Before the
**DEPARTMENT OF COMMERCE**
**National Telecommunications and Information Administration**
Washington, DC 20230

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| In the Matter of | ) | |
| | ) | |
| Development of a National Spectrum Strategy | ) | Docket No. NTIA-2023-0003 |
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# COMMENTS OF ERICSSON

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## I. INTRODUCTION AND SUMMARY

Ericsson welcomes the opportunity to share our vision for a U.S. national spectrum strategy.[1] At its core, the national spectrum strategy should not only create a roadmap to secure future spectrum for U.S. stakeholders; it should position the United States for leadership in the global wireless ecosystem and advance U.S. economic and technological security interests.

Demand continues to surge for 5G, for wide-area mobile services, and increasingly for fixed wireless access. Ericsson forecasts that the average monthly data usage per smartphone in North America will grow from 14GB in 2021 to 55GB in 2028 – the highest level anywhere in the world.[2] And that exponential growth will precede commercial 6G deployments, which will fuel further demand for high-capacity, low-latency wireless services.

Although U.S. wireless operators are investing more than ever before in next-generation, innovative, spectrally efficient technologies – $35 billion in 2021 alone[3] – a lack of access to

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[1] Development of a National Spectrum Strategy, 88 Fed. Reg. 16244 (Mar. 16, 2023) ("RFC").

[2] Ericsson, *Ericsson Mobility Report – Q4 2022 Update* (Nov. 2022), https://www.ericsson.com/4ae28d/assets/local/reports-papers/mobility-report/documents/2022/ericsson-mobility-report-november-2022.pdf.

[3] CTIA, *2022 Annual Survey Highlights*, at 3 (Sept. 13, 2022), https://api.ctia.org/wp-content/uploads/2022/09/2022-Annual-Survey.pdf. ("CTIA 2022 Annual Survey").

additional suitable spectrum will stall these efforts. Today there is no spectrum pipeline, making this national spectrum strategy all the more important.

Our focus here is to identify the spectrum shortfall for commercial wireless service and to expand the availability of full-power, wide-channel, wide-area spectrum for licensed access. This licensed framework offers the assured access to spectrum and interference protection that generates massive investment in next-generation commercial technologies, and network deployments that trigger innovation across verticals, from smart cities to augmented reality (AR)/virtual reality (VR), to improved implementation of federal missions. To lead the world in wireless, the U.S. must have a strong presence in global spectrum bands for 5G and 6G in the near future.

Unfortunately, the United States is falling further behind other nations in the amount of spectrum allocated for full-power licensed use. As other nations move forward identifying harmonized bands for 5G, U.S. spectrum allocations are increasingly unaligned with international allocations. This is in part due to some federal allocations used by the U.S. military, although such operations may not be allowed in other countries; it is also in part due to U.S. adoption of experimental shared access frameworks in bands where other nations are embracing full-power 5G licensing. As a result, the United States is increasingly on the outside looking in on globally harmonized spectrum bands, limiting U.S. leadership in standards development and increasing the risk that other countries dominate the wireless supply chain.

In considering how best to meet commercial demands and federal mission needs, it is imperative to consider federal spectrum holdings and the potential to repurpose spectrum for commercial use. Today, the federal government holds twelve times the amount of mid-band spectrum as licensed commercial wireless use. Federal missions cannot continue to rely on

aging communication systems, which are also not spectrally efficient. The national spectrum strategy should focus on making the federal government's spectrum footprint more efficient and increasing federal systems' capabilities and resilience. Funding and incentives must be considered as an integral part of the federal use of spectrum.

In repurposing spectrum, exclusive use licensed access is the priority for commercial wireless deployment at scale. In some bands, however, sharing with federal incumbents may be necessary – in those cases, NTIA and federal stakeholders should accommodate commercial access to bands through the least restrictive means possible, including incumbent relocation or band segmentation, and, if necessary, predefined sharing methods (e.g., geographic or time-driven protection zones). Sharing methods based on dynamic sharing facilitated by spectrum access systems are not a panacea for spectrum scarcity.

As we look to the future, Ericsson is leading the way on 6G, studying its possibilities and the infrastructure and spectrum necessary to support it. Through its research, Ericsson considered both 6G use cases that require access to wide-area, high-capacity, high-reliability bands, and more localized niche use cases, where mmW bands may be sufficient. To support projected 5G demands in the near-term (prior to 2027) as well as demand forecasted by 6G in the longer term (after 2028), NTIA should identify 1.5-2.2 gigahertz of additional wideband spectrum in suitable mid-band frequencies that can be repurposed for commercial networks, while ensuring critical federal missions are supported.[4]

Of course, in terms of priorities, access to sufficient mid-band spectrum remains a critically important missing piece of the 5G/6G portfolio for commercial mobile operators in the

[4] RFC at 16246 (Pillar # 1, Question 3). The RFC pillars and questions are referenced throughout as P#_, Q_.

United States today. Consequently, NTIA needs to move quickly to help repurpose spectrum in the Lower 3 GHz (3.1-3.45 GHz) band, the 4.4-4.94 band, and the 7/8 GHz (7.125-8.5 GHz) band. More broadly, other spectrum in the 7-15 GHz range offers a balance of wide-channel bandwidths and reasonable outdoor propagation as we move toward 6G applications. Lower bands in this range are preferred because the lower the frequency band, the wider the area that can be covered, while still providing the capacity networks need. NTIA should note that opportunities above the 10 GHz band will require denser network deployment. Finally, in prioritizing bands, NTIA should consider the benefits of harmonization globally, especially in regions adjacent to U.S. interests.

To guide its implementation of a national spectrum strategy, NTIA should adopt a set of principles to help establish and execute spectrum planning:

- Identify Spectrum for 5G, 6G, and Beyond
    - Ensure that to the extent possible, spectrum is harmonized globally, even where that means repurposing federal bands domestically.
    - Recognize that wide-area, full-power, wide-channel, exclusive use access regimes remain a priority for the United States to maintain its competitiveness and lead in future technologies.
    - Initiate activities as soon as possible to make spectrum available for 6G given the time-consuming process of repurposing.
    - Pursue an evolving spectrum pipeline, with specific timeframes, so stakeholders know which bands to target for study and development.
- Enhance Federal Systems
    - Prioritize the upgrade or replacement of aging federal systems.
    - Study federal systems to determine where there are opportunities to modernize those services.
    - Ensure that federal networks utilize commercial partners and standards, which promote efficient use of spectrum and may be easier to upgrade over time.

- Improve Spectrum Policy
    - Adopt a whole-of-government approach to global spectrum advocacy so that the U.S. interests have a unified message in global discussions.
    - Make clear that receivers have a role to play in avoiding harmful interference, and commercial and federal spectrum users alike should upgrade or replace receivers over time.
    - Focus on the need for sustainable wireless networks, both for commercial and federal spectrum users.
    - Create incentives to repurpose non-federal spectrum, especially for exclusive, flexible-use spectrum licenses.
    - Partner with industry in research and development and standards settings.

These actions will help create a strong national spectrum strategy that will support U.S. leadership in next-generation technologies.

## II. NTIA'S SPECTRUM STRATEGY SHOULD PRIORITIZE OPPORTUNITIES TO REPURPOSE SPECTRUM FOR WIDE-AREA, FULL-POWER, LICENSED ACCESS

### A. The Benefits of Wide-Area, Full-Power, Licensed Spectrum Access Cannot Be Overstated

Ericsson urges NTIA to ensure the national spectrum strategy prioritizes the well-established, highly successful, flexible-use, interference-protected, licensing regimes behind all successful wide-area network deployments in the United States and across the globe. The national spectrum strategy should pursue access regimes that enable such licensing, while ensuring that critical federal missions continue to be met.

[P#I, Q7] Licensing of spectrum on an exclusive-use basis, combined with flexible rights, has been instrumental in spurring investment and innovation. For years, the FCC has licensed spectrum on an exclusive basis and afforded wireless licensees the right to use their spectrum flexibly. This combination has offered wireless providers certainty that network investments will not be compromised by interference and that they can deliver the quality of service that

customers demand and deserve. The results of exclusive-use, flexible-rights licenses speak for themselves:

- Wireless providers have invested over $635 billion in their networks, including $121 billion since 5G was first introduced in 2018.[5]
- The nationwide rollout of 5G has happened much faster than 4G. Today, 5G networks cover 315 million Americans and demand for 5G-connected devices grew over 513% in 2022.[6]
- As 5G continues to develop, deployment is expected to contribute $400 to $500 billion to the U.S. economy and create 800,000 to 1 million new jobs by 2030.[7]

[P#I, Q3, Q7] Exclusive use, wide-area access regimes are critical for supporting new innovative services and use cases in the 6G era, as discussed further below. While Wi-Fi and other indoor solutions will continue to play an important role in offering data connectivity in indoor environments, licensed wireless networks remain key to enabling wide-area mobility and to ensuring dependable and resilient connectivity across all environments. This is especially important because cloud technologies will allow for distribution of computation for use cases like XR that require the seamless mobility that wide-area wireless networks provide. In contrast, spectrum sharing access models may dictate that only certain use cases can be supported.

[P#I, Q6; P#III, Q 5] 5G also enables new business model innovation across all industries and offers a form of sharing that meets users' unique needs. In particular, 5G enables network slicing. The network slice is a logically separated, self-contained, independent, and secured part of the commercial wireless network, targeting differentiated service characteristics based on a customer's specific requirements for speed, latency, and reliability. In effect, network slicing is

[5] CTIA 2022 Annual Survey at 3.

[6] *Id*. at 6.

[7] Enrique Duarte Melo, et al., *5G Promises Massive Job and GDP Growth in the US*, Boston Consulting Group (Feb. 2, 2021), https://www.bcg.com/publications/2021/5g-economic-impact-united-states.

a form of sharing of network capacity that can benefit commercial and federal users alike, just as leasing agreements can be used to increase access to spectrum.[8]

Simply put, full-power spectrum licenses with interference protection and flexible rights for wide-area deployments provide a platform that can be shared by many industries and should remain the preferred spectrum access model for wireless services to maintain service quality.

### B. Where Sharing Is Necessary, NTIA Should Focus on Predefined Solutions That Enable the Assured Access, Full-Power, and Interference Protection Rights Critical to Robust, Wide-Area Deployments

[P#I, Q6, Q7] Sharing with federal operators or other incumbents in non-federal bands may need to be considered, but in all cases, the national spectrum strategy should seek to accommodate incumbent uses of the band through the least restrictive means on the new services in the band, including relocation or repacking of incumbents. Ericsson agrees with NTIA that "[t]o implement the most effective sharing arrangement, in some situations incumbent users may need to vacate, compress or repack some portion of their systems or current use to enable optimum utilization while ensuring no harmful interference is caused among the spectrum users."[9] If necessary, consideration should be given to predefined sharing methods (e.g., some repacking, the creation of narrowly defined protection zones).

[P#I, Q1] In any event, NTIA should pursue solutions that enable full-power deployments and wide-channelization. While thirty kilohertz channels may have been sufficient in the early days of mobile networks, today's 5G and tomorrow's 6G networks will owe their performance advantages largely to the availability of hundreds of megahertz of bandwidth.

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[8] *See* Shahzada Rasool & Jared Carlson, *Network Slicing: a key ingredient of US 5G leadership*, Ericsson (Apr. 3, 2023), https://wcm.ericsson.net/en/blog/6/2023/network-slicing-and-5g-leadership (explaining how using a slice on public 5G networks could augment and simplify the DoD's complex connectivity requirements and add new capabilities).

[9] RFC at 16246.

### C. Dynamic Sharing Frameworks Are Not a Solution to Spectrum Scarcity

[P#I, Q7; P#III, Q5] Dynamic spectrum sharing is not a panacea for spectrum scarcity. To date, dynamic sharing approaches offer intermittent or preemptible access to spectrum and only allow lower power levels, restricting the band to only small cell deployments and limiting the use cases that can be deployed. Dynamic spectrum sharing has yet to be proven to permit high performance uses at scale, and it is too soon to embrace dynamic sharing for the next pipeline without more evidence that intermittent or preemptible spectrum can somehow support envisioned use cases.

[P#I, Q7] Dynamic sharing frameworks will dictate the type of use cases that a band can support. For example, applications requiring low-latency and high reliability and wide-area access cannot rely on dynamic shared spectrum. It is difficult to imagine any spectrum-rights model that can match the availability and resilience offered by exclusive access licensed spectrum. The mobile industry thrives when a band is available to all manner of infrastructure, whether high-power macrocellular radios, medium base stations, or small cells.

[P#I, Q9] For example, the global cellular market has benefitted from the definition of band n77 (3.3-4.2 GHz) in 3GPP for use by 5G NR. Meanwhile, in the United States, the segment of this band devoted to low-power CBRS and restricted to small cells provides for less coverage than typical 5G infrastructure. The economics that drive use of 5G or 6G technologies are based on connectivity that enables higher qualities of service and experience, whereas dynamic spectrum sharing methods typically tend to force networks to offer best-effort outcomes and lower availability of spectrum. As a result, CBRS deployments tend to be combined with bands in other wireless networks to aggregate capacity.

[P#I, Q7] Some regulators around the world have attempted novel regulatory regimes, such as local licenses or leasing between commercial and private operators. It is still too early to

assess the policy outcomes as the enthusiasm for these spectrum access frameworks has not been matched by way of corresponding capital investment in networks. This may partly be due to slow market mechanisms or lack of commitments by interested customers. In any event, when identifying 6G spectrum, NTIA should recognize that spectrum sharing on a secondary basis is typically employed only in conjunction with dependable licensed opportunities. Providers cannot deliver the quality-of-service consumers expect with access only to shared secondary access.

## III. THE SPECTRUM STRATEGY SHOULD IDENTIFY AN ADDITIONAL 1.5-2.2 GIGAHERTZ OF SPECTRUM OVER THE COMING DECADE TO SUPPORT ADDITIONAL 5G USAGE AND THE TRANSITION TO 6G

### A. Ericsson Is Leading the Way in Setting the Vision for 6G

Ericsson recently published a white paper titled "6G Spectrum – Enabling the Future Mobile Life Beyond 2030."[10] The paper focuses on the role of spectrum to unleash the full potential of 6G, the importance of existing spectrum as well as additional spectrum, and the need to consider proper spectrum access regimes. Here we provide a summary and how the national spectrum strategy, and commercial spectrum access, is critical to realizing that vision.

[P#I, Q1] ***6G is quicky moving beyond hypothetical to reality***. Standardization work for 6G is already underway both in 3GPP and ITU-R. Ericsson expects that the first implementable 3GPP 6G specification will be available in 2028.[11] A critical component for the success of 6G is the availability of sufficient spectrum in a timely manner.

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[10] Ericsson, *6G Spectrum – Enabling the Future Mobile Life Beyond 2030* (Mar. 2023), https://www.ericsson.com/4953b8/assets/local/reports-papers/white-papers/6g-spectrum.pdf ("Ericsson 6G White Paper").

[11] *Id*. at 18.

[P#I, Q4] Spectrum targeting 6G use cases should be made available at the same pace as technology evolves. With the first commercial deployments expected in 2030 and the time-consuming process for licensing spectrum, activities toward ensuring spectrum availability for 6G need to be initiated as soon as possible.[12]

[P#I, Q1, Q2] ***6G requires about 3 gigahertz of total wide-area spectrum and reflects the need for outdoor and indoor mobility***. The Ericsson 6G White Paper examined 6G use cases such as holographic communication, the internet of senses, massive digital twins, and the exponential increase in mobile broadband communication.[13] Existing mid-band spectrum will be insufficient to meet capacity needs for these use cases, and mmW spectrum will be unable to provide the coverage needed.[14] Technology developments and refarming existing bands will not meet future traffic demands. Access to additional suitable spectrum is necessary.

[P#I, Q1, Q2] For example, one 6G use case that will drive the demand for more spectrum is holographic communication. Today, we live in a world with 2D video communication (e.g., Teams, Zoom, etc.), but with 6G, our digital experiences will become more immersive.[15] First, we will experience XR (extended reality) and then we will experience full blown holographic communication. Not only is holographic communication demanding from a data rate perspective, but it is also more challenging from a capacity perspective. Over time, the photorealistic holographic communication will be complemented with multisensory extensions such as touch, taste, and smell to increase the level of immersion beyond audio-visual and realize

[12] *Id*. at 20.

[13] *Id*.

[14] *Id*.

[15] *Id*. at 7.

the internet-of-senses vision. This will further drive the data demands.[16] The value of a large-scale, mobile network for the metaverse and holographic use cases is incalculable, as compared to use cases restricted only to the home.

[P#I, Q1, Q2] Another use case driving the need for significantly more spectrum to support wide-area 6G application is the massive digital twin. A digital twin can be defined as an emulation of the physical world within a near-real-time simulation of the environment modeling that physical reality. Modern cloud systems are now being constructed with abundant processing power that includes accelerators that can perform massive calculations in graphics processing units (GPUs) or neuromorphic computational accelerators that can achieve performance capable of such emulation. For example, building a high-precision 4D digital map of a city requires collecting data and information on the city's buildings, vehicles, roads, traffic situations, water management, sanitation, garbage collection, and electricity services, just to name a few examples.[17] Real-world measurements fusing sensor readings can be used to dynamically learn and model such environments, thereby improving performance of the service as well as the operation of the network hosting that application. Although the data rate from each sensor in many cases is modest, the sheer number of sensors results in challenges in terms of aggregated data rates.[18]

[P#I, Q1] Radio-based sensing – that is, radar-like operations – can also provide input to the digital twin in addition to the sensors discussed above. For example, a base station located in a street intersection can be used to estimate the position or speed of vehicles to assist traffic

[16] *Id*.

[17] *Id*.

[18] *Id*. at 8.

safety applications. The spectrum needs for massive digital twin and radio-based sensing are in addition to what is motivated by holographic communication as they are uncoordinated use cases by different users.

Networks deployed by 2030 are expected to benefit from more spectrally efficient technology and thus gradually migrate to 6G as use cases and demand develop. This is a common exercise today and it is expected that this will continue to happen. Wireless providers will combine densification with the acquisition of additional spectrum to expand their deployments to include both macro and small cells, as required in a case-by-case scenario. But 6G demands more spectrum.

[P#I, Q2, Q3] Just the set of 6G use cases described above will require around 3 gigahertz of wide-area spectrum in appropriate frequencies by 2030. Assuming a simplistic calculation, in which all existing mid-band spectrum[19] in the U.S. would be used to address these 6G use cases over time, a shortfall of over 1.5-2.2 gigahertz of spectrum exists in terms of spectrum availability for licensed, wide-area, exclusive use, commercial spectrum by 2030. This spectrum shortfall will need to be addressed in the Lower 3 GHz, 4.4-4.94 GHz, the 7.125-8.5 GHz, and spectrum in the 7-15 GHz range. NTIA will also need to identify even more spectrum in the national spectrum strategy to support other spectrum needs.

[P#I, Q1] ***The wide-area use cases Ericsson examines in its paper are not exhaustive***. There will be continued innovation and growth that will create additional demand for spectrum that can support wide-area, high-capacity, high-reliability, mobile use cases. These new use

[19] In the near term, the U.S. will have 450 MHz of licensed mid-band spectrum available. Janette Stewart, Chris Nickerson, & Juliette Welham, *Comparison of total mobile spectrum in different markets*, Analysis Mason, at 10-11 (Sept. 2022), https://api.ctia.org/wp-content/uploads/2022/09/Comparison-of-total-mobile-spectrum-28-09-22.pdf ("Analysis Mason Report").

cases are in addition to the continued growth of existing services such as traditional mobile broadband, fixed wireless access, and AR/VR.[20]

[P#I, Q1, Q3] ***Localized 6G use cases reflect user needs for extreme data rates in niche scenarios***. Remote surgery, professional high-resolution holographic communication, and other extreme data rate use cases will likely require 10 gigahertz of spectrum.[21] For these specific use cases that may have extremely high bitrate requirements, spectrum in the sub-THz frequency range may be suitable.[22]

[P#III, Q3] ***The availability of the right amount of spectrum in the different ranges at the right time is key for a nation to succeed in connectivity.*** The national spectrum strategy has an essential role to play in developing a well-defined pipeline that can help ensure industry and government spectrum users can plan equipment development and testing. It will also put incumbents on notice that changes may be coming to their bands so that they can begin preparing for those effects, including making sure that they understand the potential impact of new users on their systems.

### B. NTIA Should Focus First on Creating a Pipeline for the Mid-Band Spectrum That Commercial Operators Have Already Identified as Critical

[P#I, Q1, Q3] To support the 5G networks of today, and eventually 6G, the U.S. wireless industry will need access to additional mid-band spectrum. As a result, near-term action is needed. Specifically, the immediate bands of interest within the 3-8 GHz frequency range are the Lower 3 GHz, 4.4-4.94 GHz, and 7.125-8.5 GHz bands.[23] The national spectrum strategy

[20] Ericsson 6G White Paper at 8.

[21] *Id*. at 20.

[22] *Id*.

[23] The 4-5 GHz range has spectrum that could serve federal and commercial purposes, thereby offering the U.S. Government opportunities for adoption of commercial-off-the-shelf technologies. The

must prioritize efforts to free up spectrum for wide-area, full-power, exclusive flexible use licenses in those bands.

[P#I, Q9, P#II, Q6] As noted, Ericsson forecasts that North American average smartphone use will be the highest of any region across the globe, but the United States is hundreds of megahertz behind rival nations in mid-band spectrum for licensed commercial use. According to one recent study, the U.S. currently ranks 13th out of 15 countries in the amount of spectrum allocated to commercial wireless in the lower mid-band range with approximately 270 megahertz available between 3 GHz and 8.4 GHz, while countries such as Japan and China have over 650 megahertz available on average.[24] Globally, other nations rely heavily on the 3.3-4.2 GHz and 4.4-5 GHz ranges for their 5G networks. In the future, other nations may rely on spectrum in the 6 GHz band. WRC-23 will consider whether to identify the 6425-7025 MHz band for IMT. The United States has already allocated that band for unlicensed. Therefore, repurposing the 7.125-8.5 GHz band just above this range for wide-area, exclusive use, licensed spectrum is all the more important.

### C. More Broadly, NTIA Should Focus on Additional Bands in the 7–15 GHz Range and Complementary Spectrum in Higher and Lower Frequencies

[P#I, Q3] Ericsson has been developing testbeds to explore the characteristics of different spectrum bands with a particular focus on the 7-15 GHz range.[25] Ericsson expects that more spectrum will be needed in this range to support multiple service providers with wide channelization needs. In addition to the 7.125-8.5 GHz band, which has long been identified by commercial operators as a band of interest, Ericsson's initial analysis concludes that suitable

availability of products in that band, also known within 3GPP as band n79, is an advantage in the near term and offers potential for the future.

[24] Analysis Mason Report at 10-11.

[25] Ericsson 6G White Paper at 12-14.

segments in the 7-15 GHz range should be studied and identified as bands to repurpose.[26] Ericsson's research demonstrates that wide-area licensing should be pursued within any such identified frequencies to support 6G applications.

[P#I, Q3] It is important to highlight that different frequencies in the 7-15 GHz range will play different roles. Ericsson's analysis has shown that the lower and closer to 7 GHz, the closer the performance of the band is to mid-band in terms of coverage. The approximate "breaking point" at about 10 GHz is where coverage starts to become more challenging. Spectrum in the 10-15 GHz range will offer a sound opportunity for 6G in dense areas. Those ranges also offer potential for alternative co-primary sharing of spectrum on a limited geographical basis with existing use cases.

[P#I, Q3, Q4] At the same time, capacity-driven, local-area 6G use cases will require large spectrum bandwidth, which typically is easier to find the higher the frequency.[27] Sub-THz bands like the W and D bands may provide complementary spectrum serving these localized, specific 6G use cases.

## IV. NTIA SHOULD DEVELOP A SET OF PRINCIPLES TO GUIDE THE DEVELOPMENT OF SHORT- AND LONG-TERM SPECTRUM PLANNING GOALS, IN ADDITION TO IDENTIFYING SPECIFIC SPECTRUM BANDS

As NTIA develops the national spectrum strategy, it should first identify and adopt a set of guiding principles that can help inform the implementation of both short- and long-term goals. Specifically, we urge NTIA to adopt the following principles as it creates the national spectrum strategy:

[26] *Id*. at 20.

[27] *Id*. at 11.

[P#I, Q4] ***An evolving, long-term spectrum pipeline for 5G, 6G, and beyond is critical to U.S. wireless leadership and U.S. technological security.*** Given how long it takes to identify and repurpose spectrum, a pipeline will enable access to spectrum in a well-considered and timely fashion. To execute this principle, NTIA should take the following actions.

[P#I, Q1, Q4] Ensure that, to the extent possible, spectrum is harmonized globally, even where that means in some cases repurposing federal bands domestically. Globally harmonized spectrum allocations result in a broader ecosystem for technology, equipment, and engineering expertise, leading to economies of scale, lower costs for deployment, more rapid roll-out of new services, and enhanced competition among suppliers to the U.S. and global markets. And U.S. participation in globally harmonized bands allows for U.S. leadership in the global ecosystem, contributing directly to U.S. technological security.

[P#I, Q4, Q7] Recognize that wide-area, full-power, wide-channel, exclusive-use access regimes remain a priority for the U.S. to maintain its competitiveness and lead in future technologies. As discussed above, the benefits of the licensed access regime that has successfully underpinned 3G/4G/5G will not diminish with 6G. NTIA should make clear that to be successful, the national spectrum strategy should only rely on spectrum sharing where exclusive access is not available. Where sharing is needed, the governing principle should be simple, predefined sharing that enables commercial operators the greatest potential for wide-area, full-power, wide-channelization operations.

[P#I, Q4] Pursue an evolving spectrum pipeline so stakeholders know which bands to target for study and development. As part of this pipeline, NTIA should work with the FCC to establish a proposed timeline for auctioning bands, including those already identified in the mid-band.

***Outdated systems should be evaluated and modernized.*** To execute this principle, NTIA should take the following actions.

[P#I, Q1, Q5, Q8; P#III, Q2, Q3] Prioritize the upgrade or replacement of aging federal systems. Federal government users cannot continue to rely on aging systems and should take steps to significantly improve their spectral efficiency and performance with cost-effective state-of-the-art building practices. The national spectrum strategy should prioritize ways to incentive federal users to upgrade equipment. The Spectrum Relocation Fund uses spectrum auction revenues to fund updated federal systems resulting from repurposing and can be an important part of this process. Congress may need to play a role in improving the Fund.

[P#I, Q1; P#III, Q2, Q3] Study federal systems in bands of interest to determine where there are opportunities to modernize those services. NTIA should begin the process now of inventorying systems and identifying which equipment is most in need of replacement, especially where there are opportunities for better spectral efficiency. This process should not be a one-time effort, but a concerted effort maintained over time.

[P#II, Q1; P#III, Q2, Q3] Promote federal system use of commercial partners and standards, which promote efficient use of spectrum and may be easier to upgrade over time. Over the years, technology transfer has shifted direction. Where feasible, federal agencies should use commercial standards and services. Indeed, there is already federal agency engagement to modernize communications systems by leveraging commercial 5G capabilities. Such an approach should continue and expand in the 6G era. In addition, as commercial and government users work to implement the national spectrum strategy, they should consider working in partnership to jointly identify technical frameworks that promote efficiency in commercial and government networks (e.g., identification of better, standardized path loss

models). Further, DoD systems need to be flexible in a changing domestic and international spectrum environment. A long-range spectrum plan is needed to transition incumbent federal systems to operate more resiliently with a view towards frequency agility and wide frequency tuning ranges.

***The national spectrum strategy should reflect decisions that create a more unified and sustainable vision.*** To execute this principle, NTIA should take the following actions.

[P#II, Q5] Adopt a whole-of-government approach to global spectrum advocacy so that the U.S. interests have a unified message in global discussions. The U.S. government must speak with one voice in the WRC process to ensure that U.S. interests are advanced.

[P#II, Q3] Make clear that receivers have a role to play in avoiding harmful interference, and commercial and federal spectrum users alike should upgrade or replace receivers over time. NTIA should make clear that incumbent operators, federal or commercial, may need to update their receivers to ensure that spectrum is being used efficiently. The FCC's draft Policy Statement on spectrum management principles makes clear that it is the responsibility of both transmitters and receivers to reduce the likelihood and impact of harmful interference.[28] These principles should apply both to federal spectrum users and to commercial operators.

Focus on the need for sustainable wireless networks, both for commercial and federal spectrum users. Commercial and federal operators have a role to play in sustainability. Both commercial and federal operators can contribute to the reduction of carbon emissions. Ericsson is hard at work on these efforts already. Ericsson was recently named the leader in an ABI

[28] *Principles for Promoting Efficient Use of Spectrum and Opportunities for New Services*, Policy Statement, ET Docket No. 23-122, FCC-CIRC2304-01 (Mar. 30, 2023) (pending adoption).

Research assessment that evaluated the capabilities of telecom vendors to reduce energy use and waste across the industry.

[P#I, Q5, Q8] Create incentives to repurpose non-federal spectrum, especially for exclusive, flexible-use spectrum licenses. The U.S. should continue to promote incentives for efficient and effective repurposing of non-federal spectrum, especially those that lead to exclusive, flexible-use spectrum licenses. The appropriate means of repurposing spectrum will be a function of the type of service involved, the number of incumbents that must be cleared, among other factors. Two-sided auctions and secondary markets should be considered where they would expedite the repurposing process.

[P#III, Q3] Partner with industry in research and development and standards settings. NTIA should encourage federal agencies to partner with the wireless industry to research next-generation technologies.

## V. CONCLUSION

Ericsson fully supports the Administration's effort to develop a national spectrum strategy and urges the strategy to incorporate the recommendations set forth above.

Respectfully Submitted,

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