IEEE P802.11
Wireless LANs

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| IEEE 802.11 TGbqInterim Meeting Minutes May 2025 |
| Date: 2025-06-24 |
| Author(s): |
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Abstract

This document contains the IEEE 802.11 TGbq minutes for the May Interim 2025.

Revision history:

R0: initial version

R1: some editorial changes

R2: performed editorial corrections throughout the document

R3: some editorial changes

Abbreviations:

Q Question

A Answer

C Comment

# Monday PM3, May 12, 2025, 19:30pm - 21:30pm (CET)

TGbq Chari: Edward Au (Huawei)

TGbq Vice-Chair: Rui Cao (NXP)

TGbq Vice-Chair: Abhishek Patil (Qualcomm)

TGbq Vice-Chair: Sang Kim (LG Electronics)

TGbq Secretary: Jonghoe Koo (Samsung Electronics)

TGbq Editor: Cheng Chen (Intel)

**Opening formalities**

1. The IEEE 802.11 TGbq meeting was called to order at 19:30pm CET by the Chair.
2. Chair introduced the TGbq leadership members.
3. Chair reminded the meeting registration.
4. Chair presented the TGbq meeting agenda [IEEE 802.11-25/0515r2](https://mentor.ieee.org/802.11/dcn/25/11-25-0205-02-00bq-tgbq-agenda-2025-march-plenary.xlsx) and reviewed the agenda items.
5. Chair reviewed the meeting agenda and the agenda was approved by unanimous consent.

**[Administrative items]**

1. Chair presented TGbq supplementary materials [IEEE 802.11-25/0516r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0417-00-00bq-supplementary-material-for-march-2025-plenary.pptx) slides.
2. Chair reviewed IEEE 802 required notices (emphasizing to ensure to announce name and affiliation at the first time to speak, anti-trust compliance, IEEE 802 WG rules and policies, etc.), IEEE SA meeting guidelines, IEEE Codes of Ethics and Conduct, IEEE individual process, and IEEE-SA standards activities with the fair and equitable consideration.
3. Chair remineded all to record their attendance in IMAT and other meeting reminders.

## General buisness

**Meeting minutes**

1. Motion (Procedural): Move to approve the March 2025 plenary meeting and the April 2025 teleconference call meeting minutes
	1. Moved: Nikola Serafimovski (University of Cambridge)
	2. Seconded: Abhishek Patil (Qualcomm)
	3. Discussion: No discussion
	4. Result: Approved by unanimous consent

**Contributions**

**Presentation of** [**IEEE 11-25/0434r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0434-00-00bq-third-equation-for-long-term-slot-sync.pptx)**, Third Equation for Long-Term Slot Sync (Brian Hart, Cisco)**

1. Brian presented IEEE 11-25/0434r0, Third Equation for Long-Term Slot Sync.
2. Q: If there is an AP synchronized to AP A and this AP is also able to overhear the transmission of AP B, then how the synchronization decision is going to be done, is this AP synchronized to AP A or AP B?
3. A: Good question. Essentially, it will look like what we have today, which is kind of uncoordinated, but fundamentally devices are still synchronized to the most recent transmission. In addition, in that way, if you have a cluster of devices that are recently active transmitters, and then a new one joins it, then they will automatically synchronize to the body. Then that island of coordination grows and then everyone is within that bound.
4. Q: An AP in the middle of two AP groups, which have independently synchronized each other, get confused.
5. A: I would argue that the groups will become aligned by virtue of CSMA rule. If a more active BSS will tend to push. For example, AP A and C are misaligned and if AP B happens to be more active, then for just a short interval of time, AP A and C will synchronize to AP B.
6. Q: Question on the use case of it.
7. A: It makes more sense of lower bands rather than mmWave. However, for the enterprise network, the role of the network is to provide of coverage everywhere. The IMMW is pretty short range, which will lead to many APs. However, a directional beam and a one side of the transmission may change the equation. If we have one AP per room, then connected through the wall, then that’s totally different thing.
8. Q: Assume that both AP and STA have a similar number of antennas or phase array. There is another architecture that would add more complexity to AP to have a bigger phased array making a beam more directional.
9. Q: I have a concern that it probably needs to change some of inter-frame spacing, e.g., SIFS or PIFS.
10. A: In this proposal, we do not change SIFS, PIFS, and DIFS. We just make ‘SIFS + transmit time’ the integer multiple of the slot time.
11. Q: I’m worried about that it may impact the whole implementation such as a state machine.
12. A: I would like to say that the kind of work that we will have to do for a upclock of PHY clock will be very much like the kind of work we need to do for this solution. I totally would accept that if you upclock both MAC and PHY clock with the same ratio, but as soon as we decouple those clocks, we will buy mixed work and this is not really changing the amount of work. For avoidance of doubt, I’m not changing SIFS time or the slot time.
13. Q: What do you mean upclocking the MAC clock?
14. A: We have SIFS time of 16 usec and the slot time of 9 usec. If we upclock the MAC clock by the factor of 8, SIFS drops down to 16/8 usec and the slot time drops down to 9/8 usec.
15. Q: Then, the clock drift starts to become a substantial portion of the slot time. Secondly, some of these times are used to accumulate energy over the channel for detection. Just because we increase sub-carrier spacing, does it change the physics of energy accumulation which is the function of amount of time that we need to accumulate enough energy for detection.
16. A: For 20 ppm, 190-picoseconds is not significant for a waveform of 160 MHz. As long as APs are reasonably active, and let’s say 40 ppm, 1 usec drift takes 25000 usec before it happens, which is essentially a lot of TXOPs. Instead of having sort of asynchronism saying 4 usec, and that takes a long time to accumulate, it’s very quiet network, and at that point, the cost of soft synchronize, asynchronism, is very low. So, for your first concern, I’m not very worried about that concern. For the second concern about energy distribution, the preambles are not changed in this proposal so that’s not a factor.
17. Q: In practice, let’s say that AP B is going to be inactive and AP A and AP C do not hear each other, but AP B comes back. This is a practical case.
18. A: As soon as you get the denser you get, the more active you get, leading to slot synchronization.
19. Q: For the first transmission of AP B at the time it comes back, AP A and AP C won’t be able to get the smart synchronization done.
20. A: From the second transmission, it can. The cost would be up to normally 8 usec divided by upclocking rate.
21. Q: Do you have a sense of efficiency?
22. A: If we ever think about P-EDCA in mmWave, I think the gain is not quite large.
23. Q: I’m just curious of the overhead vs. gain.
24. Q: Slide 4, my question is what effect this has on the neighbor APs? For example, there are AP D, AP E, and AP F, and AP E is in the middle. AP D and AP F are synchronized to AP E. Then, at the edge, AP C is getting interfered with because other group of three APs have a different slot synchronization?
25. A: If there is a rule to synchronize to the last burst, then they will never be worse than what we have today.
26. Q: There’s actually a concept called percolation theory that defines boundaries on when such as propagation method will converge or with whether it will cause just an instability in the network where you have these cycles of slot synchronization that they’re spiralling around. But I think it’s going to work in certain condition, but maybe not for others.
27. A: What the percolation theory would offer is that for larger times the larger areas we would get more slot synchronization.
28. Q: In practice, I think it’s okay for only AP’s point of view, forget about STA for a moment which are even more challenge. 40 ppm, which means if we synchronize up every 100 msec beacon interval we have 4 msec clock drift. So, in order to have 1 msec granularity, we need very frequent time synchronization between APs and we have need very complicated measurement for timing adjustment.
29. A: I think I’m taking one step and you’re saying that it’s bad because it takes two steps. If you have only beacons, you don’t need slot synchronization. You only need slot synchronization if you have also traffic. I’m still talking about organic synchronization based on local transmission. I’m not talking about global synchronization.
30. Q: I don’t think this organic thing works in the mmWave case where many times you do the beamforming. Between different APs, for many times beams are not aligned. Unless those beams have aligned at a pre-assigned certain time, it is very difficult to hear other device’s transmissions trying to synchronize. In practice, it is doable but it’s hard to maintain microsecond-level of granularity.
31. A: It just happens in a distributed way with reasonable traffic. However, I agree that directional beamforming training will create an unexpected synchronization of it.
32. Q: I would like to remind that upclocking the current system is not an easy work.
33. A: We could have 8x PHY and 1x MAC.

**Presentation of** [**IEEE 11-25/0856r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0856-00-00bq-subchannel-beam-training-for-immw-communication.pptx)**, Subchannel Beam Training for IMMW Communication (Qisheng Huang, ZTE)**

1. Qisheng presented [IEEE 11-25/0865r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0261-02-00bq-immw-for-consumer-device-and-tgbq-timeline.pptx).
2. Q: In slide 6, do you want to enable multi-link scheme in this mmWave? I think if you want to enable 2 or 3 links active, then it causes high cost and complexity. In slide 7, the mode 2 is also quite complex to do. What is the motivation? If you have multiple channels, we can use frequency-divided beamforming. For the first half of the PPDU is transmitted to direction A and the remaining half of it is transmitted to direction B while whole PPDU is used for beamforming.
3. A: I agree that it has a high cost. I would like to present several options. The mode 2 is preferred than mode 1.
4. Q: What is the motivation and benefit of the mode 2? If you do the beamforming training first and then go to data transmission used in TRN, then you can do the beam tracking. What you need is to simultaneously transmit those PPDUs having such a complex way.
5. A: The current time-division beam tracking causes a lot of delay. The mmWave communication has very large bandwidth but in current standard, we do not have a frequency-division way.
6. Q: In Slide 4, what does it mean that choosing sub-channels with smaller center frequency differences?
7. A: That is the key consideration about how to utilize the sub-channel sweeping. The larger difference between sub-channels, the larger errors. The solution here is to put sub-channels close to the center of the data transmission band.
8. Q: In Slide 5, the second one is what you are proposing.
9. A: I think the second one is easier to realize.
10. Q: You mentioned that you want to change TDMA to FDMA then why do you say ‘converting frequency domain overhead to time domain’ as described in Slide 5?
11. A: I’d like to reduce time delay.
12. Q: In Slide 6, you assume that more than one link use 60 GHz? Do you think it is feasible? According to 11be, more than two links cannot use the same channel. In Slide 7, for the shared RF front-end case, data transmission occupies majority of channel bandwidth, so you only have small sub-band for scanning.
13. A: We may use a small amount of area that you need for a sub-channel. I think we can narrow such area of beam to a little wider beam sector. That’s the purpose of my proposal.
14. Q: What the benefit of alignment method in Slide 7, i.e., one of header alignment or tail alignment?
15. A: The benefit is to reduce the internal interference between Tx and Rx. It’s a similar concept that is considered for NSTR multi-link.
16. Q: It would be a single radio.

**Presentation of** [**IEEE 11-25/0841r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0841-00-00bq-some-considerations-for-mlo-based-bft-announcement.pptx)**, Some considerations for MLO-based BFT Announcement (Hongwon Lee, LGE)**

1. Hongwon presented IEEE-11/250841r0.
2. Q: In Slide 8, what is the motivation of periodic BFT? In 11ad/ay, there are BTI procedures where the AP can transmit beacon periodically. For 11bq, we have a sub-7GHz link. Why we need to send a periodic beam forming training information?
3. A: It’s one of the options. This can reduce overhead of sub-7GHz link.
4. Q: Regarding SP2, do you want to also include the types of BFT procedures defined in 11ad/ay such as I-TXSS?
5. A: BFT methods used for 11bq will be discussed. I’m not sure whether to reuse SLS or BRP or to define a new BFT method. The types of BFT in SP2 text are just an example. My intention is that we should indicate a type of BFT in a frame.
6. Q: First question. Is it your intention that the BFT is always initiated by AP? I think we should also consider the scenario where the BFT is initiated by STA. Secondly, the necessity of periodic beamforming. We only use mmWave link when it is necessary. The periodic BFT is burden to both AP and STA. Before having discussion on a periodic BFT, we have to think about a scenario to keep the mmWave link for a long time.
7. A: For the first question, yes, STA can also initiate the BFT procedure. For the second question, this is just a high-level contribution, so we need to have further discussion.
8. Q: I’m wondering which frame you want to reuse to enable your proposal?
9. A: We need to have more discussion on what kind of frames to be used to deliver the type of BFT.
10. Q: Question on timing relationship between an announcement frame in a sub-7GHz and actual time that beamforming in the mmWave happens. How to ensure that the beamforming in mmWave link is operated in a scheduled time announced via sub-7GHz. How to detect the start of beam sweeping in the mmWave?
11. A: I think it’s a next level discussion.
12. C: A trigger-based STA-specific BFT is more preferred. However, if there are many mmWave STAs, then the periodic BFT makes sense.
13. Q: What about overhead of sub-7GHz link?
14. A: Sub-7 GHz overhead can be reduced if we perform one signalling for all BFTs.
15. Q: In multi-STAs scenarios, there may be larger overhead. What is the scenario where multiple STAs perform BFT at the same time?
16. A: Some scenarios for AR/VR applications.

**Presentation of** [**IEEE 11-25/0900r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0900-00-00bq-su-ofdm-beam-division-case-for-immw-ap.pptx)**, SU OFDM Beam Division Case for IMMW AP (Bo Cao, ZTE)**

1. Bo presented [IEEE 11-25/0900r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0310-00-00bq-new-cca-schemes-for-immw.pptx).
2. Q: In Slide 2, it seems that your proposal is MU-MIMO not SU-MIMO. Then, it is out-of-scope of 11bq. As per TGbq PAR, we assume to have a single radio.
3. A: I’m assuming a single user.
4. Q: In your proposal, two spatial streams support two different STAs located in the different locations.
5. C: I prefer to have MU-MIMO which is more common than SU case. However, we have agreed to start with single use case first. We can discuss more about MU-MIMO case together.
6. C: It will be very complicated if we consider the MU-MIMO. Another comment is that we can reuse 11bn’s unavailability report mechanism.
7. Q: What is the benefit of sending unavailability window than just sending CTS-to-self?
8. A: If there are multiple users that a single AP supports simultaneously, then, unavailability window may help.

**Closing formalities**

1. The next meeting is scheduled from 1:30pm to 3:30pm CET on Tuesday, May 13.
2. Chair mentioned that there will be a timeline discussion and presentations of several PHY contributions. Chair reminded the meeting registration.
3. The chair announced that the meeting is recessed at 09:20pm CET.

# Tuesday PM1, May 13, 2025, 13:30pm - 15:30pm (CET)

TGbq Chari: Edward Au (Huawei)

TGbq Vice-Chair: Rui Cao (NXP)

TGbq Vice-Chair: Abhishek Patil (Qualcomm)

TGbq Vice-Chair: Sang Kim (LG Electronics)

TGbq Secretary: Jonghoe Koo (Samsung Electronics)

TGbq Editor: Cheng Chen (Intel)

**Opening formalities**

1. The IEEE 802.11 TGbq meeting was called to order at 13:30pm CET by the Chair.
2. Chair introduced the TGbq leadership members.
3. Chair reminded the meeting registration.
4. Chair presented the TGbq meeting agenda [IEEE 802.11-25/0515r4](https://mentor.ieee.org/802.11/dcn/25/11-25-0205-02-00bq-tgbq-agenda-2025-march-plenary.xlsx) and reviewed the agenda items.
5. Chair reviewed the meeting agenda and the agenda was approved by unanimous consent.

**[Administrative items]**

1. Chair presented TGbq supplementary materials [IEEE 802.11-25/0516r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0417-00-00bq-supplementary-material-for-march-2025-plenary.pptx) slides.
2. Chair reviewed IEEE 802 required notices (emphasizing to ensure to announce name and affiliation at the first time to speak, anti-trust compliance, IEEE 802 WG rules and policies, etc.), IEEE SA meeting guidelines, IEEE Codes of Ethics and Conduct, IEEE individual process, and IEEE-SA standards activities with the fair and equitable consideration.
3. Chair reminded all to record their attendance in IMAT and other meeting reminders.

**Operation aspect**

Proposed Selection Procedure for IEEE 802.11bq

1. Motion: (Procedural): Move to approve the selection procedure as shown in the document 25/0372r0.
	1. Motion: Abhishek Patil (Qualcomm)
	2. Seconded: Jonghoe Koo (Samsung)
	3. Discussion: No discussion
	4. Result: Approved by unanimous consent

**Contributions**

**Presentation of** [**IEEE 11-25/0700r1**](https://mentor.ieee.org/802.11/dcn/25/11-25-0700-00-00bq-tgbq-timeline-proposal-follow-up.pptx)**, TGbq timeline proposal (Jonghoe Koo, Samsung)**

1. Jonghoe presented [IEEE 11-25/0700r1](https://mentor.ieee.org/802.11/dcn/25/11-25-0700-00-00bq-tgbq-timeline-proposal-follow-up.pptx).
2. Q: In SP, I do not think it’s a fair SP because you only mentioned two timeline options. Doing a preference survey with only two options can make it difficult to derive a better timeline. One thing is to add an option saying that none of the options is preferred. In addition, there should be timelines for all D1.0, D2.0, D3.0, and D4.0. You need to consider the sufficient time from D1.0 to D2.0, and the time from D2.0 to D3.0. You allocated 12 months from D0.1 and D1.0 but only allocated 4 months to the remaining, which might be quite strange. Timeline Option A looks better than Option B. I have a contribution for the TGbq timeline derived from the average of other TG’s timelines. Let’s discuss it together.
3. A: Both proposed timelines have the same completion time. The only difference between two options is the expected time for recirculation and the expected time to get D1.0.
4. Q: Do you think that 4 months time is sufficient for recirculation?
5. A: Assuming the remaining time until the end of the project is the same, we have no choice but to decide how much time to spend on D0.1, how much time to spend on D1.0, and how much time to spend thereafter. If D1.0 is somewhat premature due to short development time, a longer recirculation time may be required.
6. Q: For the PHY topics to do, you mentioned that upclocking 11ac or 11ax PHY and determining bandwidth and channelization and so on. However, there have been discussed for ELR and DRU in 11bn. You proposed a required specification development time similar to 11bn. I think we may not need such a long time to develop 11bq PHY.
7. A: No one can predict how long it will take for us to do what we need to do in the future. I would like to emphasize that I’m open to adjust the timeline based on the discussion.
8. C: From implementation point of view, for the success of commercial market we do not repeat the same failure.
9. C: AP installed on ceiling suffers from heating issue. Practically, if we do not consider the practical considerations, then the solution is difficult to be successfully adopted by the market.

**Presentation of** [**IEEE 11-25/0952r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0952-00-00bq-discussion-on-802-11bq-timeline.pptx)**, Discussion on 802.11bq Timeline (Mengshi Hu, Huawei)**

1. Mengshi presented [IEEE 11-25/0952r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0952-00-00bq-discussion-on-802-11bq-timeline.pptx).
2. Q: 11ay is a great standard, but it failed to commercialize in the market. We need to take an approach for TGbq in a different way than before. The scope of TGbf is almost MAC only ranging. Timeline of TGba is also not a fair comparison. I strongly insist that we should delay the timeline and develop a standard that takes into account many technical comparisons and implementations and is successful in the market.
3. A: 11ay took a long time because it defined a lot of new things. 11bq will define a lot of things by reusing the existing specifications. This reflects that.
4. Q: I say we should consider implementation together. We need one or two implementations.
5. A: Timeline adjustments are possible by adding 1-4 months.
6. Q: I would suggest a timeline that delays 4 months to every milestone. That's my proposed timeline.
7. Q: I am afraid that the 60GHz bandwidth will be occupied by other entities or communication systems. It is important to make sure that Wi-Fi can use 60GHz bandwidth. As for the technical details, we decided to reuse them, so we will not make it complicated, and hence it will not take a long time.
8. Q: 11ad and 11ay timeline should also be considered as the reference. It's weird to consider other TG timelines that have different technical scopes. It would be good to consider increasing the time taken for D0.1, D1.0 and D2.0 by 2 months each and reducing the remaining timelines by 2 months each.
9. Q: There is only one proposal in the SP. Why not have another option?
10. Q: I would say it is supportive. It is a bit aggressive, but it is okay because it is aimed at a limited technical scope. Another thing to consider is that there are a lot of resources invested in 11bn and it is actively being carried out.
11. Q: We need to consider the scope. Small scope. Lesson from 11ad/11ay. Important thing is commercial successful. I think it should also be taken into consideration that the ecosystem must be well prepared. I would like to encourage more discussion to have better convergence.
12. Chair asked Mengshi and Jonghoe to prepare one SP text with options to be run on PM3, Tuesday.

**Presentation of** [**IEEE 11-25/0824r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0824-00-00bq-immw-ray-tracing-propagation-in-a-large-factory.pdf)**, IMMW Ray-Tracing Propagation in a Large Factory Charlie Pettersson (Ericsson)**

1. Charlie presented [IEEE 11-25/0824r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0824-00-00bq-immw-ray-tracing-propagation-in-a-large-factory.pdf).
2. Q: In Slide 6, did you consider penetration loss? There are many research results that indicate that penetration loss should be considered in mmWave.
3. A: In this simulation, there are open in the ceiling.
4. Q: What is the dB difference between the value inside the room and the value outside the room? What is the difference? What is the dB difference between the yellow dot and the red dot?
5. A: There is a legend on the right side of the slide. It’s 20 dB difference
6. Q: It seems like a large scaling fade analysis. We should also consider multi-path effects. Don't we need to consider small-scaling fading?
7. A: It’s not easy to answer. Need more discussion.
8. Q: I think you should consider penetration loss. What software did you use for this simulation? How to derive the conclusion saying that “theory says ~21 dB difference in free space propagation between 5.2 and 60 GHz, here we see 22-35 dB difference for 90% of locations” ?
9. A: It’s because propagation difference between 5.2 and 60 GHz can largely be compensated for by bigger antenna arrays. I considered penetration effect in the mathematical equation to derive this conclusion.

**Presentation of** [**IEEE 11-25/0867r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0867-00-00bq-immw-phy-performance-and-design-implications.pptx)**, IMMW PHY Performance and Design Implications (Thomas Handte, Sony)**

1. Thomas presented [IEEE 11-25/0867r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0867-00-00bq-immw-phy-performance-and-design-implications.pptx).
2. Q: You preclude 1280 MHz bandwidth in your contribution. Is it correct?
3. A: I think it may not be reasonable. BPSK and QPSK should be okay. However, higher MCS is not reasonable.
4. Q: I think we have use cases that can utilize 1280MHz bandwidth in order to achieve higher throughput. Therefore, I would like to keep 1280MHz bandwidth option.
5. Q: It is too early to conclude that 1280 MHz bandwidth is questionable. What is the use case that 80 MHz is used for omni-reception or even omni-transmission?
6. A: I haven't thought of a use case yet, but I think we could consider an omni-directional case in low capability mode.
7. Q: I don’t think we need 80MHz in mmWave. It seems the waste of spectrum resource. I think we need to restrict the number of bandwidth modes. Precluding 1280MHz bandwidth but adopting 80MHz bandwidth is not convinced.
8. Q: For 80MHz bandwidth, I cannot see the strong benefit. For the data transmission, we have larger sub-carrier spacing compared to EHT.
9. A: I agree that 80MHz bandwidth may be difficult to be achieved by upclocking.
10. Q: It presented a lower potential throughput compared to the EDMG single carrier. Is it due to narrower bandwidth?
11. A: If you see the Slide 3, there is not much difference in terms of normalized spectral efficiency. mmWave with 1.6GHz may have a similar performance with EDMG with 1760MHz. However, the issue is the characteristics of the waveform because the OFDM carrier has a different PAPR characteristic than EDMG single carrier. The link margin of OFDM 1.6GHz mmWave may be lower than the EDMG 1760MHz single carrier.
12. Q: Slide 8, how many antennas do you expect to have for AP side and STA side?
13. A: In Slide 6, we have 6 elements to be considered. For the AP, phase antenna array gain, PA maximum transmit power tend to be higher for the AP side than the STA side.
14. Q: In Slide 6, 80MHz bandwidth may not be good for marketing point of view
15. Q: 80MHz bandwidth in sub-7GHz is mandatory for 5GHz and 6GHz link. So, no need to have 80MHz bandwidth in IMMW. In Slide 8, could you clarify that why you compare the data rate with 320MHz bandwidth in case of lower MCS but compare the data rate with 640MHz in case of higher MCS?
16. A: In Slide 7, the link margin with 320 MHz and lower MCS is same as that with 1760MHz and lower MCS of EDMG SC while the link margin with 640 MHz and higher MCS is similar to that of higher MCS of EDMG SC.

**Closing formalities**

1. The next meeting is scheduled from 19:30pm to 21:30pm CET on Tuesday, May 13.
2. Chair called for contribution again and asked the participants to consider a best practice in uploading their contributions one day before the presentation.

The chair announced that the meeting is recessed at 15:30pm CET.

# Tuesday PM3, May 13, 2025, 19:30pm - 21:30pm (CET)

TGbq Chari: Edward Au (Huawei)

TGbq Vice-Chair: Rui Cao (NXP)

TGbq Vice-Chair: Abhishek Patil (Qualcomm)

TGbq Vice-Chair: Sang Kim (LG Electronics)

TGbq Secretary: Jonghoe Koo (Samsung Electronics)

TGbq Editor: Cheng Chen (Intel)

**Opening formalities**

1. The IEEE 802.11 TGbq meeting was called to order at 19:30pm CET by the Chair.
2. Chair introduced the TGbq leadership members.
3. Chair reminded the meeting registration.
4. Chair presented the TGbq meeting agenda [IEEE 802.11-25/0515r5](https://mentor.ieee.org/802.11/dcn/25/11-25-0515-05-00bq-tgbq-agenda-2025-may-wireless-interim.xlsx) and reviewed the agenda items.
5. Chair reviewed the meeting agenda and the agenda was approved by unanimous consent.

**[Administrative items]**

1. Chair presented TGbq supplementary materials [IEEE 802.11-25/0516r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0417-00-00bq-supplementary-material-for-march-2025-plenary.pptx) slides.
2. Chair reviewed IEEE 802 required notices (emphasizing to ensure to announce name and affiliation at the first time to speak, anti-trust compliance, IEEE 802 WG rules and policies, etc.), IEEE SA meeting guidelines, IEEE Codes of Ethics and Conduct, IEEE individual process, and IEEE-SA standards activities with the fair and equitable consideration.
3. Chair reminded all to record their attendance in IMAT and other meeting reminders.

**Presentation of** [**IEEE 11-25/0822r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0822-00-00bq-discussion-on-numerology-and-bandwidth-for-11bq.pptx)**, Discussion on Numerology and Bandwidth for 11bq Eunsung Park, LG Electronics)**

1. Eunsung presented [IEEE 11-25/0822r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0822-00-00bq-discussion-on-numerology-and-bandwidth-for-11bq.pptx).
2. Q: 160 MHz bandwidth is preferred. It’s good for low cost device.
3. A: We are open to determine the minimum bandwidth.
4. Q: We had a similar discussion two 2 years ago. The statement in your contribution, “upclocking parameter should be equal or larger than 4 times” is not correct. It may be misleading.
5. A: We assume to have 40 ppm in 60GHz. We may be able to reduce the ppm restriction since it is applied to a high-end device. We can have further discussions.
6. Q: What is your proposal for sub-carrier spacing (SCS)?
7. A: There is no impact to SCS in terms of CFO.
8. Q: We need to determine the baseline PHY to be used for upclocking. 11ac has larger SCS, which is good in terms of phase noise.
9. A: I’d like to say that 4x numerology is fine in terms of CFO.
10. Q: We had a tone-spacing discussion. Table in Slide 7 looks misleading. Need more clarification.
11. A: 4x numerology means HE/EHT. Legacy preamble part is 1x numerology and data transmission part is 4x numerology. The legacy preamble part and data transmission part are different.
12. Q: Is it tolerable to CFO. Phase noise impact will happen.
13. A: It depends on which implementation we will use. At least, there is no impact in terms of CFO.
14. Q: If you use 4x numerology-based upclocking, you apply the same upclocking ratio for both preamble and data. Is that correct that there are 4 times difference between legacy preamble and data part in terms of tone spacing? Is same upclocking rate applied to both preamble and data in your simulation result in the following contribution?
15. A: Yes.
16. Q: You mentioned that most of the delay spread was measured within 100 ns. Do you also consider the guard interval value lower than 100 ns? We may have much smaller value for guard interval.
17. A: Based on 11ac numerology, we have shorter guard interval. If we apply 8x upclocking, we have 0.1ms guard interval.
18. Q: It’s too early to have a decision for now. Before going to determine which baseline to be used for upclocking and what is the best upclocking ratio, we have to discuss about the use case and target performance. In addition, we need to calibrate parameters used for simulation and what is the reasonable phase noise model. All factors that can affect performance should be carefully considered and many simulations result using accurate models should be compared.
19. A: This is an initial proposal. So, it would be a good starting point for a discussion.

**Presentation of** [**IEEE 11-25/0854r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0854-00-00bq-considerations-on-numerology-for-immw.pptx)**, Considerations on Numerology for IMMW (Insik Jung, LG Electronics)**

1. Insik presented [IEEE 11-25/0854r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0854-00-00bq-considerations-on-numerology-for-immw.pptx).
2. Q: Which phase noise model did you use?
3. A: We used 11ad channel model.
4. Q: MCS 4 is too low for fair comparison. We need to consider higher MCSs too.
5. Q: Could you clarify why upclocking helps CFO/PN?
6. A: Upclocking makes subcarrier spacing wider, thus leading to reduced CFO/PN.
7. Q: Phase noise is coming from hardware.
8. Q: What implementation are you trying to use to overcome phase noise?
9. A: I think it would be possible to use an appropriate phase noise mitigation algorithm and hardware.
10. Q: If you are using a phase noise compensation method, why not consider a PHY with a wider SCS? I think we need to carefully consider the pros and cons. It's too early to come to this conclusion.
11. Q: We need to be careful about phase noise impact. We also have a simulation result conducted with different phase noise models. Let's check by performing performance calibration for the same parameters. In slide 6, you used 1000 bits packet size. I think MCS 7, 64QAM, probably also needs to be considered as a comparison.
12. A: I agree that we need to have simulation results with much longer packet size and MCS 7.

**Presentation of** [**IEEE 11-25/0853r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0853-00-00bq-immw-tone-plan-discussions.pptx)**, immw tone plan discussions (Rui Cao, NXP)**

1. Rui presented [IEEE 11-25/0853r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0853-00-00bq-immw-tone-plan-discussions.pptx).
2. Q: In Slide 6, could you clarify that “PN mode has 3dB bandwidth BPLL = 1MHz and tone spacing should be larger than 2\* BPLL”?
3. A: This is not a restriction. It’s a design limitation. We need to have enough separation in order to support higher QAM. So, two times of 3 dB bandwidth is a general recommendation.
4. Q: In Slide 3, we may consider 320 MHz bandwidth, which upclocked 11ac 40 MHz by 8x. 20 MHz-based tone plan might not be good.
5. A: If you recommend using 40 MHz tone plan, then we need further discussion since we do not have it yet. This is an example of what a PPDU looks like.
6. Q: We may not need to have U-SIG.
7. A: That’s a topic in the reference [7]. We can discuss further on the PPDU format.
8. Q: In Slide 8, you assumed 64QAM. Do you also consider 256QAM for IMMW?
9. A: That one is debatable. It’s very challenging. If we have better a phase noise model, then it can be considered. Otherwise, 256 QAM may not be considered.
10. Q: Have you used any mechanism for phase noise mitigation?
11. A: No specific receive process. It’s a generic receiver.
12. Q: If we convert PER result to throughput, then is the result trend the same? Or can we say that 4x numerology is better than 1x numerology?
13. A: It depends on the OFDM efficiency. If we consider a default setting, i.e., 25% GI, we don’t expect any difference.
14. Q: Regarding Slide 8, different tone plan and tone spacing result in different tone efficiency. In addition, different tone efficiency requires different SNR requirement.
15. A: Same as the previous comment, if it is converted to the throughput, then that might be different.
16. Q: You compared VHT\_4x and EHT\_16x. Those are the same in terms of data portion. EHT\_16x is consistently worse than VHT\_4x across all SNR range. What is the reason? Both use 256 FFT.
17. A: That’s the observation. Possibly, it’s due to different tone plan, but it is not the only reason. We haven’t investigated details yet.
18. Q: In Slide 5, comparing to sub-7GHz delay, IMMW delay is much larger. But, this value in Slide 5 is small.
19. A: Propagation loss is higher than sub-7GHz case. Energy diminishes much faster than sub-7GHz case.

**Presentation: Timeline**

1. Straw poll: Do you agree with the following timeline as the initial time estimation for the development of P802.11bq amendment?
* D0.1: Jul. 2026
* D1.0: Mar. 2027
* D2.0: Sep. 2027
* D3.0: Mar. 2028
* D4.0: Sep. 2028
* Final 802.11 WG approval: May 2029
* 802 LMSC approval: May 2029
* RevCom and SASB approval: Jul. 2029

[Note] The above timeline is a result of harmonizing between 11-25/0952r0 and 11-25/0700r1.

Results:

* 1. Discussion: No discussion
	2. Result: Approved by unanimous consent

**Closing formalities**

1. The next meeting is scheduled from 1:30pm to 3:30pm CET on Thursday, May 15.
2. Chair reminded the meeting registration.
3. The chair announced that the meeting is recessed at 20:56pm CET.

# Thursday PM1, May 15, 2025, 1:30pm - 3:30pm (CET)

TGbq Chari: Edward Au (Huawei)

TGbq Vice-Chair: Rui Cao (NXP)

TGbq Vice-Chair: Abhishek Patil (Qualcomm)

TGbq Vice-Chair: Sang Kim (LG Electronics)

TGbq Secretary: Jonghoe Koo (Samsung Electronics)

TGbq Editor: Cheng Chen (Intel)

**Opening formalities**

1. The IEEE 802.11 TGbq meeting was called to order at 13:30pm CET by the Chair.
2. Chair introduced the TGbq leadership members.
3. Chair reminded the meeting registration.
4. Chair presented the TGbq meeting agenda [IEEE 802.11-25/0515r6](https://mentor.ieee.org/802.11/dcn/25/11-25-0205-02-00bq-tgbq-agenda-2025-march-plenary.xlsx) and reviewed the agenda items.
5. Chair reviewed the meeting agenda and the agenda was approved by unanimous consent.

**[Administrative items]**

1. Chair presented TGbq supplementary materials [IEEE 802.11-25/0516r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0417-00-00bq-supplementary-material-for-march-2025-plenary.pptx) slides.
2. Chair reviewed IEEE 802 required notices (emphasizing to ensure to announce name and affiliation at the first time to speak, anti-trust compliance, IEEE 802 WG rules and policies, etc.), IEEE SA meeting guidelines, IEEE Codes of Ethics and Conduct, IEEE individual process, and IEEE-SA standards activities with the fair and equitable consideration.
3. Chair reminded all to record their attendance in IMAT and other meeting reminders.

**Presentation of** [**IEEE 11-25/0812r2**](https://mentor.ieee.org/802.11/dcn/25/11-25-0812-02-00bq-consideration-on-mmwave-radar-and-immw-coexistence.pptx)**, Consideration on mmWave radar and immw coexistence (Zisheng Wang, ZTE)**

1. Zisheng presented [IEEE 11-25/0812r2](https://mentor.ieee.org/802.11/dcn/25/11-25-0812-02-00bq-consideration-on-mmwave-radar-and-immw-coexistence.pptx).
2. Q: In Slide 6, you proposed IMMW/radar coexistence. However, we do not have any requirement for radar implementation. The radar topic is out of the scope.
3. A: My contribution is to consider the coexistence with Wi-Fi module used for radar. I’m not developing radar solution itself.
4. Q: In Slide 5, it has the conclusion that IMMW has a big influence on existing mmWave radar. But, this is not true. For the FMCW (Frequency Modulated Continuous Wave) radar, it uses a narrow bandwidth. So, its impact to mmWave receiver is very small.
5. A: Even though FMCW radar uses only 1 GHz, the receiver has to be open to whole bandwidth. Our front-end is not designed to see only one single tone.
6. Q: It’s not true. It just sweeps narrow band at a particular time.
7. A: I agree that at a given time it only sends a single frequency carrier, but the receiver should see a full bandwidth for all time.
8. Q: Regarding Slide 9, in Japan, all of 60GHz bandwidth is occupied. So, there is no way to avoid interference.
9. A: I’m willing to update the Appendix. Please provide some suggestion to update it.
10. Q: I think mmWave radar may not have to use full bandwidth to receive a signal. So, mmWave radar may not impact severely to mmWave data transmission.
11. A: There are two bands for radar, 1) 24 GHz where many people have already used, 2) 60 GHz that is used to have higher resolution. For 60 GHz, it uses 4 GHz bandwidth, which is large.

**Presentation of** [**IEEE 11-25/0878r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0878-00-00bq-immw-idle-power-consumption.pptx)**, IMMW Idle Power Consumption (Leonardo Lanante, Ofinno)**

1. Leonardo presented [IEEE 11-25/0878r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0878-00-00bq-immw-idle-power-consumption.pptx).
2. Q: I totally agree that we need to reduce the idle power consumption of the mmWave. However, most of the power consumption comes from the RF portion. How effective do you think reducing idle power will be? This is also related to the amount of time in the idle state.
3. A: It depends on the implementation. The bandwidth is related to the ADC power consumption. So, I think the ADC also takes up a significant portion. We will also investigate how much power is consumed in RF part.
4. Q: You mentioned cross-link ICF/ICR. Is it exchanged via sub-7GHz or 60 GHz link?
5. A: Both are possible. However, when making this slide, I thought it is transmitted at sub-7GHz link.
6. Q: In cases where the ICR is transmitted at 60GHz, I think it is difficult to meet the timing requirement between the ICF and the ICR, i.e., sending ICR on another link within SIFS time is challenging. So, assuming that both ICF/ICR are transmitted at sub-7GHz, how quickly does the mode switch of the 60GHz link occur? Is it SIFS timing requirement?
7. A: We can discuss more.
8. Q: If we define too many bandwidth modes, this can also increase complexity. Another comment is that this seems similar to the wake-up receiver defined in 11ba.
9. A: We can consider the already defined sub-7GHz as the main radio. We can judge the situation by simply checking the RSSI of the ICF transmitted in sub-7GHz. The difference is that we do not need a separate wake-up radio. A wake-up packet can be an ICF defined in 11bn.

**Presentation of** [**IEEE 11-25/0428r0**](https://mentor.ieee.org/802.11/dcn/25/11-25-0428-00-00bq-mmwave-link-mac-txop-protection-medium-access-power-save.pptx)**, mmWave Link MAC: TXOP Protection, Medium Access, Power Save (Liwen Chu, NXP)**

1. Liwen presented [IEEE 11-25/0428r0](https://mentor.ieee.org/802.11/dcn/25/11-25-0428-00-00bq-mmwave-link-mac-txop-protection-medium-access-power-save.pptx).
2. Q: In Slide 3, 60 GHz beacons are transmitted repeatedly in each sector. Then, it may not be a beacon frame. It could be something other frames. What frames do you think could be?
3. A: I think it is some frame that can do TSF synchronization. We think TSF synchronization can be done in sub-7GHz. Or we think it can be detected through critical update while receiving 60GHz beacon.
4. Q: In Slide 4, can't we make TSF synchronization simpler? We consider MLO. Here, we can get TSF synchronization information of other links through some link. For example, through probe response. There is also a requirement of +-30 us. It can also work by referencing information of other links.
5. Q: In Slide 10, what is the timing expectation between ICF/ICR exchange on sub-7GHz link and data transmission on mmWave? Are you expecting SIFS?
6. A: We need to do backoff at 60GHz. So, it cannot be SIFS. We can also utilize TWT SP. In this case, we should perform backoff at the beginning of TWT SP.
7. Q: In Slide 11, could you clarify the second half of the content, i.e., non-AP power save without TWT?
8. A: Both AP and STA need to use a specific beam sector. It’s on-demand service period for this case.
9. Q: What do you think the content of a 60GHz beacon could be?
10. A: 60GHz beacon can carry BSS color, beacon sector, and TSF offset. When 60GHz link transmits beacons, it sends beacons to different sectors.
11. Q: Very short beacons are transmitted at multiple beacon sectors, correct?
12. A: Yes.
13. Q: In Slide 3, do you intent to carry all the information in SIG field if we use NDP?
14. A: SIG field is enough to carry that information.
15. Q: If you propose an on-demand mode, then why do you call it a beacon? NDP is a frame format. It is not a name of a function.
16. A: I’m saying to use NDP for this purpose. In this case, we do not need a beacon.
17. Q: In Slide 5, could you clarify that why we need a duplicate PPDU?
18. A: We need to do backoff before using the medium at 60GHz. We need to use something like virtual carrier sensing. We need to make neighboring terminals obtain TXOP duration. If we use a wide bandwidth without duplicate PPDU, neighboring STAs may not be able to detect.
19. Q: In Slide 3, could you clarify that “IMMW AP schedules the transmission”?
20. A: Scheduling happens in sub-7GHz and actual data transmission happens in 60GHz.
21. Q: In Slide 7, could you elaborate how the multiple STAs are scheduled in one TXOP?
22. A: We can apply a similar operation rule used for UL MU transmission in 11ax. If a trigger frame sent by the AP is not directed at me, I can set intra-NAV, otherwise I can transmit.
23. Q: My question is how to apply 11ax at 60GHz where transmission is directional.
24. A: If TWT SP is scheduled, then AP knows the member of TWT, i.e., it knows which STA is transmitted, and hence, which beam sector it has to use based on the previous BFT.
25. Q: Is there specific reason to use ICF/ICR exchange as a purpose of 60GHz link wake-up?
26. A: We have a special use info field in the BSRP Trigger frame to carry feedback.

**Presentation: Timeline**

1. Motion (Procedural): Move to approve the following timeline as the initial time estimation for the development of P802.11bq amendment:
* D0.1: Jul. 2026
* D1.0: Mar. 2027
* D2.0: Sep. 2027
* D3.0: Mar. 2028
* D4.0: Sep. 2028
* Final 802.11 WG approval: May 2029
* 802 LMSC approval: May 2029
* RevCom and SASB approval: Jul. 2029
	1. Moved: Mengshi Hu (Huawei)
	2. Seconded: Abhishek Patil (Qualcomm)
	3. Discussion: None
	4. Results: Approved by unanimous consent

**Closing formalities**

1. Chair mentioned that the TGbq teleconference call time may change from Tuesday 7AM PT to Wednesday 10 AM PT, the TGbi call time, when TGbi comment resolution is completed. As of now, the TGbi comment resolution is still in progress.
2. Chair announced the future teleconference call schedules as follows:
	1. 9:30am ET to 11:00am ET
	2. Tuesday, 3 June, 10 June, 17 June, 24 June.
3. Chair called for technical contribution and straw polls for the scheduled teleconference calls.
4. **Adjourn**
5. The chair announced that the call was adjourned at 15:08pm CET.