IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGbp Ambient Power Communication  November 2024 Plenary Meeting Minutes  Vancouver, British Columbia, Canada | | | | |
| Date: 2024-11-15 | | | | |
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Abstract

Rev 0: This document contains the IEEE 802.11 TGbp November 2024 Plenary 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

Meeting agenda document is [IEEE 802.11-24/1671](https://mentor.ieee.org/802.11/dcn/24/11-24-1671)

All times are given in local time of the meeting venue (i.e., Pacific Standard Time / UTC-8)

# Monday PM1 (2024-11-11T13:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r2).

* Chair calls the meeting to order at 13:30.
* 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 (slide 20).

Some discussion about the Thu PM2 session as it overlaps the TGbn session.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1671r2 (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
* FRD/SFD motions
* Contribution discussion (FR/PHY) [25 mins for each w/o prior request]
  + 11-24/1786, Tradeoffs - Active and Backscattering AMP Tags, Dror Regev (Huawei)
  + 11-24/1529, Some observations related to OOK, Leif Wilhelmsson (Ericsson)
  + 11-24/1802, OOK generation for AMP DL, Ke Wang (OPPO)
  + 11-24/1537r1, Wireless connectivity challenges for AMP only IoT devices under 802.11 specification, Solomon Trainin (Wiliot)
* Any other business?
* Recess

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

Some discussion on the agenda. Agenda approved.

## Motion: Approve TGbp Meeting Minutes

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

https://mentor.ieee.org/802.11/dcn/24/11-24-1609-00-00bp-2024-09-interim-meeting-minutes.docx

https://mentor.ieee.org/802.11/dcn/24/11-24-1787-00-00bp-teleconference-minutes-october-november-2024.docx

Moved: Sebastian Max

Seconded: Leif Wilhelmsson

Result: Approved with unanimous consent

## Motion: Approve FRD Update

Approve the updated 11bp FRD as included in:

https://mentor.ieee.org/802.11/dcn/24/11-24-1307-02-00bp-proposed-tgbp-functional-requirements.doc

Moved: Bin Qian

Seconded: Sebastian Max

Result: Approved with unanimous consent

## Motion: Approve SFD Update

Approve the updated 11bp SFD as included in:

https://mentor.ieee.org/802.11/dcn/24/11-24-1613-02-00bp-specification-framework-for-tgbp.docx

Moved: Yinan Qi

Seconded: Weijie Xu

Result: Approved with unanimous consent

## Contributions

### Presentation of IEEE 802.11-24/1786, Tradeoffs - Active and Backscattering AMP Tags, Dror Regev (Huawei)

Q: How much power is needed by the amplifier for the backscatterer?

Q: What about the size of the capacitor, is that feasible?

A: Analysis is theoretical. Uplink amplifier was proposed by another attendee, as well as the larger capacitor.

Q: Slide 5. Do you consider self-jamming of the carrier? For all these distances the link is jamming-limited, not SNR limted.

A: No, not considered here.

Q: AP has different receiver sensitivity. Is the threshold -98dBm?

A: Yes. for 2MHz.

Q: Is the SNR at the tag or the AP?

A: At the AP.

Q: Limit is the downlink, I agree. Slide 8: backscatter device tx power is the received signal minus a penalty. For active tx the transmit power can be increased, like 0dBm or even higher. So, the rate on the UL can be increased, decreasing the on-air time, saving power. So, the capacity can be smaller.

A: Took power for active tag from reference [2], -25dBm at 2.4GHz.

Q: SNR calculation, did not consider direct link leakage?

A: Will need more analysis.

Q: What level of SNR is needed?

A: I am using reference [2], 3dB is sufficient.

### Presentation of IEEE 802.11-24/1529r0, Some observations related to OOK, Leif Wilhelmsson (Ericsson)

Q: Support conclusion. On the CSF: what component can this be, is it possible for a low-complexity device? Filter may be expensive.

A: Did not think about design, used Butterworth filter.

C: On PSD limits, may not be true in sub-GHz if frequency hopping is used.

Q: How does it relate to the previous presentation? Devices are limited by energy harvesting.

A: Having a wide signal may be an advantage for the energy harvesting.

A: Not sure about sub-GHz. Others will not appreciate frequency hopping.

Q: Receiver bandwidth, is it 20MHz?

A: SNR is defined over 20MHz, at the input of the CSF. CSF filters out noise, as it is matched to the signal. However, reducing the bandwidth by 2 (3dB) does not reduce the noise by 3dB.

Q: What if we use 100MHz, no CSF?

A: Will have much worse performance, more noise.

C: On the CSF. We need to understand what it is for the different AMP device types. There can be also adjacent channel interference in 2.4GHz, which we'll see if the filter is wide.

A: Agree, interference in the band is a problem.

Q: How does the CSF operate? Is it fixed bandwidth?

A: Filter is matched to the expected received signal.

Q: How does the tag know the signal bandwidth?

A: I assume it knows the bandwidth.

Q: Is the CSF implemented on the tag or on the reader side?

A: Assumed at the tag. Submission is focused on the DL, using OOK.

C: A CSF with BW < 20 MHz will inflict high loss and addutional PNoise if implemented on chip to allow tunability of the center frequency. A citcuit used for such cases in RFID is an N-path filter which also requiers several LO phase and high-power consumption.

### Presentation of IEEE 802.11-24/1802r0, OOK generation for AMP DL, Ke Wang (OPPO), presented by Weijie Xu (OPPO)

Q: What is the problem of the OOK-OFDM? Is it related to the symbol rate?

A: Cannot use MC-OOK as in 11ba due to 1Mb/s requirement. We might use the presented procedure, but then the CP remains.

Q: Interesting idea to use DSSS. Support this direction. What is the proposal for the preamble, also use 11b?

A: We are working on the legacy preamble part.

Q: Might it help not to generate/transmit the CP?

A: The generation is based on the legacy procedure. IFFT length 64, symbol length 4µs. It's baked in the system.

Q: We might have both, the tag does not care how the signal is generated.

A: Yes, it is transparent to the tag. DSSS-OOK gives better performance in our analysis.

C: OFDM has a higher PAPR.

C: There's a number of ways to change/increase the bandwidth. But what bandwidth do we want? Also depends on if there's a channel-selective filter. Might vary on the class of device.

Q: For different data rates different types of DSSS must be generated?

A: Depends on the data rate that we want to support.

Q: Can we reduce the chip-rate of DSSS to reduce the bandwidth?

A: We want to re-use a legacy transmitter, with 11Mb/s chiprate, so it is fixed here.

## Recess

The chair announced the session recessed at 15:30.

# Monday PM2 (2024-11-11T16:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r2).

* 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/24/11-24-1671r2 (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
* Contribution discussion (PHY) [25 mins for each]
  + 11-24/1846, AMP client types, Rojan Chitrakar (Huawei)
  + 11-24/1799, Analysis of Free Running Oscillators Accuracy for Active Transmission AMP Devices, Amichai Devorich (Wiliot)
  + 11-24/1780, Further Discussion on AMP PPDU Design, Yinan Qi (OPPO)
  + 11-24/1859, preamble (10 min)
  + 11-24/1731, Downlink data rates for bi-static backscatter, 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 802.11-24/1846, AMP client types, Rojan Chitrakar (Huawei)

Q: Not going to be simple. In 11ba we talked to ARC. For a device that listens to HT, and to DL-AMP. Is that one STA or two?

A: We follow what 11ba has done, similar approach.

C: No need to push beyond HT, that should be ok.

Q: Tag that can do multiple things from the list, what is then the name. For example, backscatter and active uplink.

A: We did not anticipate this.

Q: Similarity between backscatter modes, also from the hardware capabilities. Will there be no differences in the protocol?

A: There may be differences. But that would be different modes of operation.

Q: How to differentiate an active device and a legacy device?

A: Not good to specify all detailed capabilities.

Q: There may be even more names, which makes it very complex. But it might be a capability instead, similar to, for example, "beamforming". So, an AMP STA that is "backscatter-capable".

A: Need to discuss further.

C: Name should be more similare to the description.

C: "AMP Assisted non-AP STA" might also be co-located STA to a non-HT STA.

C: In the baseline the type is coupled to the PHY. But here all support the same AMP PPDU. It should be different PPDU.

C: Slide 4: Monostatic is short-range, bistatic is long-range here. But maybe monostatic can also be long-range?

A: We've just collected the names from the different contributions. Our proposal does not preclude monostatic being long-range.

### Presentation of IEEE 802.11-24/1799, Analysis of Free Running Oscillators Accuracy for Active Transmission AMP Devices, Amichai Devorich (Wiliot)

Q: Slide 6. 15,000ppm to 650ppm, how is this done?

A: By temperature compensation with 5 degree Celsius accuracy.

Q: Slide 7. Are the two LO close in frequency? What is their relationship?

A: This is an implementation issue, there are many options here.

Q: What about a frequency divider? Even in 700nm full frequency divider consumes only 10µW, significantly lower that in this presentation. No calibration needed; it comes from the energizer.

A: This is for an active transmitter, where we don't require full duplex at the reader.

Q: Inaccuracy might be due to device imperfections during the production.

A: Yes, need to be calibrated during the production in the factory, some might also be compensated online. Temperate cannot be controlled, so it is very hard to compensate.

### Presentation of IEEE 802.11-24/1780, Further Discussion on AMP PPDU Design, Yinan Qi (OPPO)

Q: Is this DL or UL sequence? What is the design criteria?

A: Both. Design is in the companion contribution.

Q: Slide 8. CRC of 1b is too low. Need more protection.

A: It's a compromise between robustness and size.

Q: It's not clear what is MAC and PHY, and where to put the information.

A: SIG signals the format of the data part.

C: Slide 6. Why not use 11ba preamble?

### Presentation of IEEE 802.11-24/1859, TGbp PPDU preamble follow up, You-Wei Chen (Mediatek)

Q: This is the OFDM preamble format?

A: Yes, only for OFDM.

### Presentation of IEEE 802.11-24/1731, Downlink data rates for bi-static backscatter, Bin Qian (Huawei)

Q: Will short-range also consider security?

A: No consideration on security yet.

C: Security might have a large impact on the architecture, so that might be separating factor.

Q: Slide 8. How long is an exitation field?

A: The duration depends on the capacitor and received power. 1ms is an approximation.

Q: On the interference. 256kb/s is ok for the link budget. Lower rate is better for interference. But lower rates increase the time on the air, so it becomes more susceptible to interference. And there can be interference from Bluetooth devices, or other readers.

A: It mostly depends on the location of the interference source.

Q: What signal is assumed for the interference?

A: Just the power, no assumption on the signal of the interference.

Q: What interference was simulated?

A: It's just a theoretical analysis, no system level simulation.

Q: Slide 10 recommends 3 data rates. I'd prefer fewer than 3 and spaced out more.

A: Maybe drop 125kb/s.

## Recess

The chair announced the session recessed at 18:00.

# Tuesday AM1 (2024-11-12T08:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r3).

* 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/24/11-24-1671r3 (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
  + 11-24/1793, AMP Downlink Data Rates, Steve Shellhammer (Qualcomm)
  + 11-24/1794, Robust Method for AMP Active Uplink Multiple Data Rate Support, Steve Shellhammer (Qualcomm)
  + 11-24/1797, Design considerations of DL data rate and SYNC, Rui Cao (NXP)
  + 11-24/1798, Backscattering UL data rate and modulation, Rui Cao (NXP)
  + 11-24/1801, Data rates for AMP IoT, Weijie Xu (OPPO)
* 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 802.11-24/1793, AMP Downlink Data Rates, Steve Shellhammer (Qualcomm)

Q: On the bandwidth, slide 8. 1Mb/s data rate, 4MHz bandwidth. Why not use 8MHz or 10MHz to boost the power?

A: Current this is single carrier and the narrowest bandwidth. We could widen it. The SP does not talk about the bandwidth, can be wider than 4MHz.

Q: Single-carrier OOK – is that easy to generate by the AP?

A: It is generated with 2 MHz symbol rate, give it a mean. That's easy. It could be widened. Using OFDM for this will be hard, 1/8th of a symbol. One way could be direct spread. We should fit within the current spectral mask.

Q: Slide 6. Is this for devices with LO? For simple backscatter devices the SCO is more critical.

A: Yes, had active transmitter in mind.

Q: What about having just one data rate?

A: 1Mb/s has the advantage of short packets. One data rate would probably be 250kb/s, so 4x slower, and close to 11ba.

C: Difference might not be huge as the packet size is small, so in absolute terms the duration is not that different.

Q: Slide 5, 1000ppm is using LO. This clock uses a lot of power.

A: 1000ppm was discussed for the active tx uplink, active tx downlink has lower precision. Non-backscatter will have to have a clock.

Q: Different waveforms for active and backscatter?

A: For backscatter it's likely OOK. For active there are two proposals, OOK and MSK.

Q: What if an active rx device sees a signal for a backscatter device?

A: Agree, this should not cause problems. It should not confuse the device, also for the opposite.

C: Maybe the base-rate should not be common for all the device types?

### Presentation of IEEE 802.11-24/1794, Robust Method for AMP Active Uplink Multiple Data Rate Support, Steve Shellhammer (Qualcomm)

Q: Convincing case for wider bandwdith. We also need to look at spectral masks of the larger bandwidth.

A: Did not look at the masks. Not sure yet if we use MSK or OOK. However, mask is less important for the uplink, as the transmit power is low anyways.

Q: Large bandwidth is good for the frequency diversity. For the downlink we also get higher power. But for the uplink the power is limited by the device. Also, more bandwidth means more noise.

A: Yes, but this is countered by the coding. Extended-range Wi-Fi does something similar (but more complicated).

Q: What kind of repetition is done?

A: The presentation is high-level, not at this detail level.

Q: If MSK is used a coherent decoder is needed, which requires fine frequency estimation. Otherwise, loose 6dB. Furthermore, the channel is frequency selective. To use this as a gain a complex equalizer is needed. Also, the nice spectrum of MSK is only given without repetition.

A: Not proposing MSK or OOK. Yes, for MSK the receiver is more complicated, but it is at the Access Point side. Repetition could be scrambled. So, issues could be addressed, but we first need to decide MSK vs. OOK.

### Presentation of IEEE 802.11-24/1797, Design considerations of DL data rate and SYNC, Rui Cao (NXP)

Q: Slide 6. What's the location of the random data?

A: Before the sync field, just to test the performance. Tag wakes up to an ongoing packet, study the probability of false positive.

Q: Slide 7. Preamble detection based on switch on-off. Manchester receiver detects differently, so it needs additional hardware.

A: Tag is low-cost, can be 100k ppm. Lose 10% per bit. So on-off detection is needed to sync. The difference that for Manchester code the transition is in the middle of the bit.

Q: How is the sync detection implemented on the tag? Is there an ADC and a code detector?

A: Baseline is an envelope detector, which is then sampled with the clock rate.

### Presentation of IEEE 802.11-24/1798, Backscattering UL data rate and modulation, Rui Cao (NXP)

Q: Should we focus on just one backscatter modulation?

A: For first generation AMP prefer to have something simple, so to unify backscatter modulation to Manchester Encoding.

Q: Slide 7. DL exitation waveform is 20MHz, reader is using 40MHz?

A: 40MHz is the receiver operating bandwidth, so 2x Nyquist.

Q: Will 20MHz also work?

A: Yes, but here assuming a typical Wi-Fi receiver.

Q: What is the bandwidth of the signal itself?

A: Same as energizer, 20MHz.

Q: How to achieve 250kb/s?

A: Just extend on/off duration by 4.

Q: What is the "effective" receiver noise floor?

A: Wi-Fi receiver will go to low-gain mode, which has a low noise floor.

Q: What is the residual noise?

A: Did not analyze this aspect.

### Presentation of IEEE 802.11-24/1801, Data rates for AMP IoT, Weijie Xu (OPPO)

Q: Why different receiver architectures?

A: Different capabilities, dependent on the use-case. For example, if WPT is the bottleneck, the receiver can be simple anyways.

Q: Slide 16. This is received at the AP. Do you assume single rx antenna?

A: We assume single rx antenna. Will check the details.

C: Even a phone might have two. There will be fading, but multiple rx antennas will help.

Q: Do you assume a "physical AP"? They might have up to 4 antennas?

A: Did not consider yet, but performance will be better.

Q: For higher rate and channel D: what is the assumed distance? For the short range the delay spread will be smaller, so the channel will be better.

A: We set it to 10m.

Q: Delay spread cannot have this impact. Channel D, 50ns. Less than 10% of the symbol rate should not need an equalizer.

A: Need to check.

## Recess

The chair announced the session recessed at 10:00.

# Tuesday PM2 (2024-11-12T16:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r3).

* Chair calls the meeting to order at 16:00.
* 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/24/11-24-1671r3 (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 (PHY) [25 mins for each]
  + 11-24/1687, Frequency Shifting in Backscatter Operations, Nelson Costa (Haila)
  + 11-24/1782, Timing issue for AMP, Yinan Qi (OPPO)
  + 11-24/1803, Sync field for AMP PPDU, Ke Wang (OPPO)
  + 11-24/1816, AMP Downlink Sync Field Options, Steve Shellhammer (Qualcomm)
  + 11-24/1819, Downlink Sync Sequence Design, Bin Qian (Huawei)
* Contribution discussion
* 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 802.11-24/1687, Frequency Shifting in Backscatter Operations, Nelson Costa (Haila)

Q: Slide 6. How can we know that the tag / rx has antenna gain.

A: Presentation is for an actual implementation, it's not an average case.

Q: Shift introduces at least 3dB loss, it is not an ideal multiplication. 5dB sounds low for the backscatter loss.

A: Backscatter efficiency is all-inclusive. Not all energy will be in the correct channel. 5dB is related to all the energy that is backscattered, double-sided.

Q: 50MHz separation requires 50MHz LO, what is the power consumption and the ppm accuracy?

A: Better than 20ppm accurarcy.

C: Need more information on the 50MHz shifting and the efficiency in practice.

Q: Does this tag belong to a different category?

A: No, this is backscattering.

Q: Tx on channel 1, backscatter on channel 11, and thus receiver as well, is there a feedback mechanism?

A: Yes. There needs to be a feedback channel. But this principle is needed for long-range backscattering.

Q: Signal processing in the tag. How complex is that? What about a signal on channel 2?

A: Implementation-specific, the tag only requires the timing information.

A: Shifting of the 50MHz only needs 1000ppm clock to reach sufficient precision. Also, 20MHz shift is feasible, which essentiall results in a HT-40 transmission.

### Presentation of IEEE 802.11-24/1782, Timing issue for AMP, Yinan Qi (OPPO)

Q: SP3, is that intended for backscatter?

A: Yes. Not needed for active devices.

Q: SP3, what is the intention?

A: We don't need the sync for every data part, so it should be allowed not to send it every time.

C: Proposal is only for backscattering. Based on the capability, the clock is 100,000ppm. So, it is not possible to maintain any kind of clock, it is synchronized on a bit level.

A: Maybe there are higher capability tags with less drift rate?

C: Yes, but still for backscattering devices it will not be possible.

C: First sync might be longer, to signal the start of the frame. In the middle only a couple of bits might be needed. So, the overhead of re-sync might not be significant.

Q: How does the receiver know that there is no sync?

A: That information can be carried in the data part.

Q: SP2. Should indicate that this is for backscattering. AP knows how long UL is, when the next DL starts. There is no flexibility on the tag side.

A: Exitation field might be more flexible, configured by the data before. But the AP knows the schedule.

Q: What happens if the DL has different length?

A: This is possible. Might be signalled by the SIG.

Q: But this means that every device has to receive every part of the transmission?

A: Yes.

### Presentation of IEEE 802.11-24/1803, Sync field for AMP PPDU, Ke Wang (OPPO), presented by Weijie Xu (OPPO)

Q: If SIG has a bit to signal the rate, it is not needed by the SYNC. We prefer to use the SYNC just for the synchronization.

A: Depends on how many data rates will be supported. In 11ba it is signalled by the SYNC.

Q: Maybe explain the assumption of the correlator? What is the input, soft values, bits? False positive rate with 8b is very high.

A: We referenced the design in 11ba.

Q: 11ba design philosophy was reused here, for two data rates. Long sequence for low data rates was to match the SNR. But here we don't need a long sequence for the low rate, we might need a shorter sequence.

Q: Slide 7. Example is not sufficient to show that the cross-corellation is good with random data.

A: Compare peak of 8 vs. peak of 5 with random data. Plus, we have 3 consecutive 1 / 0 to differentiate from a Manchester Code. But we need more data in any case.

### Presentation of IEEE 802.11-24/1816, AMP Downlink Sync Field Options, Steve Shellhammer (Qualcomm)

C: A 20MHz with 1000ppm clock was proposed. This changes the prior assumption of 100,000ppm clock for backscatters.

A: Yes – this needs to be set, these are input parameters for the sync field.

Q: For DL there might not be major differences. We see value for having low rates for all types of devices (no-backscatter with low SNR). So, a single sync for all types would fit.

A: It's more a clock accuracy problem, not a SNR problem.

Q: Design partitioning into backscatter and non-backscatter needs more thoughts. Maybe rather receiver capability / preamble detection designs.

Q: Is there a SIG field?

A: DL has sync and data, SIG is not decided.

C: Option #2 might not need a SIG field, if they are different enough.

C: Need description on how the receiver might work, then we can decide on the Option #1 or #2.

### Presentation of IEEE 802.11-24/1819, Downlink Sync Sequence Design, Bin Qian (Huawei)

Q: A STA that can receive 2 rates will have to sync with both sequences, doubling the sync correlator?

A: For only single sequence then SIG field needs to use the lowest rate. Also, it cannot be the bottleneck of the lowest rate, it needs to be long. Only one correlator is needed as the sync is based on a base sequence.

Q: Side-lobe level is not a metric to design; we would like to focus on misdeted and false alarms.

A: Peak-to-sidelobe ratio is a common criteria.

C: Manchester-type sync would improve hardware reuse.

Q: Slide 6, 2nd point. What does it mean?

A: Either .11-preamble or exitation field is before the sync field. These are all on/off symbols for the receiver, affecting the left part of the correlation.

Q: For two data-rates it is ok. For more rates it's not enough to signal it implictly.

A: Yes. Currently there's no consensus on the DL rate.

C: Receiver bandwidth may be very wide, especially in the backscatter case. OFDM in adjacent channels should also not trigger a false positive. Maybe there should be a test for this.

Q: Is this targeting very high or low reception levels? Classic backscatter case has -25dBm, no sequence might be needed. Much more difficult for -80dBm, especially if Manchester encoding is not used, as then the threshold level needs to be set.

A: Need to check this.

C: There is a preamble before this. We should consider the relative power of the preamble vs. the following sync case.

C: Better to avoid having an AGC in the device, this increases the complexity. Manchester is a simple solution.

Q: RFID does not use Manchester encoding in the sync field. How is it solved?

A: RFID has very high reception level, -30dBm. For lower levels this changes.

## Recess

The chair announced the session recessed at 17:52.

# Wednesday AM1 (2024-11-13T08:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r3).

* 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/24/11-24-1671r3 (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 (MAC) [25 mins for each]
  + 11-24/1548, Throughts on Security for AMP Rojan Chitrakar (Huawei)
  + 11-24/1774, Details of AMP trigger procedure, Chuanfeng He (OPPO)
  + 11-24/1775, Duty-cycle AMP operation, Chuanfeng He (OPPO)
  + 11-24/1776, Multiple access mechanisms for AMP, Chuanfeng He (OPPO)
  + 11-24/1804, CDM Access for AMP IoT, Weijie Xu (OPPO)
* 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 802.11-24/1548, Throughts on Security for AMP Rojan Chitrakar (Huawei)

C: Direct use of PMK in [1]. Key difference is that AMP device is assumed not to keep any memory. So, no way to preserve a message. But for AMP device that can keep memory between accesses the proposed method works. We need to see how capable devices are in the future.

Q: What about group keys?

A: Did not show here, but this should be a straightforward extension. To be discussed further, depending on if group keys are required.

Q: Group key is a challenge to use in both down and uplink direction.

A: Agree. Need to analyze further. Unicast is the first step.

Q: Assume to have unique and constant unicast addresses?

A: Yes, we assume a unique identifier.

Q: How does this impact the PHY? What is the expected payload size to support this security?

A: Details need to be worked out. Few octetts to be added for the protected communication.

Q: Key generation and authentication are not a big payload?

A: Don't have answer right now. SAE key generation could be big. We share the concern that it might be a problem for AMP.

### Presentation of IEEE 802.11-24/1774, Details of AMP trigger procedure, Chuanfeng He (OPPO)

Q: Slide 6. AMP STA 1 & 2 are active transmitters?  
A: All are backscatter STAs.

Q: They can support FDM and CDM?

A: Yes. Details on CDM will be discussed later.

C: Not sure if this is feasible. Need more information on that.

Q: Scheme requires energizer that is constantly on. How does this work with the discussed PPDU formats we have discussed?

A: We need to design a new frame format for the AMP Trigger.

### Presentation of IEEE 802.11-24/1775, Duty-cycle AMP operation, Chuanfeng He (OPPO)

Q: Slide 8. Concern where TSF is carried. TSF in trigger may be sufficient to synchronize in a TXOP. For duty cycle operation with very large duty cycles drift can be several seconds. 1h duty cycle = 36s. So, it will not even wake up in the same second.

A: Trigger interval should be short. Duty cycle operation is needed if there are many devices. Trigger is sent very frequently.

Q: But for this the sleep duration must not be longer than the trigger interval.

C: Assume trigger frame wakes up / poll many tags. But tags do not charge at the same rate. Some might not be able to respond or have a TSF clock.

A: Device needs to have sufficient power to maintain a clock, this is our assumption.

C: Tag has no control how much power it can harvest, that's the big problem.

C: Capability if a tag is awake in the next trigger time also depends on if there has been a frame exchange before. There needs to be a way to communicate this capability / the energy status.

Q: Do you assume to trigger each AMP STA separately, or to trigger multiple devices?

A: Trigger group by group, multiple devices at the same time. It contains signalling to assign the resources to each device.

Q: But the devices might have different state of energizing. So, a single duty cycle cannot apply.

Q: How do you allow new devices?

A: Assume that all devices are known by the AP.

### Presentation of IEEE 802.11-24/1776, Multiple access mechanisms for AMP, Chuanfeng He (OPPO)

Q: Slide 4. How does the AP grant the slots to the AMP STAs?

A: Trigger grants the slots, based on pre-defined rules, for UL PPDU transmissions.

C: But the AP does not know which AMP STAs are active. AP may grant slot to an AMP STA that has not enough energy.

Q: Slide 8. What are the sync signals? What do they carry? What is the need for the first sync signal?

A: It can be the AMP SYNC field for DL PPDU. For the first sync signal, we prefer a unified design for the operation.

C: Overhead should be minimized. Need to discuss further.

C: Slide 9. There is a direct leakage in backscattering tags. FDM needs to work together with the leakage.

### Presentation of IEEE 802.11-24/1804, CDM Access for AMP IoT, Weijie Xu (OPPO)

Q: Slide 9. m-length sequences. For a given length there's only one sequence. Differentiation is in shift. For multipath this will show up several times. There's no way to differentiate.

A: We evaluated Wi-Fi channel D. 50ns delay. Chip length is 2µs. Delay spread is small.

Q: How many devices will be part of this in practice? Will be more than 2.

A: For example, for 10 devices, reader need to allocate more than 10 slots to avoid collisions. With CDM, less slots are needed for the same collision probability. AP needs to set the parameters for the access probability.

Q: Slide 9. Two clear peaks are present. But what if they are close to the noise? How does the reader know how many tags access the medium at the same time?

## Recess

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

# Wednesday AM2 (2024-11-13T10:30)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r4).

* 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 agenda for the meeting slot.

## Agenda

Chair presents the agenda of the session: https://mentor.ieee.org/802.11/dcn/24/11-24-1671r4 (slide 35).

* 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 (WPT) [25 mins for each]
  + 11-24/1767, AMP Energizer, Ian Bajaj (Huawei)
  + 11-24/1769, Further discussion on the AMP WPT protocol, Ian Bajaj (Huawei)
  + 11-24/1781, Further Consideration of WPT for AMP, Yinan Qi (OPPO)
  + 11-24/1808, OFDM-based WPT waveform, Panpan Li (Huawei)
  + 11-24/1939, Follow Up on Power Budget Negotiation, Ugo Campiglio (Cisco)
* 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 802.11-24/1767, AMP Energizer, Ian Bajaj (Huawei)

Q: SP1. Why is the energizer an IEEE 802.11 non-AP STA?

A: If the energizer is non-colocated it needs to receive instructions via 2.4/5 GHz. If the energizer is colocated with the AP it's a different use case.

Q: Slide 5. Should the frequency be considered?

A: Received feedback that feedback is not important.

Q: SP1. Even if the energizer is non-colocated the communication might be via wire. So it's not needed to be a non-AP STA

A: If it is a wired connection 11bp does not design the communication. Only need to specify if it's wireless.

Q: Energizer can also send a preamble in addition to the energizing.

A: Yes, may add this information.

Q: Slide 4. Not clear what is the reader, what is its function?

A: Not covered here, may be supported. We just want to enable WPT exitation.

Q: Why not allow the energizer to have link access?

A: Then it is essentially the AP.

Q: Is the AMP STA associated with the AP?

A: In some use cases it can be associated.

Q: The AMP STA is not associated to the energizer?

A: Correct.

Q: And the energizer, is it associated to the AP?

A: Yes, for the control.

### Presentation of IEEE 802.11-24/1769, Further discussion on the AMP WPT protocol, Ian Bajaj (Huawei)

Q: How to include regulatory requirements, like LBT, duty cycle?

A: From the regional aspects that should be already known. Not sure if it is necessary that the AP informs the energizer.

Q: So, they know their region?

A: AP and energizer, yes. AMP STAs are too simple.

Q: Slide 8. Don't agree with both step 1 and step 2. Impossible for device to measure exactly how much energy it has. Also hard for AP to make good use of this information. Only consider step 2.

A: Maybe step 1 is not required in every use case, but it is beneficial on other use cases.

C: Slide 5. Think that step 1 may be quite useful. It is helpful to optimize the energizing procedure.

C: Slide 5. Some parameters are rather power related, not energy harvesting related. Also relates to SP 1.1.

Q: Slide 4. Sinle AP, single AMP STA, one energizer. It’s more complicated, multiple energizer may power the AMP STA. AP has no idea who best provides power to the AMP STA. Need passive observation, this active procedure does not allow to control the procedure.

A: Yes, diagram does not show other APs / energizers.

A: AP receives WPT responses from multiple AMP STAs. AP knows roughly where the energizers are located. AP tells energizers when and how often to switch on. Overlap of energizers is not an issue.

Q: Not worried about the protocol. But concern how useful the approach is.

A: I will bring a contribution to highlight the usefulness.

### Presentation of IEEE 802.11-24/1781, Further Consideration of WPT for AMP, Yinan Qi (OPPO)

Q: Slide 11, Power Category. Is the goal to limit the information, to save bits?

A: Yes.

C: I see pros and cons. Quantization leads to information loss.

Q: Slide 14. Is this for data on sub-1GHz?

A: Yes.

Q: Slide 15. Preamble for WPT. Is this along 11ah?

A: Thinking of new design. Motivation is to be understood by other energizers. Not many features needed, can be very simple. Could also start with 11ah, but this needs modification.

Q: Energizer sends the frame?

A: Yes.

Q: Slide 15. Why differentiate preamble and charging part, could repeatedly send the preamble?

A: Yes, that's an option.

Q: AP to be able to indicate to AMP STA to start the energy harvesting. What is the intention?

A: Energizer cannot always transmit the WPT signal. So, the energizer must have a duty cycle. This is sent to the energizer, but not to the AMP STA.

C: Preamble and charging part will have different design criteria.

Q: ED might be not good.

A: May be more sophisticated if the preamble is designed carefully.

### Presentation of IEEE 802.11-24/1808, OFDM-based WPT waveform, Panpan Li (Huawei)

Q: SP. OFDM-waveform can be quite useful. Can we also consider a single carrier?

A: I'm not excluding other options.

Q: Need to stay within the spectral masks. Only solution is to have a strong amplifier.

A: Amplifier is not the only problem. Different regions may have strict regulations. In China the first rejection level is -40, second is -60. Very difficult to make the spectrum decrease quickly.

Q: High PAPR, how does the conversion efficiency improve?

A: Not now, need to give a follow up.

Q: Is the efficiency better because the energy harvesting is better with a higher power level?

Q: How much PAPR is needed?

A: Depends on the hardware, ratio is 5-10.

Q: For the comparison to a single tone, do they have the same average power?

A: Yes, total transmit power is the same.

C: For sub-1GHz the limiting power is much higher than in 2.4GHz. It's not easy to get to this limit using OFDM. For a single tone it's much simpler to reach this limit, and to transmit with high power. However, the energizer efficiency decreases for a single tone. It's not clear what is the best solution.

### Presentation of IEEE 802.11-24/1939, Follow Up on Power Budget Negotiation, Ugo Campiglio (Cisco)

Q: You propose to have several profiles for devices. Can you give examples? What is the differentiation?

A: Energy capacity in joules. Can vary, some might have a capacity, some a battery.

Q: Slide 8. Is this similar to the "power category" presented earlier?

A: Each devices has its own profile. Feedback is only the percentage; AP does the calculation. ID is assigned by the manufacturer.

Q: Slide 10. ProfileID is given in the association, it's a one-time-thing. The feedback then should also be allowed to be triggered by the AP, not only via piggyback.

A: Agree. However, if there's a frame only for the report, this would also consume energy. That's not productive.

Q: UL data rate could be 250kb/s. This information needs 100s of µs. This is a big overhead.

A: Trying to reduce as much as possible. Assume frame size of 200b.

Q: Is it necessary to transmit the WPT feedback always?

A: Depends on the use case.

Q: Slide 8. We don't know how this will be used. However, there's value in feedback on the current level. But why exactly 7b, 17b?

A: Only an example to show few bits are sufficient. 7b will be a percentage, with respect to the energy capacity in the device profile.

Q: So, the world needs to agree on device types and the operating modes?

A: Each manufacturer can define its own operation modes.

Q: Slide 10. How does the AP use the Type Profile ID? How does it use this information?

A: It gets the details OOB. Then, it will know the operating details of the STA.

Q: How is this sufficient?

A: The first part are the capabilities and requirements. The second part is the feedback on the WPT. The AP needs to combine the capabilities, requirements with the feedback.

Chair reminds attendees that in the next slot, Thu AM1, the SPs will be run. SPs should contain the information about the related contribution and if later a motion shall be run.

## Recess

The chair announced the session recessed at 12:30.

# Thursday AM1 (2024-11-14T08:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r5).

* 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/24/11-24-1671r5 (slide 37).

* 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 [20 mins for each presentation including Q&A]
  + *Following presenting order*
* Any other business?
* Recess

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

No discussion, no objection, agenda approved.

## Straw Polls

### SP Set #1, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 38)

Results: [withdrawn]

### SP Set #2, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 39)

Discussion:

C: Only makes sense for the 2.4GHz band, for sub-1GHz it will be hard to find a channel that supports this rate.

A: Agree to amend the SP by including "in 2.4GHz" after "Downlink PPDU".

Results: No objecting opinion.

### SP Set #3, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 40)

Discussion:

Q: Energizer is on sub-1GHz. What kind of PPDU is assumed for the energizer?

A: Backscattering is on 2.4GHz.

C: SP needs clarification, can be mis-used.

Q: This opens a lot of complexity and questions. If it is a non-AP STA, what is the relation to the AMP STA? Would like to defer the SP.

A: This is needed for the bi-static backscattering. We did not consider interaction of non-AP STAs with AMP STAs.

C: Against the SP, leaves too many things open where we don't have consensus.

Results: [Deferred]

### SP Set #3, SP#2

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 40)

Discussion:

C: Did not define AMP Energizer yet.

Results: [Deferred]

### SP Set #3, SP#3

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 40)

Discussion:

C: Suggest removing the "to the AP".

A: Ok.

C: No evidence is provided that the reporting is needed.

A: Discussion was done.

C: Additional mechanism may be beneficial. But AMP STA should be as simple as possible, has hardware and energy constraint. So there can be some kind of reporting, but only critical information. Need discussion what is critical.

A: Therefore, we have added the TBD.

C: Reporting is quite essential. Plus, reporting might not be repeated after the activation of the device. Hence the reporting will have low overhead.

Results: 25 Y / 9 N / 7 A

### SP Set #4, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 42)

Discussion:

C: Concern on the details of the figures referenced in the SP. Suggest removing reference to the figures.

A: SP text updated, removed reference to the figures.

Q: If a smartphone is used to read the AMP STA, is that an AP in this case?

A: It can be interpreted as mobile AP.

Results: No objecting opinion.

### SP Set #5, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 43)

Discussion:

C: Makes sense for 2.4GHz, but not for sub-1GHz. Text should state this.

A: Agree. Add "2.4 GHz" after "AMP Downlink PPDU".

C: Change "pulse duration" to "chip duration".

A: Agree.

Results: No objecting opinion.

### SP Set #5, SP#2

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 43)

Discussion:

C: Also add "2.4 GHz" after "UL transmission".

A: Agree.

C: Speak against the SP; I don't see the need to do that, limits options. Ok for the DL.

C: Too restrictive for active transmissions. AMP STA should be able to use other mechanisms.

A: Other mechanisms can be included later; this is not exclusive.

Results: 28 Y / 7 N / 7 A

### SP Set #6, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 44)

Discussion:

C: Replace "device" with "non-AP STA".

Results: No objecting opinion.

### SP Set #6, SP#2

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 44)

Discussion:

C: Need to make distinction between backscatter and active AMP STA.

A: Can be used for both active and backscatter AMP STA.

C: Exitation field and data part of the PPDU should be differentiated.

A: This is for the UL part, AMP STA.

C: Backscatter case has no uplink PPDU. This is only for the active AMP STA.

A: Modify the text to add "for active transmissio," after "Uplink PPDU".

C: Text excludes anything other than OOK. Change "will" to "may". Restriction excludes legacy STA to receive the PPDU.

A: Modify "will" to "can".

C: There are much better modulation schemes for active devices than OOK.

C: AMP STAs may be normal legacy devices. We should not preclude this.

A: This is for active devices.

C: Support SP, justified by simulations.

C: Do not use "can".

C: Suggest rephrasing to "11bp will define On-Off Keying (OOK) modulation for AMP-Sync field and the AMP-Data field in an AMP Uplink PPDU for Active Transmission.

A: Agree.

Results: No objecting opinion.

### SP Set #7, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 45)

Discussion:

C: Suggest withdrawing. If any security text is adopted the editor will automatically create a section on security.

A: Agree.

Results: [withdrawn]

### SP Set #7, SP#2

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 45)

Discussion:

Q: Need for security is clear in general. "Security associations" has a very special meaning in the baseline. "based on existing 802.11 security protocols" means it needs security associations. Text should be clearer.

A: Correct, current baseline assumes that STA can "survive" the gap between communications. Therefore, the division is done in the sub-bullets.

Q: "existing security protocol", does this refer to a particular kind?

A: "security association" includes many things, that we don't want to assume.

C: Text does not convey the information just discussed.

A: The SP is about the text before the "Note". Delete the first bullet in the "Note".

C: Not clear how the security protocol affects the backscatter case.

Results: [deferred]

### SP Set #7, SP#3

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 46)

Discussion:

C: Group needs more time to compare options, too early.

Results: [deferred]

### SP Set #8, SP#1

https://mentor.ieee.org/802.11/dcn/24/11-24-1671r5 (slide 47)

Discussion:

C: Existence and capability are two different things. I don't undertstand the goal of the SP.

A: AMP STA can send the responds with or without its capabilities.

C: Suggest to split up "existence" and "capabilities" in the SP. Suggest to change "or capabilities" to "and capabilities if needed."

C: Against the SP. Both are unnecessary.

A: Capability reporting can be one-time or periodically. It can be used for resource allocation and management.

Results: [deferred]

## Motions

See document IEEE 802.11-24/1322r5.

### Motion #16

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

The AMP Downlink PPDU in 2.4 GHz shall support the following data rates:

* 1 Mb/s (for non-Backscatter STAs only)
* 250 kb/s

[Reference DCN# 11-24/1793r1]

31 Y / 2 N / 8 A, passed

### Motion #17

Move to include the following topologies for energizer in FRD?

* Topology 1: Energizer is physically integrated with the AP.
* Topology 2: Energizer is connected to the AP with wired connection.
* Topology 3: Energizer is connected to the AP with wireless connection.
  + The details of the wireless connection are TBD

[Reference: 11-24/1781r2]

Approved with unanimous consent.

### Motion #18

Move to include the following text to the 11bp SFD:

The AMP-Sync field in AMP Downlink PPDU in 2.4 GHz is defined with chip duration of 2us for backscattering case.

[Reference contribution: 11-24/1797r0]

Approved with unanimous consent.

### Motion #19

Move to include the following text to the 11bp SFD:

11bp defines Manchester encoding for the data portion of UL transmission in 2.4 GHz, including both backscattering and active transmission.

*[Reference contribution: 11-24/1798r0]*

Approved with unanimous consent.

### Motion #20

Move to add the following content to sub-clause 4 of SFD:

When performing transmission, the maximum clock offset is ± 10^3 ppm for AMP Non-AP STA supporting active transmission.

[Reference: 11-24/1475r3, 11-24/1799r0]

Approved with unanimous consent.

### Motion #21

Move to add the following content to sub-clause 4 of SFD:

11bp will define On-Off Keying (OOK) modulation for AMP-Sync field and the AMP-Data field in an AMP Uplink PPDU for Active Transmission

[Reference: 11-24/1780r1, 11-24/1237r0]

Approved with unanimous consent.

## Recess

The chair announced the session recessed at 09:48.

# Thursday PM2 (2024-11-14T16:00)

## Opening

The TG Chair, Bo Son (Sanechips), presents the TG bp meeting agenda slides (IEEE 802.11-24/1671r6).

* Chair calls the meeting to order at 16:00.
* 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/24/11-24-1671r6 (slide 49).

* 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 (MAC/Sec./rest) [20 mins for each presentation including Q&A]
  + 11-24/1805, AMP time-based channel access discussions, Rojan Chitrakar (Huawei)
  + 11-24/1806, AMP time-based channel access for Active tags, Rojan Chitrakar (Huawei)
  + 11-24/1811, Frame format discussion, Liwen Chu (NXP)
  + 11-24/1839, AMP STA Access, Sanket Kalamkar (Qualcomm)
* 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.

## Contributions

### Presentation of IEEE 802.11-24/1805, AMP time-based channel access discussions, Rojan Chitrakar (Huawei)

C: UHF describes a frequency, not a protocol. RFID also has a protocol.

C: In EPC there's only UHF and HF. There's an old protocol that was transferred to 2.4GHz, but that is different.

A: UHF RFID defines a radio interfance (this is not meant here), and a logical interfance (which is meant here).

Q: Maybe we should expand this to have more capabilities than RFID?

A: Yes, if there are things we can improve we might. But let's re-use as much as we can, RFID is a very well-developed standard.

Q: Two backscatter modes a mentioned. Do you mean bi-and monostatic?

A: No, this is orthogonal to the bi- or monostatic operation. Monostatic was discussed to be single mode.

Q: Slide 6. About the efficiency. In RFID only one device can be handled per time. If multiple devices can be triggered per DL signal the system efficiency can be improved.

A: Agree. This is tightly connected to the state machine. It could be made more efficient by letting multiple STAs respond at the same time.

Q: For example, 4 AMP STAs could send their Id.

A: The point is to re-use the command as well as the behavior of RFID. For example, following the timeout procedure of the RFID protocol for the reply.

Q: Slide 7. On the default TXOP limit. The limit on the slide is not a hard limit that any external entity describes. This is not an issue. Airtime should be used efficiently, but the AP can override this and assign larger values. We should look at what external entities set.

A: This is not the limit that should be used, an AP might set this. However, in a mixed scenario with legacy STAs should not receive a different setting; not sure if the AP can set a dedicated TXOP duration for AMP queries.

C: Agree, mixed scenario might be an issue. Still, limits of 4ms to 6ms should be fine.

Q: Do you think that there might be use cases in AMP that are not similar to UHF RFID?

A: Single-mode category refers to this. It is possible that they use something different, but UHF RFID is by far the most used. It is simpler if we use this. For the active transmitter this might not be true.

### Presentation of IEEE 802.11-24/1806, AMP time-based channel access for Active tags, Rojan Chitrakar (Huawei)

Q: Why is it time slotted, do you also think of FDM or trigger-based with flexible slots?

A: TDM is the simplest. We're supportive if FDM can be done on top of this, but we don't know if this is possible.

C: We've done similar analysis in 3GPP. There it's called 2-way and 4-way / random access and random access plus scheduled access. Random access was found to be faster.

A: Yes, this could be an option. It depends on what during the random access is sent. I'm assuming that the reader does not know which STAs are present. In a later stage scheduled access may be more efficient.

Q: Slide 5. Before slot 0: PPDU is preamble + sync. Is this a new PPDU format?

A: That's not intentional, we can discuss how to achieve this. I assume we need at least a preamble, but I need to check. For the backscatter case no preamble might be needed, but here there should be a preamble. At least it should be very short.

Q: Already before the first AMP Poll there's a preamble and a AMP-Sync. So probably the additional preamble is not needed.

A: I did not consider this. The important issue is that in slot 0 there is no response. So the reader, after a short timeout, can transmit a short packet and therefore foreshorten the slot to increase efficiency. I assumed that a preamble is required before.

Q: I don't see this being an issue. Since everything is protected by the NAV in the CTS-to-self it's fine. It could become difficult to pair the preamble with a non Wi-Fi signal. According to an earlier presentation, the Wi-Fi preamble is not sufficient, but with the NAV being set it should be ok.

A: I'd be happy to get rid of this preamble.

Q: When the AP schedules the AMP STAs in the scheduled access phase, how does it schedule the AMP STAs?

A: This is deterministic scheduling. The AP decides the assignment.

Q: How does the AP know to whom schedule a slot? E.g., if one of the STAs does not have sufficient energy to transmit the slot will be empty.

A: It illustrates one means how the AP can schedule. Your question is beyond the channel access scheme. The AMP STA could feedback power or an energy state, and the AP could prioritize it.

At 17:20 Guido R. Hiertz takes over as recording secretary.

### Presentation of IEEE 802.11-24/1811, Frame format discussion, Liwen Chu (NXP)

Q: We are very aligned but on page five, you propose two different options. Do you believe we need to choose one of them?

A: If we carry the information, the peer device could differentiate. We could carry this is in the PSDU.

Q: Do you believe there are only different two formats?

A: There are two different use cases. We need to further discuss about the frame format use.

A: If we use the AMP SIG field, we can differentiate what follows. We don’t need further frame control fields

Q: Will the usability be limited with just two different frame types? Or do we allow other use cases, too? We need to think about what entities are on the other side. There are implications on 802.1.

A: We need the MAC address to indicate source and destination. Here in RFID, we assume that there is no such address information because we don’t maintain peer state information. Either we have the frame control of the AMP SIG field.

Q: You believe we might have the frame control field even with the AMP SIG?

A: The RFID message could follow the AMP SIG. We don’t anything more for these tags.

Q: The first use cases are the two backscatter cases?

A: Yes.

Q: Does this also assume active uplink transmission?

A: We need this peer device ID for request, response frames.

Q: For a sensor there is a need to maintain association. For other use cases this might not be the case.

A: We go to the second proposal with sensor applications.

Q: We might be able to compress the header.

A: Yes.

### Presentation of IEEE 802.11-24/1839, AMP STA Access, Sanket Kalamkar (Qualcomm)

Q: On slide six, I agree with the timing shown here. It is the safest way to energize the AMP STA. But in some cases, the energizer signal will be in a different band than the trigger frame.

A: Yes, I agree, we have to discuss this and to come up with a simple mechanism.

Q: What category of STAs are you considering?

A: This is a high-level discussion. I am looking at all use cases. Wee need to have a simple mechanism.

Q: What do you mean by the presence report?

A: In the discovery phase, the AP has no idea what is happening and who is present. A simple mechanism to know would be to send some control frame. The AMP could respond with a single bit.

Q: I want to understand of the discovery phase? We would get some present or not information. What would the AP do with this?

A: The AP needs to know with whom it is going to communicating. There may be additional information exchanges. Once the AP knows these are active clients around it. Otherwise, it is completely blind.

C: Tags are energizing at different distances, they might come and go. I don’t see how a single discovery phase would help.

A: That is a valid point. It is better for the AP to have some information.

C: I don’t understand this. In the next minutes, things may change. I don’t see the value of this period and the information gathered.

C: You start with listing different device categories. Then you go into the discovery phase. Then you start with the detection of the presence of active AMP STAs. Basically, you are limiting this to active STAs.

C: On slide three, you emphasize the improvements for unassociated devices. But we can break away from the conventional thinking. I want to point out if we consider the very limited capabilities of devices, there might be no differentiation between association and authentication phases of clients. There doesn’t need to be a clear cut.

A: Yes, this is a good point.

### ~~Presentation of IEEE 802.11-24/1537r1, Wireless connectivity challenges for AMP only IoT devices under 802.11 specification, Solomon Trainin (Wiliot)~~

## Current Timeline

Chair reviews the current timeline: 11-24/1671r6 (slide 50)

## Teleconference Plan

* 2024-12-03 (Tuesday), 9:00am, EST, 2 hours; Webex
* 2025-01-07 (Tuesday), 9:00am, EST, 2 hours; Webex

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

## Adjourn

The chair announces the session adjourned at 18:00.

Next session will be the teleconference on December 3rd.

Next hybrid (face to face & online) session will be the IEEE 802.11 interim meeting starting from 2025‑01‑12.