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

In the Matter of	)
	)
Development of a National Spectrum Strategy Implementation Plan	)
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COMMENTS OF ERICSSON

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January 2, 2024

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I. INTRODUCTION AND SUMMARY.

Ericsson welcomes the opportunity to respond to the Notice of Opportunity for Public Input issued by the National Telecommunications and Information Administration ("NTIA") on implementation (the "Implementation Plan") for the National Spectrum Strategy ("Strategy").[1] As we have stated before, at its core, the Strategy should not only create a roadmap to secure future spectrum for licensed commercial wireless stakeholders; it should position the United States for leadership in the global wireless ecosystem and advance U.S. economic and technological security interests.[2] To achieve these goals, the Implementation Plan should establish the amount of spectrum to be repurposed for commercial licensed, full-power use and set timelines for repurposing, along with guiding principles for the Strategy's spectrum evaluation process.

The U.S. has been a global leader in wireless, thanks in large part to making available spectrum for wide-area, full-power licensed use that, in turn, has enabled highly consequential

[1] Implementation of the National Spectrum Strategy, 88 Fed. Reg. 85266 (Dec. 7, 2023); *National Spectrum Strategy*, NTIA, (Nov. 13, 2023) ("Strategy"), https://www.ntia.gov/sites/default/files/-publications/national_spectrum_strategy_final.pdf.

[2] Comments of Ericsson, NTIA Docket No. NTIA-2023-0003, at 1 (Apr. 17, 2023) ("Ericsson Strategy Comments").

societal, economic, and national security benefits. Today, however, there is no spectrum pipeline, particularly in the mid-band range, one that is critical to beneficiaries of commercial wireless licensing. As CTIA has noted, "[t]he U.S. is well behind key benchmark nations in the amount of mid-band spectrum, and lower mid-band spectrum in particular, that it has dedicated to commercial wireless licensing. A review of 15 leading markets confirmed that other nations are committing far more mid-band spectrum to licensed use."[3]

The United States is facing a looming licensed spectrum deficit in the near term, as ever-growing demand and emerging innovations will trigger more wireless network capacity needs. America's ability to continue to lead in 5G, 6G, and beyond is at risk without an adequate spectrum pipeline. The Implementation Plan is a crucial opportunity to remedy the spectrum shortfall.

The Implementation Plan should seek to maximize the spectrum made available for commercial use. While the industry has suggested an allocation of 1.5-2.2 gigahertz, that amount is barely enough to keep the United States in the middle of the pack globally. Although the Strategy identifies nearly 2,800 megahertz of spectrum for study, it does not identify an amount of spectrum to be repurposed for commercial use suitable for 5G, 6G, and beyond. This lack of any goal for allocating spectrum for licensed, full-power use creates a real risk that the Strategy's studies may produce zero megahertz of spectrum for the wireless broadband industry or that technical restrictions may be so onerous to make use of the spectrum for wide-area connectivity infeasible.

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[3] Comments of CTIA, NTIA Docket No. NTIA-2023-0003, at 8 (Apr. 17, 2023) ("CTIA Strategy Comments").

Ericsson submits that NTIA and the Federal Communications Commission ("FCC") should set more ambitious goals, with a specific focus on the Lower 3 GHz (3.1-3.45 GHz) and the 7/8 GHz (7.125-8.4 GHz) bands over the near term, as well as the 4.5 GHz (4.4-4.94 GHz).[4] This focus on the lower mid-band would serve as a core for 6G if it is combined with centimetric wave bands in the 10-15 GHz range, such as the 14 GHz (14.8-15.35 GHz) band, adding to the 12.7-13.25 GHz range that is already being considered by the FCC.[5] It is, therefore, imperative for NTIA to take the next step and lead this initiative by establishing actionable goals for the amount of spectrum to be made available for licensed, full-power use. Licensed, full-power spectrum access enables the wireless ecosystem by maximizing coverage, increasing capacity in areas of high traffic, and promoting new use cases like fixed wireless access that are quickly becoming an important complement to broadband connectivity in the last mile. Put differently, it is the wide-area base stations radiating at high power that make the high-speed street micro installations and indoor/outdoor small cells viable; coverage and capacity provisioning go hand-in-hand.

The Implementation Plan should also prioritize exclusive-use licensing for commercial use, which the President's *Memorandum on Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy* ("Presidential Memorandum") recognizes must be

[4] The Ericsson Strategy Comments defined the 7/8 GHz band to include the 8.4-8.5 GHz segment. Ericsson continues to support evaluation of that portion of the band but defines the 7/8 GHz frequencies herein consistent with the band identified in the Strategy for study evaluation.

[5] *See Expanding Flexible Use of the 12.7-13.25 GHz Band for Mobile Broadband or Other Expanded Use*, Notice of Proposed Rulemaking and Order, FCC 23-36 (rel. May 19, 2023).

considered as part of the Strategy.[6] A licensed spectrum pipeline offers the assured access and interference protection that generates massive investment in next-generation commercial technologies and wide-area network deployments that trigger innovation across verticals, from smart cities, augmented reality/virtual reality, and autonomous vehicles, to improved communications technology implementation in Federal missions.

In addition to NTIA setting goals for a licensed spectrum pipeline, Ericsson urges that the Implementation Plan should embrace seven essential principles to inform the Strategy's spectrum study process:

- ***Study Transparency and Collaboration*.** As NTIA develops its roadmap for completing the near-term spectrum studies, it should identify essential elements of the spectrum study process. All stakeholders should have an opportunity to provide input on the sharing parameters, with transparency throughout the study process. Likewise, all stakeholders should have an opportunity to participate in development of the study outputs as well.
- ***Federal System Modernization*.** The Implementation Plan should prioritize ways to incentivize Federal users to upgrade their systems to ensure improved spectral efficiency and system performance. In addition, it may be necessary to consider use of commercial services, repacking, and relocation to achieve the identification of exclusive-use, licensed spectrum in the ranges identified in the Strategy. Considering these options is essential to avoiding the "zero megahertz" pipeline, described above.
- ***Study Timeline Efficiency and Expediency*.** The Implementation Plan should find ways for NTIA to accelerate the studies. Once spectrum is identified for repurposing, implementing the decision for reallocation – especially involving spectrum currently allocated for Federal use – is a time-consuming process that can take years. If spectrum sharing is decided in a portion of the spectrum, it may take years to develop a sharing framework. It is thus critical that the studies move quickly, especially in cases where initial investigative work has already been done (e.g., in the Lower 3 GHz band).
- ***Sharing Models*.** Where sharing is the only option, NTIA should acknowledge that there are a variety of sharing models that must be considered, including static sharing that has

[6] *Memorandum on Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy*, The White House (Nov. 13, 2023) ("Presidential Memorandum"), https://www.whitehouse.gov/briefing-room/presidential-actions/2023/11/13/memorandum-on-modernizing-united-states-spectrum-policy-and-establishing-a-national-spectrum-strategy/.

worked well in prior spectrum allocations and retained the spectrum value at auction. Dynamic spectrum sharing ("DSS"), which the Strategy contemplates, is but one flavor of sharing and has yet to be proven – especially for wide-area deployments – and the evaluation of DSS would be longer-term and considered separate from the near-term spectrum studies.

- ***Whole-of-Government Policy for Benefitting the People*.** Even as NTIA studies the viability of various spectrum ranges, consideration from the various stakeholders should include evaluation of the impact of various policies on the value derived from spectrum. Static allocations will fetch higher auction proceeds that will facilitate relocation and modernization of Federal systems. In contrast, more dynamic forms of sharing may lead to underfunding the Spectrum Relocation Fund ("SRF").
- ***Private Networks Need Access to Exclusive-Use Spectrum*.** Private networks are developing and may be an opportunity for localized use for both commercial and government purposes; but quality of service is still critical, which can only be ensured by exclusive-use spectrum. While advanced sharing technologies could serve as a long-term complement to exclusive-use operations, solutions that incorporate an element of exclusive use must be prioritized to ensure service quality to incentivize commercial investment by operators and enterprises.
- ***Fact-based Decision Making*.** The spectrum studies should be rooted in fact, incorporate early stakeholder engagement on spectrum modeling, and use economic evaluation to ensure recommendations account for deployment realities. The sustainability of wireless networks should also be accounted for.

NTIA has an historic opportunity to ensure the Implementation Plan secures continued U.S. global wireless leadership for decades to come and to advance U.S. economic and technological security interests. We look forward to working with NTIA and other stakeholders to advance wireless innovation and investment.

II. THE IMPLEMENTATION PLAN SHOULD PROMOTE CONTINUED U.S. LEADERSHIP IN THE GLOBAL WIRELESS ECOSYSTEM AND ADVANCE U.S. ECONOMIC AND TECHNOLOGICAL SECURITY INTERESTS.

Ericsson supports the President's goal of "accelerat[ing] United States leadership in wireless communications and other spectrum-based technologies and to unlock[ing] innovations

that benefit the American people."[7] Although U.S. wireless operators are investing more than ever in leading-edge, innovative, spectrally efficient network deployments – $39 billion in 2022 alone[8] – a shortfall of additional suitable spectrum will stall these efforts. The only way to avoid a negative outcome for the nation is by identifying spectrum for advanced wireless use. A spectrum pipeline for 5G, 6G, and beyond is critical to U.S. wireless leadership, to innovation that advances consumer welfare, and to economic benefits and technological security. Given how long it takes to identify and repurpose spectrum, the identification of a spectrum pipeline is imperative, and the alternative is a lost opportunity for the United States.

Exclusive-use, wide-area networks are essential for supporting new innovative services and use cases in the advanced 5G and 6G eras that enable innovation and new business models across all industries. This is especially true for enterprise services, which cannot rely solely on preemptible spectrum access that introduces uncertainty for mission-critical operations.

Ericsson is leading the way in setting out the vision for 6G, which will rely on additional spectrum availability.[9] This 6G vision hinges on five points:

(1) The first implementable 3GPP 6G specification will be available in 2028, and sufficient spectrum will need to be available in a timely manner for 6G success;

(2) 6G will require about three gigahertz in total of wide-area spectrum and it reflects the need for outdoor and indoor mobility;

(3) Innovation and growth will continue to add use cases and demand for spectrum capable of supporting high-capacity, wide-area, high-reliability, mobile use cases;

(4) Extremely high data-dependent use cases will likely require 10 gigahertz of additional spectrum; and

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[7] *Id*.

[8] *2023 Annual Survey Highlights*, CTIA, at 4 (July 25, 2023), https://api.ctia.org/wp-content/uploads/2023/11/2023-Annual-Survey-Highlights.pdf.

[9] Ericsson Strategy Comments at 9-13.

(5) A spectrum pipeline with the right kind of spectrum at the right time is key for connectivity success.

III. THE IMPLEMENTATION PLAN SHOULD IDENTIFY 1.5-2.2 GIGAHERTZ OF MID-BAND SPECTRUM FOR FULL-POWER LICENSED USE TO SUPPORT WIDE-AREA CAPABILITIES.

A. Additional Licensed, Full-Power Spectrum is Needed to Meet Growing Wireless Needs.

The U.S. is facing a near-term licensed spectrum shortfall, which jeopardizes the nation's ability to compete technologically and reap the economic and national security benefits that wireless leadership brings. As CTIA has explained, the U.S. is behind its peer nations by an average of 378 megahertz in terms of mid-band spectrum available for licensed use.[10] And demand keeps growing. Ericsson forecasts that the average monthly data usage per smartphone in North America will grow from 26 GB in 2023 to 66 GB in 2029.[11] Total North American mobile data traffic will grow from 6.8 EB/month in 2022 and 9.6 EB/month in 2023 to 27 EB/month by 2029.[12] These figures will only grow more as fixed wireless access expands, bringing new competitive options to consumers in the home broadband market, and as new applications like extended reality are implemented. The Implementation Plan is an important opportunity for NTIA and the Administration to advance spectrum policies that will keep pace with this growth and further the benefits of advanced wireless connectivity.

In the face of increasing demand for wireless resources, the wireless industry is doing its part by consistently innovating to ensure that its products and services use spectrum efficiently.

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[10] CTIA Strategy Comments at 8 (citing to an Analysys Mason report that evaluated spectrum allocations in the 3-7 GHz range).

[11] *Ericsson Mobility Report*, Ericsson, at 12 (Nov. 2023), https://www.ericsson.com/4ae12c/assets/local/-reports-papers/mobility-report/documents/2023/ericsson-mobility-report-november-2023.pdf.

[12] *See id*. at 39.

As the Strategy emphasizes, advancing the state of technology for spectrum access can sustain and extend the role of wireless networks in the efficient use of spectrum.[13] Ericsson is at the forefront with technological tools including advanced antennas, digital beamforming, artificial intelligence technologies, cloud platforms, distributed computation, spectrum management, and digital twins for automation. But efficiencies alone will not solve the mid-band spectrum gap that is projected as data demands increase.

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 prioritize the availability of full-power, wide-channel, licensed spectrum for wide-area use. Such action will help meet the President's directive that NTIA consider the benefits of licensed spectrum access as part of the Strategy.[14]

Stakeholders need to have an understanding of how much spectrum is targeted for licensed use in the near term, and in which bands, so they can invest in commercial study and development. There are obvious long poles in the tent, such as radio technology, which require a long lead time to mature and industrialize and which are dependent on the spectrum band, the bandwidth, and the power levels available, among other factors. The greater insights NTIA can provide today regarding the amount of spectrum and which bands will be made available, and under what operating parameters, the better positioned industry will be to lead in the market development of such technologies and services.

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[13] *See* Strategy at 14.

[14] *See* Presidential Memorandum § 3(c).

B. The Implementation Plan Should Detail Specific Amounts of Spectrum to be Repurposed for Commercial Use with a Near-Term Focus on the Lower 3 GHz and the 7/8 GHz Bands.

To provide necessary certainty for the next generation of wireless innovation, NTIA should establish an Implementation Plan with a deliverable of 1.5-2.2 gigahertz of additional spectrum in suitable mid-band frequencies that can be repurposed for commercial networks, while ensuring critical Federal missions are supported. Today, the spectrum pipeline is empty, and the Strategy explicitly states that there is no guarantee that any of the spectrum identified for study will ultimately be made available for commercial wireless use.[15] Simply put, a two-year study cycle without a goal introduces too much uncertainty. Sufficient contiguous mid-band spectrum for commercial use that is licensed and made available for full-power operations with minimal restrictions is especially critical in the near term.

The immediate bands of interest are the Lower 3 GHz band, the 7/8 GHz band, and the 4.5 GHz (4.4-4.94 GHz) band. As discussed below, NTIA should identify goals for making substantial portions of the bands identified in the Strategy – the Lower 3 GHz and 7/8 GHz bands – available for licensed use in the near term. These bands create the opportunity for contiguous wide-channel licensed spectrum, which is crucial to handle ever-increasing U.S. wireless data demands. NTIA should also continue to evaluate opportunities for access to the 4.5 GHz range.

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[15] *See* Strategy at 7 ("U.S. policy (and stakeholders) must recognize that 'studying' a band for potential repurposing to enable more efficient use does not prejudge the outcome of the study (i.e., that all, part, or none of the band ultimately will be repurposed as a result of the study)").

Lower 3 GHz.

Ericsson supports the Strategy's commitment to pursue "follow-on" studies for the lower 3 GHz band, after the Department of Defense ("DoD") study last year, and the Strategy's commitment that NTIA should lead those studies in coordination with DoD.[16] The Lower 3 GHz band is a central part of the global 5G ecosystem, which continues to mature as the world increasingly opens up this band for 5G.[17] NTIA should implement the Strategy in a manner that explores opportunities for licensed, full-power use throughout the 3 GHz band, with an emphasis on harmonization with 3GPP Band n77 (3.3-4.2 GHz). U.S. prospects for advanced 5G and 6G would be well served by policymakers taking advantage of the n77 ecosystem, setting policies as consistent as possible with the n77 standards, and resisting any calls for making spectrum in this range an extension of the low-power, preemptible Citizens Broadband Radio Service ("CBRS") framework.[18] Moreover, at the 2023 World Radiocommunication Conference ("WRC-23"), the lowest portion of the standardized band obtained a new mobile allocation and identification in the Americas Region for International Mobile Telecommunications ("IMT") systems (i.e., 5G),[19] making it all the more imperative for study for licensed 5G access in the United States.

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[16] Strategy at 6.

[17] Ericsson, Spectrum Awards, https://www.ericsson.com/en/public-policy-and-government-affairs/spectrum-awards (last visited Dec. 27, 2023).

[18] *See generally* Comments of Ericsson, WT Docket No. 19-348, at 2, 4-5 (Nov. 20, 2020).

[19] *See* WRC-23 Agenda, ITU-R Preparatory Studies for WRC-23, International Telecommunication Union, at Agenda Item 1.2, https://www.itu.int/wrc-23/wrc-23-agenda/ (last visited Dec. 21, 2023) ("WRC-23 Agenda"); *see also* Resolution COM6/23 (WRC-23), Agenda for the 2027 World Radiocommunication Conference, WRC-23 Provisional Final Acts, ITU, https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.15-2023-PDF-E.pdf (last visited Dec. 27, 2023) ("WRC-23 Provisional Final Acts").

7/8 GHz.

In light of the decision to make the 6 GHz band available on an unlicensed basis in the United States, the 7/8 GHz band is now the only extended mid-band spectrum that can support initial introduction of exclusive licensed, full-power 6G use cases. While the FCC allocated the full 6 GHz band for unlicensed use, many other nations are expected to leverage the 6 GHz band for IMT following decisions made at WRC-23, where numerous countries identified the upper 700 megahertz of this band for IMT.[20] The decisions at WRC-23 make repurposing the adjacent 7/8 GHz band for wide-area, exclusive, licensed use all the more important for the United States to facilitate licensed access while enabling economies of scale across a global mid-band tuning range. Given the time it takes to secure additional spectrum through regulatory deliberations in the International Telecommunication Union ("ITU") or regional groups, and to avoid delaying initial 6G commercial deployments expected after 2028, now is the time to start the process of creating a pipeline to support next-generation wireless use.[21] Timing and leadership are critical if the United States is going to be successful in driving a worldwide allocation in the 7/8 GHz band at WRC-27 and take a leadership role in the 6G ecosystem.

The fragmented access models available in mid-band spectrum today, coupled with the release of 6 GHz spectrum for unlicensed use in the U.S., also puts an emphasis on the need for access to the 7/8 GHz band for commercial, licensed wireless use well before the 6G timeframe.

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[20] *See* Matt Daneman & Dugie Standeford, *WRC-23 Seen as 'Clear Success' for U.S.; 6 GHz Protection from IMT Cheered*, at 2, COMMUNICATIONS DAILY (Dec. 18, 2023) ("China and its allies wanted to take 6425 GHz to the top of the 6 GHz band "and put an IMT stamp on it," which would have precluded unlicensed access."); *see also* WRC-23 Provisional Final Acts.

[21] Eliane Semaan, et al., *Realizing the 6G vision - Why is spectrum fundamental?*, ERICSSON (June 7, 2022), https://www.ericsson.com/en/blog/2022/6/6g-spectrum-why-its-fundamental.

To ensure that these bands are used efficiently and provide a balance between coverage and capacity, they must also enable full-power commercial use.[22]

C. The Administration Should Also Support Longer-Term Spectrum Repurposing Initiatives.

The Administration should also take action beyond the near-term bands in the Strategy. Other nations rely heavily on the 4.4-5 GHz range for their 5G networks. Here in the U.S., the 4.4-4.94 GHz band remains a band of interest and, while not part of the Strategy, it should be studied with the goal of repurposing for commercial use. This band is under consideration for expanded IMT use at WRC-27 and remains a prime resource for expanded wireless use.[23] And in the longer term, 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.[24] Spectrum in this range should be added to the long-term spectrum pipeline as a post-2028 goal. Spectrum above the 10 GHz band will require denser network deployment than is typical in the U.S. today, placing demands on U.S. operators that will require policies that offer cost-effective approaches to deployment and ubiquity of coverage.

NTIA, the FCC, the State Department, and other participants in the Administration should be proactive in influencing discussions within the ITU to inform outcomes for WRC-27 on these bands, with the goal of promoting pragmatic outcomes and keeping the U.S.

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[22] Kumar Balachandran, Mark Racek & Noman M. Alam, *Why a National Spectrum Strategy is Crucial for US Leadership – Part 2*, ERICSSON (Oct. 18, 2023), https://www.ericsson.com/en/blog/6/2023/national-spectrum-strategy-crucial-for-us-leadership-part-2.

[23] *See, e.g.*, Paul Kirby, *U.S. Officials, Industry Welcome WRC-23 Results*, TR DAILY (Dec. 15, 2023); *see also* WRC-23 Provisional Final Acts, WRC-27 Agenda Item 1.7 (resolving to study the frequency range 4.4-4.8 GHz, among other, for IMT); WRC-23 Agenda Item 1.1 (listing countries with an IMT designation in the 4.8-5.25 GHz range).

[24] Ericsson Strategy Comments at 14-15.

competitive in the global wireless economy. We encourage the U.S. to assume a leadership role specifically in the identification of globally harmonized spectrum bands for 6G use. 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 rollout of new services, and enhanced competition among suppliers to the U.S. and global markets.[25] And U.S. participation in globally harmonized bands allows for continued U.S. leadership on the world stage.

IV. THE IMPLEMENTATION PLAN SHOULD OUTLINE ESSENTIAL PRINCIPLES TO INFORM THE SPECTRUM STUDY PROCESS.

The Implementation Plan and its deliverables should provide early clarity regarding the study processes and principles for the Lower 3 GHz and 7/8 GHz bands, including their timing, inputs, and outputs. Such processes should be data-driven – consistent with the Administration's focus on data-based decision-making – and increase transparency into current and future Federal and non-Federal spectrum use. They should also reflect the near-term nature of the present spectrum evaluation and identify opportunities to incentivize Federal system services modernization.

Additionally, consistent with the Presidential Memorandum, which calls for "plans to optimize United States spectrum management and use by considering different types of spectrum governance models, including exclusive licensing, unlicensed use, shared use, and combinations of these approaches," NTIA should consider all opportunities for licensed use.[26] Where sharing is contemplated, the Implementation Plan should recognize the need for commercial/private

[25] *Id*. at 16.

[26] Presidential Memorandum § 3(c).

networks to have a portion of exclusive licensed spectrum to ensure guaranteed minimum levels of service. Spectrum that cannot be relied upon in a sharing arrangement will not support commercial service. This is especially critical for applications that do not have other bands that are licensed where aggregation or roaming can take place.

A. The Spectrum Study Process Should be Open and Transparent.

The forum for evaluating the spectrum bands identified in the Strategy should be open and transparent. Spectrum repurposing or sharing is complex and requires a diverse set of experts – both in government and the private sector – to properly engage in the discussion. As discussed in the Strategy, "decision-makers would benefit from increased transparency and additional data regarding Federal spectrum usage when making [spectrum usage] decisions—to the extent permitted by law and subject to necessary operational security protections."[27] All stakeholders represented in the process should have their views shared and reflected in any study report.

Incumbent Federal systems users should be as transparent as possible to enable meaningful evaluation of the spectrum for repurposed, exclusive use or for any sharing mechanism that may be necessary to accommodate commercial access to the band. This information sharing should be informed by lessons learned from earlier spectrum evaluations, including the CBRS and Partnering to Advance Trusted and Holistic Spectrum Solutions ("PATHSS") processes.

To that end, we encourage NTIA and others to find ways to meaningfully engage in discussion of classified technical information. When it comes to repurposing or sharing Federal

[27] Strategy at 4.

spectrum for non-Federal use, non-Federal users require access to confidential information (beyond Controlled Unclassified Information); otherwise, a comprehensive analysis of repurposing or sharing is not possible. Not all non-Federal individuals have had access to the necessary clearances to participate in the classified discussions in the past. To reach the objective of a transparent, inclusive process with the broadest possible involvement, expanded access to secure information is needed by those parties that are interested and qualified during the relevant discussions.

The goal should be to facilitate transparent, NTIA-led discussions, as envisioned in the Strategy and Presidential Memorandum, with stakeholder input fully and responsibly considered. The study forum and its outcomes should be informed by balanced discussions between incumbents and possible new commercial entrants. As NTIA stated in the Strategy, "[u]sing best practices developed through collaboration between Federal and non-Federal stakeholders, and in compliance with existing law and policy, will serve to ensure better acceptance and fewer disputes over findings."[28]

B. The Spectrum Study Process Should Identify Opportunities to Incent Federal System Services Modernization.

Consistent with the Strategy's recognition that existing efforts to modernize Federal spectrum management capabilities are "a positive first step,"[29] the Implementation Plan should identify plans and timelines to upgrade and/or replace incumbent systems and ensure that Federal networks use commercial partners and standards where possible, which can promote efficient use of spectrum and may be easier to upgrade over time. The reality is that Federal government

[28] *Id*. at 11.

[29] *Id*. at 12.

users cannot continue to rely on aging systems and so, where feasible, Federal agencies should consider using commercial services.

To that end, incumbent spectrum occupancy should be evaluated with the stated intent of improving efficiency of use.[30] The Implementation Plan should include plans for surveys and/or analyses to identify Federal incumbent services that are not using their spectrum as efficiently as the current market technology enables. NTIA should also develop plans that include investing in and promoting the development of Federal technological advancements in spectrum utilization, with a focus on upgrading and enhancing Federal systems to enable repacking and relocation to further the ability to repurpose spectrum for the commercial spectrum pipeline. Studies should include whether and how the upgrade or replacement of aging Federal systems was considered.

NTIA should also prioritize ways to incent Federal users to upgrade equipment. NTIA should begin the process now of inventorying systems and identifying which Federal 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. The SRF enables the use of spectrum auction revenues to reimburse Federal agencies for costs associated with repurposing a spectrum band for commercial use, including costs for relocating to a new band or utilizing an alternative technology. The SRF can thus be an important part of this process, potentially with improvements that may need to be considered by Congress. Study deliverables should also include which Federal networks can utilize commercial partners and standards, as these measures promote efficient spectrum use and may be easier to upgrade over time.

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[30] *Id*. at 13.

In some cases, receiver specifications have not evolved over time. The Strategy's focus on the need to improve receiver performance in the face of harmful interference is well-placed.[31] Critical to overall improved receiver immunity performance are "holistic policies that address a path for legacy receiver upgrades that promote coexistence[] and are also not susceptible to transmitters operating in their prescribed manner. Without holistic technology policy [which considers all receivers], some receivers may be developed without regard to adjacent band services or efficiency improvements over time."[32] Thus, study deliverables should identify baseline receiver specifications that improve receiver immunity.

C. The Spectrum Study Process Should Conclude as Soon as Possible.

The timing of spectrum access is critical. Some of the Strategy's goals involving technology developments – e.g., for DSS – should be considered as longer-term goals and should not delay the study of, and access to, the spectrum bands that have been targeted for near-term study, including the Lower 3 GHz and 7/8 GHz bands. The Presidential Memorandum expressly calls for studies of these bands in the next two years, with the Strategy noting that "timely, evidence-based decision-making [is] needed to best serve the public interest."[33] Where feasible, as NTIA Administrator Alan Davidson expressed last month,[34] these studies should conclude as soon as possible and ahead of the two-year timeline. To promote expeditious and efficient

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[31] *Id*. at 14.

[32] *Radio Frequency Receiver Performance*, 5G Americas, at 4, (Feb. 2023), https://www.-5gamericas.org/wp-content/uploads/2023/02/Receiver-Performance-Id.pdf.

[33] Strategy at 11.

[34] *See Oversight Of The NTIA Before the Subcomm. on Commc'ns & Tech.*, 118th Cong., at 38:44-38:54 (Dec. 5, 2023) (Alan Davidson, Assistant Sec'y of Com. for Commc'ns and Infor. & Adm'r, responding to Rep. Doris Matsui, Ranking Member, Commc'ns & Tech.) ("We have a shot clock that is put on us – two years max. And we hope that [on] some of these studies that are going to come in, that it won't take two years. And NTIA is in the driver's seat, we are going to be pushing them forward.").

studies, information obtained from prior spectrum evaluations should be leveraged (e.g., information shared or obtained through the PATHSS process for the Lower 3 GHz band, or prior drive testing and quantitative assessments for both the Lower 3 GHz and 7/8 GHz bands).

D. The Spectrum Study Process Should Carefully Evaluate the Benefits and Drawbacks of Spectrum Sharing.

Studies of the identified bands should consider how to accommodate commercial access to bands through the least restrictive means possible. In repurposing spectrum, exclusive-use licensed access is the priority for commercial wireless deployment at scale. But in some bands, 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 DSS facilitated by spectrum access systems are not a panacea for spectrum scarcity.

While the Strategy highlights DSS for evaluation,[35] this spectrum access model is still in an experimental stage that has yet to achieve demonstrated success in permitting high performance uses at scale. While an admirable long-term goal of the Strategy is to embrace and promote innovation to expand spectrum access capabilities,[36] ensuring the reliability of innovative spectrum access models can take years, and there are more immediate ways in which

[35] *See* Strategy at 14 (stating that "U.S. spectrum regulating agencies, Federal agencies, U.S. commercial industry, academia, and technology developers will work collaboratively to encourage dynamic spectrum sharing").

[36] *Id.*

the U.S. can improve spectrum access. Indeed, the Strategy calls evaluation of DSS a "moonshot" endeavor,[37] which by its very definition is a lofty, longer-term goal.

The study processes should thus, at least in the near-term, consider spectrum governance models that have proven successful in spectrum repurposing efforts, with priority for exclusive-use licensing. The goal of spectrum sharing evaluations should be to identify the most appropriate and least restrictive vehicle for making the spectrum available in the near term to support the Administration's priorities – namely, promoting innovation and wireless deployment while maintaining Federal missions.

Notably, and as the Implementation Plan should recognize, there are significant drawbacks to spectrum sharing models.[38] First, restrictions on spectrum access (e.g., low power levels or other requirements that limit wide-area deployment) reduce the value and use of spectrum. The more spectrum access is restricted, the fewer customers that can be served with that spectrum, and thus the less valuable that spectrum becomes to commercial providers. And dynamic shared spectrum cannot be relied on by applications requiring low-latency, high-reliability and wide-area access, including critical sector and enterprise applications.

Moreover, there can be negative implications to U.S. leadership in technology deployment when unique spectrum access models are adopted, as deviations from harmonized bands increases the risk that other countries will dominate the wireless supply chain. Experimental shared access frameworks in particular, such as CBRS, can isolate U.S. investment, take many years to develop, and ignore the benefits that exclusive licensed use has

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[37] *Id*. at 13.

[38] *See* Ericsson Strategy Comments at 7-9.

provided for all users. Further, each sharing solution is likely to have unique characteristics that are not amenable to a commonly standardizable model. A combination of all these factors over three ITU-R regions and the hundreds of possible governmental regulatory authorities will fragment products into sub-standard network solutions. Policymakers should consider whether that is a desirable outcome.

Where sharing is evaluated and considered, options must include repacking or relocation. This offers an opportunity for Federal incumbents to leverage auction revenues through the SRF to upgrade their systems. Just as NTIA has recognized that its need to modernize spectrum management systems is acute,[39] Federal incumbents should seek to identify where their systems need upgrading and take steps to improve flexibility, resilience, and reliability in their spectrum use. The Implementation Plan should also describe the proposed sharing solutions sufficiently and specifically, noting risks, timeframes, cost to incumbents and industry, performance, research dependencies, funding, and whether labor is an issue. Funding mechanisms that will require legislation should also be identified. Finally, and as discussed, global harmonization is key for economies of scale and attraction of investment. Thus, deliverables should leverage 3GPP standardization to ensure that sharing solutions are not tailor-made to the U.S., but rather apply broadly across the world.

E. The Spectrum Study Process Should Ensure Service Quality and Promote Investment.

In localized network deployments, where sharing approaches are envisioned, NTIA should nonetheless recognize the need for a holistic approach to spectrum access that includes

[39] *See* NTIA, *Federal Spectrum Data Systems Modernization*, Request for Information (Sept. 6, 2023) https://sam.gov/opp/fe85cc8737bc43cfa6ad9a41431423b8/view.

licensed spectrum as the anchor for commercial/private networks, ensuring the continuity and quality of service that users are accustomed to and are ultimately willing to pay for.

Private networks are developing and evolving, and they may be an opportunity for use of shared spectrum, especially if localized. 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 millimeter wave bands may be sufficient and sharing might not present a major risk of interference.[40] Our experience is that the advantages of millimeter wave spectrum are best realized when that spectrum is combined with coverage-enhancing approaches that employ mid-band or low-band spectrum. Thus, some critical use cases will not find commercial expression without a comprehensive industry approach that will require partnership of enterprises with network service providers.

With purely shared access approaches, preemption of commercial spectrum is "a barrier to applications that require guaranteed levels of service."[41] For example, when a provider holds a license in a band where incumbents (or any other licensee) have absolute preemption over the provider's use of the band, that provider is effectively rendered a permanent subtenant.[42] This inability to ensure consistent and reliable spectrum access in a given band, which translates to an inability to ensure service quality, results in a reluctance by preemptible entities to invest significant resources in the band.[43]

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[40] Ericsson Strategy Comments at 3.

[41] *See* Recon Analytics LLC, *CBRS: An Unproven Spectrum Sharing Framework*, at 1 (Nov. 14, 2022), https://api.ctia.org/wp-content/uploads/2022/11/CBRS-Recon-Analytics.pdf.

[42] *See id.* at 6.

[43] *See id.* at 7.

Thus, while further investigation of advanced sharing technologies could serve as a long-term complement to exclusive-use operations that otherwise support wide-area wireless connectivity, it remains important that spectrum be made available on a licensed basis to ensure that a minimum level of service can continue.

F. The Spectrum Study Process Should Be Grounded in Data-Driven, Economic Evaluations with a Focus on Standard Spectrum Modeling Techniques.

NTIA's evaluation of the identified spectrum bands should be rooted in fact, use economic evaluation, and incorporate early stakeholder engagement on spectrum modeling, including which assumptions are to be used. Both the Presidential Memorandum and the Strategy are clear on the need for data-driven processes to inform the spectrum evaluations, with the Strategy calling for "an evidence-based national spectrum decision-making methodology."[44] Spectrum modeling should similarly be based on accepted practices using standard models and accepted incumbent and shared service technology/system characteristics that include the typical occupancy of actual operations in a given band. Propagation models should be used that more accurately reflect the environments in which networks are deployed; all modeling anomalies should be clearly identified in any final reports stemming from the studies; and final reports should identify assumptions, modeling approaches, and conclusions.

The studies should also focus on the need for sustainable wireless networks, both for commercial and Federal spectrum users, consistent with NTIA's statement that the Strategy will be implemented consistent with other Administration policies and priorities, including those relating to climate initiatives.[45] Commercial and Federal operators have a role to play in

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[44] Strategy at 11; *see also* Presidential Memorandum § 3(b).

[45] *See* Ericsson Strategy Comments at 18-19; *see also* Strategy at 22.

sustainability, and Ericsson itself is hard at work on efforts to reduce energy use and waste across the industry.[46]

V. CONCLUSION.

Ericsson believes clear, firm, near-term action is needed to make spectrum available soon for the burgeoning licensed, commercial wireless ecosystem to continue to thrive and urges NTIA to incorporate the recommendations set forth above in its Implementation Plan.

Respectfully submitted,

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January 2, 2024

[46] *See* Megan Young & Kim Johnson, *Sustainability Assessment: Telco Technology Suppliers Technology Analysis Report*, at 19, ABI Research (Oct. 17, 2022), https://www.ericsson.com/en/reports-and-papers/further-insights/abi-research-sustainability-report#report ("Ericsson led the vendor sustainability assessment overall for implementation, and the company also led all competitors in implementation of four categories of telco network equipment, including mMIMO, 5G RAN, Open RAN, and antenna solutions (including the acquisition of Kathrein that is now rolled into 'Ericsson Antenna System').").