

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Expanding Flexible Use in Mid-Band Spectrum)	GN Docket No. 17-183
Between 3.7 and 24 GHz)	

COMMENTS OF IEEE 802

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I. INTRODUCTION

IEEE 802 respectfully submits these responses to the FCC (“the Commission”) in the above mentioned proceeding¹.

IEEE 802, as a leading consensus-based industry standards body, produces 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.

II. BACKGROUND

The broad success of wireless networks since initial marketing of the Wi-Fi brand in 1999, based on the IEEE 802.11 standard, is a testament to the engineering, innovation and industry success as envisioned by the Commission when it began the unlicensed spectrum “experiment”. From the days of 1 Mbps, this industry has applied countless engineering resources and billions of dollars towards improving its network speeds, connectivity, and security, while providing benefits to many other industries and consumers as well as public institutions such as schools and hospitals that now rely heavily on Wi-Fi. All this success, and all of the jobs Wi-Fi helped create, came in spite of the challenging radio frequency environment and technical rules that require IEEE 802.11 devices to accept all interference and protect the incumbents with which it shares spectrum from harmful interference. Dynamic Frequency Selection (DFS), devised as a means of protecting radars from these devices, has proven to be an effective spectrum sharing mechanism, providing an apparently perfect record of protecting sensitive Federal government radar operations from harmful interference.

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.

However, Wi-Fi's success has come at a cost, as the billions of devices in service have begun to crowd all of the available channels. Now, even with the addition of new unlicensed technologies in the 5 GHz band, congestion clouds the future for IEEE standard products. The Commission's 2013 attempt to provide additional bands for unlicensed services has been met with limited success. The promise of 775 MHz of contiguous spectrum, from 5150 MHz to 5925 MHz, spurred the industry to develop new technologies that could efficiently provide 1 Gbps of throughput to support many new and innovative applications. The recent decision to hold back 120 MHz in the middle of the band (5350 MHz to 5470 MHz) has forced a whole rethinking of the future of those applications and the industry, as well as those that depend on it. This proceeding, in addition to the Commission's ongoing efforts to open the 5850 MHz to 5925 MHz band for unlicensed use, now provides new hope for that future.

III. UNLICENSED SHARING OF 5.925 GHz to 7.125 GHz

In accordance with the Commission's Notice of Inquiry, and to best enable the next generation of Wi-Fi, we believe that the 5.925 GHz to 6.425 GHz and 6.425 GHz to 7.125 GHz bands should be designated as U-NII bands, with limits equal to the current 5 GHz U-NII rules as appropriate. This would allow products based on IEEE 802.11 standards to be adapted to support this band without major redesign.

Based on the segmentation of incumbents operating under different rules (Parts 74, 78 and 101), these bands should be assigned as these separate U-NII bands:

U-NII-5: 5.925 GHz to 6.425 GHz (sharing with FS and FSS incumbents)

U-NII-6: 6.425 GHz to 6.525 GHz (sharing with BAS and CARS)

U-NII-7: 6.525 GHz to 6.875 GHz (same as U-NII-5)

U-NII-8: 6.875 GHz to 7.125 GHz (sharing with BAS and CARS)

In order to expedite the release of this badly needed spectrum, the Commission should consider optimal timing for release of these different bands, based on the complexity of the technology required to mitigate interference to incumbents. Therefore the bands should be released as soon as possible for each band.

IV. INCUMBENT PROTECTION

Although there is no precedent for Wi-Fi protecting these specific incumbents, there are a number of approaches that we are confident will be as effective as DFS has been in protecting radars. Some examples of methods similar to those in use today for this purpose are:

- An antenna restriction for outdoor operations or specialized antennas may be employed to control interference to incumbents, as the FCC has done in its revised U-NII-1 rules to protect Mobile Satellite Service feeder links.²
- Indoor deployments may utilize transmit power control and take advantage of Building Entry Loss (as specified in ITU P.2109, formerly P.(BEL)) to limit interference to incumbents. Until the recent changes in the U-NII-1 band, this was employed to protect satellite services.
- Fixed outdoor devices may require geo-location database spectrum access to ensure protection of incumbents. Although there are currently few deployments using this method, it has been shown to be effective in protecting broadcast TV and wireless microphones. Techniques similar to IEEE 802.11 Enablement³, devised as a protection mechanism in the 3550 MHz to 3700 MHz band, could be employed to ensure that all devices operate under constraints determined by protection criteria based on ULS data.

V. UNLICENSED SPECTRUM NEEDS

Data traffic continues to grow exponentially. According to the 2017 Cisco Visual Networking Index (VNI) report, data originating on mobile and other wireless devices will continue to outpace traffic generated from wired devices. In 2016, wireless originated traffic accounted for 49% of total global device traffic. This traffic was primarily split between Wi-Fi (41%) and cellular (8%) technologies. By 2021, Wi-Fi and cellular are expected to account for 63% of the device-originated traffic. In particular, between 2016 and 2021, various video applications will continue to drive data traffic significantly. Data points from the VNI report include:

- Live video is expected to grow 15 times
- Video surveillance will grow seven-fold
- Consumer Video on Demand (VoD) will nearly double

² See 47 C.F.R. § 15.407(a)(1)(i).

³ See IEEE 802.11-2016 Subclause 11.12.2.2

In addition, the emerging areas of Virtual Reality and Augmented Reality are expected to add to the data growth. All of these are highly data-intensive applications and are expected to use wireless access either on the street or within buildings, driving the need for greater data rates enabled by the use of 80 and 160 MHz channels.

Two independent spectrum needs studies completed during this past two years⁴ have shown that expected spectrum shortfall will be a significant problem within the next three to five years, so action by the Commission is needed soon.

In order to provide the most benefit to these unlicensed services, we suggest that the NPRM should address these bands as soon as possible, utilizing requirements comparable to the current 5 GHz U-NII bands.

VI. INCUMBENT PROTECTION DATA INTEGRITY

In order to assist in guaranteeing protection for incumbents, it is essential that the relevant FCC databases be reviewed to ensure that all entries are correct and current. The company Higher Ground, which, we understand, has been approved for use of the 5925 MHz to 6425 MHz (Earth-to-space) and the 3700 MHz to 4200 MHz (space-to-Earth) frequency bands, has done an exhaustive study of the ULS database and could be employed in assisting the FCC with this task. In addition, licensees could be asked to indicate intent to continue use and present a timeline for any prospective phase out plan.

The Commission should also check that the number and location of registered FSS earth stations is correct and current, acknowledging that the FCC's rules do not require registration and many earth stations are unregistered. And as with the FS incumbents, licensees could be asked to indicate intent to continue use and present a timeline for any phase out plan.

VII. GLOBAL HARMONIZATION

IEEE 802 is aware that, in Europe, CEPT and ETSI have begun the process of exploring expanding license-exempt use for WAS/RLANs in bands above 6 GHz. This effort is just beginning but offers the potential for global harmonization of this spectrum, opening up the opportunities for economic benefits to American companies to offer additional wireless products in international markets. We look to the Commission to provide leadership in harmonizing unlicensed/license-exempt sharing of this band.

⁴ Quotient Associates, *Wi-Fi Spectrum Needs Study: Final Report to Wi-Fi Alliance* (Feb. 2017), <https://www.wi-fi.org/file/wi-fi-spectrum-needs-study>; Qualcomm, *A Quantification of 5 GHz Unlicensed Band Spectrum Needs*, <https://www.qualcomm.com/documents/quantification-5-ghz-unlicensed-band-spectrum-needs>

VIII. OTHER CONSIDERATIONS

We recognize that other IEEE 802 technologies operate under Ultra-Wide Band (“UWB”) Part 15 rules in the bands under consideration. Specifically, UWB devices utilizing the IEEE 802.15.4a (2007), IEEE 802.15.6 (2012) and IEEE 802.15.4f (2012) standards support a number of applications. Some examples include:

- Automotive passive entry systems based on secure proximity detection.
- General indoor navigation, autonomous robot guidance, factory automation, smart home

With their very low power limit (-41.3 dBm/MHz), UWB devices are difficult to detect and protect using existing methods. The IEEE 802.19 Wireless Coexistence Working Group (WG) has the responsibility to ensure that IEEE 802 wireless technologies can coexist. Work within the 802 family to develop effective coexistence methods is anticipated but, depending on what rules are adopted for the bands under consideration, particularly allowed power levels, development of effective methods may not be possible. Consequently, use of this band by higher power devices may adversely affect the performance of UWB devices based on the aforementioned IEEE 802 standards.

IX. URGENCY

We specifically do not comment on sharing with Federal users in the 7.125 GHz to 7.250 GHz band at this time due to the urgency of the need for additional spectrum for unlicensed services. Sharing with Federal users will take significantly more time than with non-Federal.

Two separate spectrum needs studies show serious impairment of expected Wi-Fi connections within the next three years without additional spectrum. This would affect consumers and businesses that rely on Wi-Fi. IEEE 802 therefore urges the Commission to move forward in the near term to authorize unlicensed use of the 5.925 GHz to 7.125 GHz band, and released them as soon as possible for each band.

X. CONCLUSIONS

IEEE 802 has developed wireless networking standards that have become essential to consumers and businesses alike. These have supported the highest performing link between the Internet and its endpoints. With the demand for greater and greater speeds, for business and advanced wireless applications, IEEE 802 continues to support the demands with new standards, such as IEEE 802.11ax.

However, with no new allocations since 2003, the growing spectrum congestion of billions of Wi-Fi devices, and now new technologies sharing the limited unlicensed spectrum, the future is seriously threatened.

IEEE 802 believes that the 5.925 GHz to 6.425 GHz and 6.425GHz to 7.125 GHz bands provide the best opportunity for spectrum sharing to maintain the viability of this essential unlicensed service for consumers, businesses and the public sector. With proven ability to protect incumbent users while sharing their allocation, we believe IEEE 802 standard technologies will protect the incumbents in these bands while providing the wireless connectivity that support business and consumer needs for the future.