IEEE P802.18
Radio Regulatory Technical Advisory Group (RR-TAG)

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| Draft response to NTIA’s consultation |
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This document drafts a proposed response to US NTIA’s consultation “Development of a national spectrum strategy”.

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Re: Consultation “Development of a National Spectrum Strategy” / DOCKET NO. 230308-0068

Dear National Telecommunications and Information Administration,

IEEE 802 LAN/MAN Standards Committee (LMSC) thanks the National Telecommunications and Information Administration (NTIA) for issuing the consultation “Development of a National Spectrum Strategy” and for the opportunity to provide feedback on this topic.

IEEE 802 LMSC 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 also produce standards for wired Ethernet networks, and technologies produced by implementers of our standards are critical for all networked applications today.

IEEE 802 LMSC is a committee of the IEEE Standards Association and Technical Activities, two of the Major Organizational Units of the Institute of Electrical and Electronics Engineers (IEEE). IEEE has about 400,000 members in over 160 countries. IEEE’s core purpose is to foster technological innovation and excellence for the benefit of humanity. In submitting this document, IEEE 802 LMSC acknowledges and respects that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802 LMSC. Therefore, this submission should not be construed as representing the views of IEEE as a whole[[1]](#footnote-1).

**Current and future state of IEEE 802 wireless technology development**

As the NTIA observes, significant access to spectrum is critical to continue positioning the U.S. as a world leader of advanced technology and enhance the U.S.’s national and economic security. Significant economic value is provided by IEEE 802-based systems today. Wi-Fi technology, based on the IEEE 802.11 standard, has an estimated 18 billion devices in use worldwide, with over 4 billion devices added annually [1]. The current deployments of IEEE 802.15 devices are found in markets ranging from consumer devices to industrial plants, automobiles to buildings and agriculture to space.[[2]](#footnote-2) IEEE 802 wireless technologies are a critical part of the modern communications infrastructure, benefiting billions of people, governments, and businesses every day. Underserved communities stand to gain from IEEE 802 wireless technologies. They are used in community networks both to empower and provide an opportunity for education. IEEE 802 wireless technologies are in the forefront as an enabler of emerging applications such as augmented and virtual reality (AR/VR).

*IEEE 802.11*

Today, Wi-Fi networks based on IEEE 802.11 standards are found in residential, office, and industrial environments, in public and private settings. Users in an array of industries[[3]](#footnote-3) rely on these cost-effective, energy-efficient technologies. Each new generation of IEEE 802.11 technologies continues to improve efficiency, reliability, latency, throughput and determinism. IEEE 802.11 supports operation in several frequency bands [2], including the 6 GHz (5925 MHz to 7250 MHz) band, with significant deployments underway [3].

*IEEE 802.15*

Technologies based on IEEE 802.15 standards are embedded in an increasing number of devices. For some applications, such as cars or utilities, industry consortia exist to manage deployments. For other applications, proprietary protocols are used in conjunction with IEEE 802 standards. IEEE 802.15.4 can operate in many frequency ranges [2] and supports data communication, location discovery and device ranging. IEEE 802.15.6 is specialized for short range communication in the vicinity of, or inside, a human body. For high-speed, low-latency media transfers, IEEE 802.15.3 provides a specialty solution. IEEE 802.15.16 accommodates the needs of some utility networks.

*IEEE 802.19*

Many IEEE 802.15 standards, as well as the IEEE 802.11 standard, support operation on frequencies lower than 1 GHz. The IEEE 802.19 Wireless Coexistence Working Group published best practice coexistence mechanisms for sub-1 GHz technologies in 2021 [4].

**IEEE 802 LMSC’s response to Pillar #1 Question 1**

IEEE 802 LMSC is a leading consensus-based industry standards body and we are a critical part of the ecosystem that enables full value from available spectrum. IEEE 802 LMSC recommend the NTIA to include us in any future spectrum strategic effort so that we are able to inform the NTIA any spectrum requirements for next-generation networks and emerging technologies and standards under development.

IEEE 802 LMSC has and continues to be a leader in developing wireless standards that are widely adopted. Some IEEE 802 wireless standards, e.g. IEEE 802.11 standard, are well known, while other standards, e.g., IEEE 802.15 standards are very widely used but in applications where the “branding” is not overt. Examples include many consumer applications, as well as critical applications in smart grid, smart city, vehicles, and medical devices. As examples of relevant work ongoing in IEEE 802 LMSC which should inform future policy, we have various ongoing projects that not only focus on higher throughput, but also improve upon the way spectrum is used to enable higher reuse, better coexistence, and greater energy efficiency. These projects enable further technological innovation that will provide value to federal and non-federal users.

Wi-Fi 7 technologies, operating in the 2.4 GHz, 5 GHz and 6 GHz band, are developed based on the IEEE P802.11be project [9]. IEEE P802.11be continues to improve performance and enhance spectrum coexistence capacities. In order to achieve these target performance measures, IEEE P802.11be introduces advanced features including channel bandwidths of up to 320 MHz, 4K-quadrature amplitude modulation (QAM), multiple resource units (RUs) to a single station (STA), multi-link operation, enhanced quality of service (QoS), improved Target Wake Time (for improved battery life for IoT or other applications), and improved punctured transmission/subchannels to accommodate coexistence with incumbents more effectively and efficiently. IEEE P802.11be is designed to meet the target application performance requirements and at the same time to scale to meet the requirements of enterprise, commercial and dense deployments when multiple simultaneous sessions of similar or different applications on multiple Wi-Fi networks are coexisting with incumbent service operation.

Starting in September 2022, the IEEE 802.11 Working Group established a project authorization request study group, namely Ultra High Reliability Study Group [10], that investigate physical layer and medium access control layer technologies to improve reliability of WLAN connectivity, reduce latencies, increase manageability, increase throughput including at different signal-to-noise levels and reduce device level power consumption.

**IEEE 802 LMSC’s response to Pillar #1 Question 9**

Global convergence on policies for spectrum is needed to enable wider deployment of technologies already developed by IEEE 802 LMSC.

Expanded global availability of the 6 GHz band (5925 MHz to 7250 MHz) for license-exempt shared use (indoor and outdoor) is critical to IEEE 802 wireless technologies. The IEEE Std 802.11ax-2021 [8], the ongoing IEEE P802.11be project [9], IEEE Std 802.15.4z-2020 [6], and the ongoing P802.15.4ab project [7] for instance, introduce capability to operate in the entire 6 GHz band to meet the growing demand for connectivity and to achieve the performance required by new applications. Regulatory certainty is needed to further the benefits enjoyed by users of IEEE 802 wireless technologies around the world.

Global convergence on policies for the sub-1 GHz bands is needed to enable wider deployment of technologies already developed by IEEE 802. Standards-based systems operating in these bands make efficient and effective use of the spectrum. Allowing expanded use would further increase the economic and social value of sub-1 GHz spectrum.

**IEEE 802 LMSC’s response to Pillar #3**

Rapid development of advanced communications technology and a diverse range of radiofrequency spectrum uses are shaping the way the U.S. citizens stay connected. The appetite for advanced connectivity and the ubiquity of communications devices across all of U.S.’s economic, social, and public interest activities are key factors driving the demand for spectrum.

A core principle of IEEE 802 wireless standards is to enable spectrum sharing by using appropriate coexistence techniques. The coexistence technique or mechanism might change depending on the standards in use and the regulatory requirements.

The use of Ultra-Wideband (UWB) is expanding rapidly, supporting a robust ecosystem delivering products providing significant value. IEEE 802.15 standards specify UWB technology operation, which is finding adoption for numerous short-range sensing and ranging applications. IEEE Std 802.15.4-2020 [5] and IEEE Std 802.15.4z-2020 [6] are standards for precision ranging that are capable of using both the 6 GHz and 7 GHz frequency bands and are increasingly used in many high value applications. The capability of IEEE Std 802.15.4z-2020 to support secure ranging has led to a renewed interest in UWB from industry. The automotive industry was the first to include IEEE 802.15.4 UWB devices in consumer products and mobile handset makers have followed closely. This is generating significant economic and social value, attracting further interest in developing future UWB standards, e.g. IEEE P802.15.4ab [7], which provides features to make greater use of the spectrum, and enable continued innovation in uses such as precise (centimeter accurate) location services, secure entry, in-vehicle use for presence detection and multimedia communications, and many others.

While we do not predict a near term need for more spectrum for UWB, we seek to preserve and enhance the usability of the available spectrum through spectrum sharing. UWB operates at extremely low signal power and shares effectively. The extremely low transmit power makes interference with higher power services highly unlikely. To the best of our understanding, there has not been a reported incidence of UWB operating under the FCC Part 15 rules interfering with any licensed service. The signal and use characteristics of UWB enable very high spectral reuse, enabling dense deployment of devices, which in turn makes UWB a valuable compliment to other unlicensed technologies.

Ongoing work in IEEE 802 LMSC is developing more effective mutual coexistence strategies between UWB and RLAN. Within IEEE 802 LMSC and elsewhere in the industry, strategies for positive coexistence are being developed and tested. While IEEE 802 understands unlicensed services receive no protection, we ask that in developing and implementing the national spectrum strategic plan, the high value provided by existing unlicensed services be considered and measures taken to preserve the usability for unlicensed operation including UWB and RLAN. In particular there is concern that repurposing bands for expanded high-power use that are currently used for unlicensed services on a shared basis (e.g., 7 GHz to 8.5 GHz) may effectively make the band unusable for any but the licensed use, limiting diversity of use, which diminishes efficient use of the spectrum resources.

**Conclusion**

IEEE 802 LMSC thanks the NTIA for the opportunity to provide this submission and kindly requests the NTIA to take into account our responses in its decision towards the development and implementation of the US’s national spectrum strategy.

Respectfully submitted

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References:

[1] Wi-Fi Alliance: Value of Wi-Fi. [Available online](https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi) [accessed: 5 April 2023]

[2] IEEE 802.18 Wireless Standards Table of Frequency Ranges, 27 Sep 2022. [Available online](https://mentor.ieee.org/802.18/dcn/22/18-22-0009-01-0000-ieee-802-wireless-standards-table-of-frequency-ranges.xlsx) [accessed: 5 April 2023]

[3] Wi-Fi Alliance: Wi-Fi 6E momentum underscores need for entire 6 GHz band. [Available online](https://www.wi-fi.org/news-events/newsroom/wi-fi-6e-momentum-underscores-need-for-entire-6-ghz-band) [accessed: 5 April 2023]

[4] "IEEE Recommended Practice for Local and Metropolitan Area Networks—Part 19: Coexistence Methods for IEEE 802.11 and IEEE 802.15.4 Based Systems Operating in the Sub-1 GHz Frequency Bands," in IEEE Std 802.19.3-2021, vol., no., pp.1-79, 26 April 2021, doi: 10.1109/IEEESTD.2021.9416944.

[5] “IEEE Standard for Low-Rate Wireless Networks,” in IEEE Std 802.15.4-2020 (Revision of IEEE Std 802.15.4-2015), vol., no., pp.1-800, 23 July 2020, doi: 10.1109/IEEESTD.2020.9144691.

[6] “IEEE Standard for Low-Rate Wireless Networks—Amendment 1: Enhanced Ultra Wideband (UWB) Physical Layers (PHYs) and Associated Ranging Techniques,” in IEEE Std 802.15.4z-2020 (Amendment to IEEE Std 802.15.4-2020), vol., no., pp.1-174, 25 Aug. 2020, doi: 10.1109/IEEESTD.2020.9179124.

[7] IEEE P802.15.4ab. [Available online](https://www.ieee802.org/15/pub/TG4ab.html) [accessed: 5 April 2023]

[8] “IEEE Standard for Information Technology—Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks—Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications”, in IEEE Std 802.11-2020 (Revision of IEEE Std 802.11-2016), vol., no., pp.1-4379, 26 Feb. 2021, doi: 10.1109/IEEESTD.2021.9363693.

[9] “IEEE Standard for Information technology—Telecommunications and information exchange between systems - Local and metropolitan area networks—Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 2: Sub 1 GHz License Exempt Operation”, in IEEE Std 802.11ah-2016 (Amendment to IEEE Std 802.11-2016, as amended by IEEE Std 802.11ai-2016), vol., no., pp.1-594, 5 May 2017, doi: 10.1109/IEEESTD.2017.7920364.

[10] IEEE 802.11 Ultra High Reliability Study Group. [Available online](https://www.ieee802.org/11/Reports/uhr_update.htm) [accessed: 5 April 2023]

1. This document solely represents the views of IEEE 802 LMSC and does not necessarily represent a position of either the IEEE or the IEEE Standards Association. [↑](#footnote-ref-1)
2. Some examples of devices which implement IEEE 802.15.4 technologies are TV remote controls, lighting, windows, door locks, heating and air conditioning systems, alarm systems and remote medical monitoring. The introduction of IEEE 802.15 UWB-enabled devices in smartphones and laptops puts forecasts at more than 1 billion devices shipped annually worldwide by 2025 (FiRA Consortium, August 2022). [↑](#footnote-ref-2)
3. Leisure (gaming, multimedia, browsing), education, health, transportation, and public services are just a few examples. [↑](#footnote-ref-3)