

I. Introduction

IEEE 802 is pleased to provide comments in the above-captioned proceeding.

IEEE is a leading consensus-based industry standards body, producing standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless specialty networks (“WSNs”), wireless metropolitan area networks (“Wireless MANs”), and wireless regional area networks (“WRANs”). We appreciate the opportunity to provide these comments to the Commission.

IEEE 802 is a component of the IEEE Standards Association, one of the Major Organizational Units of the Institute of Electrical and Electronics Engineers (IEEE). IEEE has about 420,000 members in about 190 countries and supports the needs and interests of engineers and scientists broadly. In submitting this document, IEEE 802 acknowledges and respects that other IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802. Therefore, this submission should not be construed as representing the views of IEEE as a whole.¹

II. IEEE technologies and 6 GHz

On October 23, 2018, the Commission adopted a Notice of Proposed Rulemaking (Notice) to evaluate new opportunities for unlicensed use in the 5.925-7.125 GHz (6 GHz) band. Among the many benefits the Commission cited in its Notice is the ability for manufacturers to migrate unlicensed devices that today operate in the 5 GHz band into the 6 GHz band.² The Commission recognized the enormous benefit consumers have derived from unlicensed devices in the 5 GHz band.³ It noted that the popularity of unlicensed technologies is continuing to grow, and that Congress has specifically tasked the Commission to find additional unlicensed spectrum. Moreover, the Commission stated its view that unlicensed technologies are key to enabling broadband connectivity available to all Americans, including those in rural and underserved areas.

The benefits of unlicensed devices that the Commission cited stand on the shoulders of

¹ This document solely represents the views of the IEEE 802 LAN/MAN Standards Committee and does not necessarily represent a position of either the IEEE or the IEEE Standards Association.

² Unlicensed Use of the 6 GHz Band, ET Docket No. 18-295, released October 24, 2018 at para. 19.

³ Unlicensed Use of the 6 GHz Band, ET Docket No. 18-295, released October 24, 2018 at paras. 3-7.

the decades of work of IEEE 802 work groups promulgating the standards that are a critical foundational element of the market for unlicensed devices. Not only do standards-based technologies attract market participants, standards provide an important forum for innovation and evolution of technology over time. However, wireless standards require regulators allocate spectrum that the standards-based devices can utilize.

In our 2017 filing on the Notice of Inquiry (NOI) on mid-band spectrum,⁴ IEEE 802 called attention to the difficulties in securing sufficient spectrum for Wireless Local Area Networking (“WLAN”), commonly known as “Wi-Fi” devices. As we reported in that comment, the popularity of Wi-Fi, steeply rising demand, and changing technology (e.g., in particular the use of wider radio channels of 80 or 160 megahertz in size) is creating a spectrum shortage that the Commission needs to address.

This comment seeks to highlight the existing IEEE 802 standards and current work of the relevant IEEE 802 work groups, task groups and study groups on future technology standards that will take advantage of existing and proposed technical rules for unlicensed devices in the 6 GHz range. In doing so, IEEE 802 also wishes to acknowledge the Commission’s critical role in setting spectrum policy in order to provide opportunities for IEEE 802 technologies.

A. IEEE 802.11 Standards

IEEE 802.11 promulgates Wireless Local Area Network (WLAN) standards, commonly branded as “Wi-Fi”. As the Commission has recognized, the consumer appeal of WLAN has reached unprecedented levels, and continues to grow as consumers network more devices to their WLAN modems. Similarly, in the enterprise segment, WLAN has become more than just a technology allowing employees to log on to the enterprise network; it is rapidly becoming embedded in how businesses generate revenue or accomplish their mission, whether in agriculture, banking, retail, education, healthcare and more.

The IEEE 802.11 Working Group has produced an evolving set of standards for WLAN, each one more capable than the last, and similarly, today an active project is working to develop IEEE 802.11ax that improves upon the current IEEE 802.11ac technology. The IEEE 802.11ax

⁴ Comments of IEEE 802 in GN Docket No. 17-183, filed October 2, 2017 (hereinafter “NOI Comments of IEEE 802”) (<https://ecfsapi.fcc.gov/file/1002043724729/Comments%20of%20IEEE%20802%20in%20GN%20Docket%2017-183.pdf>)

standard is on track to be published in 2020 and will enable WLAN devices to utilize spectrum in the 5925-7125 MHz range, in addition to spectrum presently available in the 5 GHz range.⁵

For spectrum policy purposes, there are several aspects of IEEE 802.11ax that are important to understand. First, the standard utilizes the same channel raster as IEEE 802.11ac – namely, channels that can be 160 MHz wide, and that can operate in channel widths of 80 MHz, 40 MHz, or 20 MHz. Like its predecessors, “ax” is deployed using an access point and associated stations, sometimes known as “clients”. While the access point is ordinarily deployed in infrastructure, it can also be deployed in a mobile device.

There are, however, important differences between “ax” and its “ac” predecessor. One difference that separates 802.11ax from its predecessors is that it can operate using Multi-User MIMO and OFDMA channels. The “ax” technology also will allow devices to differentiate transmissions in their own network from transmissions in neighboring networks.^[1] Spatial reuse is further supported by Adaptive Power and Sensitivity Thresholds to allow transmit power and signal detection to be dynamically adjusted, with attendant power savings. Networks can also schedule access, reducing transmission overhead and reducing collisions. Data carrier modulation increases by a factor of four relative to 802.11ac, to 1024-QAM. As a result of these and other innovations, the technology has been designed to be multiple times more efficient than 802.11ac. Yet for all the improvements available in the standard, there is insufficient radio spectrum in the existing unlicensed bands to enable innovation to stay ahead of rising consumer demand.⁶

IEEE 802.11 members are already in the process of forming a next generation project tentatively known as 802.11EHT for “extremely high throughput.”, that will include the mid-bands.

B. IEEE 802.15 standards

In addition to WLAN, IEEE 802 members have also produced standards for ultra-wideband (UWB) and part 15.250 wideband devices that are deployed in the 6 GHz band. These 802.15.4 devices typically transmit at a lower data rate and are capable of high precision ranging.

At present IEEE 802.15 is working on the next generation standard to add increased security, higher data rates, and improved ranging capabilities to enhance the current standards

⁵ <http://www.ieee802.org/11/PARs/P802.11ax.pdf>

⁶ Comments of IEEE 802, at Sections V and IX.

that were published in 2007 and 2012 in IEEE Std 802.15.4a and IEEE Std 802.15.4f respectively.⁷

Devices utilizing these IEEE 802.15 standards are found in applications that require very long battery life, measured in years, when powered by a coin cell battery; or in some cases using energy harvesting from a transmitter to provide a response. Additionally, some applications require the high precision ranging capabilities.

In some applications these devices are standalone, and in other applications, they may be combined with WLAN devices, with each utilizing its unique capabilities to provide value.

Installations using these standards include IOT and Industry 4.0 which require low power and high accuracy ranging capabilities such as inventory management, sports tracking, indoor and outdoor geofencing, or improving the efficiency of product picking. They are also used in consumer applications such as secure wireless access (e.g. automotive) and will be used in smart retailing to improve user experience in stores and malls with the addition of these capabilities to smart phones. The typical range for these IEEE 802.15 technologies is up to 100 meters.

III. IEEE 802 based technologies and band sharing in the 6 GHz band

As IEEE 802 said in its comment to the Notice of Inquiry, IEEE 802 devices have a strong history of band sharing both between unlicensed devices and with incumbent licensed systems. This rulemaking will provide a useful platform for discussion of how the introduction of WLANs into the 6 GHz band might impact existing users of the band, including technologies promulgated by IEEE 802.15.⁸ IEEE 802 has a process to evaluate coexistence during development of a new standard. As noted in the two November 2017 filings from IEEE 802.11⁹ and IEEE 802.15¹⁰ in this proceeding, IEEE 802 continues to progress its work on the coexistence of the proposed IEEE 802 standards for the 6 GHz band.

IEEE 802.15 members are concerned about the ability of the new high-power broadband devices to coexist with the low power devices that use the current UWB and part 15.250 rule set.

⁷ Per FCC regulations the technology being promulgated here would fall under Section 15.250 of the Commission's rules, qualifying it as "wideband" technology. <http://www.ieee802.org/15/pub/TG4z.html>

⁸ Comments of IEEE 802, at Section VIII.

⁹ Comments of IEEE 802.11,

<https://ecfsapi.fcc.gov/file/1116022486416/Reply%20Comments%20of%20IEEE%20802.11.pdf>

¹⁰ Comments of IEEE 802.15,

https://ecfsapi.fcc.gov/file/111090749912/IEEE%20802.15%20FCC%20NOI%20Reply%20Comments_2017-11-10%5B315%5D.docx

Currently there is no obvious resolution to the difference in power levels in the same band and IEEE 802 is aware that resolution to this problem must be determined.

IV. Conclusion

As discussed in the Notice of Inquiry comments, IEEE 802 has developed wireless networking standards that have become essential to consumers and businesses alike, IEEE 802 continues to support the demands with new standards.

Regards,

By: /s/ Paul Nikolich

Paul Nikolich
IEEE 802 LAN/MAN Standards Committee Chairman
em: IEEE802radioreg@ieee.org