**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**

**Table of** **Contents**

**[I.](#_Toc493078457)****[INTRODUCTION](#_Toc493078457)** [2](#_Toc493078457)

**[II.](#_Toc493078458)****[BACKGROUND](#_Toc493078458)** [2](#_Toc493078458)

**[III.](#_Toc493078459)****[UNLICENSED SHARING OF 5.925-7.125 GHz](#_Toc493078459)** [3](#_Toc493078459)

**[IV.](#_Toc493078460)****[INCUMBENT PROTECTION](#_Toc493078460)** [3](#_Toc493078460)

**[V.](#_Toc493078461)****[UNLICENSED SPECTRUM NEEDS](#_Toc493078461)** [4](#_Toc493078461)

**[VI.](#_Toc493078462)****[INCUMBENT PROTECTION DATA INTEGRITY](#_Toc493078462)** [5](#_Toc493078462)

**[VII.](#_Toc493078463)****[GLOBAL HARMONIZATION](#_Toc493078463)** [5](#_Toc493078463)

**[VIII.](#_Toc493078464)****[OTHER CONSIDERATIONS](#_Toc493078464)** [5](#_Toc493078464)

**[IX.](#_Toc493078465)****[URGENCY](#_Toc493078465)** [6](#_Toc493078465)

**[X.](#_Toc493078466)****[CONCLUSIONS](#_Toc493078466)** [6](#_Toc493078466)

# **INTRODUCTION**

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

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.

# **BACKGROUND**

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

However, Wi-Fi’s success has become its own worst enemy, as the billions of devices in service have begun to crowd all of the available channels. Now with the addition of new unlicensed technologies in the 5 GHz band, congestion clouds Wi-Fi’s future. 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, and support many new and innovative applications. The recent decision to hold back the 120 MHz in the middle of the band (5350-5470 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 5850-5925 MHz band for unlicensed use, now provides new hope for that future.

# **UNLICENSED SHARING OF 5.925-7.125 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 U-NII-1 band. This would allow products based on IEEE 802.11 standards to be adapted to support this band without requiring 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 these different bands, based on the complexity of the technology required to mitigate interference to incumbents. The U-NII-5 and U-NII-7 bands should therefore be the first candidates for release.

# **INCUMBENT PROTECTION**

Although there is no precedent for Wi-Fi protecting these specific incumbents, there are a number of approaches that we are certain 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.[[1]](#footnote-1)
* Indoor deployments utilizing transmit power control, and taking 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.
* Database control of spectrum access is not necessary indoors, but could also be employed to support higher power, indoor use.
* 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 Enablement[[2]](#footnote-2), devised as a protection mechanism in the 3550-3700 MHz band, could be employed to ensure that all devices operate under constraints determined by protection criteria based on ULS data.

# **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

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, and drive the need for greater data rates enabled by the use of 80 and 160 MHz channels.

Two independent spectrum needs studies have been undertaken during this past year[[3]](#footnote-3) have shown that the expected spectrum shortfall will be a significant problem within the next three to five years, so action by the Commission is needed soon. A coalition of most of the largest companies with Wi-Fi investments is in the process of completing a comprehensive study of the incumbents, and effective means for protecting them.

In order to provide the most benefit to these unlicensed services, we suggest that the NPRM should address U-NII-5 and U-NII-7 as soon as possible, utilizing requirements comparable to the current U-NII-1 band.

The U-NII-6 and U-NII-8 bands, which will have to protect mobile services, could take more time to develop, and should not slow down the release of U-NII-5 and U-NII-7 for mobile use. Further research and development will be required to prove additional protection mechanisms for incumbents in U-NII-6 and U-NII-8.

# **INCUMBENT PROTECTION DATA INTEGRITY**

In order to assist in guaranteeing protection for incumbents, it is essential that the relevant FCC databases be scrubbed to ensure all entries are correct and current. Higher Ground, which has been approved for use of the 5925-6425 MHz (Earth-to-space) and the 3700-4200 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.

# **GLOBAL HARMONIZATION**

IEEE 802 is aware that ETSI is beginning a process exploring expanding license-exempt use for WAS/RLANs in bands above 6 GHz. Presently, 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.

# **OTHER CONSIDERATIONS**

IEEE 802 also recognizes that other IEEE 802 technologies operate under Part 15 rules in this band. Ultra-Wide Band (“UWB”) devices, based on IEEE 802.15.4a (2007), IEEE 802.15.6 (2012) and IEEE 802.15.4f (2012) standards support a number of applications including:

* Security of infants and geriatrics in a hospital/home setting
* Safety of personnel operating in proximity to machinery
* Guidance/safety of first responders, e.g. firefighters entering smoke filled buildings
* Automotive passive entry systems based on secure proximity detection.
* Position based secure access to buildings. Position based payment systems.
* Security of inmates/staff in a prison setting
* General indoor navigation, autonomous robot guidance, factory automation, smart home

With their very low power limit (-41.3 dBm), they are difficult to detect and protect using existing methods. IEEE 802.19, the Wireless Coexistence Working Group (WG), has the responsibility to ensure that IEEE 802 wireless technologies can coexist. At this time we will work within the 802 family to develop effective coexistence methods.

# **URGENCY**

We specifically do not comment on sharing with Federal users in the 7125 MHz to 7250 MHz band at this time due to the urgency of the need for additional unlicensed 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 a spectrum add, affecting 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 5925-7125 MHz band, proceeding first with bands where proven spectrum sharing methods can be used or adapted (U-NII-5 and U-NII-7), and following on with additional bands that may require more extensive technical work (U-NII-6 and U-NII-8).

# **CONCLUSIONS**

IEEE 802 has developed wireless networking standards that have become essential to consumers and businesses alike. It has been 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, like IEEE 802.11ax.

However, with no new allocations since 2003, the 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 5.925-6.425 GHZ and 6.425-7.125 GHz bands provide the best opportunity for spectrum sharing top maintain the viability of this essential unlicensed service. 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.

1. *See* 47 C.F.R. § 15.407(a)(1)(i). [↑](#footnote-ref-1)
2. *See* IEEE 802.11-2016 Clause 12.2.2 [↑](#footnote-ref-2)
3. 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> [↑](#footnote-ref-3)