

Modernizing Radio-Spectrum Management

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Summary

The next administration should pursue a set of policies aimed at maximizing productive use of the radio spectrum, a key public good that can be used to create economic and social value. These policies should include adjustments to the institutions that manage the nation's spectrum; a redefinition of spectrum rights and responsibilities enjoyed by companies that use the spectrum; and options for using the economic value created by spectrum auctions to address persistent public problems.

1. Challenge and opportunity

The radio spectrum is one of the most valuable resources in the 21st century economy. When Americans use their smartphones, navigate by GPS, connect to a WiFi network, or consult a weather forecast, they are using services that rely on the radio spectrum. Policies governing use of the spectrum therefore have an outsized impact on many aspects of daily life and work.

Spectrum policy is also an enormous opportunity for creating economic and social value. Over the past 25 years, evolving government policies—particularly flexible use, new licensing techniques such as auctions, recognition of the contribution of unlicensed spectrum, and (more recently) the adoption of advanced spectrum-sharing techniques—have enabled substantial innovation, economic growth, and consumer benefits. Allowing the spectrum to evolve to its highest and best use, and recognizing that use may change over time, has turned out to be highly beneficial for the nation and the public.

The challenge is that much spectrum regulation continues to be conducted in a traditional “command-and-control” way, which limits future opportunities. For example, the commercial wireless spectrum can be used for multiple services in a way that preserves opportunities for currently unknown future uses. But it is difficult to use frequency bands designated for television broadcasting or for satellite communications for anything other than those purposes. Similar issues arise on the Federal Government side, where portions of the spectrum are assigned by the National Telecommunications and Information Administration (NTIA) for very specific purposes (e.g., radar or airborne uses). There is little ability for federal agencies to repurpose assigned spectrum to improve their own mission capabilities—even when it would serve the national interest—without going through a complex and time-consuming process.

In this paper, we discuss options for updating our approach to spectrum management. We begin by providing background on how spectrum policy is formulated in the United States. We then present several sets of recommendations. We recommend ways to modify spectrum governance and administration by the two responsible federal

agencies, the Federal Communications Commission (FCC) and the NTIA. We also recommend ways for the FCC to refocus its spectrum policy on preventing harmful interference. We discuss how revenues from spectrum auctions could be used to address persistent public-policy problems. Finally, we describe key considerations for implementation of these recommendations.

2. Background

Because different radio systems can interfere with one another, a complex body of regulations has been developed to minimize conflict between different entities using the spectrum. Particular spectrum bands are designated for primary government or primary non-government use. Other bands are designated as shared between different types of users. While no entity “owns” the radio spectrum, private use is permitted “under licenses granted by Federal authority.”¹ Technical rules apply across a given frequency band, while additional procedures govern assignments of particular rights to particular entities. For example, a given band might be designated for satellite use. Technical rules for that band could set power limits, and the licensing process could authorize specific satellite companies to use the band.

Technology-specific spectrum policies may be helpful in initially getting an industry off the ground. For example, the domestic satellite industry in the United States benefited tremendously from specialized policies that supported its development. Over time, however, industry-specific policies may create entitlements and stifle innovation. The existence of a set of incumbents with a strong interest in maintaining their spectrum licenses tends to slow the re-designation of spectrum bands to new uses, particularly when re-designation would benefit an industry segment other than the one for which the spectrum policy was originally designed.

In the future, we can expect increased pressure on radio-spectrum management due to trends including the advent of very fast wireless broadband (5G, WiFi 6); the connection of billions of devices through the “Internet of Things”; the rise of autonomous vehicles (e.g., drones and connected cars); and the commercialization of space. These developments will put a greater strain on spectrum management, as many different technologies clamor for additional spectrum and seek to use the spectrum in ways that may conflict with other uses. The result will be greater challenges in continuing to employ command-and-control spectrum approaches—but also greater potential benefits from alternate management strategies.

¹ 47 U.S.C. §301.

In this paper, we largely forego discussion of specific, near-term policy objectives (how best to promote 5G, for example). Rather, our proposals address deeper questions about how to evolve spectrum policy in a flexible and principled way so that spectrum policy can easily adapt to meet future needs, many of which are presently unknown. The fundamental question is how to maximize productive use of the radio spectrum. In addressing this question, we must keep in mind the relationship of spectrum policy to other policy arenas: competition, innovation, and furtherance of various public-interest goals.

3. Reforming spectrum governance and administration

Congress has tasked two government agencies with managing the radio spectrum. The Federal Communications Commission (FCC) oversees all civilian and state and local government access to the spectrum. The National Telecommunications and Information Administration (NTIA), part of the Department of Commerce, oversees access to the spectrum by the federal government. Within the FCC, separate bureaus handle rulemaking and licensing for various spectrum bands and for various user types such (terrestrial wireless, public safety, broadcasting, satellite, etc.).

This administrative structure makes it challenging to resolve tensions between different interest groups. For example, NTIA and the FCC are frequently called upon to balance the interests of large industries with the needs of federal agencies such as the Department of Defense and the Federal Aviation Administration. (A recent controversy, for example, involved the possibility that 5G wireless systems might interfere with climate-sensing satellites in the 24 GHz band.²) Similarly, the FCC frequently confronts competing demands of different commercial users and technologies. We do not expect that administrative redesign would entirely eliminate the frictions inherent in the FCC and NTIA's spectrum management jurisdiction. However, as we discuss below, faster and better resolution of issues could be achieved through three basic institutional reforms:

- Consolidating spectrum management at the FCC into a single bureau.
- Improving decision-making around spectrum allocation.
- Facilitating coordination between the FCC and the NTIA.

3.1 Consolidate spectrum management at the FCC

We recommend the FCC consolidate its spectrum-management functions into a single Spectrum Bureau. Currently, these functions are spread across several FCC bureaus and

² Jason Samenow, "FCC to auction off wireless spectrum that could interfere with vital weather data, rejecting requests from U.S. House and science agencies", *The Washington Post*, March 13, 2019. <https://www.washingtonpost.com/weather/2019/03/13/fcc-auction-off-wireless-spectrum-that-could-interfere-with-vital-weather-data-rejecting-requests-us-house-science-agencies/>

offices. Licensed private and cellular wireless systems are administered by the Wireless Telecommunications Bureau, broadcast services by the Media Bureau, satellite by the International Bureau, and unlicensed uses by the Office of Engineering and Technology. This dispersed management structure creates several problems, for example:

- Lack of commonality in tools and platforms for basic functions such as licensing databases.
- Non-alignment on policy areas affecting adjacent spectrum bands used by different industries.
- Forum shopping by industry sectors seeking favorable treatment with respect to spectrum regulations (e.g., broadcasters advocate before the Media Bureau, cellular interests before the Wireless Bureau, and satellite interests before the International Bureau).

The FCC has sought to overcome these issues via organizational overlays like the Spectrum Task Force³ or the Incentive Auction Task Force.⁴ A superior, more durable strategy would be to integrate the FCC's spectrum-management functions into a single, centralized Spectrum Bureau. The Spectrum Bureau would include crosscutting divisions to manage functions common to all types of spectrum services and users (e.g., licensing and systems) as well as distinct divisions to manage policy and rulemaking duties for specific services (e.g., terrestrial wireless, satellite, etc.) Not all functions currently performed by the FCC's industry-focused spectrum bureaus would be carried into the Spectrum Bureau. Certain agency-wide functions (e.g., intergovernmental relations), or policy issues (e.g., competition- and conduct-related decisions) might be properly (re)situated in other parts of the FCC. We note that establishment of a Spectrum Bureau is incompatible with some recent proposals to organize the entire FCC along functional lines (economics, engineering, etc.).⁵ We believe that spectrum management is an inherently interdisciplinary endeavor and should be managed as such.

3.2 *Improve spectrum allocation*

Domestic and international regulations divide swaths of the radio spectrum into "allocations", which may be designated as "federal" (to be used by federal government agencies), "non-federal" (commercial and local and state government users), or both federal/non-federal (i.e., shared use). NTIA oversees federal spectrum allocations, the

³ "FCC Chairman Michael K. Powell Announces Formation of Spectrum Policy Task Force," Federal Communications Commission, released on June 6, 2002, <https://www.fcc.gov/document/fcc-chairman-michael-k-powell-announces-formation-spectrum-policy-task>.

⁴ "Statement of FCC Chairman Julius Genachowski on the Incentive Auction Task Force," Federal Communications Commission, released on March 21, 2012, <https://www.fcc.gov/document/chairman-statement-incentive-auction-task-force>.

⁵ See, e.g., David Honig, "FCC Reorganization: How Replacing Silos with Functional Organization Would Advance Civil Rights," *University of Pennsylvania Journal of Law & Public Affairs* 3, no. 2 (2018): 169.

FCC oversees non-federal allocations, and the two agencies coordinate with one another, particularly in shared or neighboring bands.

Within the FCC, spectrum allocation is overseen by the Office of Engineering & Technology, but negotiated internationally by the International Bureau in conjunction with NTIA and the Department of State. The Office of Engineering & Technology coordinates with other FCC bureaus regarding any change that would affect a domestic spectrum use. Coordination between the FCC and NTIA may also involve other federal agencies (such as the National Oceanic and Atmospheric Administration [NOAA], the Department of Defense [DOD], the National Aeronautics and Space Agency [NASA], and the Federal Aviation Administration [FAA]). These negotiations can be prolonged and difficult. Treaty agreements with foreign regulators via the World Radio Conference process take even longer.

Reorganizing radio-spectrum management at the FCC into a centralized Spectrum Bureau, as recommended above, would improve the internal FCC process for allocations. Below, we suggest improvements to facilitate coordination between the FCC and NTIA.

3.3 *Facilitating coordination between the FCC and NTIA*

The relationship between NTIA and the FCC goes back to the decision made by Congress in the 1927 Radio Act⁶ not to merge the previously existing Interdepartment Radio Advisory Committee (IRAC) into the newly formed Federal Radio Commission.⁷ Much ink has been spilled about whether the FCC and the NTIA should be part of the same agency. Those in favor frequently point out that many—if not most—countries do not divide up authority for radio-spectrum management as the United States does. At this point, though, the FCC and NTIA are well-established as separate entities and would be difficult to merge.

More modest changes could do much to improve and normalize the agencies' interactions. First, the FCC and NTIA could be co-located in a single office complex.⁸ Co-location would facilitate staff communication and collaboration without requiring any broad-scale institutional changes or legislation. Second, a program could be established to formalize staff "details" between the agencies: *i.e.*, a program under which NTIA employees spend time embedding at the FCC and vice versa. Such details have been arranged on an *ad hoc* basis (primarily with engineers) in the past to general success.

⁶ The 1927 Radio Act was the predecessor to the 1934 Communications Act.

⁷ The Federal Radio Commission merged into the FCC in 1934.

⁸ Dorothy Robyn, former Commissioner of the Public Buildings Service in the U.S. General Services Administration, first proposed this idea to us several years ago.

Expanding this practice and permitting longer-term details (say 18–24 months) would enable employees at each agency to better understand the structure and operations of the other and would foster the sense of partnership and mutual respect needed for effective collaboration. More generally, the agencies should seize opportunities to enhance informal collaboration and communication whenever they arise. While these kinds of changes are unlikely to prevent differences on fundamental policy issues, there is little downside—and much potential upside—to facilitating stronger cross-agency relationships, better understanding of different perspectives/concerns, and more venues for creative problem solving.

4. Anchoring spectrum policy

Radio-spectrum management is a complicated, multidisciplinary domain. There is no shortage of competing ideas as to how best to govern spectrum use. Some scholars and policy makers view the spectrum as a resource that should be “propertized” for maximum efficiency, assigning all rights to use of the radio spectrum to particular entities (just as property rights are assigned),⁹ while others argue the opposite.¹⁰ Without wading too far into the “Great Spectrum Debate,”¹¹ we recommend several ways for the FCC to consciously re-anchor its spectrum rulemaking in its statutory mandate to prevent “harmful interference” between different spectrum users.¹² In short, we recommend that the FCC:

- Avoid over-regulation of the upper reaches of radio spectrum.
- Protect license holders without excluding additional, non-interfering uses.
- Modernize performance requirements commonly imposed on licensees.

4.1 Avoid over-regulation in the “spectrum stratosphere”

A central issue in spectrum policy is determining which portions of the radio spectrum should be subject to regulation. In some cases, regulation is clearly inappropriate. Consider visible light. As with radio waves, it is possible for two users of the visible portion of the spectrum to interfere with each other. Person A can frustrate Person B’s enjoyment of an orange door by shining a blue light on it. But such interference is

⁹ See Thomas Winslow Hazlett, *The Political Spectrum: The Tumultuous Liberation of Wireless Technology, from Herbert Hoover to the Smartphone*. New Haven: Yale University Press, 2017.

¹⁰ See Yochai Benkler, “Open Wireless vs. Licensed Spectrum: Evidence from Market Adoption,” *Harvard Journal of Law and Technology* 71, no. 2013–14 (2012): 69–163.

¹¹ See John S. Leibovitz, “The Great Spectrum Debate: A Commentary on the FCC Spectrum Policy Task Force’s Report on Spectrum Rights and Responsibilities,” *Yale Journal of Law & Technology* 6 (2004): 390–414.

¹² See 47 U.S.C. §302a: “The Commission may, consistent with the public interest, convenience, and necessity, make reasonable regulations...governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications.” See also 47 U.S.C. §303(f): “The Commission, from time to time, as public convenience, interest, or necessity requires shall... Make such regulations not inconsistent with law as it may deem necessary to prevent interference between stations and to carry out the provisions of this chapter...”

inherently localized, transitory, and usually preventable (block the light with your window shades!). To the extent the interference is harmful, the costs of mitigation are trivial. By contrast, the costs of administering licenses for visible light would be enormous. All of which is to say it would be absurd to expect the government to regulate beams of light in the same way it regulates licensed radio transmissions.

So, at what point in the radio spectrum should the FCC stop issuing licenses? This question was recently addressed by the FCC in its *Spectrum Horizons* proceeding, which considered rules for the presently vacant frequencies from 95 GHz to 300 GHz. The FCC noted that “the generally high propagation losses in these bands, the high losses due to atmospheric effects at specific frequencies, as well as the tendency of objects in the transmission path to block signals at these frequencies and prevent them from reaching and thus causing harmful interference to authorized service receivers.”¹³ The Commission authorized unlicensed operation in a portion of the band, while deferring action on licensed services for the time being.¹⁴

We applaud the FCC’s discretion in this case. There is a need for some regulation of the technical attributes of radios using the band on an unlicensed basis. There is also a need to protect particular uses, such as radio astronomy, that rely on access to portions of this spectrum. However, premature licensing of the band could limit its availability for future users and technologies that are likely to be able to coexist without interference. Congress should consider, as a matter of deregulatory policy, creating a statutory presumption that the FCC refrain from licensing these “stratospheric” bands unless and until a significant risk of harmful interference is demonstrated—a risk large enough to outweigh the considerable administrative and economic costs of over-licensing.

4.2 *Achieve protection without exclusion*

Licensing of the radio spectrum (in bands below 95 GHz) would benefit from a return to the principle of preventing harmful interference. While radio licenses are often thought to convey a fully exclusive right to use some swath of frequencies in a given territory, the FCC has, in certain circumstances, permitted additional uses that will not impose interference on the license holder. For example, cable TV operators are permitted to transmit radio frequency (RF) signals in the “beachfront” spectrum below 1 GHz used by wireless systems provided the transmission occurs via a shielded coaxial cable.¹⁵ Similarly, all radio frequencies are available for wireless transmissions in tunnels or mines

¹³ Federal Communications Commission, *FCC Opens Spectrum Horizons for New Services & Technologies*, 34 FCC Rcd 1605 (2) (2019), at paragraph 30.

¹⁴ *Id.* at paragraph 2.

¹⁵ 47 CFR §15.115.

provided the signal is fully contained and does not leak to the outside.¹⁶ The principle at work is that spectrum exclusion should not apply where the likelihood of interference with a licensee is negligible due to an isolated radio environment.

The Citizens Broadband Radio Service (CBRS) in the 3.5 GHz band contains a “use or share” rule that establishes a means of achieving such isolation. Specifically, a database called the Spectrum Access System allows non-licensees to use frequencies assigned to license holders in areas where the license holder has no operating system.¹⁷ This approach promises to increase the productive use of spectrum by fully protecting licensed interests without permitting those interests to exclude others’ access to the spectrum where there is no risk of harmful interference to the primary licensee. This practice should be expanded to other spectrum bands, especially higher-frequency bands where transmissions are inherently more focused and shorter in range (and hence the risk of harmful interference is lower).

4.3 *Modernize performance requirements*

To prevent warehousing of the radio spectrum and to encourage service provision within a license area, the FCC routinely imposes performance requirements on licensees. These requirements effectively mandate the construction of networks within a specified time period.¹⁸ The exact construction measures and deadlines by which “performance” is determined vary for different spectrum bands. Typically, for modern “flexible use” licenses, a significant percentage of the population must be covered at the midpoint and conclusion of a license term.

Such performance requirements are difficult to administer and enforce. Seemingly straightforward metrics like “population coverage” may require the submission and review of detailed maps, as well as extensive back and forth between licensees and FCC staff about how those maps should be interpreted. Reclaiming licenses from those who do not meet performance requirements is challenging as well. Political lobbying and litigation threats often lead to “second chance” settlements. In one recent example, a company willfully missed its construction milestones and yet was able to sell licenses to a large telecom carrier at a massive profit, as the FCC prioritized a policy goal (promotion of 5G networks) over strict application of its rules.¹⁹ The FCC’s rules also typically contemplate use of a particular technology or wireless-system topology (e.g., wide-area

¹⁶ 47 CFR §15.211.

¹⁷ 47 CFR §96.25(c), 47 CFR §§96.53–96.66

¹⁸ See U.S. Government Accountability Office, *Spectrum Management: FCC’s Use and Enforcement of Buildout Requirements*, GAO-14-236 (2014).

¹⁹ See, e.g., Mike Dano, “AT&T to lose hundreds of 5G millimeter wave spectrum licenses as part of FCC/FiberTower settlement,” *FierceWireless*, published on January 26, 2018, <https://www.fiercewireless.com/wireless/at-t-to-lose-hundreds-5g-millimeter-wave-spectrum-licenses-as-part-fcc-fibertower>.

cellular or point-to-point microwave networks) to meet buildout requirements. This creates regulatory bias towards deployment of certain wireless technologies over others. Finally, construction requirements can waste resources by forcing companies to build out simply to preserve their licenses—even when build-out does not yield any real societal benefits.

It is high time for the FCC to revisit and revise performance requirements. The first step is for the FCC to conduct an internal review to determine which—if any—performance requirements are necessary to ensure that the radio spectrum is put to good use. In conducting this review, the FCC should consider alternatives such as the CBRS’s use-or-share rule, which supports many of the goals of performance requirements (e.g., promotion of deployment, prevention of spectrum warehousing) but in a more efficient and technology-neutral way. Another alternative is establishing economic incentives (e.g., spectrum fees or payments when milestones are reached) that would spur productive use of the radio spectrum without brute force construction requirements. Changing construction requirements would also free up resources by avoiding companies building out simply to preserve a license, and FCC staff spending time evaluating whether the build-out is adequate.

5. Addressing persistent public problems

The core mandate of the FCC is to promote the “public interest”.²⁰ The radio spectrum is a valuable public resource. As the FCC has moved from “command and control” to a more market-based approach to the radio spectrum for most commercial purposes, a great deal of value has been created—and will continue to be created in the future. This includes economic value for the companies that hold spectrum licenses, as well as social value for consumers who use spectrum-based services (such as mobile internet access). In addition, revenue from the FCC’s spectrum auctions goes to the U.S. Treasury.

A portion of FCC auction revenues should be set aside to address persistent public-policy problems related to the FCC’s jurisdiction. There is precedent for earmarking FCC auction revenues for specific purposes. For example, the Middle Class Tax Relief and Job Creation Act of 2012 directed a portion of FCC auction revenues to a Public Safety Trust Fund. This fund was used to support FirstNet (the nationwide public safety broadband network) as well as 911 grants and public-safety research. We recommend that Congress give the FCC general authority to direct a portion of auction revenues to a particular objective, rather than requiring specific legislation to do so. If desired, this authority could be limited by, for example, stating that no more than a certain

²⁰ See, e.g., 47 U.S.C. Section 309.

percentage of auction revenues could be designated for a particular objective. Congress could also provide a menu of authorized public-policy objectives related to the FCC's jurisdiction, such as public safety or support for local news.

6. Implementation

Implementing the recommendations outlined above will require consensus-building, explaining to non-experts why spectrum policy changes are important, and recognition of the need to make changes attractive to incumbent spectrum users, including federal agencies. While the FCC is an independent agency, there are steps the White House can take to advance the recommendations presented above. In particular, the Office of Science and Technology Policy (OSTP) and/or the National Economic Council (NEC) should include personnel with spectrum-policy expertise. These personnel should convene inter-departmental discussions about spectrum policy, help liaise with external stakeholders, and coordinate activities between the FCC and the NTIA, and coordinate the federal agencies.

The White House must also balance interests of existing sectors (e.g., commercial wireless companies and large technology companies) with the interests of new sectors that will certainly emerge in the future. This will involve promoting bedrock values in spectrum policy such as greater flexibility, a focus on "first principle" regulations, institutional collaboration, and competitive access. Using these values as governing principles will serve the public interest by ensuring that the radio spectrum is available for and accessible to a wide variety of users, systems, and technologies—including those yet to come.

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