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national security depend heavily on leadership in cutting-edge platforms and technologies, including 5G. Not only does licensed spectrum provide certainty for network investment and assured quality of service for users, but full-power operations can better and more cost-effectively reach rural and remote parts of the country.

Demands on wireless networks are dramatically increasing. Between January 2021 and June 2022, data usage on Verizon’s 5G Ultra Wideband network increased 249 percent.⁴ This is part of a global trend, with worldwide wireless network traffic projected to quadruple in the next five years as 5G use cases and deployments mature. Yet despite this expansive growth, the United States is falling behind our competitors in terms of licensed spectrum access. Today, peer nations have access to 140 percent more licensed spectrum in the critical mid-band range, and that gap is expected to grow nearly 40 percent in the next five years.⁵ Meanwhile, China is leading efforts to make the 6 GHz band available for licensed use, whereas the U.S. dedicated this entire 1,200 megahertz of spectrum to unlicensed operations.⁶

As a result of the disparity in licensed mid-band spectrum availability, the U.S. risks foreclosing economic opportunities and undermining our national security. Our spectrum policy decisions risk isolating the domestic marketplace from broad swaths of the harmonized

⁴ Press Release, Verizon, *Data usage on Verizon’s 5G Ultra Wideband network has increased 249%* (June 1, 2022), <https://www.verizon.com/about/news/data-usage-verizon-5g-ultra-wideband-network-increased>.

⁵ *Comparison of Total Mobile Spectrum in Different Markets*, CTIA (Sept. 20, 2020), <https://www.ctia.org/news/comparison-of-total-mobile-spectrum-in-different-markets> (citing Janette Stewart, Chris Nickerson & Juliette Welham, *Comparison of total mobile spectrum in different markets*, Analysys Mason (Sept. 2022) (“Analysys Mason Report”), <https://api.ctia.org/wp-content/uploads/2022/09/Comparison-of-total-mobile-spectrum-28-09-22.pdf>).

⁶ Analysys Mason Report at 11; see also *Spectrum Allocation in the United States*, at 18, Accenture (Sept. 2022) (“Accenture Spectrum Report”), <https://api.ctia.org/wp-content/uploads/2022/09/Spectrum-Allocation-in-the-United-States-2022.09.pdf>.

international mobile telecommunications (“IMT”) ecosystem, enabling China to fill the technology void in its own strategic interest.

Given these imperatives, Verizon supports development of a National Spectrum Strategy that focuses on repurposing at least 1,500 megahertz of mid-band spectrum for commercial, full-power, licensed use. Identifying spectrum for repurposing will require evaluation of more than 1,500 megahertz to achieve this goal. As part of its implementation plan, NTIA should, as an initial step, delineate targeted bands for repurposing to commercial use – which should at least include Lower 3 GHz (3.1-3.45 GHz), 7/8 GHz (7.125-8.4 GHz), and 4 GHz (4.4-4.94 GHz), along with a timeline for action. NTIA should develop a path for studying additional bands as well to meet the needs of commercial wireless users in the years ahead.

Licensed spectrum remains the bedrock for commercial wireless deployments. The primary focus of the National Spectrum Strategy should therefore be on clearing spectrum to facilitate the secure and reliable connectivity enabled by commercial wireless networks.

Where clearing spectrum is not possible, however, sharing mechanisms that prioritize certainty and foster investment while protecting federal incumbents are preferred. Such static sharing models have proven successful in making spectrum available for commercial use while ensuring continued operations and protection of federal missions. This contrasts with dynamic or opportunistic sharing models, which remain unproven for deployments at scale. As a licensee in the Citizens Broadband Radio Service (“CBRS”) band, Verizon is well positioned to comment on the challenges of low-power and preemptible access.

Finally, NTIA plays a foundational role as the voice on behalf of federal agencies on federal spectrum policy and allocation. The National Spectrum Strategy should promote further collaboration between and among federal and non-federal users, including by incentivizing

transparent and consistent dialogue with potentially affected stakeholders and the Federal Communications Commission (“FCC”) regarding equitable and efficient spectrum use.

By taking steps consistent with these comments, NTIA can foster a spectrum strategy that promotes the Administration’s economic, security, and equity objectives.

II. COMMERCIAL WIRELESS NETWORKS POWERED BY LICENSED SPECTRUM ARE VITAL TO U.S. ECONOMIC AND NATIONAL SECURITY OBJECTIVES, EXPAND CONNECTIVITY, AND SUPPORT INNOVATION.

A. The Wireless Industry is Key to U.S. Economic Growth and Jobs.

The wireless industry contributes heavily to our nation’s economy, thanks in large part to networks deployed at scale that are the foundation for mobile connectivity, innovation, and ever-growing reliance on all things wireless. During the 4G decade, from 2010 to 2020, the wireless industry supported one out of every six American jobs,⁷ and gross output from the U.S. wireless industry topped \$9.5 trillion.⁸ In 2020 alone, the wireless industry accounted for \$1.3 trillion in gross output and \$825 billion in GDP.⁹ And 5G is projected to create an additional 4.6 million jobs and contribute up to \$1.7 trillion to U.S. GDP over the next decade, spurring activity across the consumer, industrial, and public sectors.¹⁰

Spectrum – in particular, full-power, licensed spectrum with rights of assured access and protection from interference – is the key input powering this economic success story. Licensed

⁷ *The 4G Decade: Quantifying the Benefits*, at 3, 6, Recon Analytics (July 29, 2020), <https://api.ctia.org/wp-content/uploads/2020/07/The-4G-Decade.pdf>.

⁸ Aren Megerdichian, *The Importance of Licensed Spectrum and Wireless Telecommunications to the American Economy*, at 3, Compass Lexecon (Dec. 7, 2022), <https://api.ctia.org/wp-content/uploads/2022/12/Compass-Lexecon-Licensed-Spectrum-Report.pdf>.

⁹ *Id.*

¹⁰ *5G Promises Massive Job and GDP Growth in the US*, at 3, Boston Consulting Group (Feb. 2021) (“BCG Economic Impact Report”), https://api.ctia.org/wp-content/uploads/2021/01/5G-Promises-Massive-Job-and-GDP-Growth-in-the-US_Feb-2021.pdf.

spectrum provides certainty and reliability and enables investment in networks at scale, creating the infrastructure for this growth and productivity. With networks increasingly delivering high-capacity, low-latency capabilities, today with 5G and in the years to come with 6G, new applications and services will develop, contributing further to economic growth.

The National Spectrum Strategy should account for these realities and proactively identify more licensed spectrum for wireless services.¹¹ Given projected demand, a spectrum deficit is looming. A Boston Consulting Group report has found that delay in making additional licensed spectrum available could have significant opportunity costs, as every six-month delay in 5G network deployment could, on average, result in a \$25 billion loss of economic benefits over a decade.¹²

B. U.S. Wireless Leadership Is Critical to America’s National Security Interests.

The Administration’s 2022 National Security Strategy highlighted that “[t]echnology is central to today’s geopolitical competition and to the future of our national security, economy and democracy,”¹³ with U.S. investments in innovative technologies enabling the U.S. “to anchor an allied techno-industrial base that will safeguard our shared security, prosperity and values.”¹⁴ Of particular relevance here, the National Security Strategy emphasizes the importance of trusted global telecom supply chains and secure 5G networks.¹⁵ To achieve these goals, the United States must support a pro-5G spectrum policy internationally and here at home.¹⁶

¹¹ See Request at 16245 (Pillar #1, Question 1).

¹² See BCG Economic Impact Report at 10.

¹³ The White House, *National Security Strategy*, at 32 (Oct. 2022), <https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf>.

¹⁴ *Id.* at 33.

¹⁵ See *id.* at 32-34.

¹⁶ See generally Request at 16245.

Significantly, the U.S. is in competition for technological superiority with China in particular and other rival nations. The United States and allied leadership in globally harmonized spectrum bands is directly linked to achieving economic scale and a trusted supply chain. Harmonizing bands for substantially similar use worldwide generally minimizes the threat that high-risk suppliers from foreign adversary nations can use predatory techniques to dominate strategic bands.¹⁷

Today, China and other nations are identifying additional bands for 5G, for wide-area, full-power licensed networks. By 2027, China is expected to have more than double, and perhaps more than three times, the amount of licensed spectrum than the United States.¹⁸ And we are behind other nations, too. Today, we rank 13th out of 15 benchmark nations in terms of mid-band spectrum available for licensed use.¹⁹

At the upcoming WRC-23, China supports all five bands under consideration for future and expanded 5G mid-band use, whereas the United States to date supports only one.²⁰ The U.S. may thus be on the outside looking in on future bands and policies for 5G. This scenario necessarily impacts the Administration's national security goals. If the U.S. is not in future 5G

¹⁷ *See, infra*, Section III.C.

¹⁸ Analysys Mason Report at 11. The range of outcomes is impacted by how much spectrum China ultimately makes available in the 6 GHz band, which the U.S. has already fully allocated for unlicensed use.

¹⁹ *Id.* at 10.

²⁰ Agenda Item 1.2 is considering identification of the 3300-3400 MHz, 3600-3800 MHz, 6425-7025 MHz, 7025-7125 MHz, and 10.0-10.5 GHz bands for IMT use. *See* ITU, Agenda of the World Radiocommunication Conference (WRC-23), Resolution 1399, Corrigendum 1 to Document C20/69-E (Feb. 22, 2023). The U.S. position today only supports IMT use in the 3600-3800 MHz band. *See, e.g.*, FCC, U.S. contributions sent to CITEP PCC.II (for WRC-23), <https://www.fcc.gov/us-contributions-sent-citep-pccii-wrc-23> (last visited Apr. 12, 2023). *See also* ITU, ITU-R CPM23.2, Second Session of the Conference Preparatory Meeting for WRC-23 (CPM23-2), [https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-CPM23.2-C&question=AI%201.2&source=China%20\(People](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-CPM23.2-C&question=AI%201.2&source=China%20(People).

bands, Chinese and other vendors – not from the U.S. – will be leading standards development and developing products to sell across the globe.

Spectrum is necessary for the U.S. to out-compete China and prevent a future in which China’s Belt and Road Initiative, including the Digital Silk Road, seeks to predominate over U.S. and allied technology by actively promoting Chinese equipment and subsidizing its deployment across the globe, particularly in developing nations.²¹ As one recent report noted, “[t]o weave democratic values into the fabric of next-generation technology, the United States needs to be at the forefront of developing and supplying that technology, particularly as the [People’s Republic of China] focuses on deploying more licensed spectrum and growing its own 5G sector for export.”²²

The United States should be working to ensure a strong U.S. presence in global bands for 5G and for 6G in the future. Similar to the National Cybersecurity Strategy,²³ the National Spectrum Strategy should be considered one component within the suite of strategies under the umbrella of the National Security Strategy.

C. Commercial Wireless Technologies and Deployments are Helping Bridge the Digital Divide for All Americans.

The Administration prioritizes ensuring equitable access to broadband, and Verizon’s wireless services, both mobile and home broadband, help bridge the digital divide, bringing

²¹ See, e.g., Council on Foreign Relations, *Assessing China’s Digital Silk Road Initiative*, <https://www.cfr.org/china-digital-silk-road/> (last visited Apr. 12, 2023).

²² Clete Johnson, *The Strategic Imperative of U.S. Leadership in Next-Generation Networks*, Center for Strategic and International Studies, at 9, CSIS (Jan. 20, 2023) (“CSIS Report”), <https://www.csis.org/-analysis/strategic-imperative-us-leadership-next-generation-networks>; see also, e.g., *International Botnet and IOT Security Guide 2020*, at 31-32, 35, 39, Council to Secure the Digital Economy (2019), <https://www.fcc.gov/ecfs/document/1223244673503/1> (Appendix A: Cyber Crisis Scenarios Examined by CSDE).

²³ See The White House, *National Cybersecurity Strategy*, at 5 (Mar. 2023), <https://www.whitehouse.gov/wp-content/uploads/2023/03/National-Cybersecurity-Strategy-2023.pdf>.

opportunity to underserved and marginalized communities. Verizon provides connectivity to communities in remote and underserved areas, making available affordable devices and services, fostering digital literacy skills, and more.²⁴

Verizon supports and participates in the FCC’s Affordable Connectivity Program (“ACP”), providing subsidized internet services to eligible low-income consumers. Through the program, Verizon offers free (with the ACP discount) unlimited voice and texting along with five GB of data per month for eligible wireless consumers.²⁵ This is notable given that the majority of ACP enrollees are choosing mobile broadband services.²⁶ The Verizon Forward Program supplements the company’s ACP offering by providing new and existing ACP-qualified customers with free high-speed internet access with no data caps, no equipment charges, and no additional taxes and fees.²⁷

Fixed wireless access is also growing in scale and bringing new competition in the home broadband market.²⁸ As of the end of 2022, Verizon LTE Home was available in parts of all 50 states, offering unlimited broadband access with download speeds that can support remote work, distance learning, and more, while Verizon’s 5G Home Internet is making high-performing home internet more affordable to both new and existing customers.²⁹ By the end of 2022, Verizon had

²⁴ See *Environmental, Social and Governance (ESG) Report 2022*, at 64-67, Verizon (2022) (“Verizon 2022 ESG Report”), <https://www.verizon.com/about/sites/default/files/Verizon-2022-ESG-Report.pdf>.

²⁵ See Verizon, Total by Verizon, ACP, <https://www.totalbyverizon.com/acp> (last visited Apr. 12, 2023).

²⁶ See Universal Service Administrative Co., Additional ACP Data, <https://www.usac.org/about/-affordable-connectivity-program/acp-enrollment-and-claims-tracker/additional-acp-data/> (last visited Apr. 12, 2023).

²⁷ See Verizon 2022 ESG Report at 65; see also Comments of Verizon, GN Docket No. 22-69, at 5 (filed Feb. 21, 2023).

²⁸ See *5G Fixed Wireless Broadband: Helping close the digital divide in rural America*, Accenture (Nov. 18, 2021), <https://api.ctia.org/wp-content/uploads/2021/11/CTIA-Rural-HHs-mini-POV-V2-20211115.pdf>.

²⁹ Verizon 2022 ESG Report at 65.

approximately 1.5 million fixed wireless access broadband connections,³⁰ and Verizon expects to cover 50 million homes with its wireless broadband services by the end of 2025.³¹

To ensure industry can continue to address the broadband needs of people across the country both now and into the future, the National Spectrum Strategy should provide sufficient licensed spectrum to support growing needs.³²

D. Wireless Networks are Fueling American Innovation.

Wireless deployments serving American consumers and businesses with wide-area coverage at scale are supporting a multitude of use cases across an array of economic domains.³³

As NTIA recognizes, advanced transportation technologies are just one example of spectrum-reliant use cases that should be supported as part of the National Spectrum Strategy.³⁴ For instance, connected vehicle technologies (“V2X”) supported by high-speed, low-latency connectivity on licensed spectrum are a critical complement to transportation safety applications. Among other things, V2X applications can connect vehicles, infrastructure, and other road users, enabling directed safety messages, optimizing traffic flow, and alerting vehicles and roadway users of potential issues through low-latency, high-reliability networks when even milliseconds matter. These applications are expected to expand dramatically to the benefit of the traveling public. Uncrewed aircraft systems are another example expected to grow substantially as the variety of use cases increases, from newsgathering and precision farming to infrastructure inspection and post-disaster communications. These uses rely on spectrum for payload

³⁰ *Id.*

³¹ See Verizon Investor Day 2022 Presentation, at 53 (Mar. 3, 2022), https://www.verizon.com/about/sites/default/files/2022-05/Investor-Day-2022-Presentation_rv1.pdf.

³² See Request at 16246 (Pillar #1, Question 4).

³³ See *id.* at 16246 (Pillar #1, Question 4).

³⁴ See *id.* at 16245.

communications and for management and control, requiring uninterrupted communications that cannot be served by unlicensed or shared spectrum that is vulnerable to interference.

The manufacturing, healthcare, and public safety sectors also benefit from broader network deployments. For example, 5G can facilitate the use of advanced technologies to improve supply chain efficiency, including through use of private network slices.³⁵ The healthcare sector is seeing near real-time mobile diagnostics and analysis across secure, reliable networks.³⁶ And wireless connectivity can support large volumes of high-quality video streaming, offering the potential for greatly improved situational awareness for first responders.³⁷

5G networks can enable providers to deliver specialized offerings to users through a unique, customized virtual network slice. With network slicing, the radio resources of a single physical network can be efficiently shared so that multiple sets of users can access differentiated virtual networks with customized capabilities as needed to meet their individualized needs, including security, bandwidth, and latency, alongside traditional best efforts mobile broadband.³⁸ And network slicing can provide solutions to fully control and support critical Internet of Things and other services with the sort of reliable and secure communications that cannot be achieved with unlicensed spectrum.³⁹

³⁵ Verizon, Building a more connected manufacturing future, <https://www.verizon.com/business/-solutions/industry/manufacturing/> (last visited Apr. 12, 2023).

³⁶ Verizon, Private 5G Network, Healthcare, <https://www.verizon.com/business/products/networks/-connectivity/private-wireless-network/> (last visited Apr. 12, 2023).

³⁷ Keith Shaw, *How 5G can help improve situational awareness for first responders*, Verizon, <https://www.verizon.com/business/resources/articles/s/how-5g-can-help-improve-situational-awareness-for-first-responders/> (last visited Apr. 12, 2023).

³⁸ See Gary Hilson, *What is 5G network slicing?*, Verizon, <https://www.verizon.com/business/resources/-articles/s/5g-network-slicing-do-you-have-the-team-you-need/> (last visited Apr. 12, 2023).

³⁹ See Heidi Vella, *The benefits of network slicing: flexibility and more*, Verizon, <https://www.verizon.com/business/resources/articles/s/benefits-of-network-slicing-flexibility-and-more/> (last visited Apr. 12, 2023).

5G networks are also reducing our impact on the climate. Wireless-enabled systems are increasingly monitoring, managing, and lowering energy consumption and emissions, making 5G a powerful tool for decarbonization.⁴⁰ 5G-enabled technologies are projected to make up to a 20 percent contribution to U.S. carbon emission reduction targets by 2025.⁴¹ NTIA recognizes the importance of a National Spectrum Strategy that supports climate monitoring and forecasting endeavors,⁴² and 5G wireless connectivity will be a key enabler in that mission.

III. A NATIONAL SPECTRUM STRATEGY SHOULD PRIORITIZE IDENTIFYING SPECTRUM FOR LICENSED, FULL-POWER COMMERCIAL USE.

A. There is Insufficient Licensed Spectrum Available Today to Support Growing Data Demands.

Nearly every facet of our lives today is impacted by, and linked to, broadband connectivity, which is generating a surge of wireless data demand. In 2021, U.S. wireless networks carried more data than in 2010-2017 combined.⁴³ Between 2020-2021, wireless connections grew to 499 million.⁴⁴ Numerous states in Verizon's nationwide footprint are far over-indexing the average national 5G growth, several of which saw usage grow more than 1,500 percent since January 2021.⁴⁵ And 5G home broadband grew 140 times faster than all other

⁴⁰ See *Decarbonizing industries with connectivity & 5G*, MIT Technology Review Insights (Oct. 20, 2021), <https://www.ericsson.com/4a98c2/assets/local/about-ericsson/sustainability-and-corporate-responsibility/environment/mit-technology-review-decarbonizing-industries-with-connectivity-and-5g.pdf>.

⁴¹ *5G Connectivity: A Key Enabling Technology to meet America's Climate Goals*, Accenture (Jan. 26, 2022), <https://api.ctia.org/wp-content/uploads/2022/01/5G-Connectivity-A-Key-Enabling-Technology-to-meet-Americas-Climate-Change-Goals-2022-01-25.pdf>.

⁴² See Request at 16245.

⁴³ *2022 Annual Survey Highlights*, at 4, CTIA (Sept. 13, 2022) ("CTIA 2022 Annual Survey Highlights"), <https://api.ctia.org/wp-content/uploads/2022/09/2022-Annual-Survey.pdf>.

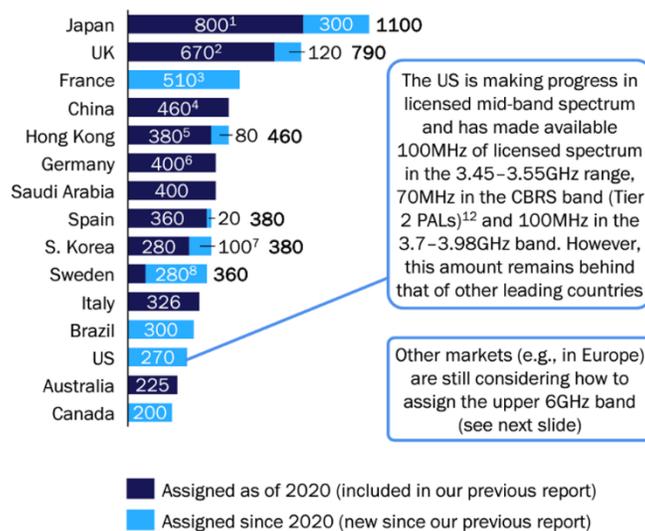
⁴⁴ *Id.* at 6-7.

⁴⁵ Verizon Press Release, *supra* note 4.

home broadband offerings.⁴⁶ These trends are showing no signs of abating: total global mobile network data traffic is projected to nearly quadruple by 2028.⁴⁷

Yet the U.S. is falling behind in access to the critical mid-band airwaves for licensed wireless use – frequencies that remain a prime target for 5G globally. Today, domestic providers have access to just 270 megahertz of licensed mid-band spectrum, including the preemptible, low-power Priority Access Licenses in the CBRS band, with only another 180 megahertz coming online in the second tranche of C-Band spectrum.⁴⁸ Global rivals, on the other hand, have access to 140 percent more mid-band today on average, and within five years, the U.S. will trail the leading three countries by an average of 415 megahertz absent federal action to address this deficit.⁴⁹

Licensed mid-band spectrum currently assigned for mobile use (total MHz)



Source: Analysys Mason Report at 10.

⁴⁶ CTIA 2022 Annual Survey Highlights at 10.

⁴⁷ *Ericsson Mobility Report*, at 22, 38, Ericsson (Nov. 2022), <https://www.ericsson.com/4ae28d/assets/-/local/reports-papers/mobility-report/documents/2022/ericsson-mobility-report-november-2022.pdf> (projecting total mobile network traffic, including fixed wireless, will reach 452 EB/month by 2028).

⁴⁸ Analysys Mason Report at 10.

⁴⁹ *Id.* at 4.

The reality is that domestic mid-band allocations today are skewed heavily against licensed wireless use: federal users have access to 12 times more mid-band spectrum than commercial users, and unlicensed spectrum in mid-band frequencies outpaces licensed more than four-to-one.⁵⁰

Verizon and other wireless providers that acquire spectrum at auction or in the secondary market are incentivized to make highly efficient use of the spectrum they hold. During the 4G decade, wireless providers invested in infrastructure that enhanced efficiency by 42-times over the beginning of the decade.⁵¹ Providers also “refarm” legacy spectrum to the extent possible to replace older technologies with advanced, more efficient services. But exponentially increasing data demands cannot be met through efficiencies or increasing site density alone. The Administration must ensure adequate licensed spectrum is available to address projected growth and foster innovation.⁵²

B. NTIA Should Identify At Least 1,500 Megahertz of Mid-Band Frequencies for Licensed, Full-Power Use.

NTIA should develop a clear spectrum roadmap for the next decade, repurposing at least 1,500 megahertz of mid-band spectrum for commercial use, which will require identifying and studying more than 1,500 megahertz of spectrum the Request proposes. Identifying bands for study and potential repurposing, with a timeline for action, will facilitate access and serve as notice to potentially affected stakeholders regarding any potential changes to the spectrum landscape.⁵³ In particular, the Administration should explore the following frequency ranges for

⁵⁰ Accenture Spectrum Report at 2.

⁵¹ *Smarter and More Efficient: How America’s Wireless Industry Maximizes Its Spectrum*, at 3, CTIA (July 9, 2019), https://api.ctia.org/wp-content/uploads/2019/07/Spectrum_Efficiency.pdf.

⁵² See Request at 16245-47 (Pillar #1, Question 1; Pillar #2, Question 1; Pillar #2, Question 2).

⁵³ *Id.* at 16246 (Pillar #1, Question 4).

licensed, full-power commercial use: the Lower 3 GHz (3.1-3.45 GHz), 7/8 GHz (7.125-8.4 GHz), and 4 GHz (4.4-4.94 GHz) bands.⁵⁴

The Lower 3 GHz band is an important near-term target for licensed, commercial wireless use that is currently under study by the Department of Defense (“DoD”) for potential repurposing, pursuant to Congressional directive.⁵⁵ This band is particularly attractive given that the world is coalescing around a harmonized band class (3GPP Band n77) for 5G in this range.⁵⁶ In fact, the 3.3-4.2 GHz range has been responsible for approximately 80 percent of worldwide 5G launches across dozens of countries.⁵⁷ The U.S. should strive to take part in this global harmonization that provides for cost savings and speedier access to 5G infrastructure and devices. Verizon supports a whole-of-government effort to repurpose some or all of the Lower 3 GHz band for licensed, full-power use.

The 7/8 GHz band is also ripe for further study. This federal-only band was previously studied by NTIA and found to be underutilized, with minimal usage in markets where government and military facilities are known to be present.⁵⁸ The Department of Commerce

⁵⁴ See *id.* at 16246 (Pillar #1, Question 3; Pillar #1, Question 9); see also Accenture Spectrum Report at 4; *Spectrum Policy Trends 2023*, at 12, GSMA (Feb. 2023) (“GSMA 2023 Spectrum Policy Report”), <https://www.gsma.com/spectrum/wp-content/uploads/2023/02/Spectrum-Policy-Trends-2023.pdf>; 5G Americas, *Mid-Band Spectrum Update* (White Paper), at 12 (Mar. 2023), <https://www.5gamericas.org/wp-content/uploads/2023/03/Mid-Band-Spectrum-Update-2023-Id.pdf>.

⁵⁵ See Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, § 90008(b)(1)(A), 135 Stat. 429, 1349 (2021).

⁵⁶ GSA, *3300-4200 MHz: A Key Frequency Band for 5G – How administrations can exploit its potential* (2020) (“GSA 3 GHz Report”), <https://gsacom.com/paper/3300-4200-mhz-a-key-frequency-band-for-5g/>.

⁵⁷ GSMA 2023 Spectrum Policy Report at 11.

⁵⁸ See Comments of CTIA, ET Docket No. 18-295 & GN Docket No. 17-183, at 15 (filed Feb. 15, 2019); see also Chriss Hammerschmidt, *Broadband Spectrum Survey in the San Diego, California Area*, NTIA Report No. TR-14-498, at 103-05, 116 (Mar. 2014), <https://its.ntia.gov/umbraco/surface/download-publication?reportNumber=TR-14-498r.pdf>; Chriss Hammerschmidt, Heather E. Ottke & J. Randy Hoffman, *Broadband Spectrum Survey in the Denver and Boulder, Colorado, Metropolitan Areas*, NTIA

previously required a review by Executive Branch agencies of the frequency assignments in this band as well as quantification of federal spectrum usage,⁵⁹ which could be leveraged for further investigation and engagement with commercial stakeholders.

The National Spectrum Strategy should also investigate the 4.4-4.94 GHz band, which is similarly licensed exclusively for federal use and provides an opportunity for a contiguous, harmonized segment to support growing wireless needs.⁶⁰

Other frequencies should continue to be studied separately from the goal of identifying 1,500 megahertz of mid-band spectrum for repurposed commercial use. For instance, the National Spectrum Strategy should explore opportunities to open upper mid-band spectrum as well. NTIA should build on the work the FCC is undertaking in the upper mid-band frequencies (e.g., 12.7-13.25 GHz) to explore additional opportunities for relocating spectrum for advanced wireless use.⁶¹

Low-band and high-band spectrum also remain important to a holistic spectrum allocation approach, particularly given the various propagation characteristics that will be needed to support continued 5G and future 6G deployments. Such frequencies should continue to be investigated for licensed commercial allocations.

Report No. TR-13-496, at 113-18, 129 (Mar. 2014), <https://its.ntia.gov/umbraco/surface/download/-publication?reportNumber=TR-13-496r.pdf>.

⁵⁹ See Memorandum from Diane Rinaldo, Assistant Secretary of Commerce for Communications and Information (Acting), to Executive Branch Departments and Agencies (Aug. 1, 2019), <https://ntia.gov/-other-publication/review-current-frequency-assignments-and-quantification-spectrum-usage> (requiring affected agencies to review their assignments in the 7.125-8.4 GHz band within nine months and to quantify their use).

⁶⁰ See Accenture Spectrum Report at 36.

⁶¹ See *Expanding Use of the 12.7-13.25 GHz Band for Mobile Broadband or Other Expanded Use*, Notice of Inquiry and Order, FCC 22-80 (rel. Oct. 28, 2022).

In making spectrum available for commercial licensed use, the National Spectrum Strategy should promote flexible-use operations that enable providers to evolve the spectrum to support changing needs.⁶² Standard-power deployments are especially essential to reducing deployment costs and providing coverage to broader geographic areas.⁶³ Large geographic license areas, like those generally found in other countries, similarly support deployment at scale. Finally, large, contiguous blocks of spectrum remain important to meeting latency and capacity needs, and the National Spectrum Strategy should prioritize 100-megahertz channel blocks and, where possible, auctions that yield contiguous spectrum for bidders through assignment phases.⁶⁴

C. Harmonization Should be Prioritized Where Possible to Encourage Economies of Scale that Benefit the U.S. Economy and National Security.

The risk to our economic and national security of implementing a spectrum regime that is detached from global trends is real, as demonstrated by prior technology transitions. Lack of a harmonized and effective wireless governance framework has been attributed as one of the causes for Europe losing its substantial leadership between the 3G and 4G wireless generations, where the continent went from having a reported 80 percent of the mobile equipment market in 2008 to losing nearly all market share.⁶⁵ As China takes aggressive steps to deploy 5G and align other nations to its spectrum allocation plans, “the United States should show its allies and

⁶² See Request at 16245 (Pillar #1, Question 1).

⁶³ See, e.g., *CBRS: An Unproven Spectrum Sharing Framework*, at 7-8, Recon Analytics (Nov. 14, 2022) (“Recon Analytics CBRS Report”), <https://api.ctia.org/wp-content/uploads/2022/11/CBRS-Recon-Analytics.pdf>; see also 47 C.F.R. § 27.50.

⁶⁴ See, e.g., *5G Spectrum: GSMA Public Policy Position*, at 5, GSMA (June 2022), <https://www.gsma.com/spectrum/wp-content/uploads/2022/06/5G-Spectrum-Positions.pdf>.

⁶⁵ See *How America’s 4G Leadership Propelled the U.S. Economy*, at 15, Recon Analytics (Apr. 16, 2018), https://api.ctia.org/wp-content/uploads/2018/04/Recon-Analytics_How-Americas-4G-Leadership-Propelled-US-Economy_2018.pdf. Similarly, Japan tethered its 4G future to nation-specific technologies, leaving the U.S. with a critical advantage as the home of operating systems and devices that revolutionized the global market. *Id.*

partners—including in Europe—the path to 5G leadership, drawing on lessons learned from Europe’s stumbles.”⁶⁶

Making harmonized spectrum bands available domestically for licensed, full-power commercial use enables economies of scale that benefit the U.S. market while also promoting U.S. leadership in the global equipment market.⁶⁷ In contrast, pursuing novel or unique spectrum bands and policies isolates the U.S. wireless marketplace, increasing costs for unique network equipment and devices while positioning other – potentially rival – nations to advance their technology leadership in countries with aligned spectrum allocations and frameworks. Harmonization in spectrum policy and allocations is thus important to the Administration’s goal of fostering a trusted supply chain at home and abroad⁶⁸ and reinforcing vendor diversity through an open, interoperable, and standards-based networks.⁶⁹

As discussed, the 3 GHz band creates an opportunity for harmonized use given that dozens of nations have made licensed spectrum in this range available for 5G.⁷⁰ The Lower 3 GHz provides an opportunity to make up for the licensed mid-band deficit by adding additional Band n77 spectrum for full-power, licensed use.

The 6 GHz band is a further case study on the effects of failing to leverage harmonization in our domestic interest. In the U.S., the FCC dedicated this entire 1,200-megahertz swath for

⁶⁶ CSIS Report at 5.

⁶⁷ See, e.g., GSA 3 GHz Report at 5 (discussing the benefits of international harmonization, including “a broader ecosystem for technology, equipment, and engineering expertise, leading to economies of scale, lower costs for deployment, and more rapid roll-out of new services”).

⁶⁸ See Request at 16246 (Pillar #1, Question 4).

⁶⁹ See NTIA, *Public Wireless Supply Chain Innovation Fund Grant Program – Expanding Testing and Evaluation*, Notice of Funding Opportunity (Apr. 12, 2023), https://www.ntia.doc.gov/sites/default/files/publications/pwscif_final_nofo.pdf.

⁷⁰ See, *supra*, Section III.B.

unlicensed use. Meanwhile, China is spearheading international efforts to dedicate some or all of the band for licensed wireless deployments in the next five years, positioning itself to promote and subsidize deployment and equipment in this band.⁷¹ Numerous countries are exploring a mix of both licensed and unlicensed allocations in this broad frequency range, thereby widening the potential equipment market.⁷² By making the band wholly available for unlicensed use, our domestic policies have enlarged the disparity in licensed mid-band allocations and sidelined American businesses from participating in the global licensed 6 GHz IMT marketplace.

The Administration is properly focused on our nation's economic and national security, and harmonized spectrum is a key component of both. With a focus on promoting leadership in harmonized frequencies and licensing models, the National Spectrum Strategy will help advance sound spectrum policy and other top Administration priorities.

IV. THE NATIONAL SPECTRUM STRATEGY SHOULD PRIORITIZE LICENSED SPECTRUM FOR COMMERCIAL USE AND, WHERE SHARING IS THE ONLY OPTION FOR REPURPOSING, CERTAINTY OF ACCESS.

A. Certainty of Access is a Top Priority for Spectrum to Advance Administration Economic and National Security Goals.

As discussed above, licensed, full-power spectrum fosters investment and innovation in commercial wireless networks and should remain the priority as we look to wireless networks to support the Administration's broad economic, policy, and security objectives. Licensed

⁷¹ See *id.* at 11; CSIS Report at 9; Robert D. Atkinson, *How China's Mercantilist Policies Have Undermined Global Innovation in the Telecom Equipment Industry*, Information Technology & Innovation Foundation (June 22, 2020), <https://itif.org/publications/2020/06/22/how-chinas-mercantilist-policies-have-undermined-global-innovation-telecom/>.

⁷² See, e.g., *Update on the upper 6 GHz band*, Ofcom (Dec. 6, 2022), https://www.ofcom.org.uk/_data/-assets/pdf_file/0028/248770/update-on-upper-6hz-band.pdf.

spectrum provides assured access that encourages massive investment and ensures service quality for users.

Given the varying demands on spectrum resources today and anticipated future growth, federal/commercial sharing may have a role to play in spectrum management decisions moving forward. To the extent the Administration considers opportunities for shared access to spectrum, it should prioritize targeted and predictable sharing regimes that ensure licensees and spectrum users have certainty as to their access rights and obligations. This can be best achieved through static sharing models that have proven effective and workable in past federal/commercial sharing efforts and which create more certainty for all affected stakeholders. The National Spectrum Strategy should fully recognize the benefits of these approaches, including where incumbent federal systems may be subject to planned relocation or expected technology retirement, and should ensure that research and development projects account for investigation of static sharing access approaches.⁷³

B. NTIA Correctly Defines Sharing to Include Proven Sharing Mechanisms.

Verizon supports the Request's proposal to define sharing to include static models across geographies, frequencies, and time, and the Request's position that effective sharing may require incumbents to vacate, compress, or repack some portion of their systems.⁷⁴ This definition appropriately reflects the proven, ongoing sharing frameworks utilized in numerous bands that have been made available for commercial use over the last decade through some relocation or repacking, including the AWS-3 and 3.45 GHz bands. In each of those instances, a sharing framework was developed among the FCC and NTIA, with coordination with affected agencies

⁷³ See Request at 16246 (Pillar #1, Question 6).

⁷⁴ See *id.* at 16246-47 (Pillar #1, Question 6; Pillar #1, Question 7; Pillar #3, Question 1).

and commercial stakeholders, to protect federal missions while providing sufficient certainty for commercial entities to participate in the associated spectrum auctions.⁷⁵

Targeted static sharing mechanisms like geographic or temporal sharing can be appropriate and workable where incumbent operations are contained or limited in time or if relocation would cause significant delays in commercial access to the desired spectrum. The FCC, NTIA, DoD, and commercial wireless industry have demonstrated that spectrum can be shared in win-win solutions that make available wide-area, full-power licenses for next-generation wireless services while protecting federal missions in a shared band, and the National Spectrum Strategy should reflect the benefits of this approach.

C. Dynamic Sharing Models are Ill-Suited for Broadband Deployment at Scale.

Verizon is uniquely positioned to comment on the impact of dynamic sharing frameworks on commercial broadband deployment⁷⁶ given our use of the CBRS band. In brief, dynamic sharing models such as CBRS are better viewed as opportunities to augment capacity and coverage in limited geographical areas rather than as a playbook for successful nationwide deployments at scale given the limitations associated with channel availability, reliability, and decreased power levels.

Verizon deploys CBRS service utilizing both the Priority Access License and General Authorized Access (“GAA”) tiers.⁷⁷ For both types of deployments, the technical rules only

⁷⁵ See, e.g., C. Todd Lopez, *AMBIT Gambit Pays Off, Advances U.S. 5G Efforts*, DoD (Aug. 10, 2020), <https://www.defense.gov/News/News-Stories/Article/Article/2306902/ambit-gambit-pays-off-advances-us-5g-efforts/>; Lawrence E. Strickling & Alexander Macgillivray, *AWS-3 Auction Highlights New Approach to Spectrum Policy*, NTIA (Jan. 29, 2015), <https://ntia.gov/blog/aws-3-auction-highlights-new-approach-spectrum-policy>.

⁷⁶ See Request at 16246 (Pillar #1, Question 7).

⁷⁷ See Press Release, Verizon, *Verizon to expand 5G Ultra Wideband availability using CBRS spectrum* (June 14, 2022), <https://www.verizon.com/about/news/verizon-5g-ultra-wideband-availability-cbrs->

allow low-power use, which restricts deployments at scale, and in any event the service is preemptible.⁷⁸ Further, service may be disrupted if the Spectrum Access System (“SAS”) or Environmental Sensing Capability network goes down or the governing SAS loses connectivity or becomes congested. These effects add unpredictability to the quality of service offered and increases costs to operators and consumers. The sharing model and the customized tools it requires have also proven challenging to manage, particularly given the regular operational updates that are needed for base station products and the myriad ad hoc workarounds that are being utilized to accommodate GAA grants.

As a result, Verizon and others have leveraged CBRS to augment capacity where and when it is available but are not deploying CBRS for primary coverage at scale. Mobile Virtual Network Operators use CBRS to offload traffic from the network of their underlying wireless provider in localized pockets of dense use, and they otherwise rely on their underlying provider for the wide-area wireless connectivity their subscribers rely on. Verizon believes that dynamic spectrum sharing has potential for localized and enterprise uses, but to date, it only allows for low-power, preemptible service and does not enable the assured access and wide-area capability that is fundamental to full-fledged wireless service.

D. Commercial Providers Can Support Federal Users’ Domestic Needs.

In considering what policies might encourage sharing arrangements among federal and commercial users, NTIA should bear in mind that wireless innovations and technologies have

[spectrum](#) (“Verizon and its vendors are ready to support 5G on both shared and Priority Access License (PAL) CBRS spectrum, which will supplement Verizon’s current deployment of 5G service over C-band and mmWave spectrum.”).

⁷⁸ See, e.g., Recon Analytics CBRS Report at 8; see also Verizon White Paper Response to Request for Information for Next Generation Electromagnetic Spectrum Strategic Roadmap, Notice ID 632369514, at 7-8 (filed Feb. 17, 2023) (“Verizon DoD RFI Comments”).

dual-use benefits that aid the U.S. military as well.⁷⁹ Federal users can and do gain access to next-generation commercial technologies and the networks they ride on through secondary market arrangements that can support federal missions. Verizon engages in such arrangements with federal partners today, including through test beds and living labs that bring secure, low-latency connectivity to support our national defense.⁸⁰ Technology innovations such as network slicing and virtualization, mobile edge computing, and private cellular network capabilities – coupled with the certainty and security of licensed airwaves – make such partnerships relevant for federal users.⁸¹ To date, DoD has invested in 5G experimental testbeds at more than 12 military sites across the country, with these prototyping efforts demonstrating the feasibility, utility, affordability, and scalability of 5G technologies in support of federal modernization objectives.⁸²

V. THE NATIONAL SPECTRUM STRATEGY SHOULD ENCOURAGE ENHANCED COLLABORATION AND TRANSPARENCY WITH NTIA AS THE VOICE ON BEHALF OF THE EXECUTIVE BRANCH.

A. NTIA is Correctly Charged with Managing Federal Agency Use of Spectrum and Coordinating with the FCC on Behalf of Other Federal Agencies.

In the Request, NTIA asks whether changes to the government’s spectrum management processes are necessary to promote ongoing dialogue between and among federal and

⁷⁹ See Request at 16246 (Pillar #1, Question 8).

⁸⁰ See, e.g., Press Release, Verizon, *U.S. Dept. of Defense awards Verizon nearly \$1 billion in new business* (Mar. 16, 2022), <https://www.verizon.com/about/news/us-dept-defense-awards-verizon-nearly-1-billion-new-business>; *5G and technological innovation help the Department of Defense explore new frontiers*, Verizon (Sept. 2021), <https://www.govexec.com/media/how-5g-and-tech-innovations-are-helping-the-dod.pdf>; *Anatomy of a 5G Smart Base*, Federal News Network (Sept. 2021), <https://federal-newsnetwork.com/wp-content/uploads/2021/09/Anatomy-of-a-Smart-Base-FNN-Verizon-eBook.pdf>.

⁸¹ See Verizon DoD RFI Comments at 8-9.

⁸² See generally DoD, *Advancing 5G Communications for America’s Warfighters*, <https://www.cto.mil/5g/about/> (last visited Apr. 5, 2023); see also Verizon DoD RFI Comments at 8-9.

commercial users.⁸³ NTIA's federal spectrum management role is essential to ensuring that the Administration's goals are achieved, as it is well positioned to balance the interests of federal spectrum users, their missions, and their existing systems when considering repurposing bands to advance U.S. economic and national security interests.

When the Administration is speaking with one voice through NTIA, there is clarity and finality in federal interests and direction. Other spectrum users then have more certainty in access rights as well and are better positioned when making investment decisions. Federal agencies likewise have finality as to the government's position in spectrum allocation and policy, thereby dissuading agencies from relitigating allocation and auction decisions. The National Spectrum Strategy should underscore that the current system for repurposing federal spectrum, led by NTIA and the FCC as Congress mandated, is successful.

B. Collaboration and Transparency Can Facilitate More Productive Discussions, Including as Related to Development of the Incumbent Informing Capability.

NTIA is also seeking input on whether and how to improve trust and transparency between and among federal and commercial users.⁸⁴ To effectively engage in discussions on spectrum repurposing, commercial operators must have visibility into the federal operating environment and the capabilities (not just operating parameters) of federal systems. Likewise, to properly evaluate any spectrum band under discussion for commercial use, operators must also have sufficient information on possible technical parameters to assess varying spectrum access frameworks. In this way, industry is better able to collaborate on a spectrum access model that incentivizes investment and ensures federal missions are protected.

⁸³ See Request at 16246-47 (Pillar #1, Question 5; Pillar #2, Question 3).

⁸⁴ See *id.* at 16247 (Pillar #2, Question 5).

Such conversations require transparency and collaboration by all stakeholders, and this objective should be prioritized in developing the National Spectrum Strategy, as well as in the development of the Incumbent Informing Capability (“IIC”). As described by NTIA, the IIC is intended as a “mechanism for more reliably informing ‘new entrants’ in a shared spectrum band when incumbent federal systems are operating in close proximity and thus need to be protected.”⁸⁵ NTIA is an appropriate administrator for organizing such information and is well positioned to work with federal agencies, including DoD, to ensure that the IIC serves as a central mechanism for facilitating productive dialogue around efficient spectrum use.⁸⁶

C. The Spectrum Relocation Fund is a Valuable Tool for Repurposing and Verizon Supports Enhancements to Benefit Federal Spectrum Users.

Verizon has long supported the Spectrum Relocation Fund (“SRF”), which uses proceeds from FCC spectrum auctions to reimburse federal agencies for the costs they incur in repurposing spectrum, including for state-of-the-art replacement systems that enable increased functionality and more efficient spectrum use.⁸⁷ Among other things, the SRF serves as a centralized way for federal agencies to defray the costs of relocating or upgrading to alternative technologies while providing greater certainty for federal and commercial stakeholders alike.⁸⁸

Verizon supports changes to the Commercial Spectrum Enhancement Act (“CSEA”) that would make the SRF an even more effective tool for federal users that engage in relocation and

⁸⁵ Michael DiFrancisco et al., *Incumbent Informing Capability (IIC) for Time-Based Spectrum Sharing*, at 1, NTIA (Feb. 22, 2021), <https://www.ntia.gov/report/2021/ntia-report-incumbent-informing-capability-iic-time-based-spectrum-sharing>.

⁸⁶ See Request at 16247 (Pillar #3, Question 4).

⁸⁷ See 47 U.S.C. §§ 923(g)(3)(B), 928.

⁸⁸ See, e.g., *Repurposing Government Spectrum for Licensed Commercial Use: A Win-Win for Wireless Providers and Federal Agencies*, CTIA (Aug. 2020), https://api.ctia.org/wp-content/uploads/2020/08/-Win-win_8-06.pdf.

sharing with commercial systems.⁸⁹ For example, consistent with suggestions made by FCC Chairwoman Rosenworcel, Congress should “ensure that a full range of costs are covered to provide federal agencies adequate incentives and assistance, including up-front planning, technology development, and staffing to support the relocation effort.”⁹⁰ If implemented appropriately, such changes would promote the proven sharing techniques that support both commercial and federal interests, benefitting America’s economic and national security interests.

VI. CONCLUSION.

Repurposing spectrum for licensed, full-power wireless broadband is vital to support the Administration’s economic, policy, and national security objectives. Verizon urges NTIA to develop and implement a National Spectrum Strategy that identifies specific frequencies for this use and prioritizes certainty of access, to the benefit of investment, innovation, and consumers.

Respectfully submitted,

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⁸⁹ See Request at 16246 (Pillar #1, Question 8).

⁹⁰ See Letter from Jessica Rosenworcel, Chairwoman, FCC, to Bob Latta, Ranking Member, Subcommittee on Communications and Technology, U.S. House of Representatives, at 4 (Mar. 30, 2022), <https://docs.fcc.gov/public/attachments/DOC-382219A1.pdf>; see also Verizon DoD RFI Comments at 14.