IEEE P802.11  
Wireless LANs

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| IEEE 802.11bp - May 2024 Interim Meeting Minutes | | | | |
| Date: 2024-05-22 | | | | |
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Abstract

Rev 0: This document contains the IEEE 802.11bp May 2024 Interim meeting minutes.

Abbrevations:

Q Question

A Answer

C Comment

SP Straw Poll

# Monday 13 May 2024 @10:30-12:30 am CET

## Opening (IEEE 802.11-24/0666r1)

* Call to order 10:30 am CET.
* Chair, Bo Sun (Sanechips), instructed members to record attendance in IMAT.
* Sebastian Max (Ericsson) appointed as the executive secretary for this session.
* 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 and the current meeting agenda for the week (slides 15-16).

## Agenda (IEEE 802.11-24/06661r1 slide 18)

Chair presents the agenda: https://mentor.ieee.org/802.11/dcn/24/11-24-0666-01 (slide 18).

* + Call meeting to order and remind the group to record attendance on imat.ieee.org
  + IEEE-SA IPR policies and meeting rules
  + Approve meeting agenda
  + TGbp Secretary and Editor appointment and confirmation
  + TGbp kickoff summary
  + TGbp timeline plan
    - *11-24/0841, 11bp timeline discussion, Lei Huang (Huawei)*
  + TGbp selection procedure (11-24/0897)
  + Call for Vice Chair candidates
  + Contribution discussion
    - *11-24/0835, Overview of S1G and RFID Spectrum, Panpan Li (Huawei)*
    - *11-24/0854, MSK Performance For 802.11bp, Amichai Sanderovich (Wiliot)*
  + Any other business?
  + Recess

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

No discussion, no objection, agenda approved.

## TGbp Secretary Confirmation Motion (IEEE 802.11-24/06661r1 slide 19)

Confirm Sebastian Max as the TGbp secretary

No discussion, no objection

Result: approved with unanimous consent

## TGbp Editor Confirmation Motion (IEEE 802.11-24/06661r1 slide 20)

Confirm Yinan Qi as the TGbp Editor

No discussion, no objection

Result: approved with unanimous consent

Chair reviews TGbp kickoff summary (IEEE 802.11-24/06661r1 slide 21)

## TGbp Timeline Plan

Presentation of IEEE 802.11-24/0841r1, 11bp timeline discussion, Lei Huang (Huawei)

Q: I suggest postponing the initial LB by 2 months compared to Bo's proposal.

A: I am not aware of the proposal.

A: The TGbd timeplan used in the other proposal, hence the difference.

Q: The 16 months to comment collection, suggest to maybe shorten to 1 year to have Draft 0.1? We already discussed a lot in the TIG and SG phase.

A: The discussion on application scenarios did not yet converge, people talk about different scenarios. We need time to converge. 16 months are needed.

Q: We had a lot of discussion until now, use-case is clear. We need to choose which ones are supported in TGbp. I think it's possible to complete in 1 year.

A: Based on past experience we know that past groups with focus on MAC, and limited PHY, still needed 18 months.

Q: The timeline starts at May 2024, next point is comment collection in Sep 2025. What happens in between? Shall all submissions from now be draft text therefore? Most other TGs in .11 have an additional steppingstone, e.g., SFD, and/or channel/system simulation document. Here, the timeline for the near future is very vague.

A: There's another proposal the contains more details on the procedure.

Q: According to slide 22 from the agenda the D0.01 is due in March 25. Then, 1 year to comment collection is planned.

A: We need to discuss if the proposal can be achieved. Proposal is a start.

Q: What are the next steps?

A: Start trigger discussion in this meeting, finalize timeline on Thursday PM1 in this meeting. The timeline is then up to change in the future.

Q: Maybe there can be additional time for timeline discussion?

A: Offline discussion is preferred.

Chair presents IEEE 802.11-24/06661r1 slide 22: TGbp timeline plan proposal

The timeline is based on the TGbd timeline. As a TG, there can be more telephone conferences between the meetings in comparison to the SG. Timeline plan will be finalized in the Thursday PM1 meeting.

Chair presents IEEE 802.11-24/0897r0: TGbp selection procedure

Plan to motion the procedure in the July meeting

Q: TGbp has distinct use cases. Is this addressed in the functional requirements, where is a selection procedure?

A: Yes, the use cases shall be discussed when generating the functional requirement document (FRD).

Q: Do we need a separate channel modeling document? RFID-like applications are proposed with different bandwidths than Wi-Fi.

A: Maybe, it needs to be decided during the development of the FRD.

Q: Slide 9. The FRD is on top of anything else. Needs to be approved before any other contribution?

A: FRD and SFD development may be overlapping. But both are limited to be finished with D0.1.

Q: I'm skeptical. It's not easy to think about functional requirements before thinking about usages.

A: It's a progress, might need 3-4 meetings to develop FRD, starting with what is in the PAR.

Q: Everything goes into the FRD, including the skeleton? Passing threshold is 75%?

A: Yes. It's a technical motion.

Q: Slide 8. Technical discussion may go on until D1.0, and SFD as well.

A: This might happen, we don't know. Timeline is subject to change.

Consensus and motion on selection procedure will take place in the next meeting.

## Contributions

Presentation of IEEE 802.11-24/0835r0, Overview of S1G and RFID Spectrum, Panpan Li (Huawei)

Q: Slide 8. 2.4GHz spectrum regulations are more relaxed. The challenge is in sub-1GHz. No harmonized spectrum exists in sub-1GHz. For wireless power transfer we need to act like RFID. E.g., in Europe, tx power is limited to 25mW for non-RFID, which is not sufficient for power transfer.

Q: Sub-1GHz and 2.4GHz is in the scope of 802.11. We have existing specification. But this is not the case for RFID. We have nothing similar in our spec, we are not familiar with this. How can we specify an RFID-like system?

A: I have the same question.

Q: Slide 7. RFID spectrum in China is exclusive, what does that mean?

A: The spectrum is only for RFID, no other technologies are permitted. Not sure if that's correct.

C: That might be debatable. Behavior of RFID devices is only vaguely defined. Need to follow limits for power & bandwidth, but tx mode and behavior may be different.

C: The Table D-4 in REVme should be referred for Sub-1G.

C: On the RFID frequency situation in China. RFID is defined in China as one technology, including modulation and coding. A frequency band bundling with a different technology is not intended. A new technology shall follow the regulation (hopping, power, etc.). In the future once we have the specification that fulfils regulation, we will be able to deploy.

C: Slide 8. To my understanding in China the spectrum is not exclusive. Currently we have only RFID as the single technology. We should follow regulation.

Q: Slide 7. RFID is a subset of S1G spectrum. How will the coexistence be defined?

Chair suggests discussing this question further by eMail offline.

C: At PAR we agreed on bands of operation. A lot of discussion on the use case will need to happen. It is a problem if we have multiple modes of operation (testing, certification). In S1G HaLow is operating, maybe we can do similar things for coexistence. We need to define in which S1G we want to operate. But currently there's no need to have Type A, B, C. First discuss use cases, and not create sub-division for certain devices to operate in different bands.

Q: Slide 9. Reference 1, what is the exact source.

A: Need to ask colleague.

Presentation of IEEE 802.11-24/0854r0, MSK Performance for 802.11pb, Amichai Sanderovich (Wiliot)

Q: Slide 6. I have a concern on FDM. It would need to support all different frequency offsets, which increases complexity of the AMP STA.

A: We have evaluated this, there's no increase in complexity. The oscillators are already there. Only a sufficient frequency distance for FDM is needed.

C: I fully agree and have only minor comments. Slide 5, upper figure. CW signal is 100dB stronger, so the peaks far away are helpful in PSK. Need to work on this for MSK.

A: MSK can push the offset further easily.

C: Yes, but with the cost of OOB-emissions.

A: PSK still has higher OOB-emissions.

C: Yes, but intentionally to enable decoding.

C: Regarding the simulation results for coherent receiver: the phase noise must be very low. Non-coherent reception looses 6dB. This sets limit on the oscillator - but still support MSK, but with a coherent receiver.

Q: Slide 7. Can you clarify how the active/backscattering can achieve two modulation frequencies?

A: We have two oscillators, one for active, one for backscatter.

C: How to support FDM with FSK? We might have a low clock accuracy and there is the need to support sufficient guard.

A: We need to define the distance for FDM to account for clock accuracy and phase noise.

## Recess

The chair announced the session recessed at 12:30 pm CET.

Next session will be on May 14th.

# Tuesday 14 May 2024 @ 10:30-12:30 am CET

## Opening (IEEE 802.11-24/0666r3)

* Call to order 10:30 am CET.
* Chair, Bo Sun (Sanechips), instructed 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 (slide 15) and the agenda (slide 25).
* Sebastian Max (Ericsson) is the secretary.

## Agenda (IEEE 802.11-24/0666r3 slide 25)

Chair presents the agenda:

* Call meeting to order and remind the group to record attendance on imat.ieee.org
* IEEE-SA IPR policies and meeting rules
* Approval of agenda
* Contribution discussion
  + *11-24/0722, Introduction to passive sub-1GHz RFID systems, Franz Amtmann (NXP) – 1 hour*
  + *11-24/0847, Initial Thoughts on 2.4 GHz Downlink AMP PPDU Design, Bin Qian (Huawei)*
  + *11-24/0836, Thoughts on AMP UHF RFID Tags, Rojan Chitrakar (Huawei)*
* Any other business?
* Recess

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

No objection, Agenda approved.

## Contributions

Presentation of IEEE 802.11-24/0722r0, Introduction to passive sub-1GHz RFID systems, Franz Amtmann (NXP)

Q: Slide 11. Do Data-0 and -1 have different durations?

A: Yes.

Q: So they are not equally protected?

A: The data rate depends on the content. But they have the same reliability, because at the receiver side only the shifts are counted.

Q: Slide 23. What kind of memory is implemented, will memory loose information?

A: No, there is no memory loss after power loss. E^2 PROM. Even the user memory will persist, it is not a register bank.

Q: Slide 9. It is a typical full duplex problem to power the tags during the reading. Is it possible to use a different waveform than a constant carrier to power the tag?

A: Yes.

Q: For example, a OFDM broadband signal?

A: I do not see a problem with that.

Q: Even for the reader with 100dB SNR?

A: Cannot answer this question ad-hoc.

Q: Regarding the last slide, summary, last point. We are very much aligned. Could you elaborate what you mean with the re-use?

A: Mainly security part. Crypto engines are very complex compared to the state engines. If we need two crypto engines that means huge complexity.

Q: Slide 28. Operating frequency should be only the RFID bands?

A: We think it can be a different frequency. For RFID in Europe and USA, it is fixed, cannot use different band, given by regulatory.

Q: Can you use S1G bands?

A: The RFID tag does not care about the frequency, as it has a very broad range.

Q: Clock accuracy: the low complexity of the device means ~100ppm accuracy. What about the drift rate of the frequency, if the transmission is several ms?

A: The clock jitter is below 1%. So, during the communication it stays on the frequency. The clock is stable during this duration, because the temperature does not change. There are also requirements in the standard in the range of 1% for the stability.

Q: Slide 18. What is the assumed bitrate? How do the numbers change for different bitrates?

A: 640kb/s. Change will have a non-linear impact, but the most important rate is the counting rate, which will change close to linearly.

Presentation of IEEE 802.11-24/0847r0, Initial Thoughts on 2.4 GHz Downlink AMP PPDU Design, Bin Qian (Huawei)

Q: Extend the data rate from WUR, how high?

A: Currently we do not foresee a specific value.

Q: Separate SIG takes a long time to transmit, this is very inefficient?

A: Yes, but a separate SIG has a lot of benefits, for example the information for the decoding. We prefer to keep it separate from the AMP-Sync.

Q: Slide 8. My concern is that assuming that a WUR STA is receiving the new frame. It's not prepared to ignore the frame, keeps on detecting. It may detect its WUR sync, for example in the data part.

A: Let's discuss offline.

Q: Slide 6. What is the length of the PPDU with the SIG field?

A: We did not compute, depends on the application scenario, reliability, and receiver sensitivity. We are open to discuss.

Q: It might be half a ms with the data indicated, do we want to pay this price?

A: Yes, we need to consider the tradeoff. We need data-length and rate indication no matter where it is located. We might not need the other fields indicated on slide 6. But they might help with the power consumption.

Q: Will the AMP-Sync be different than the WUR-Sync?

A: Yes, we slightly prefer to have a different sync field. It will be good for early stop of decoding and lower power consumption.

Q: On the legacy part. The receiver side is very non-selective, any transmission in a different channel will interfere. Maybe we need to protect more channels?

A: No, just initial work to trigger the discussion.

Q: Looking at the previous presentation, AMP devices are not standalone, there is no need to decode everything, and they require a very efficient command structure. How does the SIG affect the efficiency?

A: There are many application scenarios, AMP STA might need to decode everything.

Q: If AMP-Sync is different from WUR-Sync, shall the AMP-STA understand the WUR-Sync?

A: No, no need to recognize the WUR-Sync.

Q: But then the AMP-STA needs to detect the whole WUR frame?

A: On the receiver side it will perform cross-corelation. If there is no peak there is no need to decode the remaining part.

Q: The WUR STA does not ignore the PPDU due to unfamiliar AMP Sync and may therefore continue to look for WUR Sync. What happens to WUR STA if it detects the WUR Sync?

The chair announces there is no more time for discussion and suggests taking the remaining questions offline.

IEEE 802.11-24/0836r0, Thoughts on AMP UHF RFID Tags, Rojan Chitrakar (Huawei)

Q: Slide 3. AMP RFID Reader is an AMP STA, AMP RFID Tag is a non-AP STA?

A: I don't want to limit the use-case. Reader can be a non-AP STA, but it is too early to limit here. An AP might do the same as a smartphone.

Q: Slide 5. What about the reader side, usually we have the same protocol layers on both sides?

A: We did not discuss the reader side, no need to support the 900MHz, only 2.4GHz. Please use the chat window / discussion via eMail, voice is very low.

Q: Re-use RFID protocol, based on this maybe PHY/MAC can be designed to re-use RFID design? This will be very different than the existing IEEE 802.11 design?

A: Re-use is our intention, no expectation to support full 802.11 MAC due to complexity. Rather re-use RFID as much as possible, like Query/Inventory command and add only what is needed to make this possible.

C: We need to re-use the IEEE 802.11 design / follow the MAC design.

A: Yes, there should be an embedding (slide 6), and follow at the reader side 802.11 (CSMA/CA). But no need to redesign procedure for query, this can be taken from RFID.

Q: Slide 7. Encapsulate RFID-protocol into IEEE 802.11 MAC. What is inside the AMP UHF frame?

A: We can discuss the details, MAC header, CRC. Maybe that's a bigger discussion. It's the narrowband portion, should be unified for all scenarios.

C / chat: If the layer structure on the Reader side is different it does not fit to the .11 structure. In .11 the structure is the same on both sides.

## Recess

The chair announced the session recessed at 12:30 pm CET.

Next session will be on May 15th.

# Wednesday 15 May 2024 @ 8:00-10:00 am CET

## Opening (IEEE 802.11-24/0666r4)

* Call to order 08:00 am CET.
* Chair, Bo Sun (Sanechips), instructed 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 (slide 15) and the agenda (slide 27).
* Sebastian Max (Ericsson) is the secretary.

## Agenda (IEEE 802.11-24/0666r4 slide 27)

Chair presents the agenda:

* Call meeting to order and remind the group to record attendance on imat.ieee.org
* IEEE-SA IPR policies and meeting rules
* Approval of agenda
* Vice Chair Election and Confirmation
* Contribution discussion
  + 11-24/0798, Close-range AMP WiFi Reader Feasibility Study followup, Rui Cao (NXP)
  + 11-24/0849, harmonization of waveform, Yinan Qi (OPPO)
  + 11-24/0851, uplink fdm for amp, Yinan Qi (OPPO)
  + TBD
* Any other business?
* Recess

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

No objection, Agenda approved.

## Vice Chair Election and Confirmation

Chair presents call for TGbp Vice chair candidates (IEEE 802.11-24/0666r4 slide 23)

Vice Chairs Confirmation Motion

Considering Steve Shellhammer and Rakesh Taori are the only two candidates, confirm Steve Shellhammer and Rakesh Taori to be the Vice Chairs of TGbp.

No discussion, motion approved by unanimous consent.

## Contributions

Presentation of IEEE 802.11-24/0798, Close-range AMP WiFi Reader Feasibility Study followup, Rui Cao (NXP)

Q: Full-duplex scenario. How can the receiver remove the leaking carrier at the RF front end to prevent it from saturating? For 20dB of isolation for CW, how can current Wi-Fi receivers can handle this without saturation?

A: For this case we assume tx power is roughly 0dBm, leakage -20dBm, should be able to handle this. Not assuming 20dBm transmit power, all distances are based on 0dBm transmit power.

Q: Slide 7. Are the reference symbols only for the reader to enable self-interference estimation?

A: Yes, not received by the tag.

Q: How to trigger the tag to do the modulation?

A: That's related to the MAC protocol and processing. More detailed discussion is required later. We need to specify control signals so that the tag knows when to modulate.

Q: Reference symbol is used to estimate leakage. Can't we just use the Wi-Fi preamble to estimate the leakage?

A: Yes, potentially we can use part of the preamble (LTF). However, if reference symbol can have more symbols, the estimation becomes better.

Q: Simulation results. CW is OFDM symbol, right?

A: Results are based on OFDM as carrier wave.

Q: Large ppm, 100k. What's the assumption on the symbol duration?

A: Every symbol is 4µs, regular 802.11a/g symbol duration. Backscattered clock is not sync with that. The reader detects FM0 boundary, not OFDM symbols.

Q: High-clock errors only affect symbol clock, not carrier, no active transmission. Reflected signal is square wave. What is the power spectral density, do we stay within 20MHz?

A: Results are based on pulsed waveform, no pulse shaping. Also results for OFDM, shows 6dB loss but spectrum mask is met.

Q: For the downlink, do you consider WUR-based / WUR-similar modulation?

A: The modulation is different: PIE modulation, not Manchester encoding. We need to take care of coexistence with WUR in the preamble, but the data part can be designed for a low-cost tag.

Q: Slide 9. Did you use FM0 or Miller code?

A: FM0.

Q: There is a gap in performance between different ppm. Maybe a longer preamble is useful to improve performance to get over the high initial offset and allow the reader to sync to the high ppm of the clock?

A: Yes, that's another way to do it, but then the duration will be longer. We are showing the feasibility, range is already >25cm, which is sufficient for the use case. We can discuss if there's a need for longer distances and thus the need for ppm correction.

Q: Transmission from the reader, slide 5, what carrier signal is used?

A: A repeated sequence. May apply random phase on top. From the energy perspective it's continuous.

Q: Slide 7 / slide 11. Two PPDU formats, for UL and for DL. Why do we need two different PPDUs? Couldn't the reader include the DL symbols before the CW starts?

A: Depends on how the protocol looks like. Potentially we can combine them. Looking at the duration of the PPDU / TXOP we might need to break it into two PPDUs. Need to discuss if we can fit it into one PPDU.

Q: Slide 7. For UL, maybe non of the tags responds (e.g., in an inventory process). Then it is a lot of waste to transmit the Wi-Fi preamble.

A: Yes, but we need to trigger the tags before with a DL PPDU. Let's discuss further.

Q: Does FM0 encoding has a drawback compared to simple OOK? Do we need FM0? What is the drawback?

A: The main challenge is the high clock inaccuracy. A tag should be simple to implement. We don't see drawbacks of FM0.

Q: Regarding the number of antennas. A RFID reader has one antenna. An AMP tag now has two antennas?

A: The initial motivation is to use Wi-Fi. The typical RFID reader design is very special, with low leakage between transmit and receive. We want to use the multi-antenna design that is already pervasive in Wi-Fi. It is very common to have 2x2 devices.

Q: There are improvements for repetition shown in simulation. What about the efficiency?

A: The considered range is for our feasibility study. The only impact of repetition is in the duration. We can discuss further details when we design the PPDU.

Q: The use-case for dual antenna is a classic full duplex communication. After the leakage removal what is the residual noise?

A: We don't expect major challenge to synchronize, symbols are tx/rx from the same clock. There is no impact to performance. If TxEVM is higher than we assume, then the effective SIR is lower.

C: First commenter asks why 0dBm tx power is used, is it because simulation is normalized on tx power, everything is in dBr?

A: Yes.

Chair suggests to delay the straw poll (slide 14). First need to decide on the functional requirements document, before starting with the SFD, according to the procedure.

Presenter wants to have feedback from the group and comments. Straw poll will be run in a later session (Thursday PM1).

C: Discussion of selection process in planned. However, when we run the straw poll now the "SFD" should be removed, to get comments. SFD has not been created yet.

A: Okay with the suggestion, we can change the language.

Presentation of IEEE 802.11-24/0849, Harmonization of Waveform, Yinan Qi (OPPO)

Q: Slide 7. Regarding the backscatter long-rate. The carrier wave and the UL data, there's an opportunity to simplify the tag if this is designed jointly. Infrastructure should generate the waveform, the tag just flips bits using BPSK. The UL data is just a re-formation of the CW. This helps with the energy budget of the tag.

A: Agree. For backscattering it's possible to integrate CW + UL data to one single signal. It is one way to go. OOK/PSK are a kind of waveform / modulation which can be on top of (e.g.) OFDM.

Q: We can go beyond just modulation. CW is a fully formatted frame, tag just used BPSK to flip bits. CW is DSSS, the frame is fully compatible to the legacy infrastructure.

A: Yes – our purpose is to start the discussion. CW can be DSSS. The design of wireless power transfer may be up to implementation, then we don't need to care about it in the specification. DSSS can be considered.

C: Slide 7. We'd like to harmonize, but there's room for discussion, especially for the UL data can be non-harmonized. We prefer more discussions and studies before we finalize. The MAC should be similar between the different types of devices though.

Q: Slide 6. What is impacting the power transfer efficiency?

A: High PAPR according to a reference, will share offline.

Q: Slide 8. WPT / CW. What is the "assistant node", what functionalities does it have?

A: Depends on the design. For example, it can be just one node, can transmit WPT & CW at the same time. But can also be two nodes, and WPT and CW is transmitted in different frequency bands.

Q: Slide 7. S2, DL communication. Does that mean reader to tag communication? What does AP mean?

A: That's the downlink node, maybe the mobile.

Q: Can it be SC also in the first column as well?

A: Yes.

Q: Slide 4. Is it the MAC frame type?

A: No, a physical layer frame.

Q: Triggering frame / data frame is MAC frame. CW is not a MAC frame.

A: We might not need to design frame for CW. We can call it transmission mode. Four different transmission modes. "Frame" is not 100% accurate here.

Q: On this slide we cannot include everything. Wireless power transfer (WPT) requires setup procedure. The slide is just a very simple start, we need to discuss details.

Q: Slide 7. CW has similar functionality for WPT. Why S2 has WPT?

A: For S2 it's the same signal. WPT may not be needed. Just to show the harmonization.

Presentation of IEEE 802.11-24/0851, Uplink FDM for AMP, Yinan Qi (OPPO)

Q: Slide 6. Access efficiency is important, however FDM has complexity issues. Suppose 4 sub-bands, means tags need to support 4 frequency offsets. This is very complex for simple tags.

A: Yes, we understand. We can consider a compromise solution. One device may support two, others just one. FDM is possible.

Q: If different tags support different offset it's not feasible.

Q: Slide 3. TDM / CDM is also considered. So, we may support also FDM. This increases the complexity. We need one multiple-access scheme, not several ones.

A: TDM is the baseline. On top there can be FDM in every time slot. CDM causes additional complexity. We can further discuss. FDM is not very complicated.

Q: FDM is needed also for the random access to make it more efficient.

A: Yes, agree.

Q: Slide 8. Link between random access with TDM, scheduled access also for FDM. Makes no sense to use just 2MHz if we have 20MHz.

A: We should consider FDM also for the random access.

Q: We understand this as a high-level proposal, many details are still missing. Is the FDM for UL, DL, both?

A: Mainly for UL. For DL maybe also applicable to address as many AMP as possible. Presentation is for UL.

Q: Is it like current Wi-Fi trigger-based transmission?

A: Yes.

Q: If every AMP STA has a high ppm, the receiver needs to handle this? The shift of the center frequency can be up to 2.4MHz. In current Wi-Fi 6 trigger-based UL STA correct their timing. Now it is up to the receiver to perform the correction(s). Also, if it is OFDM based the inter-carrier interference (ICI) will be high.

A: The ICI should be handled by the guard band.

Q: Is the proposal for OFDM-based transmissions, or for SC OOK?

A: Can be applied for both. For UL it's not OFDM, which will be too complicated.

Q: The timing of different tags may not be compensated.

A: Yes, it must be coordinated in some way.

Q: Channels are pre-assigned or randomly chosen?

A: The sub-channel configuration should be contained in the trigger frame.

Q: What is the use-case of the FDM proposal?

A: At least it's applicable to active tx, for backscattering we need further discussion, especially close-range. For long-range backscattering it might be applicable.

Q: The proposed scheme is not very efficient (slide 5/6). Only 50% usage on the 20MHz, if only one signal is transmitted. Prefer shorter transmission with larger bandwidth. On DL it might be better due to better ppm.

A: I'm a bit confused. In TDM one AMP device uses whole 20MHz. If we divide 20MHz into two and use it by two then efficiency is increased.

C: FDM improves efficiency. The AMP peak data rate is very low. FDM makes better use of the bandwidth. On complexity, MSK/FSK is easy to achieve. This is similar. Device can support multiple frequencies, at least for active transmissions. For backscattering we need to discuss, we need to check the possibility to support this to improve the efficiency, also compared to current technology.

Q: Consider the retail use case / clothing / supermarket. A key performance indicator is the speed of scanning during the inventory process. A combination of TDM / FDM is needed. However, the accuracy of detection needs to be close to 100%.

A: A better efficiency guarantees reliability. Still, Wi-Fi is only best effort. You do what you can do. Consider same procedure in OURA. If there's a failure, then repeat in the next time slot. But we can think of a new mechanism to guarantee the reliability.

## Recess

The chair announced the session recessed at 10:00 am CET.

Next session will be on May 16th AM1.

# Thursday 16 May 2024 @ 8:00-10:00 am CET

## Opening (IEEE 802.11-24/0666r4)

* Call to order 08:00 am CET.
* Chair, Bo Sun (Sanechips), instructed 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 (slide 15) and the agenda (slide 30).
* Sebastian Max (Ericsson) is the secretary.

## Agenda (IEEE 802.11-24/0666r4 slide 30)

Chair presents the agenda:

* Call meeting to order and remind the group to record attendance on imat.ieee.org
* IEEE-SA IPR policies and meeting rules
* Approval of agenda
* Contribution discussion
  + 11-24/0853, design target and device capabilities of AMP IoT, Weijie Xu (OPPO)
  + 11-24/0860, Coexistence considerations of AMP data communication, You-Wei Chen (MediaTek)
  + 11-24/0861, AMP DL PPDU consideration, You-Wei Chen (MediaTek)
  + 11-24/0867, Thoughts and Questions on AMP PHY, Pooria Pakrooh (Qualcomm)
* Any other business?
* Recess

Q: Is there time to discuss the selection procedure?

A: Not in this meeting, there will be two teleconferences before the July meeting and then we'll decide in the meeting.

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

No objection, Agenda approved.

## Contributions

Presentation of IEEE 802.11-24/0853r0, Design Target and Device Capabilities of AMP IoT, Weijie Xu (OPPO)

Q: Slide 5. What kind of UL coding is used?

A: Currently we use simple waveform. But for increased UL coverage, use Manchester encoding, similar to RFID. We can check what the device can be able to support, e.g. convolutional coding. The UL may be different from DL.

Q: Slide 7. Two different kind of DL receiver. But the standard does not touch DL receiver?

A: We try to analyze potential. In the specification architecture is not discussed. But receiver sensitivity depends on it. For some application scenarios the IF receiver can provide much better sensitivity needed for the larger coverage.

Q: So 11bp needs to support two kinds of sensitivity and clock accuracy?

A: Yes.

Q: Slide 10. Last row should be "with", not "without"?

A: Yes.

Q: Slide 18. Fully agree. Slide 10. This is for the US. Things are different in Europe. The design should be for the whole world / all regulatory regions. In addition, receive sensitivity -95dBm, it is a bit optimistic for full duplex, maybe -75dBm is more realistic. This works only for a CW, but then there are problems with the regulation.

A: The design is inspired from 11ah. But we can discuss, this is just one example.

C: Slide 10. 15dB loss for reflection, not 5dB, with the reason that tuning is not properly.

C: Slide 18. Rx sensitivity should be -50dB, not -40dB

C: Slide 9. The STA has different capabilities. How does that impact the standard? STA capability is difficult to indicate. What about indicating the power level?

Q: Does the PHY mode impact the PPDU type?

A: We tried to summarize key capabilities. We need further discussion how this affects the standard. Capabilities are more relevant to the PHY. Will discuss MAC aspects in a different submission. Impact on PPDU types / formats need to be checked.

Q: Reflection amplifier, is it a separate device?

A: No, just one component of the backscattering device / of the STA.

Q: Will not be a heavy burden?

A: It is reasonable. Power consumption 100s of µW.

Q: Slide 17. 3-4 use cases. Shall we determine the operating bands?

A: Some use cases may only work in 2.4GHz, very clear. Case 2 may be feasible in both 1GHz and 2.4GHz.

Q: Slide 17. Compatible AMP IoT. Why support 11n? 20ppm is hard to achieve.

A: This case tries to re-use legacy Wi-Fi infrastructure. No need to update network side. Needs to have an optimized implementation for low power consumption.

Presentation of IEEE 802.11-24/0860, Coexistence considerations of AMP data communication, You-Wei Chen (MediaTek)

Q: Agree to SP1. Regarding SP2: devices in UL are highly constrained. Do the devices have to transmit an OFDM-like waveform? It is hard to do on these restricted devices.

A: It's our preference, need to have more discussion on SP2.

C: A tag cannot generate a OFDM signal. We need more discussion.

Q: Slide 5. 11b/n as starting point for UL. Technical interest group report shows that UL may have a smaller bandwidth, but 11b has 20MHz.

A: There are many different device categories. This is just for the "existing Wi-Fi" category.

Q: Slide 7. We've analyzed the coexistence in the TIG / SG.

A: We might disagree. We need more technical discussion.

Q: Slide 4. What is the AMP Reader PPDU and Reader to Tag PPDU?

A: Need to refer to the reference.

Q: Agree to spoofing the preamble. Is there a new spoofing part?

A: Spoofing preamble is 20MHz portion for third-party use.

Q: The 2 BPSK symbols, preceding the 4MHz OOK. Will they interpret the 4MHz part.

A: No, they cannot receive the 4MHz part.

C: Quick follow-up to the previous question. Spoofing preamble mean first three parts. But a legacy device will continue to receive. So, it will try to receive the MAC header. Hence, 2 BPSK symbols are needed.

Q: Not many 11ba devices are deployed. 11ba is not a bi-directional waveform. For a backscatter device a new waveform may be needed.

A: It is only a "11ba-like" PPDU.

C: Slide 5. Regarding using 11b for UL. I have lots of concerns on efficiency, 11b should be deprecated. Maybe just have 11n?

C: Regarding SP1, we are still discussing technical requirements, should not commit at this early stage to this exact frame format.

C: Regarding SP2, This might be infeasible for AMP devices.

Q: UL is limited to non-backscatter. Is there a concern on coexistence for backscatter?

A: Slides just focus on the waveform, need to consider airtime as well.

C: Regarding SP1. It does not mention it is only in 2.4GHz.

Q: Do you have more details on the spoofing?

A: Yes, we have an additional presentation.

Presentation of IEEE 802.11-24/0861, AMP DL PPDU consideration, You-Wei Chen (MediaTek)

Q: The "AMP package" may be different to the "WUR package"?

A: Yes.

Q: 11ba spoofing is bulletproof, why do we need to change? SIG2 is only for new devices. Spoofing using L-SIG is very well known. Why is it not enough?

A: 11be and 11bn may do early termination. Preamble is for 3rd party STAs. But after L-SIG they keep on processing. So, two more symbols are needed. We need more time to discuss the details, need to continue discussion offline.

C: What is the compatibility of an 11be receiver with 11ba spoofing?

A: 11be should be able to handle the spoofed preamble as defined by 11ba.

Q: The preamble design assumes that a NB portion is following. We need further discussion on that. It is a new waveform, especially for the backscatter device. OOK is not constant energy, may not work. Fundamental studies have to be made before the preamble design is agreed.

A: Yes, may need to discuss.

Presentation of IEEE 802.11-24/0867, Thoughts and Questions on AMP PHY, Pooria Pakrooh (Qualcomm)

No time for Q&A, chair suggests continuing the discussion offline via the e-Mail reflector.

## Recess

The chair announces the session recessed at 10:00 am CET.

Next session will be on May 16th, PM2.

# Thursday 16 May 2024 @ 13:30-15:30 pm CET

## Opening (IEEE 802.11-24/0666r5)

* Call to order 08:00 am CET.
* Chair, Bo Sun (Sanechips), instructed 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 (slide 15) and the agenda (slide 30).
* Sebastian Max (Ericsson) is the secretary.

## Agenda (IEEE 802.11-24/0666r5 slide 32)

Chair presents the agenda:

* Call meeting to order and remind the group to record attendance on imat.ieee.org
* IEEE-SA IPR policies and meeting rules
* Approval of agenda
* TGbp Timeline motion
* Contribution discussion
  + 11-24/0826, Energy balance of the state-based AMP station, Solomon Trainin (Wiliot)
  + 11-24/0871, AMP Device Initiated Secure Transaction, Hui Luo (Infineon Technologies)
  + 11-24/0872, MAC aspects for AMP, Chuanfeng He (OPPO)
  + 11-24/0900, Wireless Power Transfer and Frequency Regulation, Joerg Robert (TU Ilmenau/Fraunhofer IIS)
* SPs
* Teleconference Plan
* Any other business?
* Recess

No objection, agenda approved.

## TGbp Timeline Motion

Motion: TGbp Timeline Plan Motion

Approve the TGbp initial timeline plan as illustrated in slide 33 as in 11-24/666r5.

Note, the timeline plan is subject to change according to the 11bp developing progress.

C: Add the text "ready for CC" to the item "D0.1" on slide 33.

Accepted with unanimous consent.

## Contributions

Presentation of IEEE802.11-24/0826r1, Energy balance of the state-based AMP station, Solomon Trainin (Wiliot)

Q: Slide 4. Looks like distance-based zones. All AMP-STAs (rectangles) have similar capability. Slide 5. Assume that energizing is by RF signal? There may be different energizers. Is RF-energizing essential?

A: Mainly thinking of RF-harvesting. But the same will happen for any periodic signal from different sources, as long as it is not synchronous with the triggering.

Q: There are a lot of assumptions about the (lack of) knowledge of the AP, there might be signaling from the STA to the AP.

A: I am skeptical about the impact of the feedback. The three zones always apply. Radiated power will never reach all AMP STAs. Crafting of the protocol depends on how we assume that the STA can hold the internal state (for example security keys). Assumptions are very simple: STAs are able to keep the state or not.

Q: Will continue offline.

Q: To clarify the assumptions, Slide 3: Trigger frame and energy supply are not synchronized. Slide 5-7: Different zones have same leakage in the idle case, accumulated energy is distance-based. Slide 8: Is the goal to compute R1 or R2 and possibly deny AMP-STAs access?

A: No. My concern is that this cannot be done. AMP STAs may exist that respond to the trigger, cannot be avoided. AP is not aware of the (power) state; nevertheless, transmits the trigger to multiple STAs.

Q: Slide 7: What is the difference of the left half and the right half. In the right half no power accumulation happens.

A: Right side has leakage plus memory retention plus functionality, left has only leakage.

Q: This is very subjective.

A: Size of zone C depends on numbers of leakage, power supply. But it will never be zero.

Q: Maybe only a couple of cm, then it's not important.

A: Good point.

Q: Is the proposal to transmit its energy status?

A: No. The only way to eliminate the problem is to require the STA to always leak/use the same energy, independent of the state. This will eliminate the zone C. Alternative is non-volatile memory.

Q: Can you bring a protocol proposal that includes a solution?

A: Yes, when we design the protocol; this presentation is an introduction.

Q: Slide 7: Why does the described effect happen? Before the transmission, power can be accumulated. After the transmission, it needs to maintain the memory and functionality, consuming more power. No accumulation is possible. Is that correct?

A: Yes. And it happens periodically.

Q: It can happen only one time?

A: No, it can happen multiple times, periodically, when the energy level reaches zero again. That scenario will not work.

Q: Can this be generalized for energization from other sources? Can the AMP STA be able to calculate the leakage and communicate its state?

A: AMP STAs far away will not be able to transmit. They are not able to accumulate enough power. Don't see how to get rid of zone C. The cause is the difference of the initial power accumulation and after the reception of the trigger.

Q: Example of the energizing signal and the field strength?

A: May be an AP, may be other devices. There is no condition on synchronization to the trigger.

Presentation of IEEE 802.11-24/0871r0, AMP Device Initiated Secure Transaction, Hui Luo (Infineon Technologies)

C: Agree security is important, but at this state it is too early for these details.

Q: Slide 6. What is a "complicated" initial request?

A: AMP STA has to compute all the information in the initial request, with the risk of retries. We would like to keep the first frame simpler.

C: Ok, then the alternative on slide 7 makes more sense.

C: AMP cannot afford 10s of ms for connection setup. There is a similar problem in vehicular communication that also needs a fast setup. One lesson learned is that the server outside produces unexpected / unpredictable delays. Need to have limits.

Q: Suggest to present variant, how the frame looks like. Not clear to me. Want to see the actual fields in the frame(s).

A: There are multiple methods, will introduce and present more later.

Presentation of IEEE 802.11-24/0872, MAC aspects for AMP, Chuanfeng He (OPPO)

Q: The MAC functions depend on the application scenario, e.g., the close-range backscattering does not have TFS and beacons.

A: Yes, agree.

Q: The procedures are triggered by the AP?

A: Yes.

Q: What is the size of the MAC address? 48bit?

A: 11ah already has a reduced MAC address. May support short ID, 6 bytes, or even only 2 bytes.

Q: Do you want to use an ID instead of the MAC address?

A: Yes, there is no need to support the whole MAC address.

Submission IEEE 11-24/0900, Wireless Power Transfer and Frequency Regulation, Joerg Robert (TU Ilmenau/Fraunhofer IIS) was not presented due to lack of time.

## Straw Polls

Do you agree that 11bp defines at least one mode of MAC/PHY that support close-range backscattering communication in 2.4GHz?

Some discussion on the exact wording, slight changes to the text, final shown above.

37 Yes / 6 No / 23 Abstain

## Teleconference Plan

Jun 11 (Tuesday), 10:00am, ET, 2 hours; Webex

Jul 9 (Tuesday), 10:00am, ET, 2 hours; Webex

At least 3 submissions must be in the queue 24h before the teleconference, otherwise the teleconference will be cancelled.

## Adjourn

The group finished all the work.

The chair announced the session adjourned at 3:30 pm CET.