Before the
UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, D.C. 20230

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

COMMENTS OF CTIA

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CTIA[1] submits the following comments in response to the Request for Comments issued by the National Telecommunications and Information Administration ("NTIA") on the Presidential Memorandum, *Developing a Sustainable Spectrum Strategy for America's Future*.[2]

I. INTRODUCTION AND SUMMARY.

CTIA commends the Trump Administration for issuing the Presidential Memorandum and advancing a comprehensive National Spectrum Strategy ("Strategy"), and we applaud NTIA for seeking input on this critically important national strategy. We welcome the opportunity to address how smart policies, including making available substantial additional spectrum, will unlock the enormous promise of 5G and spur U.S. global technological leadership – to the

[1] CTIA® (www.ctia.org) represents the U.S. wireless communications industry and the companies throughout the mobile ecosystem that enable Americans to lead a 21st- century connected life. The association's members include wireless carriers, device manufacturers, suppliers as well as apps and content companies. CTIA vigorously advocates at all levels of government for policies that foster continued wireless innovation and investment. The association also coordinates the industry's voluntary best practices, hosts educational events that promote the wireless industry, and co-produces the industry's leading wireless tradeshow. CTIA was founded in 1984 and is based in Washington, D.C.

[2] *Developing a Sustainable Spectrum Strategy for America's Future*, NTIA, Request for Comments, Docket No. 181130999-8999-01 (Dec. 20, 2018) ("Request"); Presidential Memorandum on Developing a Sustainable Spectrum Strategy for America's Future, Sect. 1 (issued Oct. 25, 2018), https://www.whitehouse.gov/presidential-actions/presidential-memorandum-developing-sustainable-spectrum-strategy-americas-future/ ("Presidential Memorandum").

immense benefit of U.S. consumers, businesses, and the national economy. As NTIA Administrator and Assistant Secretary David Redl has observed:

> The next generation of wireless connectivity is poised to unlock fantastic innovations and life-changing technologies, and America has been leading the way when it comes to developing 5G. We must do everything we can this year and beyond to accelerate America's 5G leadership.[3]

CTIA and its members are eager to work with the Administration, the Federal Communications Commission ("FCC"), Congress, and all commercial and government stakeholders to extend U.S. global leadership in wireless to the age of 5G. If we get 5G policy right, the United States will continue to lead the world in wireless, thereby strengthening our economy and our global competitiveness.

Fundamental to the Strategy should be the U.S. Government's commitment to deliver substantial additional terrestrial spectrum for 5G, and on a clearly defined schedule. History has shown that, where sufficient spectrum is available for wireless service, the private sector will invest billions of dollars to convert that raw material into innovative products and services that help consumers, create jobs, and grow the economy – and that opportunity will be even more profound with 5G. Yet today, terrestrial, flexible-use spectrum available for mobile wireless use is comprised of less than 6.5 gigahertz; by comparison, fixed (non-flexible use) allocations amount to nearly 23 gigahertz[4] and satellite allocations cover nearly 30 gigahertz.[5]

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[3] Remarks of David J. Redl, Assistant Secretary of Commerce for Communications and Information, CES 2018, Las Vegas, Nevada (Jan. 9, 2018), https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-ces-2018.

[4] This 23 gigahertz is the amount of spectrum between 900 MHz and 95 GHz that has a primary allocation for fixed use but not a primary mobile allocation.

[5] This 30 gigahertz is the amount of spectrum between 3.7 GHz and 86 GHz that has a primary allocation for Fixed-Satellite or Broadcast-Satellite service.

The Strategy should adopt a number of spectrum management principles, including the following:

- A top priority should be identifying and making available low-, mid-, and high-band spectrum for exclusive, licensed terrestrial use – more specifically, the U.S Government should make available hundreds of megahertz of mid-band spectrum and thousands of megahertz of high-band spectrum for terrestrial wireless use in the near term – and licensees should be able to provide fixed, mobile, or both types of service.
- The Administration should develop and execute on a five-year action plan for FCC auctions of identified spectrum bands, and the Strategy should outline a process, consistent with the principles herein, to prepare for the next 10-15 years of wireless developments while also retaining flexibility to account for continued innovations.
- Although the focus should remain on spectrum reallocation, in some instances a sharing regime will be the best means to repurpose spectrum, and to be effective, sharing rules should provide licensees with sufficient rights to warrant the investments needed to support advanced services.
- While unlicensed spectrum plays – and will continue to play – a key part in meeting consumer demand, the Government should appropriately balance the allocation of licensed and unlicensed operations and ensure that any unlicensed spectrum regimes are technologically neutral and available for Wi-Fi, LTE-Unlicensed ("LTE-U"), Licensed Assisted Access ("LAA"), and all unlicensed technologies.
- In international fora, U.S. policy should support harmonization in key 5G bands, while maintaining flexibility in the ITU Radio Regulations when possible.
- The Strategy should promote transparency and collaboration between Federal agencies and the commercial sector and should support use of the Spectrum Relocation Fund ("SRF") for exploring technology advancements that could facilitate the transition of Federal spectrum for commercial use.

Finally, the Strategy must be vested with a sense of urgency. Many nations are vying to lead on 5G, and the United States cannot wait.

II. U.S. LEADERSHIP IN 5G IS CRITICAL TO AMERICA'S FUTURE.

The benefits of 5G leadership are profound, and CTIA commends the Administration for the unequivocal statement in the Presidential Memorandum that "it is imperative that America be first in fifth-generation (5G) wireless technologies."[6]

[6] Presidential Memorandum at Sect. 1.

Technologically, 5G will offer speeds up to 100 times faster than today's services, enable 100 times the number of devices, and will be five times more responsive than today's networks.[7] And as the Presidential Memorandum recognizes, with these advancements, "wireless technologies … can unleash innovation broadly across diverse sectors of the economy and the public sector."[8] 5G will drive transformational improvements in day-to-day life and will support many industries such as agriculture, education, and transportation. It will drive new telehealth and telemedicine applications that can bring state-of-the-art medical care to consumers with limited access to medical services, and it will create smart industries of the future, including smart communities, precision agriculture, and the Internet of Things ("IoT"). For these reasons and more, 5G leadership is critical to "our economic, national security, science, safety, and other Federal mission goals now and in the future."[9]

With the right policies in place, the private sector, driven by American ingenuity, will invest billions of dollars in the networks, applications, and services to drive the 5G economy. U.S. wireless providers are expected to invest approximately $275 billion in 5G-related networks according to Accenture – creating three million new jobs and adding $500 billion to our economy.[10] If we get the Strategy – and 5G spectrum policy – right, the United States can maintain its edge in innovation, as 5G enables new technologies, from Artificial Intelligence to Augmented Reality. 5G will play a key role in the development of the Fourth Industrial

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[7] *The Race to 5G*, CTIA, https://www.ctia.org/the-wireless-industry/the-race-to-5g (last visited Jan. 22, 2019).

[8] Presidential Memorandum at Sect. 1.

[9] *Id*.

[10] *How 5G Can Help Municipalities Become Vibrant Smart Cities*, ACCENTURE STRATEGY (Jan. 12, 2017), https://www.accenture.com/t20170222T202102__w__/us-en/_acnmedia/PDF-43/Accenture-5G-Municipalities-Become-Smart-Cities.pdf.

Revolution, envisioned as an economy increasingly built on the connectivity of people and things.[11]

III. FORWARD-LOOKING ADMINSTRATION, CONGRESSIONAL, AND FCC SPECTRUM POLICIES ARE ESSENTIAL TO U.S. 5G LEADERSHIP.

A. Policymakers Have a Vital Role to Play in Fostering U.S. 5G Leadership.

The Administration, Congress, and the FCC must work together to ensure that U.S. spectrum policy advances U.S. 5G leadership. As Assistant Secretary Redl has observed, "4G helped create hundreds of thousands of U.S. jobs and a booming market for American hardware and software. … [And] the best path to ensuring America's 5G leadership is the entire government working in a coordinated fashion to support the industry's 5G push."[12] The era of 5G is rapidly unfolding, and the marketplace is primed to unleash investment and innovation. But U.S. Government leadership – in the form of repurposing spectrum for 5G, especially mid-band spectrum – is a linchpin.

The Administration has wisely called for a comprehensive national strategy for managing spectrum resources. As NTIA has observed: "[t]his strategy will help ensure America's national and economic security and fortify our continued leadership in wireless communications

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[11] *See, e.g.*, Sean Harrington, *Powering the Fourth Industrial Revolution with 5G*, VERIZON (Dec. 13, 2018), https://www.verizon.com/about/our-company/fourth-industrial-revolution/powering-fourth-industrial-revolution-5g; Arjun Kharpal, *5G internet is the 'beginning of the fourth industrial revolution', CEO of $23 billion telecoms firm says*, CNBC (Jan. 19, 2017), https://www.cnbc.com/2017/01/19/5g-internet-is-the-beginning-of-the-fourth-industrial-revolution-telecoms-ceo.html; Nokia Webinar, Industry applications – 5G as an enabler of the fourth industrial revolution (Sept. 18, 2018), https://pages.nokia.com/T0028V.Industry.Applications.5G.as.an.Enabler.of.the.Fourth.Industrial.Revolution.html.

[12] Remarks of David J. Redl, Assistant Secretary of Commerce for Communications and Information, CTIA's Race to 5G Summit, Washington, D.C. (Apr. 19, 2018), https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-ctias-race-5g-summit ("Redl Race to 5G Summit Remarks").

technologies."[13] While past Administrations have used spectrum policy as a tool to facilitate U.S. wireless leadership,[14] we are at a critical time as we enter the era of 5G and the Trump Administration can take action to ensure there is sufficient spectrum to fuel private investment and U.S. leadership.

Congress, the FCC, and NTIA have all taken important steps to make available high-band spectrum, to evaluate mid-band spectrum for potential reallocation, and to modernize siting policies. Congress has enacted several important pieces of legislation in recent years, including the Spectrum Pipeline Act of 2015 – which requires NTIA to work toward identifying spectrum below 3 GHz for reallocation from Federal to non-Federal or shared use and between 6 GHz and 57 GHz for shared licensed and unlicensed use[15] – and the MOBILE NOW Act, which, as part of RAY BAUM's Act, requires that NTIA and the FCC identify 100 megahertz of spectrum below 6 GHz for exclusive, licensed use and another 55 megahertz below 8 GHz for licensed or unlicensed use.[16] The FCC, under Chairman Ajit Pai, is pursuing a comprehensive strategy to "Facilitate America's Superiority in 5G Technology" – the 5G FAST Plan – which is taking action to make additional spectrum available for 5G and updating infrastructure policies to foster

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[13] David Redl, *The President's National Spectrum Strategy Will Give America a Boost in 5G*, NTIA BLOG (Oct. 25, 2018), https://www.ntia.doc.gov/blog/2018/president-s-national-spectrum-strategy-will-give-america-boost-5g.

[14] *See* Presidential Memorandum – Expanding America's Leadership in Wireless Innovation, 78 Fed. Reg. 37431 (June 14, 2013), https://obamawhitehouse.archives.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovatio; *see also* Presidential Memorandum: Unleashing the Wireless Broadband Revolution, 75 Fed. Reg. 38385 (June 28, 2010), https://obamawhitehouse.archives.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution.

[15] Spectrum Pipeline Act of 2015, Pub. L. No. 114-74, 129 Stat. 621, 625 (2015), as amended by the RAY BAUM'S Act of 2018, Pub. L. 115–141, § 614, 132 Stat. 1080, 1109 (2018).

[16] MOBILE NOW Act as incorporated in the Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, 132 Stat. 348, Division P, Title VI, § 603(a) (2018).

more private sector investment in 5G networks.[17] And, in addition to the above joint efforts with the FCC, NTIA is studying the 3450-3550 MHz band for repurposing, and worked to develop the standards for testing and certification in the 3.5 GHz Citizen Broadband Radio Service ("CBRS") band.[18] The Strategy can frame these efforts and more by establishing a clear and ongoing path for the U.S. in 5G.

B. The United States is Well Positioned to Lead in 5G if We Act Fast and Put the Right Spectrum Policies in Place.

Starting last fall, U.S. wireless carriers launched 5G and began aggressive deployment schedules. Verizon introduced 5G fixed wireless broadband, beginning with four markets in 2018 and adding more in 2019, and plans to offer mobile 5G in 2019.[19] AT&T launched mobile 5G for hotspot communications in 12 cities in 2018, intends to launch in seven more cities in the first half of 2019, and plans to have nationwide 5G coverage available on its sub-6 GHz spectrum in early 2020.[20] Sprint plans to launch mobile 5G in nine of the largest cities in the first half of 2019,[21] and announced plans for an innovative, standards-based 5G smartphone from

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[17] *The FCC's 5G Fast Plan*, FCC (rel. Sept. 28, 2018), https://www.fcc.gov/document/fccs-5g-fast-plan.

[18] *See* Remarks of David J. Redl, Assistant Secretary for Communications and Information, Mobile World Congress Americas, Los Angeles, California (Sept. 12, 2018), https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-mobile-world-congress-americas.

[19] Press Release, Verizon turns on world's first 5G network, Verizon (Oct. 1, 2018), https://www.verizon.com/about/news/verizon-turns-worlds-first-5g-network; *see also* Sascha Segan, *Verizon CES Keynote Light on 5G Rollout Details, Big on Promises*, PC MAG (Jan. 8, 2019), https://www.pcmag.com/news/365858/verizon-ces-keynote-light-on-5g-rollout-details-big-on-prom.

[20] Press Release, AT&T First to Make Mobile 5G Service Live in the U.S. on Dec. 21, AT&T (Dec. 18, 2018), https://about.att.com/story/2018/att_brings_5g_service_to_us.html; *see also* Press Release, First in the U.S. to Mobile 5G – What's Next? Defining AT&T's Network Path in 2019 and Beyond, AT&T (Jan. 9, 2019), https://about.att.com/story/2019/2019_and_beyond.html.

[21] Press Release, Sprint and HTC Announce Innovative 5G Mobile Smart Hub Coming in First Half of 2019, Sprint (Nov. 27, 2018), https://newsroom.sprint.com/sprint-and-htc-announce-innovative-5g-mobile-smart-hub-coming-in-first-half-2019.htm.

Samsung that is expected to launch in summer 2019.[22] T-Mobile has introduced Extended Range LTE in 36 states, deploying 5G equipment in 30 cities, and paving the way for its nationwide 5G network by 2020.[23]

Network and technology companies are investing aggressively to ensure that network equipment, handsets, and devices are ready for American innovators and consumers to leverage the power of the new 5G platform. For example, Ericsson opened a manufacturing facility in Texas and is now producing 5G radios in the U.S.[24] Qualcomm announced earlier this month that it is expecting the release of more than 30 5G-capable devices this year, with most of them being smartphones,[25] while Intel has plans to expand into key markets including chips for wireless communications, artificial intelligence, and autonomous driving.[26] Cisco is working with carriers on virtualized packet core buildout using distributed software defined network architecture.[27] Samsung is expected to roll out 5G-capable handsets on nationwide carrier

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[22] Press Release, Sprint Planning to Debut 5G Smartphone from Samsung in Summer 2019, Sprint (Jan. 7, 2019), http://investors.sprint.com/news-and-events/press-releases/press-release-details/2019/Sprint-Planning-to-Debut-5G-Smartphone-from-Samsung-in-Summer-2019/default.aspx.

[23] Press Release, T-Mobile 600 MHz Extended Range LTE Now Live in More Than 1,250 Cities & Towns, Laying the Foundation for 5G, T-Mobile (Sept. 10, 2018), https://www.t-mobile.com/news/600-mhz-update-puerto-rico*; see also* Mike Dano, *T-Mobile Quietly Confirms 5G Network in 30 Cities*, LIGHT READING (Jan. 14, 2019), https://www.lightreading.com/mobile/5g/t-mobile-quietly-confirms-5g-network-in-30-cities/d/d-id/748791.

[24] Press Release, Ericsson increasing US investments to support accelerated 5G deployments, Ericsson (Aug. 10, 2018), https://mb.cision.com/Main/15448/2589865/889576.pdf.

[25] Jeremy Horwitz, *Qualcomm: Expect over 30 5G devices in 2019, 'the year of 5G'*, VENTURE BEAT (Jan. 7, 2019), https://venturebeat.com/2019/01/07/qualcomm-expect-over-30-5g-devices-in-2019-the-year-of-5g/.

[26] *See, e.g.*, Patrick Seitz, *Intel Broadens Product Lineup With 5G Wireless, Baseband Chips*, INVESTORS BUSINESS DAILY (Jan. 8, 2019), https://www.investors.com/news/technology/intel-5g-baseband-chips-ces-2019/.

[27] *See* News Release, T-Mobile Launches World's Largest Virtual Packet Core with Cisco in Preparation for 5G, Cisco (Sept. 12, 2018), https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1943598. *See also* Cisco, See how Verizon's 5G pilot services will

networks this year.[28] And Nokia is working closely with T-Mobile and AT&T as a 5G supplier, and also recently completed the world's first 5G data call across 2.5 GHz spectrum in partnership with Sprint and Qualcomm.[29]

IV. U.S. LEADERSHIP IN 5G WILL REQUIRE A MASSIVE, ONGOING, AND PREDICTABLE NATIONAL INITIATIVE TO DELIVER MORE TERRESTRIAL, FLEXIBLE-USE SPECTRUM FOR 5G.

A. There is an Urgent Need for More Spectrum to Meet Consumer Demand and Fuel 5G Innovation and Investment.

Sufficient bandwidth is crucial to allow for faster speeds and greater capacity to deliver data for the bit-hungry applications and use cases expected for 5G. Current demand projections for wireless broadband usage and 5G in particular are enormous and demonstrate the need for additional terrestrial, flexible-use spectrum for 5G. In North America, mobile data traffic is expected to increase nearly fivefold between 2017 and 2022, at a compound annual growth rate of 36 percent, reaching 5.8 exabytes per month by 2022.[30] This increase is nearly double that of projected fixed internet growth in North America, which is projected to increase at a compound

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foster enterprise innovation, https://www.cisco.com/c/m/en_us/network-intelligence/service-provider/digital-transformation/verizon-pilots-5g.html (last visited Jan. 22, 2019).

[28] *See, e.g.*, Jessica Dolcourt, *Samsung brought a 5G prototype phone to CES 2019*, CNET (Jan. 10, 2019), https://www.cnet.com/news/samsung-brought-5g-prototype-phone-to-ces-2019/; Jon Porter, *Sprint will carry one of Samsung's 5G phones*, THE VERGE (Jan. 7, 2019), https://www.theverge.com/2019/1/7/18172109/sprint-samsung-5g-massive-mimo; Sascha Segan, *T-Mobile Confirms Samsung 5G Phone*, PC MAG (Dec. 20, 2018), https://www.pcmag.com/news/365578/t-mobile-confirms-samsung-5g-phone.

[29] *See* Corinne Reichert, *Sprint rounds out CES 2019 with 5G call*, ZDNET (Jan. 11, 2019), https://www.zdnet.com/article/sprint-rounds-out-ces-2019-with-5g-call/; *see also* Nokia Corporation, Q3 2018 Earnings Conference Call Transcript, The Motley Fool (Oct. 25, 2018), https://www.fool.com/earnings/call-transcripts/2018/10/25/nokia-corporation-nok-q3-2018-earnings-conference.aspx;

[30] *Cisco Visual Networking Index: Forecast and Trends, 2017–2022*, CISCO (Nov. 26, 2018), https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white-paper-c11-741490.html.

annual growth rate of 21 percent during the same period of time.[31] By the end of 2024, average data consumption per smartphone in North America is expected to be approximately 50 gigabytes per month, nearly six times the amount of data consumed per month in 2018.[32] More spectrum is an integral element to addressing this need.

These trends will only continue as 5G exponentially expands IoT. 5G will be able to support massive connection density, possibly on the order of 100 times greater than 4G LTE. Ericsson estimates that cellular IoT connections will reach 1.5 billion globally by 2022, accounting for more than 30 percent of all cellular connections.[33] Many IoT applications are already in the marketplace. For example, IoT is being used to improve the experiences of teachers and learners, creating a more immediate, virtual, and interactive learning experience in classrooms.[34] IoT farming technologies are also being used for tracking, monitoring, automating, and analyzing agricultural and industrial operations.[35]

We need substantially more spectrum to meet this growing demand. As Assistant Secretary Redl has stated, "[t]he tremendous growth in demand for wireless communications by consumers, businesses, and government agencies is one of the present challenges that requires innovative approaches to increase spectrum access for commercial and Federal Government

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[31] *Id*.

[32] *Ericsson Mobility Report*, Ericsson, at 16 (Nov. 2018), https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericsson-mobility-report-november-2018.pdf.

[33] *Internet of Things Forecast*, Ericsson, https://www.ericsson.com/en/mobility-report/internet-of-things-forecast (last visited Jan. 22, 2019).

[34] Esmat Mirzamany, Adrian Neal, Mischa Dohler, Maria Lema Rosas, *5G and Education*, JISC (2018), https://community.jisc.ac.uk/sites/default/files/Education-VM_Extended.pdf.

[35] *See* Brendan Carr, *From Farm to Cloud: How Broadband Makes Smart Ag Brilliant* (May 25, 2018), https://medium.com/@BrendanCarrFCC/from-farm-to-cloud-how-broadband-makes-smart-ag-brilliant-ae41a08cc04f.

users alike."[36] Thus, the U.S. Government should, for example, make available hundreds of megahertz of mid-band spectrum and thousands of megahertz of high-band spectrum for terrestrial wireless use in the near term.

B. The U.S. Government Should Make Available Low-, Mid-, and High-Band Spectrum.

To achieve our 5G goals, we need different types of spectrum. Low-band spectrum has beneficial physical characteristics that allow for wireless signals to propagate further and penetrate in-building more readily than higher frequency bands. High-band spectrum is well suited to support key elements of 5G, as wideband channelization available in high-band spectrum enables significantly higher speeds and far quicker response times. Mid-band spectrum blends these attributes, offering higher capacity than low-band, but with greater coverage with fewer facilities than high-band spectrum.[37] Sound spectrum policy requires a mix of all three.

C. The AIRWAVES Act Shows a Bipartisan Recognition of the Need for More and Different Kinds of Spectrum.

CTIA strongly supports reintroduction of the bipartisan Advancing Innovation and Reinvigorating Widespread Access to Viable Electromagnetic Spectrum ("AIRWAVES") Act, which provides a much-needed schedule of future spectrum auctions critical to leading the world in 5G.[38] As discussed further below, the AIRWAVES Act would set a timeline for auctioning a series of key low-, mid-, and high-band frequencies over the next five years. By recognizing that

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[36] Testimony of David J. Redl, Assistant Secretary for Communications and Information, National Telecommunications and Information Administration, U.S. Department of Commerce, before the Committee on Commerce, Science, and Transportation, United States Senate (June 13, 2018), https://www.ntia.doc.gov/speechtestimony/2018/testimony-assistant-secretary-redl-senate-commerce-science-and-transportation ("Redl Commerce Committee Testimony").

[37] *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, 33 FCC Rcd 6915, 6917 ¶ 5 (2018).

[38] Advancing Innovation and Reinvigorating Widespread Access to Viable Electromagnetic Spectrum Act, S.1682, H. 4953, 115th Cong. (2017).

different types of spectrum are needed to unlock the full complement of 5G services, the AIRWAVES Act addresses a core challenge the U.S. faces, particularly with respect to the current lack of availability of mid-band spectrum.

D. Terrestrial, Flexible-Use Spectrum Allocations Should be a Priority Given the Growing Demand for Wireless Service and Its Contribution to U.S. Global Competitiveness.

The U.S. Government should recognize the ever-expanding demand for mobile terrestrial services and should ensure that spectrum allocations are updated to meet the overwhelming mobile wireless consumer and business needs and to advance the U.S. economy. Today, terrestrial, flexible-use spectrum available for mobile wireless use is comprised of less than 6.5 gigahertz. This figure falls well short of the spectrum capacity needs that 5G is expected to require. By comparison, fixed (non-flexible use) allocations amount to nearly 23 gigahertz and satellite allocations cover nearly 30 gigahertz.[39] In light of the contribution of mobile services to the U.S. economy and U.S. consumers, it is important for the U.S. Government to ensure adequate spectrum resources are available for mobile service – including 5G.

V. TO WIN THE RACE TO 5G, THE NATIONAL SPECTRUM STRATEGY ALSO SHOULD EMBRACE THE FOLLOWING POLICIES.

A. The U.S. Should Continue to Rely on Private Investment and Commercial Networks to Ensure 5G Leadership.

It is evident that competition among private sector, commercial network providers is the most effective way to drive innovation and investment in the U.S. To that end, the tremendous success of the U.S. wireless ecosystem in meeting customers' needs, strengthening the nation's economy, and leading the world in innovative technologies, is the product of three fundamental spectrum policies: (i) exclusive licenses to provide certainty in spectrum use, (ii) flexible use to

[39] *See, infra*, notes 4 and 5.

adjust swiftly to marketplace demands, and (iii) reliance on market forces to optimize the award and transfer of spectrum rights to the highest and best use. These established policies drive efficient spectrum use to the benefit of the public and the economy. The U.S. wireless industry has relied on these policies over the last eight years to invest $226 billion in infrastructure,[40] producing world-leading 4G networks that provide coverage to 99.9 percent of the U.S. population.[41] And winning bidders in FCC spectrum auctions have contributed more than $114 billion to the U.S. Treasury.[42] U.S. carriers are investing billions of dollars and deploying 5G networks years ahead of schedule. As FCC Chairman Pai observed: "[t]he market, not the government, is best positioned to drive innovation and investment."[43]

B. The U.S. Government Should Continue to Identify Spectrum for Exclusive-Use, Flexible Rights Licensed Operations.

Exclusive Licensed Use. The FCC has determined 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 investment of capital and expertise."[44] As one economic study concluded, "the licensed spectrum used by the wireless industry boosted our nation's economy, created jobs and produced the world's best telecom and technology sector."[45] Indeed, licensed

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[40] *The State of Wireless 2018*, CTIA, at 12 (July 2018), https://api.ctia.org/wp-content/uploads/2018/07/CTIA_State-of-Wireless-2018_0710.pdf.

[41] *Communications Marketplace Report*, Report, GN Docket No. 18-231 *et al.*, FCC 18-181, ¶ 42, Fig. A-29 (rel. Dec. 26, 2018), https://ecfsapi.fcc.gov/file/122688187586/FCC-18-181A1.pdf.

[42] CTIA, Policy Brief, *The AIRWAVES Act*, https://www.ctia.org/news/the-airwaves-act-policy-brief (last visited Jan. 22, 2019).

[43] Remarks of FCC Chairman Ajit Pai at the Mobile World Congress, Barcelona, Spain (Feb. 26, 2018), https://www.fcc.gov/document/chairman-pai-remarks-mobile-world-congress.

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

[45] Coleman Bazelon & Giulia McHenry, *Mobile Broadband Spectrum: A Vital Resource for the American Economy*, at 1, THE BRATTLE GROUP (May 11, 2015),

spectrum has proven to be "a vital resource for the U.S. economy and consumers across the country."[46] Exclusive-use licenses provide more certainty and predictability to licensees that their investments will be protected against harmful interference, and that they can fully "mine" the spectrum they hold, resulting in more intense and efficient utilization. Congress has recognized the benefits of exclusive licensed spectrum as well. In the 2012 Spectrum Act, for example, it gave priority to reallocating spectrum previously used by Federal agencies to exclusive non-Federal use.[47]

Flexible Rights. Flexible rights apply to both technological choice and wireless service models. The FCC has long implemented a policy that enables U.S. wireless providers to deploy any technology consistent with technical rules, in contrast to mandating specific technologies for specific frequencies as was done elsewhere in the world. As FCC Commissioner Michael O'Rielly observed in supporting this policy, "[m]andating technologies for specific frequencies will keep a band frozen in time, also hindering future technology upgrades."[48] By permitting licensees to offer mobile, fixed, or portable services to meet whatever the market demands, flexible-use rights have fostered investment and innovation because they empower licensees to differentiate themselves by offering one service or a mix of services. The results are greater consumer choice, intensified competition, and spectrum that is put to its highest and best use.

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http://files.brattle.com/files/7801_mobile_broadband_spectrum_-_a_valuable_resource_for_the_american_economy_bazelon_mchenry_051115.pdf.

[46] *Id.*

[47] Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, Title VI, § 6701(a), *codified at* 47 U.S.C. § 923(j) (directing NTIA to "give priority to options involving reallocation of the band for exclusive non-Federal use ….").

[48] Remarks of FCC Commissioner Michael O'Rielly, Mobile World Congress Americas, Los Angeles, CA (Sept. 13, 2018), https://docs.fcc.gov/public/attachments/DOC-354084A1.pdf.

Market-Based Spectrum Access Fosters Efficient Spectrum Use. Congress has also recognized in multiple statutory provisions that market-driven spectrum policies result in the highest and best use of spectrum, first enabling secondary market transactions in spectrum licenses, then directing the auction of new spectrum licenses except in limited circumstances, and more recently by authorizing use of incentive auctions to repurpose spectrum.[49] For example, the FCC has enabled a competitive secondary market to drive efficient spectrum use by authorizing licensees to "disaggregate" to a third party a portion of the spectrum they hold, "partition" the licensed geographic area to a third party, or lease their spectrum rights. The FCC has repeatedly found that a robust secondary market for spectrum serves the public interest. And on the use of competitive bidding for spectrum rights, FCC Chairman Pai has noted that auctions "have facilitated the explosion of wireless services that have created millions of U.S. jobs and improved the American people's lives in countless ways."[50] These market-driven policies create strong incentives for licensees to make efficient use of spectrum, and have been key to driving the successive generations of wireless networks.

As the United States moves to the deployment of 5G networks, products, and services, wireless providers will need access to spectrum with an equivalent bundle of rights, as these rights will help ensure their ability to mine the spectrum to its fullest and the flexibility to deploy whatever the market demands. The Strategy should accordingly include each of these important policies – exclusive licenses, flexible rights, and market-based assignment mechanisms to place

[49] 47 U.S.C. § 310(d) (secondary market transfers); 47 U.S.C. § 309(j) (spectrum auctions generally); 47 U.S.C. § 309(j)(8)(G) (incentive auction).

[50] Remarks of FCC Chairman Ajit Pai at the Hudson Institute, The Importance of Economic Analysis at the FCC, at 2 (Apr. 5, 2017), https://www.fcc.gov/news-events/events/2017/04/chairman-pai-speech-economic-analysis-communications-policy.

spectrum in the hands of operators that will value it the highest – as linchpins of a forward-looking national spectrum policy.

C. The U.S. Government Should Make Available Large Blocks of Spectrum.

Wide channelization enables key 5G attributes, including low latency and speeds that are orders of magnitude faster than 4G. As the FCC observed in its millimeter wave proceeding, "100 megahertz is the baseline to provide 5G services."[51] The benefits of wide channelization apply to mid-band spectrum too, and spectrum policy should thus designate wide bandwidths for each additional block identified for non-Federal use. The Administration should also make available spectrum in large swaths to ensure that there is sufficient spectrum for U.S. providers and to promote economies of scale.

D. Policymakers Should Take an All-of-the-Above Approach to Spectrum that Prioritizes Clearing But Recognizes the Need for Shared Use.

As noted above, Congress has appropriately given priority to reassigning spectrum for exclusively licensed use.[52] But CTIA recognizes that there are circumstances where incumbent operations pose challenges to reallocating for exclusive-use licensed purposes, and a sharing framework will be the best means to repurpose spectrum. In that event, the sharing regime should provide spectrum licensees with sufficient rights to warrant the investment necessary to deploy robust, next-generation networks.

For spectrum sharing to be successful, arrangements must ensure the utility of the band for commercial use and any sharing conditions should be clear prior to auctioning the spectrum. Some sharing mechanisms have proven successful. For example, geographic sharing has been

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[51] *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Fourth Further Notice of Proposed Rulemaking, 33 FCC Rcd 7674, 7678 ¶ 10 (2018).

[52] *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, Title VI, § 6701(a), *codified at* 47 U.S.C. § 923(j).

used successfully for years. Coordination zones are preferable to exclusion zones, and should be minimized and based on real-world interference analysis. AWS-3 spectrum is an example of a successful sharing model between Federal and commercial interests. Individual government uses were defined and sharing criteria developed in coordination with the commercial industry. With this sharing framework in place, the FCC held the AWS-3 auction – netting more than $41 billion.[53]

Another example involves the 3.5 GHz CBRS band, where policymakers have developed a novel but highly-complex and untested framework.[54] As initially envisioned, the sharing regime would have created exclusion zones prohibiting commercial service for the majority of the U.S. population.[55] And the original rules governing license terms and conditions were so restrictive – three-year licenses, no renewal, Census tract geographic license areas – that significant questions arose as to value at auction. Revised rules adopted last year have, to some extent, helpfully altered this dynamic, but limited power levels to protect sharing continue to raise challenges.[56] As the FCC recognized when adopting the revised rules, even the lower non-rural limit for the AWS-1, AWS-3, AWS-4, and PCS bands is approximately 316 times the CBRS limit and 15,800 times the CBRS limit for Category A devices.[57] Further, the three-tier

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[53] *See* FCC, Auction 97: Advanced Wireless Services (AWS-3), https://www.fcc.gov/auction/97/factsheet.

[54] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015).

[55] *Id*. at 3967 ¶ 25 (citing NTIA, An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, 4200-4220 MHz, and 4380-4400 MHz Bands, at 1-6, 1-7 (rel. Oct. 2010), http://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf).

[56] *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, GN Docket No. 17-258, FCC 18-149 (rel. Oct. 24, 2018).

[57] *See id*. ¶ 65, n. 259 (citing 47 C.F.R. §§ 24.232, 27.50).

framework adds new degrees of complexity that have not previously been tried in commercial deployments. CTIA anticipates a host of lessons learned from the CBRS experiment and encourages the Administration to carefully consider the results of that band before relying on a three-tiered approach in other bands. The Administration should schedule an auction of Priority Access Licenses ("PALs") in this band by the end of 2019, and it should assess the results of the three-tier framework three years after deployment of PALs to determine lessons learned for supporting robust commercial mobile networks in future bands.

E. The U.S. Government Should Ensure that Future Allocations are Appropriately Balanced Between Unlicensed and Licensed.

CTIA also recognizes that unlicensed is a key component in meeting consumer demand, but the U.S. Government must maintain a keen eye as to the ongoing balance between licensed and unlicensed spectrum. The FCC historically allocated more low-band spectrum to licensed services, recognizing its vital role in mobile network deployments and facilitating broad coverage, but in the mid- and high-bands, unlicensed spectrum dominates. Today, in the mid-band, the U-NII bands offer 580 megahertz for unlicensed use, while there is no flexible-use licensed spectrum today and a commitment of only 70 megahertz of 3.5 GHz CBRS PAL spectrum in the future (which itself is subject to opportunistic sharing). Further, while the current proposal from incumbent satellite licensees holding spectrum in the 3.7-4.2 GHz C-band involves repurposing 180 megahertz of that band for flexible-use licensed services,[58] the FCC has initiated a separate proceeding on the 6 GHz band, where it proposes to allow unlicensed

[58] Comments of C-Band Alliance, GN Docket No. 18-122, at 5 (filed Oct. 29, 2018) (proposing to reallocate 200 MHz including 20-MHz guardband).

access to more than six times that amount – 1.2 gigahertz.[59] As for high-band spectrum, 5.5 gigahertz has been committed to flexible-use licensing while nearly twice that amount – 14 gigahertz – is reserved for unlicensed.[60]

The Strategy must identify sufficient additional licensed spectrum to ensure that terrestrial wireless services – and 5G in particular – have access to sufficient spectrum in order to achieve their promise for consumers, the economy, and U.S. global competitiveness. And, to the extent that additional unlicensed spectrum is allocated, the rules governing access to and use of that spectrum must be technologically neutral and available for the full panoply of next-generation unlicensed technologies, including Wi-Fi, LTE-U, and LAA.

F. U.S. Government 5G Leadership in International Fora Should Involve Support for Harmonization in Key 5G Bands, While Also Maintaining Flexibility to Make U.S. Decisions Where Appropriate.

Maintaining U.S. leadership in wireless will not only require the U.S. Government to prioritize making spectrum available to keep pace with other countries. It also must ensure that its actions on the international stage support 5G leadership at home. The following policies should accordingly be part of the Strategy.

The United States should generally support harmonization of spectrum bands while retaining the option to pursue other approaches. Harmonization enables device and equipment vendors to design wireless products and services that can operate in multiple countries, thereby generating substantial economies of scope and scale that help to minimize costs and thereby

[59] *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, ET Docket No. 18-295, FCC 18-147 (rel. Oct. 24, 2018).

[60] *See Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8096 ¶ 239 (2016); *see also Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration and Memorandum Opinion and Order, 32 FCC Rcd 10988 (2017).

increase demand. It also enables customers to seamlessly roam when traveling to different countries, further advancing the social and economic benefits of wireless technologies.

At the same time, the United States must continue to chart a path for leadership in terrestrial, flexible-use spectrum, and that path can sometimes diverge from those other nations choose. NTIA's Request recognizes the Space Policy Directive-3 ("SPD-3"), and CTIA agrees with the SPD-3 position that "[w]here appropriate" there should be consistency between domestic and international regulations – a position that acknowledges that in some situations consistency is not in the national interest.[61] For example, despite U.S. Government efforts, World Radio Conference ("WRC")-15 decided not to consider the 28 GHz band for an International Mobile Telecommunications ("IMT") identification at the upcoming WRC-19 conference. Nonetheless, the FCC moved ahead with terrestrial, flexible-use service rules in 28 GHz spectrum, and as a result, operators are investing in 5G deployments in that band. And today, many countries around the world are following suit.

As the U.S. Government prepares for and engages in the upcoming WRC-19, its overarching goal should be to ensure that its efforts are geared to promoting 5G deployment across the United States. It should support proposals to ensure that U.S. spectrum bands are included in IMT identifications for internationally harmonized tuning ranges to enable U.S. consumers and businesses to benefit from economies of scale and global roaming that flow from harmonization, even when individual countries may make different frequencies within the range available for 5G. Consistent with the tuning range approach, the Government should seek to maintain flexibility in the ITU Radio Regulations when possible to ensure the United States can

[61] Presidential Memorandum on Space Policy Directive-3, National Space Traffic Management Policy, Section 5(c)(ii), 83 Fed. Reg. 28969 (issued June 18, 2018), https://www.whitehouse.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/ ("SPD-3").

make its own decisions, rather than be constrained by international positions that do not always align with the priority of advancing U.S. 5G leadership.

Through allocations, identifications, and development of interference protection criteria, the Administration should ensure that its positions reinforce our 5G leadership and do not undermine access to critical bands identified for 5G in the U.S. The Administration should work carefully to ensure that neither U.S. nor international actions have an undue negative impact on bands that have already been identified here in the U.S. (*e.g.*, the 24 GHz, 28 GHz, 37 GHz, 39 GHz, or 47 GHz bands), noting that some decisions the WRC could make would have binding impacts on U.S. spectrum policy.

Consistent with the above points, CTIA believes that satellite services can play a role in advancing spectrum-based broadband, but promoting those services should not be conflated with advancing 5G. Satellites are efficient vehicles to bring broadband to rural, remote, or other hard-to-reach areas. However, it remains to be seen whether satellites can meet 5G performance requirements, as the high speeds, low latency, and other key improvements expected from 5G present difficult obstacles for satellite providers.[62]

G. The U.S. Government Should Promote Transparency and Collaboration in the Identification of Spectrum for Reallocation and Should Ensure Efficiency of Government Operations.

There is a long tradition of collaboration between Federal agencies and the commercial sector to improve the efficiency of government operations and make spectrum available for

[62] For example, OneWeb's low-earth orbit constellation, planned for late 2019, will offer speeds of approximately 500 megabits per second. By comparison, AT&T predicts its 5G mobile speeds will be double that of OneWeb's – approximately one gigabit per second. *See* Diana Goovaerts, *OneWeb aims to put satellites at heart of 5G*, MOBILE WORLD LIVE (Sept. 18, 2018), https://www.mobileworldlive.com/featured-content/top-three/oneweb-aims-to-put-satellites-at-heart-of-5g/; *see also This Week in 5G: The Wireless Results Are In*, CTIA (Apr. 13, 2018), https://www.ctia.org/news/this-week-in-5g-the-wireless-results-are-in.

commercial uses. As Assistant Secretary Redl stated before Congress last year, "[m]uch of the progress we have made is the result of relationships and trust developed … between government and industry."[63] Since 2004, the SRF has played a critical role in supporting Federal agency efforts to make more spectrum available for commercial use by reimbursing agencies for the costs of repurposing spectrum.[64] In 2015, the Spectrum Pipeline Act broadened the expenses covered by the SRF and authorized $500 million specifically for exploring spectrum re-purposing. Since 2015, two bands, 1300-1350 MHz and 1675-1680 MHz, have been teed up for study for repurposing for commercial use. And as noted above, NTIA has also been working with its Policy and Plans Steering Group to study the 3450-3550 MHz band for its potential to accommodate future commercial access.[65]

The Administration should foster continued efforts to increase the efficiency of government systems and to evaluate opportunities to make additional spectrum available. As NTIA has acknowledged, spectrum is a "valuable, finite resource" that must be used efficiently and effectively by the U.S. Government and the commercial sector.[66]

The Administration should explore ways to promote additional transparency regarding government use of spectrum and to promote greater information sharing and collaboration between agencies and the commercial sector. For example, the Presidential Memorandum calls on Federal agencies to conduct a review of current frequency assignments and quantification of spectrum usage.[67] CTIA supports this initiative as a useful step in further discussions regarding

[63] Redl Commerce Committee Testimony.

[64] 47 U.S.C. § 928.

[65] Redl Commerce Committee Testimony.

[66] *Id.*

[67] Presidential Memorandum at Sect. 4.

spectrum repurposing. CTIA also supports greater transparency into current spectrum investigations for repurposing, including in the 1.3 GHz, 1.7 GHz, and 3.45 GHz bands.

H. U.S. Government Policies Should Support RDT&E and Innovative Technologies.

CTIA strongly supports efforts to advance spectrum management and innovative spectrum use through research, development, testing, and evaluation ("RDT&E"). To that end, we encourage the Administration to promote initiatives that can lead to spectrum clearing and development of spectrum-sharing tools.

Video compression technology is an example of the former. Every new generation of encoding standards bring about roughly two times better compression rate with the same image quality. Put another way, next-generation compression technology can reduce capacity needs by nearly 50 percent, thereby reducing spectrum demands. For example, a transition from MPEG-2 to MPEG-4 AVC (H.264) produces video with about 50 percent of the bitrate, and a transition from MPEG-4 AVC (H.264) to HEVC (H.265) provides the same gain.[68]

The Strategy should also investigate opportunities for new secure, automated capabilities that can assess spectrum use and expedite coordinated spectrum usage among Federal and non-Federal stakeholders. As Fred Moorefield, Director for Spectrum Policy & International Engagements for the Department of Defense, recently stated, "we do not have an automated capability that would allow us to be able to quickly share spectrum, within both the Federal

[68] *See* T. Wiegand, *et al.*, Overview of the H.264/AVC video coding standard, IEEE Transactions on Circuits and Systems for Video Technology, vol. 13, no. 7, pp. 560–576 (July 2003); T. K. Tan, et al., Video Quality Evaluation Methodology and Verification Testing of HEVC Compression Performance, IEEE Transactions on Circuits and Systems for Video Technology, vol. 26, no. 1, pp. 76–90 (Jan. 2016).

government and the private sector."[69] There is opportunity to explore sensible, robust automated capabilities, while also focusing attention on innovations that will facilitate spectrum clearing.

I. Sound Federal and State Infrastructure Policies are Essential to Efficient Spectrum Use.

Supplying additional spectrum is necessary but not sufficient to achieve the immense promise of 5G – networks with the capacity to deliver 5G's dramatic speeds and capabilities must also be deployed. Policymakers in the Administration, Congress, the FCC, and in many state and local governments have all recognized the importance of modern siting policies that promote infrastructure deployment. Ensuring that wireless providers have timely and affordable access to government-owned and managed lands, buildings, and facilities, and to public rights-of-way, is the most efficient way to expedite 5G deployment. Reducing regulatory delays and costs will pay huge dividends in speeding 5G's availability, generating jobs, and jump-starting advanced services that will enable the U.S. to lead the world in wireless innovation. Examples of these forward-looking actions include:

- In January 2018, President Trump issued an Executive Order directing the General Services Administration ("GSA") to coordinate with all Federal agencies to streamline deploying broadband facilities on Federally-owned lands, and a Presidential Memorandum directing the Secretary of Interior to develop a plan to increase providers' access to lands and properties managed by the Department.[70]
- In March 2018 legislation, Congress directed Federal agencies to act on applications for siting wireless facilities on Federal property by a specific deadline of 270 days, and

[69] *See* Kelcee Griffis, *Pentagon Spectrum Expert Predicts More Dynamic Sharing*, LAW360 (Sept. 24, 2018).

[70] Presidential Executive Order on Streamlining and Expediting Requests to Locate Broadband Facilities in Rural America, Executive Order 13821, 83 Fed. Reg. 1507 (Jan. 8, 2018), https://www.whitehouse.gov/presidential-actions/presidential-executive-order-streamlining-expediting-requests-locate-broadband-facilities-rural-america/; *see also* Presidential Memorandum for the Secretary of the Interior, 83 Fed. Reg. 1511 (Jan. 8, 2018), https://www.whitehouse.gov/presidential-actions/presidential-memorandum-secretary-interior/.

directed NTIA to submit a report recommending ways to streamline the application process.[71]

- During 2018, the FCC adopted three orders to remove many infrastructure barriers, including updating and streamlining its procedures under the National Environmental Policy Act and the National Historic Preservation Act, adopting faster time periods for localities to review small cell facilities applications, and implementing the Communications Act's directives to states and localities that they not act in ways that prohibit or have the effect of prohibiting service.[72]
- Twenty-one states have adopted legislation expediting the construction of small cell facilities, and a number of localities have also streamlined their procedures.[73]

The Strategy should build on these forward-looking infrastructure policies that will promote 5G and support implementation of these reforms. The Administration should continue to support reforms that foster the rapid deployment of 5G infrastructure, by encouraging all levels of government to clear any barriers that threaten to impede 5G deployment.

For example, NTIA should work with GSA to ensure that the directives of the Executive Orders are being fully and timely carried out, and GSA should continue its efforts to standardize and streamline the siting application process for Federal lands and properties. As Congress has directed, NTIA should develop specific recommendations for legislation that will further expedite the application process. The FCC should ensure that its orders aimed at removing unlawful or unwarranted Federal, state, and local regulatory barriers that impede new broadband infrastructure are effectively implemented, and it should consider further steps to promote access

[71] *See* MOBILE NOW Act as incorporated in the Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, 132 Stat. 348, Division P, Title VI, § 606 (2018).

[72] *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment; Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, WC Docket No. 17-84, FCC 18-133, Second Report and Order, 33 FCC Rcd 3560 (2018); Third Report and Order and Declaratory Ruling, 33 FCC Rcd 7705 (2018); Declaratory Ruling and Third Report and Order (rel. Sept. 27, 2018).

[73] *See* Letter from Kara Graves, CTIA, and D. Zachary Champ, Wireless Infrastructure Association, to Marlene H. Dortch, FCC, WT Docket No. 17-79, WC Docket No. 17-84, at 1 (filed Aug. 10, 2018), https://ecfsapi.fcc.gov/file/10810298508690/180810%20CTIA-WIA%20Ex%20Parte.pdf (citing and summarizing all state small cell siting laws enacted as of that date).

to infrastructure. And NTIA and the FCC should serve as resources for states and localities that seek to develop legislation, rules, or other initiatives to promote investment in 5G networks.

Any notion of mandating that commercial entities share networks should be dismissed. The competitive model, in which providers vigorously compete to differentiate their services by investing in their own networks, has proven immensely successful in delivering innovative services, expanding networks, and increasing consumer choice. Forcing shared networks would undermine these benefits. Rather, the U.S. Government should focus on removing regulatory obstacles to deployment as the most effective way to foster multiple competitive deployments.

Finally, the Administration should work with the Advisory Council on Historic Preservation and numerous affected Executive agencies to finalize a document that would make so-called "Twilight Towers" – towers built between March 16, 2001 and March 7, 2005 – available for collocation at the very time that additional infrastructure platforms are in high demand for FirstNet, network densification, 5G deployments, and other advanced technologies.[74]

J. The U.S. Government Should Ensure that the FCC Has the Resources Necessary for a Robust Regime for Authorizing New Devices.

Prompt and comprehensive equipment authorization of new devices is a critical gating factor to achieving the immense promise of 5G. The FCC's Equipment Authorization program ensures that all devices comply with U.S. technical requirements before being imported, marketed, or operated within the United States. A streamlined and efficient equipment

[74] *See Comment Sought on Draft Program Comment for the Federal Communications Commission's Review of Collocations on Certain Towers Constructed Without Documentation of Section 106 Review*, Public Notice, 32 FCC Rcd 10715 (2017); *see also* Joint Comments of CTIA and the Wireless Infrastructure Association, WT Docket No. 17-79 (filed Feb. 9, 2018), https://ecfsapi.fcc.gov/file/10209619223884/CTIA%20and%20Wireless%20Infrastructure%20Association%20Joint%20Twilight%20Towers%20Comme....pdf.

authorization process is essential to prevent a potential backlog of 5G products that could delay the rollout of 5G. The number of devices the FCC authorizes each year has increased significantly – from 12,000 approved in 2011 to approximately 25,000 devices in 2016[75] – but the billion-plus IoT connections expected globally by 2022 will require innumerable device authorizations from the FCC before those devices can be put into use in the U.S.[76] Thus, the Administration should ensure that the FCC has the resources necessary to advance its current equipment and device application and approval processes to enable 5G.

K. The U.S. Government Should Continue Working with Industry to Advance a Sound Security Strategy for 5G.

As Assistant Secretary Redl has recognized, "[a]s we move aggressively to stand up 5G networks across the country, we must be equally aggressive in our efforts to secure them."[77] CTIA agrees with NTIA that strong cybersecurity will be key to U.S. leadership. The wireless industry has baked security into our networks since the beginning, and works diligently to continually update and build on our security capabilities with every generation of wireless.[78]

Today's mobile networks have the most advanced security features to-date,[79] and 5G has been designed from the ground up, in the 3GPP standards process that has taken place for years

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[75] Presentation by George Tannahill, FCC Office of Engineering and Technology, TCB Program Administration Review, at 2 (Apr. 5-6, 2011), https://transition.fcc.gov/oet/ea/presentations/files/apr11/1b.TCBProgramAdminReview-GT.pdf; Presentation by George Tannahill, FCC Office of Engineering and Technology, 2017 MIC MRA International Workshop in Tokyo, Japan, at 22 (Mar. 22, 2017), https://www.tele.soumu.go.jp/resource/j/equ/mra/pdf/28/01.pdf.

[76] *Internet of Things Forecast*, Ericsson, https://www.ericsson.com/en/mobility-report/internet-of-things-forecast (last visited Jan. 22, 2019).

[77] Redl Race to 5G Summit Remarks.

[78] *See generally Protecting America's Next-Generation Networks*, CTIA (July 2, 2018), https://api.ctia.org/wp-content/uploads/2018/07/ProtectingAmericasNetworks_FINAL.pdf ("CTIA 5G Security White Paper").

[79] *Id*. at 1-2.

among industry experts, to maximize security. 5G will continue to build on these security features by adding advanced encryption technologies that are built into mobile devices, among other innovations.[80] Collaboration among industry stakeholders and between industry and government, led by the Department of Homeland Security, has been – and will continue to be – the key to strong security. Indeed, 5G security issues are being worked on throughout the multi-year process of designing 5G and receive ongoing attention in the standards process as the technology is continually enhanced and refined. Yet as IoT grows exponentially, so will the opportunities for possible exploits by hackers or other bad actors.[81]

The U.S. Government should continue to work with the wireless industry on security strategies to promote 5G security and trusted suppliers of wireless and 5G equipment and network functions. As Assistant Secretary Redl noted further, "the most effective 5G security strategy will revolve principally around industry-driven standards work."[82] CTIA and the wireless industry have been focused on network security since the beginning, continue to work on security issues in standards bodies, and have partnered with the government to lead the way in developing important security standards that can continue to evolve and improve over time.[83] For that reason, the U.S. Government should draw on the market-oriented risk management principles and the industry-government leadership model of the ICT Supply Chain Risk Management Task Force.[84] The Department of Homeland Security, which co-leads the Task Force along with the two industry Chairs of the Sector Coordinating Councils for the

[80] *Id*.

[81] *Id*. at 3-4.

[82] Redl Race to 5G Summit Remarks.

[83] *See generally* CTIA 5G Security White Paper.

[84] *See* Department of Homeland Security, Fact Sheet, *ICT Supply Chain Task Force* (Dec. 7, 2018), https://www.dhs.gov/publication/ict-supply-chain-task-force-fact-sheet.

Communications and IT sectors, should continue to serve as the key Federal agency for 5G security.

The U.S. Government should also take into consideration the work of other bodies, including the Communications Security, Reliability and Interoperability Council ("CSRIC") and the Department of Commerce's National Institute of Standards and Technology ("NIST"). For example, CTIA assisted in the development of CSRIC's in-depth Report on "Best Practices and Recommendations to Mitigate Security Risks to Emerging 5G Wireless Networks."[85] CTIA and its members have also worked closely with NIST to develop the Cybersecurity Framework.[86] We encourage further collaboration among industry and government and between government agencies themselves.

VI. ACROSS THE GLOBE, NATIONS ARE EAGER TO SEIZE THE 5G MANTLE AND ARE COMMITTING SIGNIFICANT SPECTRUM RESOURCES TO LEAD IN THE RACE TO 5G.

A. The U.S. is Not Alone in Identifying that Global Leadership is at Stake in 5G.

Other countries, from Asia to Europe, are moving aggressively to lead the world in 5G. One reason is that they realize that the nation that leads on 5G will capture millions of new jobs and billions in economic growth. Lessons learned from 4G make clear that the stakes are high – U.S. leadership in 4G profoundly benefited the national economy. According to studies by Recon Analytics and Accenture, the U.S. wireless industry GDP grew from $195.5 billion in

[85] Communications Security, Reliability and Interoperability Council VI, Working Group 3, Network Reliability and Security Risk Reduction, *Final Report – Report on Best Practices and Recommendations to Mitigate Security Risks to Emerging 5G Wireless Networks v14.0* (Sept. 2018), https://www.fcc.gov/file/14500/download.

[86] *See* NIST, Cybersecurity Framework, https://www.nist.gov/cyberframework (last visited Jan. 22, 2019).

2011 to $475 billion in 2016.[87] The launch of 4G nearly doubled the number of U.S. wireless-related jobs in just three years – an increase of 84 percent from 2011 and 2014 – and 4G leadership helped drive nearly $100 billion GDP growth outside the wireless industry.[88] Further, because 4G is a largely international ecosystem, U.S. leadership also meant roughly $125 billion in revenue to American companies that could have gone elsewhere.[89] 4G also helped create the app and sharing economies in America.[90]

Conversely, losing wireless leadership in next-generation technology transitions had significant, long-term, negative effects on the European and Japanese telecommunications sectors.[91] As the European Commission's spokesman for digital economy and society acknowledged, in the "mobile equipment industry, we had 80 percent of the market in 2008 and because we were not ready for 4G mass deployment, the EU industry lost almost its entire market share for mobile phones."[92] Similarly, the majority of Japanese corporations exited the handset business and their early lead in mobile internet services faltered after the 3G to 4G transition.[93] Other nations have observed how 4G wireless leadership directly strengthened the U.S. economy.

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[87] *See How America's Leading Position in 4G Propelled the Economy*, RECON ANALYTICS, at 9 (Apr. 16, 2018), https://api.ctia.org/wp-content/uploads/2018/04/Recon-Analytics_How-Americas-4G-Leadership-Propelled-US-Economy_2018.pdf ("Recon Analytics Study"); *see also How the Wireless Industry Powers the U.S. Economy*, ACCENTURE STRATEGY, at 3 (Apr. 2018), https://api.ctia.org/wp-content/uploads/2018/04/Accenture-Strategy-Wireless-Industry-Powers-US-Economy-2018-POV.pdf.

[88] Recon Analytics Study at 1.

[89] *Id*.

[90] *Id*.

[91] *The Global Race to 5G*, CTIA, at 5 (Apr. 2018), https://api.ctia.org/wp-content/uploads/2018/04/Race-to-5G-Report.pdf.

[92] *Id*. at 5.

[93] *Id*.

B. Other Nations Are Vying to Seize 5G Leadership by Making Available Large Swaths of Spectrum.

It should not be surprising that many nations now seek to capture wireless technology leadership from the U.S. As noted above, other countries, from Asia to Europe, are moving aggressively to lead the world in 5G and are actively working to make spectrum available for 5G in both mid-band and high-band spectrum ranges.[94] For example, China is expected to make available nearly 300 MHz in the 3.5 GHz range in 2019.[95] As U.S. Commerce Secretary Wilbur Ross observed, "We cannot be complacent. While the United States leads the world in the application of 4G wireless technology, China and South Korea are trying hard to position themselves to dominate the next generation of 5G."[96]

A recent study by Analysys Mason concluded that among Australia, Canada, China, France, Germany, Japan, Russia, Singapore, Spain, South Korea, Sweden, and the United Kingdom, "nearly 200 MHz of mid-band spectrum per country is expected to be available by June 2019. By the end of 2020, an average of nearly 300 MHz of mid-band spectrum will be available per country."[97] Other countries, such as Ireland, Italy, Hong-Kong, and Austria, have

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[94] Comments of CTIA, WT Docket No. 18-122, at 5-6 (filed Oct. 29, 2018) ("China is expected to release 300 megahertz of spectrum in the 3.5 GHz range. …[T]he United Kingdom auctioned 150 megahertz of spectrum in the 3.4 GHz band. … Ireland auctioned 350 megahertz of spectrum in its 3.6 GHz auction in May; South Korea auctioned 280 megahertz of 3.5 GHz spectrum in June; and Spain and Italy auctioned 200 megahertz between 3.6 -3.8 GHz range for 5G in July and October, respectively.").

[95] *Id.*

[96] Commerce Secretary Wilbur Ross Remarks Before the National Telecommunications Information Administration Spectrum Policy Symposium, National Press Club, Washington, D.C. (June 12, 2018), https://www.ntia.doc.gov/speechtestimony/2018/commerce-secretary-wilbur-ross-remarks-june-12-2018-national-telecommunications.

[97] David Abecassis, Janette Stewart, Michael Kende, Chris Nickerson, *Final report for CTIA Mid-band spectrum global update*, ANALYSYS MASON (Nov. 2018), https://api.ctia.org/wp-content/uploads/2018/12/Analysys-Mason-Mid-Band-Spectrum-Global-Update.pdf.

either already assigned mid-band spectrum or have committed to doing so by June 2019.[98] For the United States to compete, the Strategy must make spectrum for 5G a top priority.

VII. THE NATIONAL SPECTRUM STRATEGY SHOULD PROVIDE AN ACTIONABLE PATH FOR MEETING 5G SPECTRUM NEEDS, INCLUDING A CLEAR AND PREDICTABLE PIPELINE.

A. The Strategy Should Provide an Actionable Path for Addressing 5G Spectrum Needs.

The Strategy is essential to 5G deployment and innovation in the U.S. The Administration should seize this opportunity to provide a vision for continued U.S. leadership in wireless and economic competitiveness. Given the global focus on 5G, we need clear steps that can be acted on within this Administration, based on existing and tested technological and operational approaches.

B. The Administration Should Provide and Execute on a Clearly Defined Schedule of FCC Auctions and Spectrum Availability Over the Next Five Years.

A critical component of the Strategy must be an ongoing commitment by the Administration and the FCC to deliver massive amounts of spectrum for 5G. The Strategy should outline an auction schedule of low-, mid-, and high-band spectrum necessary to fuel the full range of 5G deployments and innovations.

Prior Administrations have developed specific numeric targets for identifying spectrum for wireless use. While those efforts were productive and resulted in the identification of important frequency bands, it is imperative that this Administration focus its efforts on executing on identified spectrum targets that will support next-generation wireless connectivity. The good news is the Administration and the FCC have already identified key bands needed for our 5G future. It is now about execution and a clearly defined schedule.

[98] *Id*. at 4-5.

As highlighted above, Congress is working on a similar effort with the AIRWAVES Act, the draft of which would set a timeline for auctioning a series of key low, mid, and high bands over the next five years.[99] It is critical, however, that the Administration develop within the Strategy a comprehensive and actionable plan that delivers, on a concrete timeline, the low-, mid-, and high-band spectrum needed to foster our 5G future.

C. The Strategy Should Direct Long-Term Spectrum Planning That Promotes Efficient Use of Spectrum and Investigates Bands for Commercial Use.

The Strategy should outline spectrum principles, consistent with Section V. above, and a process to prepare for the next 10-15 years of wireless developments. While this process should maintain flexibility to account for continued innovations, the Strategy should focus on efficient use of spectrum. In particular, the Strategy should recognize the importance of improved technology, chiefly for government agencies that have significant spectrum holdings today. The Strategy should promote the use of the SRF in exploring technology advancements that may free up additional spectrum for commercial use. The Strategy should also develop a timeline for the exploration of additional potential bands for reallocation to commercial use. Finally, the Strategy should embrace transparency regarding government use of spectrum and promote information sharing that may aid in the investigation of candidate bands. Put simply, the United States must get spectrum policy right if we are to succeed in this global contest. As Assistant

[99] Advancing Innovation and Reinvigorating Widespread Access to Viable Electromagnetic Spectrum Act, S.1682, H.4953, 115th Cong. (2017). Among other things, the draft legislation provides a schedule of FCC auctions in numerous high bands, asks NTIA to report on relocating Federal operations in the 1300-1350 MHz and 1780-1830 MHz bands to non-Federal use, calls for up to 500 megahertz of spectrum to be made available between 3.7-4.2 GHz, and requires an additional 70 megahertz of Federal spectrum below 3 GHz to be identified for relocation.

Secretary Redl said late last year, "the single most important action government can take to help lay a foundation for 5G is ensuring sufficient and flexible access to spectrum."[100]

VIII. CONCLUSION.

CTIA appreciates the opportunity to participate in NTIA's important National Spectrum Strategy proceeding. CTIA supports the Administration's initiatives in the Presidential Memorandum and urges NTIA to move forward with developing a Strategy that makes additional spectrum available for 5G as quickly as possible in order to spur U.S. global competitiveness and drive economic growth.

Respectfully submitted,

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[100] Remarks of David J. Redl, Assistant Secretary for Communications and Information, White House 5G Summit, Washington, D.C. (Sept. 28, 2018), https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-white-house-5g-summit.