

**Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
DEPARTMENT OF COMMERCE**

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In the Matter of)	
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Development of a National Spectrum Strategy)	Docket No. NTIA-2023-0003
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**COMMENTS OF BROADCOM INC.
ON IMPLEMENTATION PLAN FOR NATIONAL SPECTRUM STRATEGY**

January 2, 2024

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INTRODUCTION AND SUMMARY

Broadcom is a California-headquartered global leader in wired and wireless communications semiconductors and infrastructure software technology. With over 99.9% of all Internet traffic crossing at least one Broadcom chip, we are deeply invested in the success of the National Spectrum Strategy. The National Telecommunications and Information Administration's ("NTIA") release of the Strategy comes at a pivotal time in the development of the wireless industry.¹ To remain at the forefront of wireless technologies, services, applications, and devices, the United States must make additional spectrum available for commercial use in the near future and must develop processes and tools to support future spectrum sharing. NTIA's implementation plan for the Strategy should identify short-term and longer-term measures to achieve those objectives.

To produce a key short-term success, Broadcom urges NTIA to prioritize study of the bottom 125 megahertz of the 7.125-8.4 GHz range (7.125-7.250 GHz, or the Lower 7 GHz band) for unlicensed use using the same coexistence techniques the FCC has adopted for low-power indoor ("LPI") technologies in the 6 GHz band. Unlicensed use of the Lower 7 GHz band would complete a currently stranded 320-megahertz channel at the top of the 6 GHz band that Americans could use both in today's Wi-Fi 6E and Wi-Fi 7 equipment (via software upgrades) and in next-generation Wi-Fi 8 equipment. While other parts of the 7.125-8.4 GHz range require additional work, the Lower 7 GHz band is poised for much quicker progress.

For the longer term, Broadcom recommends that NTIA consider how publicly available tools can assist in its investigation of future sharing possibilities. As Broadcom discussed in its

¹ *National Spectrum Strategy*, THE WHITE HOUSE (Nov. 13, 2023), https://www.ntia.gov/sites/default/files/publications/national_spectrum_strategy_final.pdf ("*National Spectrum Strategy*").

initial comments on the Strategy, a powerful open-source tool called “Open AFC,” developed for the 6 GHz band, can be expanded to allow federal government users to coordinate use in other frequencies and assist in sharing with other licensed users in those frequencies.

I. THE IMPLEMENTATION PLAN SHOULD PRIORITIZE STUDY FOR NEAR-TERM UNLICENSED USE OF THE LOWER 7 GHZ BAND, 7.125-7.250 GHZ

NTIA was right to identify the 7.125-8.4 GHz range as a focal point for “study in the near term” for “advanced, next-generation applications and services.”² Some parts of this frequency range have “a variety” of Federal operations that may present new “challeng[es]” for repurposing.³ But it is important to recognize that some Federal operations in the first 125 megahertz of the range are materially similar to those of the commercial microwave links present in the 6 GHz band. Study of the 7.125-7.250 GHz frequencies, or the Lower 7 GHz band, should therefore be substantially less complicated than in other parts of the 7.125-8.4 GHz range, because of the existing, robust technical record upon which the FCC permitted unlicensed use of the 6 GHz band. NTIA should study the Lower 7 GHz band immediately so that the FCC can consider it for unlicensed use. The frequencies from 7.250-7.625 GHz, or the Upper 7 GHz band, would also be extremely valuable for Wi-Fi, but the more complicated incumbent landscape in that band requires more extensive study and a necessarily longer timeline.

Study of the Lower 7 GHz band would help meet an immediate and urgent need for low-latency, high-throughput wireless broadband by completing a stranded 320-megahertz channel for indoor operations. Access to the 6 GHz band has relieved pressure on previous Wi-Fi bands in the United States, but it is not sufficient to accommodate exploding consumer needs. Increasingly demanding applications and network designs require access to frequencies that

² *Id.* at 6.

³ *Id.*

facilitate wider channels. For Wi-Fi 7 and Wi-Fi 8 in particular, 320-megahertz channels will offer not just increased capacity, but also the improved energy efficiency, reliability, latency, and location capability required to meet consumer needs. But the high-reliability and extremely low-latency needs of next-generation applications will require network densification, particularly in environments with many users, such as multi-dwelling buildings, schools, universities, and healthcare institutions. Network densification in turn requires channel diversity, especially indoors where users consume the vast majority of data. The 6 GHz band currently supports three 320-megahertz channels under low-power indoor rules, but this is simply not sufficient to meet demand. A fourth 320-megahertz channel would significantly improve network capabilities.

The best and most spectrally efficient way to achieve that fourth channel is to complete the incomplete 320-megahertz channel stranded at the top of the 6 GHz band by extending low-power indoor unlicensed use up to 7.250 GHz. In fact, there is no similar opportunity anywhere to provide such a large channel in such a spectrally efficient manner. This approach would also allow operators to use the frequencies to produce an additional 160-megahertz channel or two more 80-megahertz channels as they work to accommodate high-throughput, high-density enterprise and municipal applications such as those in transportation hubs, sports and entertainment venues, and high-density retail outlets. Furthermore, the Wi-Fi industry can make use of the Lower 7 GHz band on a very fast timeline once NTIA completes a study and the FCC adopts rules like those in the 6 GHz band. 6 GHz Wi-Fi radios already in the market are capable of being extended up to 7250 MHz with software modifications. Moreover, the IEEE standards

for Wi-Fi 7 (802.11be)⁴ and Wi-Fi 8 (802.11bn)⁵ scope operation up to 7250 MHz. Priority study by NTIA would thus pay dividends much faster than in other bands under consideration for expanded commercial use.

The success of the 6 GHz band confirms the importance of Wi-Fi in the Lower 7 GHz band. Over 2,064 different 6 GHz Wi-Fi products have been launched,⁶ and the Wi-Fi Alliance has reported that 350 million Wi-Fi 6E products were shipped in 2022.⁷ The number of products and volume of sales should be even stronger as of the end of 2023. The FCC’s recent decision to adopt rules for very-low-power operations throughout the 6 GHz band will drive further adoption and innovation in the band, with positive impacts for the entire device ecosystem. Moreover, the United States worked hard at the World Radiocommunication Conference to “preserv[e] opportunities for unlicensed technologies in the 6 GHz band” and “enable countries to take decisions promptly to make this spectrum available for next-generation Wi-Fi deployment.”⁸ Immediate action on the Lower 7 GHz band will help Broadcom and other “leading developers

⁴ See *Project Authorization Request: Amendment to IEEE Standard 802.11-2016*, IEEE Standards Association, https://www.ieee802.org/11/PARs/P802_11be_PAR_Detail.pdf.

⁵ See *Project Authorization Request: Amendment to IEEE Standard 802.11-2020*, IEEE Standards Association, <https://mentor.ieee.org/802.11/dcn/23/11-23-0480-01-0uhr-uhr-proposed-par.pdf>.

⁶ See Claus Hetting, *Intel’s Ecosystem Tracker: 1997 Wi-Fi 6E Devices Announced, Wi-Fi 7 Reaches 67 Devices*, Wi-Fi NOW (July 15, 2023), <https://wifinowglobal.com/news-blog/intel-ecosystem-tracking-2064-wi-fi-6e-devices-now-available-wi-fi-7-reaches-67-devices/>.

⁷ See *Wi-Fi® Momentum in 2022*, Wi-Fi Alliance (Mar. 15, 2022), <https://www.wi-fi.org/beacon/the-beacon/wi-fi-momentum-in-2022>.

⁸ *U.S. Department of State Leads Successful U.S. Delegation to World Radiocommunication Conference in Dubai*, Media Note, Office of the Spokesperson (Dec. 15, 2023), <https://www.state.gov/u-s-department-of-state-leads-successful-u-s-delegation-to-world-radiocommunication-conference-in-dubai/>.

of Wi-Fi technology”⁹ in the United States continue to advance U.S. interests internationally as well.

In the longer term, unlicensed technologies would benefit from accessing frequencies up to 7.625 GHz, so that a fifth 320-megahertz channel could be provided to support deployments for Internet of Things networks and to enable further network densification in industrial, medical, and other settings. As noted above, current radios can cover the fourth channel up to 7.250 GHz. For these Upper 7 GHz band frequencies, a single radio could be extended to cover the 6 GHz band up to 7.625 GHz, thus reducing the costs for connectivity in end-user devices and networking equipment. Investment in those capabilities will require both certainty regarding Wi-Fi operation in frequencies above the 6 GHz band and near-term progress on the first order of business: the Lower 7 GHz band.

II. NTIA SHOULD RECOGNIZE OPEN AFC AS A POTENTIAL TOOL FOR LONGER-TERM SPECTRUM-SHARING ANALYSIS

Broadcom agrees with NTIA that longer-term spectrum planning requires “[d]ata-driven processes” and “unbiased technical, scientific, mission, and economic analyses.”¹⁰ Broadcom encourages NTIA to consider how publicly available tools like the Open AFC can support those analyses. Broadcom, Wi-Fi Alliance, and other conditionally approved AFC system operators in the 6 GHz band have demonstrated Open AFC’s capability for protecting radio astronomy and fixed-microwave links through lab testing and through recent public trials.¹¹ The Open AFC platform is modular and customizable and can be used for a far wider set of analytic purposes.

⁹ *Id.*

¹⁰ *National Spectrum Strategy* at 7.

¹¹ *See, e.g.,* Broadcom Report on Successful AFC System Public Trial, ET Docket No. 21-352 (filed Dec. 6, 2023).

Broadcom believes NTIA and its Federal partners could incorporate information from databases unrelated to the 6 GHz band, different propagation models, and other inputs to help coordinate frequency use and even to consider possibilities for sharing with commercial users. Importantly, Open AFC will soon be available as open-source software. It will be free to use, so government users will be able to access it without complicated procurement challenges. Federal agencies could host and run it locally, without sharing any data outside the U.S. Government, and conduct analyses locally rather than in the cloud. NTIA's implementation plan should recognize the potential of tools like the Open AFC to empower it to conduct the spectrum-sharing work to come in an unbiased, scientific, and data-driven manner.

CONCLUSION

NTIA's implementation plan should (1) prioritize immediate study of the Lower 7 GHz band, from 7.125-7.250 GHz, to complete the stranded 320-megahertz channel at the top of the 6 GHz band, (2) lay the groundwork for studying the compatibility of unlicensed technologies with Federal operations higher in the band, including the Upper 7 GHz band, from 7.250-7.625 GHz, and (3) recognize the potential of Open AFC as a tool for longer-term analysis of Federal/commercial coexistence in other bands.

Respectfully submitted,

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