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COMMENTS OF ITIF

Before the

National Telecommunications and Information Administration

Washington, D.C.

In the Matter of:	)	
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	)	
	)	Docket No. 230308–0068
Development of a National Spectrum Strategy	)	
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INTRODUCTION AND SUMMARY

The three pillars of the National Telecommunications and Information Administration's (NTIA's) Request for Comment (RFC) are mutually reinforcing and all necessary to generating successful spectrum policy for decades to come. ITIF appreciates the opportunity to comment on NTIA's work.[1] The United States needs a national spectrum strategy that prioritizes productivity, that is, maximizing the potential uses for spectrum and ensuring that capacity is available for the most valuable of those uses. NTIA's three pillars of a spectrum pipeline, long-term planning, and technological development are apt categories to focus on, but they will need to have more specificity and mutual reinforcement to enable the U.S. spectrum ecosystem to thrive.

[1] Founded in 2006, ITIF is an independent 501(c)(3) nonprofit, nonpartisan research and educational institute—a think tank. Its mission is to formulate, evaluate, and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress. ITIF's goal is to provide policymakers around the world with high-quality information, analysis, and recommendations they can trust. To that end, ITIF adheres to a high standard of research integrity with an internal code of ethics grounded in analytical rigor, policy pragmatism, and independence from external direction or bias. See About ITIF: A Champion for Innovation, https://itif.org/about.

NTIA SHOULD SEEK SPECTRUM ARRANGEMENTS THAT MAXIMIZE PRODUCTIVITY

The goal of spectrum policy should be to maximize the productivity of spectrum.[2] That is, finding arrangements that allow people to make the most use of it. In this sense, spectrum management is akin to management of any other scarce resource: despite technological advancements that allow for more intensive use of spectrum, there is not enough bandwidth at every frequency for everyone to use as much as they want all the time. This is the source of interference disputes and the reason why spectrum licenses trade at high prices and why spectrum allocation attracts such passion.

Notably, this conception of spectrum is out of step with the RFC's discussion of "spectrum requirements" over time. There is no fixed set of uses for spectrum and a fixed quantity of spectrum necessary to achieve them. Rather, the possible use cases for spectrum are determined by the amount of spectrum available.

The popular rhetoric of expanding "demand" for spectrum is imprecise. Demand does not exist in the abstract; it is a function of quantity and price. It is more accurate to say that the uses of spectrum have dramatically expanded; it has become extremely useful and valuable. Wireless applications have become increasingly important to our economic and national security.

The expansion of uses for spectrum, however, depends on how much spectrum is available. The immense wireless economy we see today exists only because there is sufficient spectrum to support it, and the future of wireless technology will be forced to cope with whatever amount of spectrum is available. Every agency and industry would like more spectrum for its own use; some industries only exist because enough spectrum has been allocated for them. At current margins, for example, in-home 5G services offered by mobile carriers appear to be a productive use of spectrum, providing both new service and competition to the broadband marketplace. However, it is often viable only in locations where there is enough excess capacity to run both a

[2] Joe Kane, "Five Principles for Spectrum Policy: A Primer for Policymakers" (ITIF, Sept. 2022) https://itif.org/publications/2022/09/06/five-principles-for-spectrum-policy-a-primer-for-policymakers/; *See also,* Ronald Coase, The Federal Communications Commission, The Journal of Law and Economics 1959 2, https://www.journals.uchicago.edu/doi/abs/10.1086/466549 ("It is sometimes implied that the aim of regulation in the radio industry should be to minimize interference. But this would be wrong. The aim should be to maximize output.").

mobile network and still provide reliable fixed-wireless access. But that market will be unable to develop if usable spectrum is in short supply.

If we want to enable economies of scale and scope that will enable the development of yet-unthought-of innovations, we should seek to open up all spectrum to its most productive uses, which will include commercial and federal government uses. The goal should not be to just meet today's requirements or even what today's experts can forecast in 10 years. Rather, the goal should be to enable the development of wireless applications without regulatory bottlenecks on supply.

The United States's national spectrum strategy, therefore, should not focus on meeting abstract requirements but on enabling the most possible uses of spectrum. This entails both making more of it available for diverse, flexible use and adopting policies that incentivize its use in the most productive applications.

Exclusively licensed spectrum is a necessary component of U.S. wireless leadership

Assigning property rights to a scarce resource is one way of incentivizing its productive use. For spectrum, an exclusive license approximates property rights since the licensee internalizes both the costs and benefits of interference management. A licensee will lose if it allows users to cause harmful interference with each other but profit to the extent that it can maximize the use of the spectrum it controls. These incentives make interference management more efficient since the licensee can trust its own interference mitigation measures in a way that strangers coordinating in shared spectrum cannot. This increases efficiency by reducing the costs of reporting and verifying which spectrum is available at a given time, place, and frequency.

Exclusive licenses also have other advantages. The technical limitations on exclusively licensed spectrum are typically more permissive than in other access regimes. Power levels are usually allowed to be relatively high, allowing licensees to cover more area and transmit data more reliably than they could with stricter power limits. Though high-power use is not an inherent characteristic of exclusive licenses, the fact that licensees have exclusive rights to a band entails more freedom to transmit without fear of interfering with others.

While auction revenue should not be the goal of spectrum policy, the high prices paid for high power, exclusive licenses at auction indicate how valuable it is. Exclusive licenses in the 3.7-3.98 GHz band, for example, fetched more than quadruple the more limited priority access licenses in the Citizens Band Radio Service (CBRS).[3] This divergence derives from the fact that exclusive licensees have greater certainty that they will always have access to the frequencies they paid for and have a legal right to exclude harmful interference. This, combined with the generally higher permissible power levels, makes exclusive licenses an extremely productive policy arrangement.

Exclusively licensed spectrum should not be the only type of spectrum access in the United States, but, at current margins, additional spectrum for exclusively licensed use, especially in midband frequencies (roughly 1-8 GHz), would bring total spectrum allocation closer to the right balance.

Spectrum sharing can be an effective tool when clearing incumbents is infeasible

Exclusive licensing requires relatively clear swaths of frequencies that are becoming increasingly difficult to find as spectrum becomes more valuable. But precisely because spectrum is so valuable, the return to finding ways to squeeze in each marginal user increases. Often, this can be accomplished by reusing the same frequencies, again and again, employing databases or technical protocols to prevent harmful interference even in the presence of an incumbent user. In general, these efforts are categorized as "spectrum sharing."

Spectrum sharing is not synonymous with any particular regulatory regime. There is a broad taxonomy of sharing techniques that could each be most beneficial in different circumstances.[4] Moreover, spectrum sharing is not antonymous to exclusive licensing. Licensees that operate mobile networks, for example, are really facilitating a sharing regime among their customers: all use the same spectrum often in the same area to

[3] Monica Alleven, "C-band's first phase tops charts with $80.9B," *Fierce Wireless* (Jan. 15, 2021), https://www.fiercewireless.com/regulatory/c-band-clock-phase-auction-tops-charts-80-9b.

[4] *See,* John Leibovitz and Ruth Milkman, "Taking Stock of Spectrum Sharing" (September 3, 2021). Available at SSRN: https://ssrn.com/abstract=3916386 or http://dx.doi.org/10.2139/ssrn.3916386.

send and receive different types of data, and the licensee must construct a network architecture that enables these activities without harmful interference between users.

Of course, sharing can also occur in spectrum that is not under the exclusive control of a licensee, and this requires more careful construction of technical and legal rules to coordinate spectrum use between users whose interests are not always aligned. These systems have great potential to augment the total capacity of spectrum by enabling additional users alongside incumbents' use. Theoretically, an advanced technological system could facilitate spectrum access between more users while still providing incumbents with the same level of certainty as an exclusive license.

The sharing regime in the Citizens Band Radio Service (CBRS) is an experiment in that direction. It preserves the federal incumbent's rights to use the band whenever it wants while introducing two tiers of commercial use. Still, CBRS is not without its shortcomings since it imposes heavy limitations on commercial users that greatly reduce the possible use cases for the band and likely overprotect incumbents. Some of these limitations, however, are orthogonal to the underlying dynamic sharing technology. One could design a system that, for example, allows higher power for secondary users while still providing incumbents the right to preempt those users when needed. The greater challenge to dynamic sharing systems is whether they are able to provide the functional equivalent of exclusive licenses' certainty and incentives for spectral efficiency. Sharing mechanisms that provide incumbents with certainty of access are also a prerequisite for bidirectional sharing between commercial users and the federal government and "use it or share it" proposals that would expand the possibilities for opportunistic commercial use.

Today's technology is not yet at that level, so it would be imprudent to, for example, make the current CBRS regime a generalized gold standard for other bands. But, far from giving up on dynamic sharing technologies, the federal government should encourage private investment and engage in research and development itself to increase the capabilities of these systems to the point where they can enable large, long-term investments that enhance wireless productivity.

NTIA's proposed Incumbent Informing Capability (IIC) is one potential step in this direction. The IIC approach—which uses a database, rather than environmental sensing—would resolve some problems with the need to protect environmental sensors and potentially reduce overbroad exclusion or whisper zones along the coasts.[5] Database-based sharing systems, however, are vulnerable to gamesmanship since an incumbent may overclaim to get more certainty of access without paying much cost. NTIA should continue its work on IIC and look for ways to shore up potential shortcomings as they arise.

Under any access regime, maximize the flexibility and breadth of spectrum rights

Whether a spectrum band is allocated to licensed, shared, or unlicensed use is a separate question from what operations are permitted under that allocation. An exclusively licensed band may have narrow channels and low power limits, just as a shared band may allow commercial users to operate at high power over a broad range of frequencies subject only to time or geographic separation from other users. Since the goal of spectrum policy is maximizing productivity, it should seek to enable as broad of rights as possible given the technical and legal realities of a given band. This means looking for ways to provide wide channels and high-power limits for commercial services.

This approach is the most flexible because a licensee that prefers to use lower power or narrower channels can operate at less than the full breadth of its rights, but a more limited license naturally limits the possible use cases for those frequencies. Of course, no specific arrangement should be applied everywhere. Unlicensed bands that use low power limits to prevent interference can be efficient for short-range applications like Wi-Fi and Bluetooth. And the fact that there is currently sufficient spectrum for unlicensed uses does not mean additional unlicensed allocations will never be necessary in the future.

[5] Michael DiFrancisco et al., "NTIA Report: Incumbent Informing Capability (IIc) for Time-Based Spectrum Sharing," NTIA, February 22, 2021, https://www.ntia.doc.gov/report/2021/ntia-report-incumbent-informing-capability-iic-time-based-spectrum-sharing.

ALL SPECTRUM USERS, INCLUDING FEDERAL AGENCIES, SHOULD MAKE LONG-TERM SPECTRUM PLANS

The RFC's second pillar of long-term planning rightly conceives of spectrum policy as no longer a specialized discipline for only a few agencies or industries. Everyone now relies on radio frequencies in ways that likely exceed what they immediately comprehend. Federal agencies in particular should examine themselves and the industries under their jurisdiction to evaluate how they use spectrum, the performance level of existing radio devices, and the potential impact on those devices from foreseeable changes to the RF environment.[6] Even when wholesale upgrades to devices are not immediately available feasible, gathering and sharing detailed information about devices in the field is essential to mitigating impacts to systems in the future.[7] For example, if the FCC reallocates a band, agencies that can present a clear case for necessary mitigation are more likely to have the FCC include implementation of mitigation measures (and the costs associated with them) in its decision. In all cases, federal agencies should voice their views and concerns within the established Interdepartment Radio Advisory Committee process and respect the jurisdictional boundaries of the NTIA and FCC in spectrum policy.

Long-term planning should also conceptualize changes in market conditions and technical capabilities. For example, current movements toward interoperability between satellites and terrestrial mobile devices suggest that siloed categories of satellite and terrestrial spectrum may need to be reevaluated over the next decade.[8] Indeed, the advent of viable space communications, especially low-earth orbit broadband service, will tend to

[6] Joe Kane et al., (Filling Gaps in US Spectrum Allocation: Reforms for Collaborative Management," (ITIF, Feb. 2023) https://itif.org/publications/2023/02/27/filling-gaps-in-us-spectrum-allocation-reforms-for-collaborative-management/; *c.f.*, , "Promoting Efficient Use of Spectrum & Opportunities for New Services" *Federal Communications Commission,* Policy Statement (ET Docket No. 23-122, April 2023) https://www.fcc.gov/document/promoting-efficient-use-spectrum-opportunities-new-services (*draft*).

[7] Kane et al. at 20-21.

[8] "Single Network Future: Supplemental Coverage from Space," *Federal Communications Commission*, (Notice of Proposed Rulemaking, March 2023), https://www.fcc.gov/document/fcc-proposes-framework-facilitate-supplemental-coverage-space-0.

enhance the utility and complexity satellite spectrum which has, so far, remained largely in a parallel and second-class status compared to terrestrial spectrum policy.

Indeed, the technological developments that enable greater spectrum access, as contemplated by the RFC's third pillar, must be accompanied by technological developments in securing radio systems so that the proliferation of wireless devices and critical services they provide do not become a glaring, high-stakes vulnerability. Long-term planning should consider the general risks of relying on wireless communications. For example, wireless systems are inherently vulnerable to jamming. As the world becomes more wireless, the potential harms from jamming increase.[9] Federal agencies with critical missions should be especially attuned to the threat of jamming and approach system design with resiliency in mind. Measures such as ultra-wideband transmission techniques could hold potential for jamming-resistant systems.[10]

NTIA SHOULD FACILITATE AN ONGOING PIPELINE OF SPECTRUM FROM FEDERAL TO COMMERCIAL USE

The United States needs a large and ongoing pipeline of frequencies for flexible commercial use

The RFC's goal "to identify at least 1,500 megahertz of spectrum for in-depth study to determine whether that spectrum can be repurposed to allow more intensive use" is a good start, but the goal is underspecified. If NTIA in collaboration with the FCC and other federal partners, can truly open up 1,500 megahertz per decade for flexible commercial use, that would be a reasonable pipeline under present conditions. NTIA should not be content, however, with allowing studies of federal bands to drag on for years and result in only

[9] *See e.g.*, a recent incident in which a private citizen used a jamming device to interfere with public safety calls. Jared Leone, "Police find electronic signal-jamming device inside California home," *Cox Media Group*, August 28, 2021. https://www.actionnewsjax.com/news/trending/police-find-electronic-signal-jamming-device-inside-california-home/EUFEFSKWNZGDPJFWUBL7PD3V6Y/

[10] "CSMAC UWB Subcommittee Report," Commerce Spectrum Management Advisory Committee, (Dec. 2022), https://ntia.gov/sites/default/files/publications/uwb_subcommittee_final_report_final_27_dec_2022.pdf

begrudging additions of highly restricted commercial use. The goal should be to identify large blocks of spectrum for commercial use under highly flexible rights.

Furthermore, the spectrum pipeline plan should also be forward-looking. Though identifying specific bands may be more difficult more than 10 years in the future, NTIA should endeavor to create an ongoing process for identifying bands as soon as possible so that the pipeline is continually replenished rather than running dry until the support for a new National Spectrum Strategy materializes.

Federal agencies need incentives to give up excess capacity

The focal point of such a process must be the creation of incentives for federal agencies to use spectrum efficiently, thus creating excess bandwidth that can be repurposed for commercial use.

Federal agencies have important missions and often need spectrum to achieve them. However, because the federal government does not have the same market incentives that drive productive use of spectrum in private markets, there is good reason to think spectrum held by federal users is not as productive as it could be.[11] The central problem with federal spectrum holdings is not that agencies are malicious, but that their incentives reward the status quo more than increases in efficiency. Therefore, NTIA should examine federal users' spectrum holdings and work with agencies and Congress to better align agencies mission with the national policy imperative of opening substantial amounts of spectrum for commercial use. These should include expansion of the Spectrum Relocation Fund to pay for more spectrally efficient equipment, creation of commercial overlay licenses in federal bands, more stringent standards for federal receivers, and some form of administrative pricing for federal spectrum.[12]

Many of these reforms will require legislative action, but NTIA should be an eager partner in formulating and implementing legislative efforts wherever possible. NTIA should also take the lead to the full extent of its

[11] Joe Kane and Jessica Dine, "Building on Uncle Sam's 'Beachfront' Spectrum: Six Ways to Align Incentives to Make Better Use of the Airwaves," (ITIF, Jan. 2023) https://itif.org/publications/2023/01/30/six-ways-to-align-incentives-to-make-better-use-of-the-airwaves/.

[12] Ibid.

current authority to provide closer oversight of federal agencies' use of spectrum and robustly exercise its role as the executive branch's principal spectrum management agency.

Federal procurement activities could also play a significant role in opening up more spectrum for commercial use. The more that federal systems can run on commercially built networks, the less necessary it is to incur the inefficiencies of bespoke spectrum allocations that require stringent protection from all other users. Commercial licensees are often capable of providing the reliability and security that federal users need, and the fact that they would use traditionally licensed spectrum will allow greater harmonization across frequencies and less wasted bandwidth. Operating government services over commercially licensed spectrum also allows federal users to take advantage of the far greater research and development capacity of commercial users. Indeed, many federal applications are already moving in this direction.[13] NTIA should work with agencies to continue and expand these efforts.

THE FEDERAL GOVERNMENT SHOULD MAINTAIN STATE OF THE ART DEVICE STANDARDS

Enhancing the performance of receivers and transmitters is essential to preventing costly interference conflicts and being good neighbors as wireless services squeeze closer together. Federal regulatory agencies should examine receiver performance standards. It is unreasonable for an agency to permit poorly performing devices to blockade spectrum capacity simply because they were built to outdated regulatory standards.

The Spectrum Relocation Fund is also a tool here. Not only are more efficient receivers better neighbors for increased commercial use, they also make federal devices more resilient which will make them better suited to their missions. Precisely because federal missions are so critical, federal agencies should be taking the lead to upgrade devices to the most resilient and high-performing technology available.

[13] See e.g. Mike Dano, "A closer look at the Dish 5G/satellite effort for the US military," *Light Reading* (April 4, 2023), https://www.lightreading.com/open-ran/a-closer-look-at-dish-5gsatellite-network-for-us-military/a/d-id/784185 See also, Thomas Rondeau, 5G Future Initiative Overview, Silicon Flatirons, October 2022, https://www.youtube.com/watch?v=H6uyV9Vj0Fw&ab_channel=SiliconFlatirons.

CONCLUSION

A national spectrum strategy is essential to driving U.S. leadership in wireless technology and applications. By focusing on spectrum productivity and balance between different access regimes, the United States will be poised to lead the world in spectrum. NTIA and the entire federal government must be proactive and innovative in crafting policies that facilitate the three pillars of the RFC or the United States risks falling behind and letting our valuable spectrum resources go to waste.

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