IEEE P802.11  
Wireless LANs

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| IMMW SG March 2024 Meeting Minutes | | | | |
| Date: 2024-03-15 | | | | |
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Abstract

This document contains the minutes for the IMMW SG March 2024 Meeting Minutes.

Revision history:

* Rev0: initial version

Abbreviations:

* C: Comment
* A: Answer

# 1st Meeting: Tuesday, March 12, 2024, PM2, (18:00-20:00 ET)

1. The Chair, Laurent Cariou (Intel), calls the meeting to order. The Chair notifies the attendees that the agenda is in [IMMW SG March 2024 meeting agenda](https://mentor.ieee.org/802.11/dcn/24/11-24-0248-00-immw-immw-sg-march-2023-meeting-agenda.pptx)
   * Note that this is a hybrid meeting, with some participants in person and some participating online through a webex session
   * Need to pay the registration fee to attend
2. IEEE-SA Policies and Procedure

The chair reviews the IEEE-SA Patent Policy:

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the WG Chair. Speak up now and respond to this Call for Potentially Essential Patents. **Nobody speaks/writes up**.

1. The chair goes through other guidelines for IEEE WG meetings, Patent-related information, Participation in IEEE 802 Meetings, and Copyright. The Chair asks that it be minuted that the **Copyright Policy** was presented.
2. Chair provides an attendance reminder:

3.1. Please, **record your attendance** during the session by using the IMAT system:

* login to [*imat*](https://imat.ieee.org/attendance)
* select “802 Plenary Mixed-mode Session - November 2023”
* select “C/LM/WG802.11 Attendance” entry
* click “IMMW SG” session that you are attending

1. If you are unable to record your attendance, please, contact Laurent Cariou (laurent.cariou@intel.com) and Volker Jungnickel (volker.jungnickel@hhi.fraunhofer.de) for assistance
2. Motions

*Chair reviews the proposed agenda.*

**Move to approve the agenda in doc.** [**11-24/0248r1**](https://mentor.ieee.org/802.11/dcn/24/11-24-0248-01-immw-immw-sg-march-2023-meeting-agenda.pptx)

Discussion:

C: None

**Result: Agenda approved with unanimous consent.**

**Move to approve IMMW SG minutes listed below:**

November plenary: [**11-24/0143r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0143-00-immw-immw-sg-minutes-for-january-interim-meeting.docx)

**Move: Volker Jungnickel Second: Cheng Chen**

Discussion: None.

**Result: Approved with unanimous consent.**

1. Announcements:

According to a discussion between the meetings, the proposal to include optical bands in the IMMW PAR will be discontinued. It is intended to continue the topic in a separate project.

1. Submissions

[**11-24/0116r2**](https://mentor.ieee.org/802.11/dcn/24/11-24-0116-02-immw-immw-draft-proposed-par.docx) **PAR document**

Statements not in slides: Need for the project has been added.

Q: have changes from last time been refelected

A: mostly yes, to be checked

Q: speak against single-user OFDM

A: discuss after further contributions

[**11-24/549r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0549-00-immw-immw-draft-proposed-csd.docx) **CSD document**

Statements not in slides: Just introduced, to be further discussed and evolved until the May meeting. “Broad sets of applicability” needs text. Volunteers are welcome.

Q: None

[**11-24/2215r0**](https://mentor.ieee.org/802.11/dcn/23/11-23-2215-00-immw-comparison-of-wavforms-pa-nonlinearity.pptx) **Comparison of Wavforms PA Nonlinearity, Chris Hansen (Covariant Corp.)**

Statements not in slides: Rapp model for nonlinear distortion is widely used. 802.15.3c, 802.11ad: OFDM PHY was deprecated, 802.11ay: SC PHY was implemented, OFDM was not. Theory said both perform the same. Pros and cons of SC vs. OFDM, due to short CIR in directive channel, DFE is not needed. Linear EQ works well. All factors favor SC over OFDM. 11ay evaluation methodology allowes fair comparison of both techniques, which is also used here. OFDM SNR is 2.5 dB lower, due to backoff needed for high PAPR. 1.6 dB difference in PER performance. Net gain is 4.1 dB due to non-linear PA. Phase noise was not included, the gap would increase even more. Opinion is that it makes no sense to exclude SC from the PAR.

Q: Quite a good contribution. Agree that SC has advantages. SC PHY was not widely developed, why. Reason is focus on technology and not usability. mm-wave becomes more attractive if it can be integrated in the silicon, chance of being adopted in the market is higher. Better use robust technology than chosing the best one.

A: Every 802.11 chip has SC PHY from CCK for backwards compatibility. But the radio is different.

C: SC makes link more reliable which was most important in previous implementations. Back-off in evaluation framework is actually higher than used in simulations.

Q: SC efficiency-wise is lower than OFDM w.r.t. leakage.

A: Agree, depends on filters etc..

Q: What was the backoff for SC and OFDM? Same data rate?

A: Backoff was optimized to achieve the required EVM, power difference is 2.5 dB. Same constellation, same code rate, not exactly the same data rate, due to CP definition in the PHY.

Q: Slide 15: PER curve. OFDM has two different SNR definitions (time and frequency domain). What is used here?

Q: Slide 15: What is included here? Are there any results for BPSK?

A: Many things used in the system are included, except phase noise. SC would be better against it.

A: Would like to take these discussions offline.

Q: Directionality is important for 60 GHz channel, are beams optimally aligned, beamforming has to be built into that PHY.

A: AWGN for 60 GHz means that beams are aligned. Control PHY is needed therefore.

Q: Maybe use DFT spread OFDM instead of SC.

A: Yes.

C: Would be better to compare spectral efficiency. But am sympatic to the key point. Actual numbers maybe contentious.

A: 160 MHz BW could scale up. BLER vs. Eb/No maybe the way to go.

Q: Need to keep both options open.

[**11-24/0167r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0167-00-immw-discussion-on-bandwidth-issue-in-immw.pptx) **Discussion on Bandwidth Issue in IMMW, Yue Xu (Huawei)**

Statements not in slides: Following previous contributions, 160, 320, 640, 1280 MHz BW are considered. Main advantage of BW is improved sensing accuracy (Slide 5). There are already commercial sensing products in the market w/o standardization.

Q: None.

[**11-24/0571r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0571-00-immw-march-2024-lc-proposal.pptx) **March-2024-LC-proposal, Nikola Serafimovski (pureLiFi)**

Statements not in slides: LC needs the latest Wi-Fi standard: higher speed, additional wavelength, more MIMO. Support for 11be, bn, IMMW. Greater electrical bandwidth due to new optoelectronic components (VCSELs), new wacvelengths should be included to allow greater set of applications. Forsee same goal as in IMMW: No changes in the MAC, no impact on anything else for IMMW. WDM needs FOV considerations. Not redo the work that is already ongoing. Expand the PAR to include light spectrum.

Q: Any good use case for mm-wave and LC together. If this is the case would be welcomed.

A: Bring LiFi in use cases where RF is not necessary.

C: Three use cases which were already discussed in previous contributions: 1) Parallel mm- and light-wave in outdoor P2P links. Light is susceptible against fog, mm-wave against rain. Both do not happen the same time, so there is diversity by using both bands together. 2) Offloading brings benefits for optical channel (fallback in case LOS is lost) and radio channel (remaining users enjoy greater capacity). 3) Security: Get your WiFi-key wireless in more controlled environment (e.g. at the frontdesk when entering a building) via an optical link and use it then in the entire RF coverage area.

C: Use of optical bands should be indicated in the PAR what needs a straw poll.

A: We will do that later.

[**11-24/0406r**](https://mentor.ieee.org/802.11/dcn/24/11-24-0406-01-immw-unified-if-interface-for-mm-and-light-wave.pptx)**1 Unified IF interface for mm- and light-wave, Volker Jungnickel (Fraunhofer HHI)**

Statements not in slides: Various interfaces between baseband and RF are possible: Digital IQ, Analog IQ, Analog IF/RF. In practice, only the antenna interface is open. Assuming analog IF, can be used for mm-wave by means of single-sideband upconversion, same interface is useful for LC. Second advantage is tht it can be transported with low loss over existing home networking media, other than mm-wave or light to antenna usnits e.g. at the ceiling.

Q: None.

[**11-24/0459r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0459-00-immw-multi-link-operation-for-immw.pptx) **Multi-link operation using mmWave bands, Insun Jang (LG Electronics)**

Statements not in slides: AP MLD does link discovery, multilink probing, multilink setup, non-beacon like mgmt. frame, transfer most information on sub-7GHz band, introduces mAP/mSTA for mm-wave and sAP/sSTA for sub-7GHz.

Q: agree that MLO can be reused for 60 GHz

A: MLD has to have various fields that can be organized properly

Q: Agree with many ideas here. Slide 4: not to define beacons in mm-wave is a good direction, have to transmit one DMG beacon into each sector, only transmitted via control PHY is very inefficient, IMMW to have sub-7GHz will help so no beacon is needed

A: Thanks for the comment.

*Chair decided this was last submission. Open submission in the agenda are shifted to next meeting.*

**Recess at 19:45 ET**

# 2nd Meeting: Wednesday, March 13, 2024, PM2, (18:00-20:00 ET)

1. The Chair, Laurent Cariou (Intel), calls the meeting to order. The Chair notifies the attendees that the agenda is in [IMMW SG March 2024 meeting agenda](https://mentor.ieee.org/802.11/dcn/23/11-23-1732-02-immw-immw-sg-november-2023-meeting-agenda.pptx)

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1. Motions

**Move to approve the agenda in doc.** [**11-24/0248r2**](https://mentor.ieee.org/802.11/dcn/24/11-24-0248-02-immw-immw-sg-march-2023-meeting-agenda.pptx)

Discussion: None

Result: Agenda approved with unanimous consent.

1. Review PAR and CSD

[**11-24/0116r2**](https://mentor.ieee.org/802.11/dcn/24/11-24-0116-02-immw-immw-draft-proposed-par.docx) **IMMW draft proposed PAR, Laurent Cariou (Intel)**

C: SPDU format based on OFDM locks the group into using OFDM PHY which is considered a failure. Recommendation to vote No.

C: Will vote No. It is a mistake to tackle any technical detail at this time. Sub-7 is understandable. Arguments for limitations are not technical.

C: Scope looks very different to others.

A: Scope of the standard is taken and adpted from 11bn.

**Straw Poll**: Do you support the following document as the PAR document for IMMW?

<https://mentor.ieee.org/802.11/dcn/24/11-24-0116-02-immw-immw-draft-proposed-par.docx>

**Result: 67 Y, 16 No, 25 Abstain**

Q: No Motion this time?

A: Will be done in May.

1. Submissions

[**11-24/0471r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0471-00-immw-considerations-on-power-consumption.pptx) **Considerations on Power Consumption, Sang Kim (LG Electronics)**

Statements not in slides: Power saving in mm-wave: Toggle between Awake and Doze. Active vs. Save mode. Power consumption in listening mode is significant. Extension of LPLM mode to mm-wave band is proposed. Various low-power schemes during listeing mode. Beam refinement maybe required. Power consumption should be considered from the beginning.

Q: Is your assumption that MLO doing everything in the lower band? Are you assuming a different mode of operation, i.e. 6 GHz is off during operation.

A: Good question. Two modes. One is we turn mm-wave on only. Another mode is if mm-wave is turned on after association.

Q: Do you assume that in any circumstance mm-wave will be idle listening.

A: That’s right.

Q: Difference between low-frequency band and mm-wave. What changes in the spec are needed?

A: Very similar to sub-7GHz. In addition we propose some antenna configuration should be used.

Q: Power saving is an important topic. Contol-level kind of thing. Is this more long-term or short term change of all the parameters? With On-off should be enough.

A: mm-wave is switched off is kind of long-term power saving.

Q: I suppose there are 2 stages of power save: mmW radio is OFF vs. mmW radio is in LPLM mode. OFF🡪ON (either LP or full ON) is longer transition time. When in ON state, there is LPLM🡪full capability ON needs shorter transition time. This proposal, I suppose, is suggesting the use of LPLM-to-full-ON to save further power.

A: Will be taken offline

[**11-24/0587r0**](https://mentor.ieee.org/802.11/dcn/24/11-24-0587-00-immw-multi-link-association-using-mmwave-bands.pptx) **Multilink Association using mm-wave bands, Tuncer Baykas (Offino)**

Statements not in slides: Unauthorized access is possible at sub-7GHz. Use mm-wave bands. Receive token via mm-wave link.

Q: Association in the lower band is commonly assumed. Here it is done via upper band. Complexity of beamforming is underestimated. Figure on Slide 4 will not work.

A: It is harder to do association in upper band. That is why Figure on slide 5 is proposed.

Q: Do all management exchange in sub-7GHz.

A: take is offline.

Q: Association at mm-wave band before beamforming would be tricky. Coverage ranges should be the same

A: Understand concern. But in professional setting I know where the association is possible, tell user to go there. Do association in the controlled mm-wave band and then use the lower band to communicate.

C: Original approach would be sub-7 GHz for mgmt. Are you assuming that IMMW are supporting sub-7GHz? Do we really want to bring all the overhead into the mm-wave band?

A: Thank you very much.

Q: Do you assume devices are close to each other? In mm-wave devices need sharp beam is needed to hear each other.AP does not know where STA is. This cannot be done w/o beam training.

A: Not think about STA-STA communication but about MLD.

1. Goals for March 2024
   * + - * Approve PAR and CSD documents
2. Teleconference/ad-hoc plan

* No telecon plans for now
* Will announce them with 10 days notice

1. AoB - None
2. Adjourn at 19:00 ET