timeline

Chair reviews the current timeline: https://mentor.ieee.org/802.11/dcn/24/11-24-1380r6 (slide 52)

## Teleconference Plan

* Oct 15th (Tuesday), 10:00am, ET, 2 hours; Webex
* Nov 5th (Tuesday), 9:00am, ET, 2 hours; Webex

Teleconference will take place if there is at least one submission to be presented.

## Adjourn

The chair announced the session adjourned at 18:00 EDT.

Next session will be the teleconference on October 15th.

Next hybrid (face to face & online) session will be the IEEE 802 plenary meeting starting from November 10th.