

**Before the
U.S. DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, D.C. 20230**

In the Matter of)	
)	
Developing a Sustainable Spectrum Strategy)	Docket No. 181130999-8999-01
for America's Future)	RIN 0660-XC044
)	
)	

COMMENTS OF VERIZON

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I. INTRODUCTION AND SUMMARY

The Administration’s call for a comprehensive spectrum strategy is both timely and necessary. A robust spectrum pipeline is essential for delivering the ultra-high-speed, low-latency, secure mobile connectivity that consumers expect from next-generation wireless services. Verizon has been a 5G trailblazer, leading the world in the development and deployment of innovative next-generation technologies—from founding the 5G Technology Forum in 2015,¹ to launching in 2018 the first 5G network in the world: a fixed wireless broadband service with peak speeds approaching 1 Gbps.² This year will bring even more exciting 5G developments, with Verizon poised to offer one of the first 5G smartphones on our network.³ We also announced our “Built on 5G Challenge,” calling on innovators to create

¹ The Verizon 5G Technology Forum was formed in 2015 in cooperation with ecosystem partners Cisco, Ericsson, Intel, LG, Nokia, Qualcomm and Samsung.

² Press Release, Verizon, *Verizon turns on world’s first 5G network* (Oct. 1, 2018), <https://www.verizon.com/about/news/verizon-turns-worlds-first-5g-network>; Press Release, Verizon, *5G is here* (Sept. 11, 2018), <https://www.verizon.com/about/news/5g-here>.

³ Press Release, Verizon, *Verizon and Samsung to release 5G smartphone in the U.S. in first half of 2019* (Dec. 3, 2018), <https://www.verizon.com/about/news/verizon-and-samsung-release-5g-smartphone-us-first-half-2019>.

transformative solutions that leverage 5G connectivity to realize game-changing applications.⁴ 5G speeds and ultra-low latency will transform every sector of the economy, from healthcare to manufacturing and beyond. But wireless providers need more spectrum, especially mid-band spectrum, to help 5G reach its full potential.

The United States pioneered the global transition to 4G LTE services. We did so with the help of smart spectrum policies, rooted in the principle that exclusive-use licensing drives investment and promotes innovation. Those same policies can help facilitate a successful 5G revolution and cement the United States' position as a wireless leader for generations to come. Exclusive-use licensing should continue to form the bedrock of our spectrum licensing framework.

Unlicensed spectrum and spectrum sharing mechanisms are also important pieces of the wireless puzzle with the potential to free more spectrum for commercial use than would otherwise be available. The Administration and the Federal Communications Commission ("FCC") should maintain a balance between unlicensed and licensed spectrum allocations. But in light of the substantial swaths of spectrum the FCC already has earmarked for unlicensed use, identifying additional spectrum for licensed, exclusive-use is all the more important. Making additional, licensed mid-band spectrum available is particularly critical.

The Administration should also proceed with caution in expanding the use of sharing mechanisms until such approaches are carefully studied and validated. Spectrum sharing may offer opportunities to access new spectrum bands where there are no practicable alternatives, but

⁴ Press Release, Verizon, *Verizon Issues "Built on 5G Challenge"* (Jan. 8, 2019), <https://www.verizon.com/about/news/verizon-issues-built-5g-challenge>.

it is not a substitute for the exclusive-use licensing policies that have shaped the thriving wireless industry of today and that will help secure U.S. leadership of the 5G future.

II. SMART SPECTRUM POLICIES ARE CRITICAL TO WINNING THE RACE TO 5G.

The global race to 5G is underway and winning is more important than ever. The economic stakes are high. U.S. leadership in 4G led to burgeoning economic growth – an increase in nearly \$100 billion of the annual GDP and an 84% increase in wireless-related jobs.⁵ 5G promises to deliver even more staggering benefits, including adding three million new U.S. jobs and more than \$500 billion to the U.S. economy over the next few years.⁶ With the country’s global competitive position at stake, the Administration has sensibly recognized that “it is imperative that America be first in fifth-generation (5G) wireless technologies.”⁷

Not only will 5G bring unprecedented numbers of new jobs and billions in economic growth, but it will change the way Americans think, learn, and process information and environments around them, ushering in a seismic shift leading to a Fourth Industrial Revolution.⁸ Among other things, 5G will enhance public safety and transform the mobile experience as consumers know it today. Breakthroughs in connectivity, telehealth, the Internet of Things, and

⁵ Recon Analytics, *How America’s 4G Leadership Propelled the U.S. Economy*, at 1 (Apr. 16, 2018), https://api.ctia.org/wp-content/uploads/2018/04/Recon-Analytics_How-Americas-4GLeadership-Propelled-US-Economy_2018.pdf.

⁶ CTIA, *The Global Race to 5G*, at 4 (Apr. 2018), <https://api.ctia.org/wpcontent/uploads/2018/04/Race-to-5G-Report.pdf> (“Global Race Report”).

⁷ Memorandum for the Heads of Executive Departments and Agencies, *Developing a Sustainable Spectrum Strategy for America’s Future*, 83 FR 54513 (Oct. 30, 2018) (“Spectrum PM”).

⁸ See Press Release, Verizon, *How 5G Can Power the Industrial Internet of Things* (Dec. 7, 2018), <https://www.verizon.com/about/our-company/5G/how-5g-can-power-industrial-internet-things>.

robotics will bring new opportunities and growth to both urban and rural communities as 5G unfolds. Commercial 5G networks will also have a profound impact on national security and public safety. They will unlock revolutionary applications like real-time video, media sharing, secure communications services, and more to help first responders meet new and evolving threats. New 5G technology is “just radically different,” representing a “quantum leap” from 4G.⁹

Other countries have taken note of the transformational impact that 5G will have on society, jockeying to secure a leadership role in the 5G revolution. China, South Korea, and Japan, for example, have all been moving aggressively to unleash 5G by freeing significant additional spectrum for mobile use.¹⁰ The United States has similarly been focused on pursuing policies that will enable 5G. The FCC’s 5G FAST plan, for example, is helping unleash spectrum and modernize infrastructure policy to advance U.S. leadership in the race to 5G.¹¹ NTIA has also done important work to identify additional bands, such as the 3450-3550 MHz band, for potential commercial wireless use. But while the FCC and the Administration have taken important steps toward solidifying the United States’ position as a global 5G leader, there is more work to do. Time is of the essence.

By allocating additional spectrum for flexible use, the Administration can accelerate private investment and enhance the United States’ global competitiveness in the race to 5G. In

⁹ Press Release, Verizon, *Hans Vestberg Keynotes the 2019 Consumer Electronics Show* (Jan. 8, 2019), <https://www.verizon.com/about/news/hans-vestberg-keynotes-2019-consumer-electronics-show>.

¹⁰ See Global Race Report at 7-8.

¹¹ FCC, *The FCC’s 5G FAST Plan* (Sept. 28, 2018), <https://docs.fcc.gov/public/attachments/DOC-354326A1.pdf>.

crafting smart spectrum policies that will advance 5G, the Administration should heed a few key principles:

- *First*, 5G will rely on a robust pipeline of low-, mid-, and high-band spectrum. While the FCC has done much already to unleash high-band spectrum for 5G, mid-band spectrum remains critically important as it will leverage both coverage and capacity opportunities.¹²
- *Second*, 5G will require large, contiguous blocks of spectrum. Freeing large swaths of spectrum for mobile use will thus be critical to 5G. The Administration and the FCC should repurpose multiple blocks of 100 MHz each.
- *Third*, technical rules should be designed to enable large-scale 5G deployments. Opening large swaths of spectrum for licensed, flexible-use service, subject to appropriate technical rules, will enhance opportunities for new 5G use cases.
- *Finally*, the government should “set rules that encourage the private sector to develop and deploy next-generation infrastructure.”¹³ The wireless industry’s growth and development over the past three decades confirm that “the market, not the government is best positioned to drive innovation and investment.”¹⁴ The Administration should thus reject calls to construct a nationalized 5G network.

¹² See, e.g., Roslyn Layton, *The U.S. Must Move Quickly On Mid-Band Spectrum If It Wants To Lead In 5G*, Forbes (May 23, 2018), <https://www.forbes.com/sites/roslynlayton/2018/05/23/the-us-mustmove-quickly-on-mid-band-spectrum-if-it-wants-to-lead-in-5g/#40ee41e7462a>.

¹³ Press Release, *Statement of FCC Chairman Ajit Pai On The Future Of 5G*, FCC (Jan. 29, 2018), <https://www.fcc.gov/document/statement-fcc-chairman-ajit-pai-future-5g>.

¹⁴ *Id.*

Such an undertaking would be “a costly and counterproductive distraction” from the work that must be done to help the United States capture the 5G future.¹⁵

Smart spectrum policies, including multiple spectrum auctions, helped make the United States the leader during the transition to 4G. But “past victories do not guarantee future success[es].”¹⁶ Winning the race to 5G requires swift government action to identify and repurpose large amounts of spectrum for flexible-use services. As FCC Chairman Pai has noted, “[w]hen it comes to 5G, we need to keep the playbook fresh and forward leaning,” including making aggressive moves to free additional spectrum for mobile broadband use.¹⁷ In the same vein, NTIA Administrator Redl has stated that ensuring “sufficient and flexible access to spectrum” will “help lay a foundation for 5G...propel[ing] wireless innovation and new services and capabilities for consumers.”¹⁸

III. THE BENEFITS OF EXCLUSIVE-USE LICENSING ARE NUMEROUS AND WELL-DOCUMENTED.

Exclusive-use licensing should continue to be a cornerstone of the United States’ 5G spectrum strategy.¹⁹ A proven framework, exclusive-use licensing has long been the “gold standard” for optimizing spectrum use and meeting consumer demand. Through exclusive-use

¹⁵ *Id.*

¹⁶ Ajit Pai, *Scoring a Victory for 5G*, FCC (June 20, 2018), <https://www.fcc.gov/newsevents/blog/2018/06/20/scoring-victory-5g>

¹⁷ *Id.*

¹⁸ Remarks of David J. Redl, *White House 5G Summit*, NTIA (Sept. 28, 2018), <https://www.ntia.doc.gov/spechttestimony/2018/remarks-assistant-secretary-redl-white-house-5g-summit>

¹⁹ See The Brattle Group, *Mobile Broadband Spectrum: A Vital Resource for the U.S. Economy*, at 1-2, 23-24 (2015), https://api.ctia.org/docs/default-source/default-document-library/brattle_spectrum_051115.pdf (explaining the importance of licensed exclusive-use spectrum).

licensing, the wireless industry successfully migrated from 2G to 3G services and secured the United States' global leadership in 4G LTE deployment and adoption. With this track record, the FCC has recognized that exclusive-use licensing “strike[s] the right balance between the benefits of competition, on the one hand, and the efficiencies of scale and scope that justify investments of capital and expertise.”²⁰ Indeed, exclusive-use licensing has already attracted substantial spectrum investment, with carriers like Verizon investing billions in their networks each year.²¹

The Administration should adopt exclusive-use licensing for as many spectrum bands as possible to ensure that the U.S. wins the race to 5G. Exclusive-use licensing will enable the high-quality, reliable service that American consumers have come to expect by providing clear expectations for interference protection and predictable spectrum access.²² The certainty inherent in exclusive-use spectrum licensing will, in turn, allow prospective 5G players to invest confidently in developing the novel network infrastructure and end-user devices that 5G will require. With a stable and predictable investment environment, 5G services and use cases will reach their full potential as investment and innovation will thrive across repurposed spectrum bands. Rather than experimenting with untested and complex licensing regimes, the FCC and NTIA should promote 5G by relying on the proven exclusive-use formula that has paved the way for U.S. wireless leadership time and again.

²⁰ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Notice of Inquiry, 29 FCC Rcd 13020, 13045, ¶ 88 (2014).

²¹ *See* Global Race Report at 2.

²² CTIA, *Licensed Spectrum: The Key to Continuing America's Wireless Leadership and Growing Our Economy*, at 2 (2017), <https://api.ctia.org/docs/default-source/default-document-library/ctia-white-paper-licensed-spectrum.pdf> (“*Licensed Spectrum Report*”).

IV. THE ADMINISTRATION SHOULD TAKE A BALANCED APPROACH TO ALLOCATING ADDITIONAL LICENSED AND UNLICENSED SPECTRUM AND SHOULD PRIORITIZE IDENTIFYING MID-BAND SPECTRUM FOR LICENSED USE.

5G will require large swaths of additional spectrum, both licensed and unlicensed.

Wireless providers are increasingly experimenting with unlicensed spectrum, but as noted above, exclusively licensed spectrum remains critically important. The FCC has already allocated large swaths of spectrum for unlicensed uses. In the *Spectrum Frontiers* proceeding, for example, the FCC has committed a total of 14 gigahertz of spectrum between 57-71 GHz for unlicensed uses.²³ By contrast, the FCC has adopted rules to repurpose only 5.55 gigahertz of high-band spectrum for licensed use²⁴ and has sought comment on repurposing only up to 6.55 gigahertz more.²⁵ Likewise, with respect to mid-band spectrum, the FCC has sought comment on allocating the 6 GHz band—1200 megahertz of spectrum—for unlicensed use and has introduced

²³ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 ¶ 376 (2016) (“*Spectrum Frontiers R&O and FNPRM*”).

²⁴ *See id.* (allocating 3.85 GHz of millimeter wave spectrum for licensed use); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988 (2017) ¶ 2 (making an additional 1.7 gigahertz of millimeter wave spectrum available in the 24 GHz band and the 47.2-48.2 GHz bands).

²⁵ *See Spectrum Frontiers R&O and FNPRM* ¶¶ 389, 420 (proposing reallocation of 3.8 GHz in the 31.8-33.4 GHz and 50.4-52.6 GHz bands); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, FCC 18-73 (rel. June 8, 2018) (“*Spectrum Frontiers Third Further Notice*”) (seeking comment on allocating 2.75 gigahertz in the 25.25-27.5 GHz and 42-42.5 GHz bands).

a sharing regime in the 3.5 GHz band that will use novel dynamic access techniques to enable both licensed (70 megahertz) and unlicensed (150 megahertz) operations.²⁶

While these bands offer important opportunities for innovation, 5G will require significantly more licensed exclusive-use spectrum. As Verizon and others have noted, allocating additional licensed mid-band spectrum is particularly critical for U.S. 5G interests. Across the globe, other countries have already committed hundreds of megahertz of 3 GHz spectrum for 5G.²⁷ The United States, by comparison, faces a significant mid-band spectrum deficit. Even accounting for the 3.5 GHz band, the United States now ranks sixth out of ten countries in terms of mid-band spectrum availability.²⁸ The Administration should continue collaborating with the FCC to identify additional mid-band spectrum for potential commercial repurposing. The Administration and the FCC can best fuel 5G by repurposing the 3.7 – 4.2 GHz band and reallocating as much of the 3450-3550 MHz band for commercial mobile use as possible.

As NTIA and the FCC look to unleash additional spectrum for 5G, the agencies should also restore balance between licensed and unlicensed commercial spectrum allocations. The MOBILE NOW Act (“Act”) recognizes the importance of maintaining a reasonable balance

²⁶ See *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, FCC 18-147 (Oct. 24, 2018) (“*Mid-Band NPRM*”) (proposing rules to enable unlicensed use throughout portions of the 6 GHz band).

²⁷ See, e.g., Monica Allevan, *South Korea wraps 5G auction for 3.5, 28 GHz*, FIERCE WIRELESS (June 20, 2018), <https://www.fiercewireless.com/wireless/south-korea-wraps-5g-auction-for-3-5-28-ghz> (noting South Korea auctioned 280 megahertz of 3.5 GHz spectrum in June 2018); 5GMF White Paper, 5G Mobile Communications System for 2020 and beyond, ver.1.1, at 9.2.3 (Sept. 29, 2017), <https://5gmf.jp/en/whitepaper/5gmf-white-paper-1-1/> (announcing Japanese plans to commit 500 MHz of the 3.6-4.2 GHz and 4.4-4.9 GHz bands to 5G systems by the end of FY 2018).

²⁸ See Global Race Report at 11.

between the amounts of licensed and unlicensed spectrum available for mobile use. The Act reflects a balanced approach, with Congress calling on the FCC and NTIA to identify a total of at least 255 MHz for “mobile and fixed wireless broadband use.”²⁹ In making 255 megahertz available, 100 MHz below 6 GHz must be identified for exclusive-use licensing; 100 megahertz below 8 GHz must be identified for unlicensed; and 55 megahertz below 8 GHz must be identified for licensed, unlicensed, or a combination of uses.³⁰ Verizon encourages NTIA and the FCC to be aggressive in identifying licensed spectrum to meet and exceed these goals. While unlicensed spectrum provides an important sandbox for wireless innovation, spectrum licensed on an exclusive-use basis will form the backbone of 5G networks and remains critical to meet surging consumer demand for mobile data.³¹ Where, as here, significant spectrum has already been allocated for sharing and unlicensed experimentation, identifying additional spectrum that can be made available for 5G on a licensed, exclusive-use basis is essential.

V. SHARING MECHANISMS MAY BE USEFUL TOOLS FOR INCREASING SPECTRUM ACCESSIBILITY BUT THEY REQUIRE FURTHER DEVELOPMENT AND CAREFUL IMPLEMENTATION.

Spectrum sharing offers the potential to make more spectrum commercially available where clearing bands for exclusive-use licensing may not be possible. But spectrum sharing mechanisms are still developing, and field performance must be studied further before such mechanisms can be implemented broadly across different spectrum bands. Spectrum sharing cannot supplant the need for exclusively licensed spectrum. However, if properly developed and

²⁹ See Consolidated Appropriations Act, 2018, P.L. 115-141, Division P, the Repack Airwaves Yielding Better Access for Users of Modern Services (RAY BAUM’S) Act. Title VI of the RAY BAUM’S Act is the Making Opportunities for Broadband Investment and Limiting Excessive and Needless Obstacles to Wireless Act or MOBILE NOW Act (“Mobile NOW Act”).

³⁰ See *id.* § 603(a).

³¹ See *Licensed Spectrum Report* at 3.

implemented, sharing techniques may be part of a complementary approach that helps advance 5G deployments.

Before pursuing a sharing regime in any particular spectrum band, NTIA and the FCC should evaluate incumbent and future uses of the band to ensure that spectrum sharing is a viable and sustainable option. Sharing mechanisms will also need to be tested and validated to ensure that spectrum usage will be optimized. For example, the dynamic sharing regime that the FCC has adopted for the 3.5 GHz band may be a useful model, but it will require careful implementation and further study before it is considered for other bands. As the FCC recently recognized in its Spectrum Pipeline Report to Congress, “[i]t is too soon to know whether other bands may be suitable for licensed or unlicensed use based on the techniques used in the 3.5 GHz band.”³²

To be successful, sharing systems must be tailored to meet the unique characteristics of the particular spectrum band at issue and designed to ensure incumbent protection. What works in one band may not work in another. Even if the dynamic sharing techniques in the Citizens Broadband Radio Service ultimately facilitate a thriving wireless ecosystem in the 3.5 GHz band, for example, those techniques may not be appropriate for other spectrum bands. Indeed, the Spectrum Access System (“SAS”) was designed for the 3.5 GHz band where the principal incumbents are naval radars on a finite number of vessels that infrequently operate along the U.S. coasts. That sharing mechanism may not be tenable in bands with more diverse and numerous incumbents posing greater coordination challenges.

³² FCC, *Report to Congress Pursuant to Section 1008 of the Spectrum Pipeline Act of 2015, As Amended by the Ray Baum’s Act of 2018*, Report, DA 18-1128, ¶ 26 (Nov. 2, 2018).

More broadly, sharing spectrum may be a viable option only if a band is globally or regionally harmonized, a sufficient volume of spectrum is available, and appropriate service rules are in place to facilitate commercial service.³³ *First*, the band should be well-harmonized for mobile services so that equipment is affordable and supports roaming. Consumers have an expectation that their devices will function seamlessly and supporting roaming is important to meeting those expectations. *Second*, spectrum should be available in sufficient quantities to support the desired service in the areas that require service at the time it is needed. Making small amounts of spectrum available for sharing in discrete geographic locations may not be useful, because, as discussed in greater detail below, bringing new spectrum bands online requires substantial time and capital. Put simply, shared spectrum “needs to be usable in practical and commercially viable deployments,” not narrow, piecemeal channels that lack business incentives.³⁴ *Third*, service rules in the shared band must be designed to support commercial service and attract investment. Large exclusion zones or unduly restrictive power limits, for example, could frustrate meaningful sharing.³⁵ An effective dynamic sharing ecosystem will also require an active control system that features a closed loop with access points reporting power and location details to a central database so that interference can be easily detected and resolved.

Although sharing mechanisms may hold promise for enabling mobile access to additional frequency bands, establishing a successful sharing regime in any given band takes time. A

³³ See GSMA, *Spectrum Sharing* (Nov. 2018) at 5, available at <https://www.gsma.com/spectrum/wp-content/uploads/2018/11/Spectrum-Sharing-Positions.pdf> (“*Spectrum Sharing Report*”).

³⁴ *Id.*

³⁵ *See id.*

comprehensive ecosystem must exist with the capability to put shared spectrum to use when it is identified as available. But pioneering a device and equipment ecosystem for a new spectrum band requires significant lead time for standard-setting, the development and manufacture of equipment, and, ultimately, the purchase and deployment of that equipment by mobile operators. Once the FCC reallocates spectrum for mobile use, it can take anywhere from 9-18 months for standards bodies to define new standards, establish RF requirements, and identify channel definitions. OEMs may need 12-36 months for RAN base station and handset product development and manufacturing. Mobile operators then may need another 12-36 months to plan and implement wide-area network deployments. When running in parallel, these processes may still take 36 months or more to complete. Complex sharing paradigms mired with diverse incumbents and novel licensing rules may add to these timelines, undercutting the potential value of spectrum sharing approaches. Further, to the extent a sharing regime only makes small portions of a spectrum band available for shared use, long-term, wide area deployments may not be feasible, making the business case for mobile sharing difficult, if not impossible.

VI. CONCLUSION

Making more spectrum available for commercial mobile use is critical to meet consumer demand for advanced services and ensuring the United States wins the global race to 5G. NTIA should work closely with the FCC to repurpose and license as much additional spectrum as possible—particularly mid-band spectrum—on an exclusive-use basis. While sharing techniques may be a helpful complementary approach to exclusive-use licensing, they require further development and study. Where possible, the Administration and the FCC should adhere to proven policies of flexible, exclusive-use licensing, adopting a framework that appropriately prioritizes the certainty and predictability necessary to attract investment capital.

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