International Center for Law & Economics

The Invisible Infrastructure: Spectrum Policy for the AI Era

Jeffrey Westling

ICLE Issue Brief 2026-07-24

laweconcenter.org | icle@laweconcenter.org
1104 NW 15th Ave. Ste 300 Portland, OR 97209

@laweconcenter
503.770.0076

The Invisible Infrastructure: Spectrum Policy for the AI Era

*Jeffrey Westling**

Executive Summary

Radio spectrum is essential infrastructure for artificial intelligence, augmented reality, virtual reality, and other next-generation wireless applications. Yet spectrum is not a conventional natural resource. Its scarcity arises from limits on bandwidth, interference, network design, and the legal rights that determine who may transmit, where, and under what conditions.

No single frequency band or access model can meet every need. Licensed spectrum supports wide-area networks and reliable service. Unlicensed spectrum powers Wi-Fi, short-range devices, and much indoor immersive use. Dynamic sharing can open bands that cannot be fully cleared, while satellite networks extend coverage beyond terrestrial systems. Policymakers should preserve this balance rather than judge allocations by auction revenue alone.

The current U.S. system creates avoidable delay and uncertainty. Divided authority between the Federal Communications Commission and the National Telecommunications and Information Administration complicates federal reallocation. The Spectrum Relocation Fund remains cumbersome, and worst-case interference analysis can block productive uses based on highly improbable scenarios.

The United States should strengthen interagency coordination, streamline relocation funding, adopt risk-informed interference analysis, expand advanced coordination tools, and present coherent positions internationally. These reforms would protect incumbents where necessary while making more spectrum available for investment, competition, and innovation.

---

* Jeffrey Westling is a senior scholar of innovation policy at the International Center for Law & Economics (ICLE). ICLE receives financial support from companies, foundations, and individuals, including firms whose interests both support and oppose positions taken in ICLE-supported work. Unless otherwise noted, all funding is unrestricted general support. The views expressed here are the authors' alone and do not necessarily reflect those of ICLE's advisors, affiliates, or supporters.

I. Introduction

In the opening issue brief in this series, International Center for Law & Economics Director of Innovation Policy Kristian Stout examined how infrastructure shapes where innovation takes root.[1] Technology clusters flourish where roads, power, communications networks, and other shared resources support investment and growth. The returns may take time, but the United States' past investments in these enabling conditions helped make it the world's technological leader. This approach amounts to horizontal industrial policy, which creates broad conditions for innovation without choosing favored technologies or firms.[2]

Stout identifies several forms of infrastructure that the United States will need to sustain that lead. Radio spectrum—the frequencies used to transmit wireless signals—rarely receives equal attention. It tends to make news when Congress treats auction revenue as a way to pay for must-pass legislation or when harmful interference threatens to disrupt air travel.[3] Yet every wireless service depends on predictable access to frequencies where competing signals will not overwhelm or interrupt one another. Spectrum therefore forms a basic layer of modern communications infrastructure.

Spectrum is harder to picture than a highway, power line, or pipe. It consists of a finite range of electromagnetic frequencies that can carry signals through the air. Those signals support mobile calls, Wi-Fi, GPS navigation, emergency communications, satellite services, and countless other applications. Different frequencies have different physical properties, and several operators may want to transmit on the same frequency, in the same place, at the same time. Without rules governing those uses, interference can prevent every affected service from working as intended.

The United States has therefore created operating rights that divide access to spectrum among users. Federal agencies and international bodies allocate those rights to limit harmful interference and allow different services to coexist.[4] These decisions determine who may use particular frequencies, under what conditions, and for which purposes. Spectrum management is consequently an economic and political exercise as well as a technical one.

Poor spectrum management can constrain the digital economy much as highway congestion impedes commerce. Artificial intelligence (AI), autonomous vehicles, smart manufacturing, precision agriculture, and augmented- and virtual-reality applications require substantial wireless capacity, very

---

[1] Kristian Stout, *Infrastructure Is Destiny: The Geography of the Next Technology Race*, INT'L CTR. FOR L. & ECON. (May 26, 2026), https://laweconcenter.org/resources/infrastructure-is-destiny-the-geography-of-the-next-technology-race.

[2] *Id.*

[3] Peter Elkind, *Inside the Government Fiasco That Nearly Closed the U.S. Air System*, PROPUBLICA (May 26, 2022), https://www.propublica.org/article/fcc-faa-5g-planes-trump-biden; Jeffrey Westling, *Primer: A Staffer's Guide to Spectrum Auction Reauthorization*, AM. ACTION FORUM (Feb. 20, 2025), https://www.americanactionforum.org/insight/primer-a-staffers-guide-to-spectrum-auction-reauthorization.

[4] JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: TELECOMMUNICATIONS LAW AND POLICY IN THE INTERNET AGE (2d ed. 2013).

low latency, and reliable connections. Meeting those demands requires a balanced strategy that combines high-powered exclusive licenses, shared-access regimes, and unlicensed spectrum.

Exclusive licenses give mobile carriers predictable protection from interference, allowing them to invest in dense 5G and future 6G networks. These networks can support AI-enabled and other data-intensive applications when users lack access to a dedicated local network. Unlicensed spectrum offers easier access for Wi-Fi, internet-of-things sensors, experimental technologies, and services operating over shorter distances. Shared-access regimes allow several users to operate within the same band under rules that coordinate their transmissions.

Each model serves different technical and economic purposes. Overreliance on any one of them can restrict entry, weaken investment certainty, or leave valuable frequencies underused. Exclusive licensing, shared access, and unlicensed use should therefore operate as complementary tools within a broader spectrum strategy.

The federal government must also move more quickly to reallocate underused spectrum held by incumbent users, including federal agencies. Commercial networks, scientific research, and emerging technologies will require access to additional frequencies. Delayed reallocation carries real costs by slowing deployment, investment, and experimentation.

Spectrum policy is infrastructure policy. The choices federal officials make today will shape whether the United States can build and deploy the next generation of wireless technologies.

II. What Spectrum Is, Why It Is Scarce, and How It Creates Value

Sound spectrum policy begins with a clear account of the resource being managed. Spectrum refers to the frequencies used to carry wireless signals, but the policy term often blends physical capacity, interference constraints, and government-created operating rights.

Those distinctions shape the analysis that follows. Technical scarcity reflects limits on bandwidth, receiver performance, and the number of systems that can operate without harmful interference. Legal scarcity arises from the licenses, band plans, and operating rules that determine who may transmit. Because those rights are indispensable and their value varies across commercial, public, and unlicensed uses, regulators must decide which allocation method will produce the greatest economic and public benefit.

A. What Is Spectrum?

Any discussion of spectrum policy should begin with the technology itself. Radios transmit information by modifying an electromagnetic wave, usually by changing its amplitude, frequency, or another feature of the signal. Most modern systems use digital transmission, which encodes information as binary data. Digital signals can carry large amounts of information and can be copied or regenerated with less degradation than analog signals.

An electromagnetic wave moves through repeating cycles. Its frequency measures how many cycles occur during a given period, usually one second. Frequency is measured in hertz. A wave that completes 1 million cycles per second operates at 1 megahertz, while one that completes 1 billion cycles per second operates at 1 gigahertz.

A radio receiver detects the electric and magnetic fields carried by an incoming wave. Those fields generate a small alternating current that corresponds to the wave's frequency. Because the surrounding environment contains many electromagnetic signals, the receiver must isolate the one it is designed to use.

A tuner performs that task by adjusting the receiver's resonant frequency. The receiver responds most strongly to the selected carrier frequency while filtering out much of the surrounding noise. It then demodulates the signal, extracting the information carried by the wave. Traditional amplitude modulation (AM) stores information in changes to the wave's strength. Frequency modulation (FM) stores it in changes to the wave's frequency. The receiver then amplifies and converts the extracted information into the desired output, such as sound from an AM radio broadcast.

This distinction matters for policymakers because "spectrum" can refer to different things. In physical terms, the radio spectrum is the range of frequencies used for wireless communications. In policy debates, officials often speak of "freeing up" spectrum or making more of it available. That language treats spectrum as a scarce, property-like resource. Frequency, though, differs from ordinary property in important ways. The underlying frequencies do not run out. Scarcity arises because multiple users may seek to transmit at the same frequency, time, and place, creating interference that prevents their systems from working as intended.

B. What Spectrum Scarcity Really Means

Spectrum is often described as a scarce natural resource. The analogy is useful, but incomplete. Radio frequencies are not consumed through use. Scarcity arises because communications systems have limited capacity and may interfere with one another when they operate at the same frequency, time, and place.[5]

Spectrum scarcity therefore has two related forms. Technical scarcity reflects limits on bandwidth, receiver performance, network design, and the number of systems that can operate without harmful interference. Legal scarcity results from the licenses, band plans, and operating rules that determine who may transmit and under what conditions. Together, these technical constraints and legal rights determine how much spectrum capacity users can put to productive use.

---

[5] Jean Pierre De Vries & Jeffrey Westling, *Not a Scarce Natural Resource: Alternatives to Spectrum-Think*, TPRC45 (Oct. 2, 2017), https://ssrn.com/abstract=2943502.

1. *Technical Scarcity*

From a technical perspective, spectrum scarcity can describe two different constraints. The first concerns bandwidth, which is the range of frequencies available to carry a signal.[6] Wider channels can transmit more data per second than narrower ones.

Channels sit within larger frequency bands, each defined by an upper and lower boundary and often allocated for a particular use. A channel only a few megahertz wide can carry limited information at any one time. A much wider channel can carry far more data. Higher-frequency bands often accommodate wider channels,[7] but they also tend to have shorter range and weaker ability to penetrate walls and other obstacles. Spectrum policy therefore requires tradeoffs between channel width and the physical characteristics of the frequencies involved.[8]

Radio frequencies themselves are not depleted through use. A transmission does not consume a channel or leave less of it for the next user. The relevant constraint is the amount of information a channel can carry.

Claude Shannon formalized that limit. Shannon's law establishes the maximum amount of information that a communications channel can transmit given its bandwidth and signal-to-noise ratio.[9] Better antennas, coding, and signal processing can move a system closer to that ceiling, but they cannot exceed it.

Policymakers usually have a second form of scarcity in mind. Several radios may seek to operate at the same frequency, time, and place. Electromagnetic waves can pass through one another, but a receiver may fail to distinguish its intended signal from surrounding transmissions or noise. The desired information may then become distorted, drowned out, or impossible to recover. That condition is interference.

Every radio system encounters some interference. Harmful interference occurs when interference prevents a service from functioning as intended.[10] The Federal Communications Commission (FCC) licenses many radio operations and adopts technical rules designed to limit that risk. This process is known as spectrum management.

---

[6] *Id.*

[7] *See, e.g.*, Mustafa Riza Akdeniz *et al.*, *Millimeter Wave Channel Modeling and Cellular Capacity Evaluation*, 32 IEEE J. ON SELECTED AREAS IN COMMC'NS 1164 (2014) (discussing millimeter-wave spectrum as a means to increase capacity by providing access to wider channels).

[8] Fed. Commc'ns Comm'n, Office of Eng'g & Tech., OET Bulletin No. 70, *Millimeter Wave Propagation: Spectrum Management Implications* (July 1997), https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet70/oet70a.pdf.

[9] C.E. Shannon, *A Mathematical Theory of Communication*, 27 BELL SYS. TECH. J. 379 (1948).

[10] 47 C.F.R. § 15.3 (2024) (defining "harmful interference" as "[a]ny emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with [Title 47]").

Interference does not always result from too many users competing for too few frequencies. It may instead reflect poor receiver design, inadequate filtering, insufficient network density, or other engineering choices within a particular system. Coordination can also allow several users to share a channel while each operates near the channel's technical capacity.

Technical spectrum scarcity therefore does not mean that one user consumes a finite resource at another's expense. It describes limits created by channel capacity, receiver performance, network design, and the interaction among multiple radio systems.

2. Legal Scarcity

Technical scarcity depends on both the bandwidth available to a system and its ability to operate without harmful interference. Spectrum management seeks to preserve that capacity by defining who may transmit, where, when, and under what technical conditions. Those legal rules create a second form of scarcity.

Before a radio service may operate in the United States, it generally needs authorization from either the FCC or the National Telecommunications and Information Administration (NTIA). The FCC oversees nonfederal uses, while NTIA manages spectrum used by federal agencies. Depending on the service, the FCC may issue an individual license or permit unlicensed operation under technical rules that apply within designated bands.[11]

A license gives its holder the legal right to transmit on specified frequencies, in specified locations, and subject to stated conditions. Band plans divide larger frequency ranges into channels and establish how many licenses may be issued. Because those rights are limited, several applicants may seek the same authorization. The FCC initially relied on first-come, first-served assignments and later used comparative hearings when applicants competed for the same license.[12]

The FCC and NTIA manage spectrum by separating users across frequency, geography, time, or some combination of the three.[13] Clear operating rights and technical limits can reduce harmful interference and allow more systems to function at once. Those limits can also restrict performance. Some applications therefore require several channels or exclusive rights within a band to obtain sufficient capacity and reliability.

Regulators must also distinguish harmful interference from ordinary increases in background noise. A new entrant should not lose access merely because its operations add some interference. The relevant question is whether that interference prevents another authorized service from functioning as intended.

---

[11] 47 U.S.C. §§ 154, 302a, 303, 304, 307, 336, 544a.

[12] Nuechterlein & Weiser, *supra* note 4; *see also* Thomas W. Hazlett, *Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take* 67 *Years?*, 41 J.L. & ECON. 529 (1998).

[13] *See* U.S. Gov't Accountability Off., GAO-24-106325, *Spectrum Management: Key Practices Could Help Address Challenges to Spectrum Sharing* (July 2024), https://www.gao.gov/assets/gao-24-106325.pdf.

Legal and technical scarcity together define each operator's bundle of rights and restrictions. Those rules aim to provide enough bandwidth and protection from interference for the service to work. Because many users seek the same rights, allocating licenses and bands has become increasingly difficult and politically contentious.

For most operators, the legal authorization to transmit is the scarce input that matters most. Any proposal to reassign frequencies or revise the rights attached to a license can change the value and viability of existing systems. That is why even narrow technical proceedings before the FCC and NTIA often produce fierce disputes.

C. Spectrum Rights as an Economic Input

Access to spectrum is an indispensable input for any radio operation. Unlike many production inputs, spectrum rights cannot be replaced, manufactured, or avoided. A manufacturer that cannot obtain a particular mineral may redesign a product around another material. A logistics company facing a fuel shortage may reroute shipments or use another mode of transportation. A radio operator without legal authority to transmit cannot operate.

This lack of substitutes gives spectrum rights a distinctive economic character. In most markets, scarcity raises prices, which encourages conservation, increased production, or the development of alternatives. Higher license prices cannot create additional frequencies. Engineering can increase the amount of information carried over a band or allow more users to share it, but those gains remain subject to physical limits.

Dynamic spectrum sharing, improved interference mitigation, denser networks, and more advanced modulation can increase the productive use of existing frequencies. These techniques allow communications systems to approach the capacity limit described by Shannon's law. They do not eliminate that limit.

The value of spectrum rights also varies sharply across users and applications. A license or unlicensed-access framework defines a bundle of rights and restrictions, but its economic value depends on the service involved, the capacity the operator can use, and the revenue or operational benefit that capacity can produce.

For a commercial mobile carrier, spectrum is a core input into a network serving millions of subscribers. A license's value may depend on the population within the licensed area, expected data demand, the band's technical characteristics, and the competitive consequences of allowing a rival to acquire it. The high prices paid in FCC auctions reflect carriers' assessments of the long-term commercial value of those rights.[14] Nationwide mobile carriers have historically dominated such

[14] *See, e.g.,* Fed. Commc'ns Comm'n, *FCC Announces Winning Bidders in C-Band Auction; Auction 107 of 3.7 GHz Service Licenses Yields Over $81 Billion in Gross Bids* (Feb. 25, 2021), https://www.fcc.gov/document/fcc-announces-winning-bidders-c-band-auction.

auctions, but cable companies, fixed-wireless providers, and other network operators also treat spectrum as one component of broader capital investment in communications infrastructure.

Other users value spectrum differently. A television broadcaster may care most about a signal's geographic reach and the advertising revenue associated with that audience.[15] A federal agency operating radar, military communications, or scientific instruments may measure value through mission performance rather than revenue. Traditional market measures offer only a partial account of those uses.

Unlicensed spectrum presents another valuation problem. Wi-Fi routers, Bluetooth devices, industrial sensors, and other connected technologies rely on access that no single firm owns. Businesses, cable operators, universities, hospitals, manufacturers, municipalities, and households invest heavily in equipment and networks that use those frequencies. No auction bid captures the full value of that activity because the benefits are dispersed across billions of devices and transactions.[16]

These different uses complicate efforts to allocate spectrum efficiently. Competitive auctions generally provide the best mechanism for discovering value when a limited number of operators seek exclusive licenses. Bids reveal how much firms expect to earn from the rights offered and direct licenses toward users willing to pay the most.[17]

Auction prices do not, however, capture every form of economic or public value. Users that generate direct revenue can usually express their demand through a bid more readily than users whose benefits are indirect, diffuse, or tied to public missions. A mobile carrier can estimate subscriber revenue. A weather satellite, military radar, hospital network, or open Wi-Fi system may create substantial value that never appears on a licensee's balance sheet.

Spectrum policy should seek to maximize the value created by an allocation and assignment, rather than auction receipts alone. In some cases, that goal will support an auction for exclusive licenses. In others, it may favor unlicensed access, shared use, or a private transaction that places frequencies into service more quickly.[18]

Regulators therefore face a recurring institutional choice. Markets can reveal which parties place the highest monetary value on defined rights. But government agencies must still define those rights,

---

[15] Jeffrey Westling, Eric Fruits & Kristian Stout, Comments of the Int'l Ctr. for L. & Econ., *Empowering Local Broadcast TV Stations to Meet Their Public Interest Obligations: Exploring Market Dynamics Between National Programmers and Their Affiliates*, MB Docket No. 25-322 (Dec. 10, 2025), https://laweconcenter.org/wp-content/uploads/2025/12/Network-Affiliation-Comments-of-the-International-Center-for-Law-Economics.pdf.

[16] NCTA—The Internet & Television Ass'n, *Spectrum & Wi-Fi*, https://www.ncta.com/priorities/dynamic-networks/spectrum-and-wi-fi (last modified Feb. 12, 2026).

[17] Hazlett, *Assigning Property Rights to Radio Spectrum Users*, *supra* note 12.

[18] Paul Milgrom, Jonathan Levin & Assaf Eilat, *The Case for Unlicensed Spectrum* 3–4 (Oct. 12, 2011), https://web.stanford.edu/~jdlevin/Papers/UnlicensedSpectrum.pdf.

address uses whose benefits are difficult to monetize, and decide when exclusive licensing, sharing, or unlicensed access will produce the greatest value.

III. How Spectrum Rights Are Allocated and Reallocated

Radio operating rights are indispensable inputs for wireless services, making their allocation and assignment among the most consequential decisions in spectrum management. The quality, certainty, and flexibility of those rights shape whether firms will invest in networks and devices capable of supporting artificial intelligence, augmented reality, virtual reality, and other data-intensive applications.

The current system divides authority between the FCC and the NTIA, whose differing mandates can slow reallocation and create uncertainty. Within bands under FCC control, regulators must choose among exclusive licenses, unlicensed access, and dynamic-sharing arrangements, each of which offers different levels of interference protection, flexibility, and investment certainty. Secondary markets can later move licensed rights toward more productive uses, though transaction costs and limits on federal participation constrain their reach.

A. Divided Authority and Regulatory Delay

The United States is unusual among major economies in dividing spectrum-management authority between two federal agencies with different mandates and constituencies.[19] The Federal Communications Commission (FCC) governs nonfederal radio operations. Its authority traces to the Federal Radio Commission, which Congress created in response to disorder in early radio broadcasting.[20] Congress directed the FCC to regulate radio communications in the public interest, a mandate that has often pushed the agency toward productive use, flexible allocation, and market-based assignment.[21]

The National Telecommunications and Information Administration (NTIA) manages spectrum used by federal agencies. Its role grew out of the Interdepartment Radio Advisory Committee (IRAC), a cooperative body that agencies formed before Congress created a formal regulatory system for civilian users.[22] NTIA also seeks efficient spectrum use, but its institutional structure gives incumbent agencies substantial influence over decisions affecting their operations. Its approach

---

[19] Jeffrey Westling, *Rivalrous Regulators: Historical Analysis of the Dual Agency Approach to Spectrum Management*, R STREET POL'Y STUDY NO. 231 (Oct. 4, 2021), https://www.rstreet.org/2021/10/04/rivalrous-regulators-historical-analysis-of-the-dual-agency-approach-to-spectrum-management.

[20] R.H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1, 6 (1959).

[21] 47 U.S.C. § 303 (granting the Federal Communications Commission authority to regulate radio communications "as public convenience, interest, or necessity requires"); 47 U.S.C. § 307(a) (requiring the Commission to grant broadcast licenses "if public convenience, interest, or necessity will be served thereby"); 47 U.S.C. § 309(a) (requiring the Commission to grant license applications when "public interest, convenience, and necessity will be served").

[22] R.H. Coase, *The Interdepartment Radio Advisory Committee*, 5 J.L. & ECON. 17 (1962).

therefore tends to place greater weight on protecting federal systems from harmful interference, though priorities vary by administration.[23]

The FCC and NTIA must make joint decisions about a shared resource, even though their institutional incentives often diverge. Neither agency has final authority over every decision modern spectrum management requires. The FCC can regulate nonfederal operators and reallocate bands occupied solely by commercial users. It cannot compel a federal agency to relocate, nor can it determine whether a federal assignment remains necessary without NTIA's cooperation.

NTIA can use presidential authority over the executive branch to direct agencies to relinquish or share spectrum. In practice, the IRAC gives incumbent agencies considerable influence, and aggressive action depends heavily on White House direction. The resulting structure lacks a clear final arbiter.

That uncertainty carries economic costs. Delays reduce the value of spectrum rights by postponing deployment and revenue.[24] Auction bidders and equipment manufacturers also need confidence that allocation decisions will remain settled. When later challenges may reopen those decisions, firms have less reason to invest in networks, devices, and services tied to the affected bands.

The consequences become clearest during spectrum reallocation. The 3.1-3.55 GHz band supported federal defense radar systems, and the FCC could not repurpose those frequencies without agreement from the Department of Defense (DOD) and NTIA.[25] Congress ultimately directed further study and sharing through the MOBILE NOW Act.[26] Without that mandate, even the limited arrangement covering the upper 100 MHz of the band might not have emerged because the DOD had little institutional reason to surrender access voluntarily.

The 24 GHz proceeding showed how neighboring federal operations can create uncertainty even when no federal incumbent occupies the band itself.[27] The National Oceanic and Atmospheric Administration (NOAA) raised interference objections late in the process, after auction planning was underway. The agency appeared to bypass the established IRAC process and took its concerns directly to Congress and the public. That dispute weakened confidence that the FCC's allocation decision was final and threatened to reduce the licenses' value.

---

[23] Westling, *Rivalrous Regulators*, *supra* note 19.

[24] *Id.* at 1.

[25] Press Release, Sen. Deb Fischer, *Defense Officials to Fischer: If DOD Is Forced to Vacate Spectrum Frequencies, U.S. Would Assume High Level of Risk for Homeland Defense* (May 13, 2025), https://www.fischer.senate.gov/public/index.cfm/2025/5/defense-officials-to-fischer-if-dod-is-forced-to-vacate-spectrum-frequencies-u-s-would-assume-high-level-of-risk-for-homeland-defense.

[26] MOBILE NOW Act, S. 19, § 5, 115th Cong. (2017).

[27] Jeffrey Westling, *It Takes Two to Make a Proceeding Go Slow*, R STREET INST. (July 20, 2020), https://www.rstreet.org/commentary/it-takes-two-to-make-a-proceeding-go-slow.

The 5.9 GHz proceeding revealed a related problem. An agency with no operating rights in or adjacent to the band, but with a strong programmatic interest in its use, exerted substantial pressure to reopen FCC decisions.[28] These episodes show how divided authority allows federal and other incumbent interests to resist reallocation, prolong proceedings, and reduce the value of spectrum rights even after the technical record supports a change.

Successful spectrum management therefore depends on close coordination between the FCC and NTIA, backed by clear White House direction. The next generation of wireless applications will require faster decisions involving difficult technical and economic tradeoffs. An administration that seeks continued U.S. leadership in wireless technology must align the agencies around common priorities, shared technical standards, and a consistent account of the national interest. Without that coordination, the federal government will spend too much time reopening old disputes while new technologies wait for access.

B. Licensed, Unlicensed, and Secondary-Market Access

Even when a band falls entirely under FCC control, allocating access presents difficult choices. The FCC uses two primary models. It may grant licenses to individual operators, or it may permit unlicensed operation under generally applicable technical rules.

A license defines an operator's rights and restrictions. These may include the frequencies, power levels, geographic areas, and times in which the licensee may transmit. The precise terms depend on the band plan, the service involved, and neighboring operations.[29]

Many licenses provide exclusive access to a frequency range and protection against harmful interference. Those rights give operators greater confidence that later entrants will not jeopardize investments in networks and equipment. Other licenses grant several operators similar or overlapping rights, particularly in bands used for satellite services.[30]

Licensing can also support sharing across time or geography. The 3.5 GHz Citizens Broadband Radio Service (CBRS) band, for example, gives naval radar systems priority access while allowing Priority Access Licensees to operate when they will not interfere with those federal systems.[31]

---

[28] Seth L. Cooper, *D.C. Circuit Upholds FCC's 5.9 GHz Order Reallocating Spectrum for Unlicensed Use*, FED. SOC'Y BLOG (Sept. 12, 2022), https://fedsoc.org/commentary/fedsoc-blog/d-c-circuit-upholds-fcc-s-5-9-ghz-order-reallocating-spectrum-for-unlicensed-use.

[29] *See generally* Fed. Commc'ns Comm'n, *Licensing*, https://www.fcc.gov/licensing (last visited June 8, 2026).

[30] Eric Fruits & Kristian Stout, Comments of the Int'l Ctr. for L. & Econ., *Modernizing Spectrum Sharing for Satellite Broadband*, SB Docket No. 25-157 (July 28, 2025), https://laweconcenter.org/wp-content/uploads/2025/07/2025-EPFD-Comments.pdf.

[31] Randall Berry, Thomas W. Hazlett, Michael L. Honig & J. Nicholas Laneman, *Evaluating the CBRS Experiment* (Aug. 1, 2023) (unpublished manuscript), https://ssrn.com/abstract=4528763.

The FCC's second model permits unlicensed operation. Unlicensed bands initially offered inventors a low-cost way to develop and test devices without obtaining an individual license.[32] Consumers encounter this model through Wi-Fi routers, Bluetooth headphones, and other devices that create short-range personal or local networks.

Requiring every consumer to obtain FCC approval before setting up a home network would make those technologies commercially impractical. Device manufacturers instead design products to comply with the FCC's Part 15 rules and obtain equipment authorization. Consumers may then operate approved devices in designated unlicensed bands without further agency permission.[33]

Unlicensed access supports a large share of internet traffic, much of which travels over Wi-Fi.[34] Part 15 imposes power and technical limits intended to accommodate many nearby users. Unlicensed devices must also accept interference from other lawful operations. A user generally has no regulatory remedy when a neighboring device causes interference while complying with FCC rules.

Licensed and unlicensed access serve different purposes. A license offers greater certainty, stronger interference protection, and often higher permitted power. Those features support wide-area networks (WANs) and reduce some of the risks associated with capital-intensive broadband deployment.

Unlicensed access works best for localized uses that can tolerate variable interference conditions. In a large apartment building, residents can establish separate wireless networks without seeking individual licenses and usually without causing harmful interference to their neighbors. Part 15 also allows firms to develop and deploy short-range communications for internet-of-things devices without the cost and delay of securing operating licenses.

These two models allocate initial operating rights, but only licenses generally create transferable rights. An unlicensed user has no individual property-like interest to sell or assign. A licensee, by contrast, may transfer all or part of its authorization to another party, subject to FCC rules and approval.

Secondary-market transactions can move spectrum rights toward users that value them more highly, but transaction costs often impede those deals. A licensee may need to divide a geographic license into smaller areas, separate frequencies within a band, negotiate operating protections, and obtain

---

[32] Milgrom, Levin & Eilat, *supra* note 18, at 3–5 ("[U]nlicensed spectrum is an enabling resource. It provides a platform for innovation upon which innovators may face lower barriers to bringing wireless products to market because they are freed from the need to negotiate with exclusive license holders.").

[33] 47 C.F.R. pt. 15 (2024).

[34] Opensignal, *USA, Converged Experience, April 2026* (Apr. 30, 2026), https://insights.opensignal.com/2026/04/usa-converged-experience-april-2026/dt.

FCC consent. Recent policy changes have reduced some of these costs, but they have not removed them.[35] Secondary markets remain a viable yet underused means of reallocating spectrum rights.

C. Dynamic Spectrum Sharing

"Spectrum sharing" has become a prominent theme in recent policy debates, but the term can obscure more than it clarifies. Every spectrum allocation involves sharing. The FCC defines how users divide access across frequency, geography, and time.

An exclusive license is one form of sharing. It gives one operator priority rights within a defined frequency range and geographic area while requiring others to operate in adjacent channels, different locations, or at different times. A mobile carrier that wins a C-band license receives priority within its licensed area, but it still shares the broader band with neighboring licensees and other services. Users within the carrier's network also share the same frequencies through network coordination.

Unlicensed systems rely on a different arrangement. Many short-range networks may operate on the same frequencies at the same time because their limited power and geographic reach allow nearby users to coexist. FCC technical rules govern how those devices share access without granting any one user priority rights.

Current policy debates often use "spectrum sharing" to describe a narrower model. Dynamic sharing uses technical and regulatory systems to permit multiple users to access the same frequencies in the same area, sometimes at nearly the same time. Rather than assigning static rights years in advance, these systems coordinate access as operating conditions change.[36]

Dynamic sharing has attracted more attention as regulators face fewer bands that can be cleared for exclusive commercial licenses. The 3.5 GHz CBRS band offers the most ambitious U.S. example. CBRS uses a three-tier hierarchy that assigns priority among several classes of users operating within the same frequencies.[37]

Federal incumbents, primarily naval radar systems along the coasts, occupy the highest tier. Their operations receive the strongest protection and may preempt lower-tier users when necessary. Priority Access Licensees occupy the second tier. They obtain geographically defined rights to specific channels and receive protection from other nonfederal users, but they must yield when incumbent federal systems need access.

---

[35] *Partitioning, Disaggregation, and Leasing of Spectrum*, Report and Order and Second Further Notice of Proposed Rulemaking, WT Docket No. 19-38, FCC 22-53, 37 FCC Rcd. 8825 (2022).

[36] Nat'l Telecommc'ns & Info. Admin., *Advanced Dynamic Spectrum Sharing Demonstration in the National Spectrum Strategy* (June 28, 2024), https://www.ntia.gov/issues/national-spectrum-strategy/advanced-dynamic-spectrum-sharing-demonstration-in-the-national-spectrum-strategy.

[37] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, GN Docket No. 12-354, FCC 15-47, 30 FCC Rcd. 3959 (2015).

General Authorized Access users occupy the third tier. They may operate without an individual license when federal incumbents and Priority Access Licensees are not using the relevant frequencies in the area. This structure incorporates unlicensed access into a coordinated sharing system rather than treating it as a residual use.

An automated frequency coordinator known as the Spectrum Access System (SAS) manages these priorities. The cloud-based system tracks incumbent activity, assigns channels, revokes access when higher-priority users need the band, and manages interference among the three tiers.[38] It translates the FCC's regulatory hierarchy into operating decisions that respond to current conditions rather than relying entirely on a fixed band plan.

CBRS shows that dynamic sharing can accommodate changing demand while giving commercial operators some basis for investment. It also exposes the model's costs. Priority Access Licensees face greater uncertainty than holders of traditional exclusive licenses because they may lose access when federal incumbents return. The system's geographic and technical complexity may also exceed the capabilities of some operators.[39]

Those constraints may limit the services that shared bands can support. Applications involving artificial intelligence, augmented reality, or virtual reality may require consistent capacity and low latency. A licensee that must vacate a channel on short notice may struggle to provide that quality of service.

Dynamic sharing nevertheless expands the available set of allocation tools. Spectrum management need not rely exclusively on either traditional licenses or unlicensed access. Regulators can design sharing systems around the technical characteristics, incumbent uses, and commercial demands of a particular band.

The next challenge is to determine where dynamic coordination can improve spectrum use without creating unacceptable uncertainty. That question will grow more difficult as terrestrial, satellite, and airborne systems increasingly seek access to the same frequencies. Future sharing frameworks must provide clear priority rules, reliable coordination, and enough operating certainty to support investment.

---

[38] *Id.* ¶¶ 301–378.

[39] Berry *et al.*, *supra* note 31 ("The U.S. experience in the CBRS band has not evinced efficiencies in reducing delays, or in enhancing the flow of large amounts of bandwidth to higher valued uses. In terms of what rival nations have accomplished in their 3.5 GHz allocations, which uniformly rely primarily on awarding flexible, exclusive rights and which do not include the U.S.'s approximately 50-50 split between licensed and unlicensed, substantially more spectrum has been put into play [via exclusive licensing].").

D. Secondary Markets for Spectrum Rights

Operators may also sell or lease spectrum rights, either in full or in part. Secondary markets allow licensees to exchange those rights after the initial assignment without requiring the FCC to conduct a new allocation proceeding whenever market conditions change.[40]

The economic case for secondary markets is straightforward. The value of spectrum rights varies among users and over time. One licensee may lack the infrastructure, customers, or business model needed to use a license productively, while another could generate greater value from the same rights. A voluntary transaction can benefit both parties and move spectrum toward a more productive use with limited regulatory involvement.

The FCC embraced this logic in the early 2000s by establishing a framework for license transfers and leases. A licensee may assign an entire license to another holder, partition it by selling rights in part of the geographic service area, or disaggregate it by transferring part of the assigned frequency range. A licensee may also lease some or all of its operating rights while retaining the underlying license.[41]

Together, these mechanisms support a wide range of commercial arrangements. They allow parties to transfer only the rights relevant to a transaction rather than requiring the FCC to auction a newly configured license.

Secondary-market transactions have helped carriers assemble large, contiguous blocks of spectrum suitable for nationwide 5G networks. National carriers have acquired licenses from regional operators, cable companies, and other holders that could not use the rights as intensively.[42] The C-band reallocation also incorporated market mechanisms that allowed satellite operators to negotiate relocation terms and share in some of the value created by clearing the band for flexible use.[43]

Secondary markets support other arrangements as well, including private enterprise networks, utility communications, fixed-wireless services, neutral-host systems, and mobile services offered by cable companies or mobile virtual-network operators (MVNOs). Most transactions have involved permanent transfers or longer-term leases. More advanced automated coordination could eventually

---

[40] Martin Cave, Chris Doyle & William Webb, *Spectrum Trading: Secondary Markets*, in ESSENTIALS OF MODERN SPECTRUM MANAGEMENT 85 (2007).

[41] *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, Report and Order and Further Notice of Proposed Rulemaking, WT Docket No. 00-230, FCC 03-113, 18 FCC Rcd. 20604 (2003); *see also Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, Second Report and Order, Order on Reconsideration, and Second Further Notice of Proposed Rulemaking, WT Docket No. 00-230, FCC 04-167, 19 FCC Rcd. 14165 (2004).

[42] Linda Hardesty, *Sprint PCS Spectrum Looks Like Boon for T-Mobile*, FIERCE NETWORK (Aug. 6, 2019), https://www.fierce-network.com/5g/sprint-pcs-spectrum-looks-like-boon-for-t-mobile.

[43] *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, GN Docket No. 18-122, FCC 20-22, 35 FCC Rcd. 2343, ¶ 178 (2020), https://www.fcc.gov/document/fcc-expands-flexible-use-c-band-5g-0.

permit licensees to sell unused capacity for shorter periods, allowing another operator to access the band under privately negotiated terms.[44]

Secondary markets remain an incomplete substitute for FCC action. Spectrum transfers can involve substantial transaction costs, including negotiations over geography, frequency, interference protection, and agency approval. Concerns about spectrum warehousing also persist when licensees retain underused rights in anticipation of future gains rather than deploying service.[45]

Secondary markets offer even less help with underused federal spectrum. Federal agencies generally cannot sell or lease their assignments for direct financial benefit. Moving those frequencies toward higher-valued uses still requires political direction, interagency coordination, and formal reallocation.

IV. Spectrum for AI, AR, and VR Applications

Artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) will all increase wireless demand, but they impose different technical requirements. AR and VR need sustained capacity, low latency, and reliable connections. AI generates additional traffic, including greater upload demand, while also offering tools to improve spectrum coordination and sharing.

No single frequency band or access model can satisfy all of these needs. Lower frequencies provide coverage, mid-band frequencies balance reach and capacity, and higher frequencies support dense, short-range connections. Licensed, unlicensed, and shared-access regimes each serve different applications. Satellite networks add another layer by extending coverage and backhaul beyond terrestrial systems. Spectrum policy must combine these bands, access models, and network layers into a coherent strategy that supports both investment and experimentation.

A. A Layered Spectrum Strategy

No single frequency band can meet every wireless-network requirement. Lower frequencies travel farther and penetrate buildings more effectively, while higher frequencies can support wider channels and greater capacity over shorter distances. Coverage, capacity, propagation, and reliability therefore involve unavoidable tradeoffs.

The next generation of wireless applications will require a layered spectrum strategy. Different frequency ranges must supply different capabilities within an integrated network, and each layer needs operating rights, interference protection, and regulatory certainty suited to its role.

---

[44] *See, e.g.,* Lili Cao & Haitao Zheng, *Towards Real-Time Dynamic Spectrum Auctions*, 87 COMPUTER NETWORKS 1 (2008) (proposing a low-complexity auction framework for allocating spectrum in real time among large numbers of wireless users with dynamic traffic).

[45] *See* John W. Mayo & Scott Wallsten, *Enabling Efficient Wireless Communications: The Role of Secondary Spectrum Markets*, 22 INFO. ECON. & POL'Y 61 (2010); *see also* U.S. Gov't Accountability Off., GAO-14-236, *Spectrum Management: FCC's Use and Enforcement of Buildout Requirements* (Feb. 2014), https://www.gao.gov/assets/gao-14-236.pdf (discussing spectrum warehousing concerns).

1. *Low Band Below 1 GHz*

Low-band frequencies travel long distances and penetrate buildings well, but their relatively narrow channels limit data capacity. They are poorly suited to immersive media and other data-intensive applications. They remain valuable for widespread, low-rate connectivity supporting distributed artificial intelligence (AI) and internet-of-things devices.

Low band works especially well when most processing occurs on the device and the application needs only a persistent connection. Its propagation characteristics allow users to maintain basic connectivity across large geographic areas and inside buildings.

2. *Lower Mid-Band at Roughly 1–6 GHz*

Lower mid-band spectrum is central to current 5G deployments because it balances capacity and coverage. Reallocating it can be difficult, however, because many bands already support federal and commercial incumbents.

The lower 3 GHz band at 3.1–3.45 GHz, the 3.5 GHz CBRS band, and the C-band at 3.7–4.2 GHz can support wide-area mobile augmented reality (AR) and cloud-rendered virtual reality (VR).[46] Signals in these ranges travel far enough to serve suburban and exurban areas without the dense small-cell networks required at higher frequencies. They also penetrate buildings well enough to provide indoor service without always requiring a separate indoor network.

These bands can accommodate channels wide enough to support cloud-rendered AR, AI inference, and other data-intensive applications used by pedestrians, drivers, and workers on industrial floors.

3. *The 6 GHz Unlicensed Band at 5.925–7.125 GHz*

The 6 GHz band provides 1,200 MHz of unlicensed spectrum and supports Wi-Fi 6E and Wi-Fi 7. It will play a major role in AR, VR, and many consumer-facing AI applications.

Regulators first authorized low-power indoor devices and very-low-power portable operations in the band. They later added higher-power, geofenced device categories aimed at AR and VR headsets, wearables, and similar products used indoors and outdoors.[47]

Most immersive applications operate indoors and across short distances. Those conditions make 6 GHz a natural fit for a substantial share of AR and VR traffic.

---

[46] 5G Ams., *From Spectrum Scarcity to Scale: Why the Hunt for Mid-Band Spectrum Is Defining the 5G-to-6G Transition* (Dec. 3, 2025), https://www.5gamericas.org/from-spectrum-scarcity-to-scale-why-the-hunt-for-mid-band-spectrum-is-defining-the-5g-to-6g-transition.

[47] *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 18-295, GN Docket No. 17-183, FCC 20-51, 35 FCC Rcd. 3852 (2020); *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Fourth Report and Order and Third Further Notice of Proposed Rulemaking, ET Docket No. 18-295, GN Docket No. 17-183, FCC 26-1 (Jan. 30, 2026).

4. *Upper Mid-Band at Roughly 7–15 GHz*

Upper mid-band frequencies offer wide channels without the severe range limits associated with millimeter wave. The 7.125–8.4 GHz segment, for example, can provide large contiguous blocks of spectrum while retaining propagation characteristics suitable for some wide-area coverage.

Standards organizations and industry groups have identified several extended mid-band ranges as candidates for future wireless use, including 7.125–8.5 GHz, 10.7–13.25 GHz, and 14–15.35 GHz.[48] North American studies have modeled extended-reality and other high-demand applications in the 3.1–3.45 GHz, 7.125–8.5 GHz, and 12.7–13.25 GHz bands.[49]

The shorter propagation range of upper mid-band frequencies may also make some portions suitable for unlicensed operation. Their principal advantage is the ability to support wide channels for extended reality without imposing the coverage limitations of millimeter wave.

5. *Millimeter Wave at Roughly 24–47 GHz*

Millimeter-wave bands provide enormous capacity over short distances. They are well suited to dense environments such as venues, campuses, factories, and indoor networks, where fixed or tethered AR and VR systems can use very wide channels.[50]

These frequencies travel shorter distances and are easily blocked by walls, foliage, and other obstacles. They therefore complement mid-band coverage rather than replace it. As networks become denser and equipment improves, millimeter wave will likely assume a larger role in high-capacity wireless infrastructure.

6. *Sub-Terahertz and Terahertz Bands Above Roughly 100 GHz*

Researchers are studying frequencies around 100–140 GHz and 275–325 GHz for use in the 2030s and beyond. These bands could eventually support terabit-per-second capacity for holographic communications, digital twins, and the most demanding extended-reality applications.[51]

Severe signal loss, strict line-of-sight requirements, and immature hardware will constrain these frequencies for the foreseeable future. Their most likely early uses involve short-range indoor communications and sensing. Mid-band frequencies will continue to carry most wide-area traffic.

---

[48] Nokia, *Spectrum for 6G Explained*, https://www.nokia.com/6g/spectrum-for-6G-explained (last visited June 8, 2026).

[49] ATIS Next G Alliance, *Derivation of Spectrum Needs for 6G* (June 2024), https://nextgalliance.org/white_papers/6g-spectrum-considerations.

[50] Maxim Susloparov, Artem Krasilov & Evgeny Khorov, *Providing High Capacity for AR/VR Traffic in 5G Systems with Multi-Connectivity*, IEEE PIMRC 2022 (2022), https://arxiv.org/pdf/2208.08277.

[51] Ian F. Akyildiz, Chong Han, Zhen Hu, Shuai Nie & Josep M. Jornet, *Terahertz Band Communication: An Old Problem Revisited and Research Directions for the Next Decade*, 70 IEEE TRANS. COMMC'NS 4250 (2022).

B. Matching Allocation Models to Emerging Technologies

Making additional bands available for commercial use solves only part of the problem. The FCC must also decide whether to assign those bands through exclusive licenses, unlicensed access, or dynamic sharing. AI, AR, and VR depend on different combinations of coverage, capacity, reliability, and ease of access, so the choice among these models can shape which applications develop.

Exclusive licenses give operators defined rights to exclude other users, protect against harmful interference, and operate at higher power. That certainty supports the large investments required to build wide-area networks. Auctions can also generate substantial public revenue. Exclusive rights may limit entry, though, and can leave capacity underused when licensees do not fully employ their assigned frequencies.

Unlicensed bands take a different approach. Any device that complies with the FCC's technical rules may operate without an individual license. The benefits extend across Wi-Fi, Bluetooth, and other short-range technologies, making them difficult to capture through a single auction bid or license valuation. Estimates credit unlicensed spectrum with generating trillions of dollars in annual economic value.

Dynamic-sharing systems occupy the middle ground. The 3.5 GHz CBRS band uses a three-tier coordination system that permits commercial users to operate when incumbent federal radar systems do not need the frequencies. Automated sensing and database tools manage access and enforce priority rights.

These allocation models support different uses. Indoor, tethered, and short-range immersive applications align closely with unlicensed spectrum, particularly the 6 GHz band. Outdoor and mobile AR applications, including heads-up navigation and mobile mixed reality, depend more heavily on the coverage and quality-of-service protections available through licensed mid-band networks.

AI applications use both. Latency-sensitive edge inference may rely on licensed networks when mobility and reliability matter. Large model updates, data synchronization, and stationary applications can shift substantial traffic to unlicensed networks. No single allocation model can support the full range of immersive and AI-enabled services.

The One Big Beautiful Bill Act, signed in July 2025, restored the FCC's general spectrum-auction authority after it expired in March 2023. The law directed the federal government to identify at least 800 MHz within the 1.3–10.5 GHz range for auction and required an auction of upper C-band spectrum.[52]

Congress excluded the heavily contested 3.1–3.45 GHz and 7.4–8.4 GHz federal bands from that mandate. It did not provide similar statutory protection for the 5.925–7.125 GHz unlicensed band

[52] One Big Beautiful Bill Act, Pub. L. No. 119-21, 139 Stat. 72 (2025).

or CBRS. That omission prompted concern among Wi-Fi and shared-access advocates that frequencies supporting AR, VR, and edge-AI applications could later be converted to exclusive licensed use.[53] The Trump administration has continued to support preserving the full 6 GHz band for Wi-Fi.[54]

The spectrum needs of AI, AR, and VR therefore call for a layered portfolio of both frequency bands and access models. Licensed mid-band spectrum supplies wide-area coverage and predictable service. The 6 GHz unlicensed band and millimeter-wave frequencies provide dense, short-range capacity for many immersive applications. Dynamic sharing can expand access where full clearing or exclusive licensing would prove impractical.

The allocation balance matters as much as the amount of spectrum available. A policy that favors exclusive licensing too heavily could sacrifice the dispersed benefits of Wi-Fi and shared systems. A policy that relies too heavily on unlicensed or shared access could weaken the certainty needed for large network investments and applications requiring guaranteed service. The FCC should preserve a deliberate mix of licensed, unlicensed, and shared access suited to the technical demands of each band and application.

C. Satellite Networks as a Third Connectivity Layer

A full account of spectrum demand must include low-Earth-orbit (LEO) satellite constellations, which are becoming a third connectivity layer alongside fixed and mobile networks. Systems such as Starlink and Project Kuiper operate roughly 300 to 2,000 kilometers above Earth, far below geostationary satellites at about 36,000 kilometers.[55] Their lower altitude reduces latency, often to less than 100 milliseconds, which can support many interactive applications.[56]

Connectivity-focused LEO systems rely primarily on the Ku band at 12–18 GHz for user-terminal links and the Ka band at 26.5–40 GHz for gateway and feeder links. Higher-capacity Q/V bands at 37.5–51 GHz are emerging for next-generation feeder links, though they are more vulnerable to signal loss.[57] Optical intersatellite links can also carry traffic between satellites, reducing pressure on radio frequencies and avoiding some ground-based routing delays.

---

[53] NCTA—The Internet & Television Ass'n, *Why Protecting Wi-Fi and CBRS Is Smart Policy–and Smart Business* (June 10, 2025), https://www.ncta.com/news/protecting-wi-fi-and-cbrs-is-smart-policy.

[54] Arielle Roth, Assistant Sec'y of Com. for Commc'ns & Info. & Adm'r, Nat'l Telecommc'ns & Info. Admin., Remarks at the Americas Spectrum Management Conference (Oct. 30, 2025), https://www.ntia.gov/speech/testimony/2025/remarks-assistant-secretary-arielle-roth-americas-spectrum-management-conference ("Let me be clear: OB3 does not alter U.S. policy for the 6 GHz band, which was designated for unlicensed use during the first Trump Administration. That remains our position.").

[55] LEO Policy Working Group, *Low Earth Orbit Satellites: Policies to Promote Spectrum Sharing, Foster Competition, and Close Digital Divides: A Report of the LEO Policy Working Group*, NEW AM. & INT'L CTR. FOR L. & ECON. (Oct. 30, 2025), https://www.newamerica.org/insights/leo-satellites.

[56] *Id.*

[57] Aizaz U. Chaudhry & Halim Yanikomeroglu, *Laser Inter-Satellite Links in a Starlink Constellation: A Classification and Analysis*, 16 IEEE VEHICULAR TECH. MAG. 48 (June 2021).

These systems operate through coordinated, licensed allocations governed internationally by the International Telecommunication Union's (ITU) nongeostationary fixed-satellite-service framework. Regulators do not generally assign these frequencies through national auctions. Instead, they establish interference limits and coordination rules that allow multiple constellations to use the same bands.[58]

Direct-to-device connectivity and Supplemental Coverage from Space are developing even faster. Rather than relying only on dedicated satellite bands and specialized terminals, these services allow ordinary mobile devices to connect directly to satellites when no terrestrial cell site is available. They may use terrestrial mobile frequencies or L- and S-band mobile-satellite-service spectrum. Since the FCC adopted an initial regulatory framework in 2024, the model has entered commercial service and prompted multibillion-dollar transactions involving mobile-satellite spectrum.[59]

For AI, AR, and VR, LEO service will complement terrestrial networks rather than replace them. Its clearest role is extending coverage to rural, maritime, aviation, and disaster-affected areas where fiber and dense cellular networks are unavailable. It can also provide resilient backhaul to terrestrial edge nodes that perform AI inference and cache content closer to users.

Latency will limit the most demanding immersive applications. A LEO round trip of roughly 20 to 50 milliseconds can support cloud-rendered or social VR, video, telemetry, AI inference, and model synchronization. It remains too slow for tightly coupled AR and VR experiences that require motion-to-photon latency below about 15 milliseconds. Those applications will continue to depend on on-device processing or nearby terrestrial edge infrastructure.[60]

Direct-to-device service may reach lightweight AR wearables and always-on AI assistants sooner. It could support off-grid notifications, positioning, and low-rate queries well before it can deliver full immersive video.

Satellite spectrum presents management problems that differ from those affecting terrestrial networks. Terrestrial licenses often divide frequencies into exclusive blocks. Satellite systems instead depend on coordination among operators.[61]

---

[58] Int'l Telecommc'n Union, *ITU Radio Regulatory Framework for Space Networks* (2020), https://www.itu.int/en/ITU-R/space/snl/Documents/ITU-Space_reg.pdf.

[59] *Single Network Future: Supplemental Coverage from Space; Space Innovation*, Report and Order and Further Notice of Proposed Rulemaking, IB Docket No. 22-271, FCC 24-28 (Mar. 15, 2024).

[60] Mohammed S. Elbamby, Cristina Perfecto, Mehdi Bennis & Klaus Doppler, *Toward Low-Latency and Ultra-Reliable Virtual Reality*, 32 IEEE NETWORK 78 (2018).

[61] LEO Policy Working Group, *supra* note 55.

ITU rules assign priority largely by filing date. In the United States, the FCC uses processing rounds that give earlier-authorized systems priority over later applicants. A later system must coordinate with earlier constellations or comply with default protection standards.[62]

Equivalent power-flux-density (EPFD) limits add another constraint. These rules cap the combined power that nongeostationary systems may direct toward geostationary satellites, even when no particular geostationary link faces a demonstrated threat. The limits can restrict how many satellites a constellation may direct toward one area and reduce total network capacity.[63]

In 2026, the FCC moved toward a performance-based framework for important Ku- and Ka-band frequencies. The new approach relies on a default 3% throughput-degradation threshold and good-faith bilateral coordination. The agency also granted interim waivers to leading constellations before finalizing the rules.[64]

Coordination still depends heavily on negotiation among operators. As more constellations enter service and orbital density rises, the number of overlapping systems and potential interference relationships grows quickly. U.S. rules are also moving ahead of the international framework, which continues to rely on EPFD limits.

The priority system favors incumbents. Earlier filings receive stronger protection, which rewards operators that apply and deploy first. It also encourages speculative filings because an operator can secure priority before putting spectrum to productive use.

Deployment milestones seek to limit that behavior by requiring operators to launch a specified share of an authorized constellation within fixed periods. Those requirements also raise the capital needed to enter the market and may favor well-financed incumbents over smaller or later challengers.

Rules designed to prevent interference can therefore restrict entry when they grant durable advantages to early filers or impose high upfront deployment costs. Satellite policy faces the same basic tradeoff as terrestrial spectrum policy. Regulators must protect existing operations without allowing coordination rules to preserve underused rights or exclude more productive entrants.

D. AI as Both Spectrum User and Management Tool

Artificial intelligence complicates the usual choice among licensed, unlicensed, and shared access because it affects both spectrum demand and spectrum management. Generative-AI and edge-AI

---

[62] *See, e.g.*, *Space Bureau Opens Processing Rounds for NGSO FSS Systems*, Public Notice, DA 26-552 (Space Bureau June 5, 2026), https://docs.fcc.gov/public/attachments/DA-26-552A1.pdf.

[63] Int'l Telecommc'n Union, *Equivalent Power-Flux Density Limits Examination: Part I—Overview* (Dec. 2024), https://www.itu.int/en/ITU-R/seminars/wrs/Documents/2024/Space-Workshops/EPFD%20Part%20I%20Overview%20WRS-2024.pdf; *see also Modernizing Spectrum Sharing for Satellite Broadband*, Report and Order, SB Docket No. 25-157, FCC 26-26, ¶ 18 (rel. May 1, 2026), https://docs.fcc.gov/public/attachments/FCC-26-26A1.pdf.

[64] *Modernizing Spectrum Sharing for Satellite Broadband*, *supra* note 63.

applications can produce substantial bursts of traffic across mid- and upper-mid-band frequencies. They may also require far more upload capacity than current consumer applications, placing pressure on networks designed primarily for downloads.

AI may also help networks use existing frequencies more efficiently. Machine-learning systems can identify unused capacity, predict interference conditions, and adjust channel access in real time. These tools could allow secondary users to operate without causing harmful interference to incumbents.

Research on reinforcement learning and hybrid optimization for 6G cognitive-radio networks reports gains in spectral efficiency and reductions in interference.[65] If these methods mature and regulators accept them, spectrum policy will increasingly focus on how efficiently users can share a band, alongside decisions about whether to license it exclusively or permit unlicensed access.

AI therefore occupies an unusual role. It increases demand for wireless capacity while offering tools that may ease some of the resulting congestion. Its contribution to dynamic coordination could become especially valuable as immersive applications place greater demands on scarce frequencies.

V. A Spectrum Policy Agenda for Emerging Technologies

Realizing the benefits of artificial intelligence, augmented reality, and virtual reality will require more than adding spectrum to a federal pipeline. Policymakers must preserve a balanced mix of licensed, unlicensed, and shared access, move underused federal bands into commercial use, improve coordination between the FCC and the NTIA, and replace reflexive worst-case interference analysis with risk-informed methods.

The United States must also engage more coherently in international spectrum policy. Decisions made through the International Telecommunication Union and the World Radiocommunication Conference shape global equipment markets, national-security interests, and competition with China. Each band presents distinct technical and economic questions, but these principles should guide the broader policy agenda.

A. Preserve a Balanced Mix of Access Models

AI, AR, and VR rely on different wireless capabilities at different times. Regulators should therefore preserve a mix of frequency bands and access models rather than favoring one regime across the board.

Exclusive licenses support high-powered, wide-area networks and provide the interference protection needed for capital-intensive deployment. Those features matter for mobile AR and latency-sensitive AI inference. Unlicensed spectrum supplies low-cost, permissionless capacity for indoor and short-range immersive applications, as well as AI workloads that generate substantial traffic in both

---

[65] Nada Abdel Khalek, Deemah H. Tashman & Walaa Hamouda, *Advances in Machine Learning-Driven Cognitive Radio for Wireless Networks: A Survey*, 26 IEEE COMMC'NS SURVEYS & TUTORIALS 1201 (2024).

directions. Dynamically shared bands can accommodate incumbents while opening additional capacity to commercial users. Each model serves a distinct purpose.

The political process does not value these benefits evenly. Auctions produce large, visible, and immediate federal revenue. The gains from unlicensed and shared spectrum appear more diffusely through consumer surplus, lower entry barriers, and new devices and services. They are also harder to estimate in advance.[66] When Congress uses auction receipts to offset federal spending, that asymmetry creates pressure to convert more bands to exclusive licenses.

That pressure bears directly on the 6 GHz unlicensed band and the 3.5 GHz CBRS framework. Both support immersive and edge-computing applications, yet both remain exposed to proposals for licensed reallocation.

An excessive tilt toward unlicensed or shared use would create different costs. Without enough exclusive-use spectrum and reliable interference protection, operators may lack the certainty needed to invest billions of dollars in wide-area networks.[67] Mobile immersive services cannot become widely available without that infrastructure.

Allocation decisions should therefore account for consumer welfare and total economic value rather than auction revenue alone. Regulators should compare the full benefits and costs of exclusive licensing, unlicensed access, and dynamic sharing in each band.

The same approach should govern satellite and direct-to-device systems. Rules for nonterrestrial networks should promote competition and economic value while ensuring that the satellite layer complements terrestrial networks rather than dividing spectrum policy into separate and inconsistent regimes.

B. Reform Federal Spectrum Reallocation

Much of the prime mid-band spectrum needed for AI, AR, and VR remains assigned to federal users, especially the Department of Defense (DOD). Reallocating those frequencies for commercial use requires coordination between the NTIA and the FCC. The One Big Beautiful Bill Act was designed to accelerate that process, but its structure shows why federal reallocation remains the weakest part of the spectrum pipeline. If that process stalls, pressure may shift toward nonfederal bands.

The law's 800 MHz pipeline draws on two sources.[68] It directs NTIA to identify at least 500 MHz of federal spectrum between 1.3 and 10.5 GHz, while excluding the 3.1–3.45 GHz and 7.4–8.4 GHz bands reserved for the DOD. NTIA must identify at least 200 MHz within two years, with FCC auctions scheduled on staggered deadlines extending into the early 2030s.

[66] Westling, *Primer: A Staffer's Guide to Spectrum Auction Reauthorization*, *supra* note 3.

[67] CTIA, *The Looming Spectrum Crisis* (Mar. 27, 2025), https://www.ctia.org/news/the-looming-spectrum-crisis.

[68] One Big Beautiful Bill Act, Pub. L. No. 119-21, 139 Stat. 72 (2025).

The remaining 300 MHz must come from nonfederal spectrum under FCC control. That tranche includes a requirement to auction at least 100 MHz of upper C-band spectrum between 3.98 and 4.2 GHz.

The statute does not require the auction of any particular federal band. It establishes a total target and directs NTIA to identify qualifying frequencies that the FCC must later auction. Meeting the federal target therefore depends on identifying suitable bands and relocating or accommodating incumbent systems.

That process requires cooperation from the agencies using those frequencies. Clearing a federal band may require moving systems into adjacent frequencies, modifying military equipment, or redesigning operations. The executive branch can direct NTIA to pursue relocation, but it cannot easily dismiss operational and national-security objections from agencies that must move.

If the DOD refuses to accommodate a relocation, NTIA may struggle to identify the full 500 MHz. A statutory target cannot make frequencies available when the responsible agency will not relinquish them. Congress's exclusion of the lower 3 GHz and 7.4–8.4 GHz bands illustrates the problem.[69] Those exemptions responded to legitimate defense concerns, but similar objections may arise as NTIA examines other bands.

The FCC can deliver only the 300 MHz drawn from nonfederal spectrum without relying on another agency. If the federal portion proves difficult to clear, auction deadlines, projected revenue, and political pressure may encourage the FCC to draw more heavily on bands within its own jurisdiction.

That pressure could fall on frequencies already supporting immersive and edge-AI applications, including the 3.55–3.7 GHz CBRS band and the 5.925–7.125 GHz unlicensed band. Congress declined to protect either band in the final legislation. A process intended to reclaim underused federal spectrum could therefore consume commercial, shared, or unlicensed spectrum when federal incumbents resist.

Durable reallocation requires federal-agency cooperation, adequate funding for relocation, and clear White House direction. Regulators must also reduce the procedural barriers that delay transitions once agencies agree to move.

Congress created the Spectrum Relocation Fund (SRF) through the Commercial Spectrum Enhancement Act of 2004 to reimburse federal agencies for relocation costs.[70] The fund directs a portion of auction proceeds toward expenses associated with moving federal systems. It was meant to remove a recurring obstacle by ensuring that agencies would not resist reallocation merely because their budgets could not absorb the cost.

---

[69] *Id.* § 40002(b)(1).

[70] Commercial Spectrum Enhancement Act of 2004, Pub. L. No. 108-494, tit. II, 118 Stat. 3986, 3991 (2004) (codified at 47 U.S.C. §§ 923(g)–(i), 928).

The fund has not operated smoothly.[71] Before receiving money even to study whether relocation is feasible, an agency must prepare a detailed pipeline plan, obtain review from the Technical Panel, secure approval from the director of the Office of Management and Budget, and complete a mandatory congressional-notification period. These requirements can delay the preliminary studies needed to determine whether a band can be cleared or shared.[72]

The Trump administration has taken steps to improve the process, but several of its most burdensome requirements, including the 60-day congressional-notification period, are statutory. Administrative reforms alone cannot remove them.[73]

Congress should streamline the review and notification process while preserving meaningful oversight. Faster access to relocation funding would allow NTIA to study bands sooner, shorten auction timelines, increase license values by giving bidders greater certainty, and bring additional mid-band spectrum into commercial use more quickly.

C. Strengthen FCC-NTIA Coordination

The aviation-altimeter dispute surrounding the lower C-band exposed serious weaknesses in coordination between the FCC and the NTIA. The Biden administration responded with several reforms. In February 2022, the agencies launched a Spectrum Coordination Initiative. Six months later, they signed an updated memorandum of understanding, the first revision in nearly two decades.[74]

The agreement formalized coordination at both the leadership and staff levels. It required the FCC chair and NTIA administrator to meet at least quarterly and their staffs to meet monthly. It also created procedures for sharing plans up to a year in advance and extended the notice period for proposals that could cause interference from 15 to 20 business days. These measures sought to identify conflicts early rather than allow them to erupt near the end of a proceeding.

The 2023 National Spectrum Strategy and its 2024 implementation plan expanded that effort. They called for longer-term interagency planning, peer-reviewed models for evaluating reallocation and coexistence, and a pipeline of bands for detailed study. They also proposed a national testbed for

[71] Arielle Roth, Assistant Sec'y of Com. for Commc'ns & Info., Remarks at the 2026 CTIA Summit (May 6, 2026), https://www.ntia.gov/speech/testimony/2026/remarks-assistant-secretary-arielle-roth-2026-ctia-summit.

[72] *Id.*

[73] 47 U.S.C. § 928(g)(2)(D)(ii).

[74] Press Release, Nat'l Telecommc'ns & Info. Admin., *FCC, NTIA Establish Spectrum Coordination Initiative* (Feb. 15, 2022), https://www.ntia.gov/press-release/2022/fcc-ntia-establish-spectrum-coordination-initiative; *Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration* (Aug. 1, 2022), https://www.ntia.gov/other-publication/2022/memorandum-understanding-between-fcc-and-ntia.

dynamic spectrum sharing, including the use of artificial intelligence to support real-time coordination.[75]

Coordination remains difficult, and further improvement will be necessary to carry out the One Big Beautiful Bill Act. When a band can be cleared, effective planning determines whether federal systems relocate on time and at a reasonable cost. When clearing is impractical, commercial access may depend on dynamic sharing. That approach works only when the FCC, NTIA, and incumbent agencies jointly develop, test, and trust the technical framework.

Both reallocation and sharing depend on durable cooperation grounded in a common technical record. The FCC and NTIA should continue refining their procedures, disclose concerns early, and resolve disputes before agencies and private firms commit substantial resources. Without that discipline, the new statutory pipeline may reproduce the delays and uncertainty that the coordination reforms were designed to prevent.

D. Adopt Risk-Informed Interference Analysis

Every spectrum reallocation and sharing arrangement depends on a threshold question. How much harmful interference would a proposed use cause to incumbents operating in or near the band? The method used to answer that question often determines whether regulators permit new entry at all.

For decades, agencies have relied heavily on deterministic, worst-case analysis.[76] This method assumes that transmitters operate at maximum power, at the least favorable distance and geometry, under the most adverse propagation conditions, and at the same time. Such caution imposed little cost when spectrum was lightly used. In today's congested bands, it can block entry or impose severe operating restrictions even when the probability of harm is remote.

Worst-case analysis treats every conceivable event as equally relevant, regardless of likelihood. A harmful-interference scenario may require several unlikely conditions to occur simultaneously, including peak power, minimum separation, and unusually adverse propagation. Evaluating only the most severe possible outcome systematically overstates risk and gives incumbents a potent means of resisting new services. An alarming hypothetical can derail entry even when expected harm is negligible.

Risk-informed interference assessment asks a broader set of questions.[77] What harmful events could occur? How likely are they? What consequences would follow? Aviation, nuclear, and environmental

---

[75] Nat'l Telecommc'ns & Info. Admin., *National Spectrum Strategy* (Nov. 2023), https://www.ntia.gov/sites/default/files/publications/national_spectrum_strategy_final.pdf; Nat'l Telecommc'ns & Info. Admin., *National Spectrum Strategy Implementation Plan* (Mar. 12, 2024), https://www.ntia.gov/sites/default/files/publications/national-spectrum-strategy-implementation-plan.pdf.

[76] Spectrum & Receiver Performance Working Grp., Fed. Commc'ns Comm'n Technological Advisory Council, *A Quick Introduction to Risk-Informed Interference Assessment* (ver. 1.00, Apr. 1, 2015), https://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting4115/Intro-to-RIA-v100.pdf.

[77] *Id.* at 1.

regulators have used quantitative risk assessment for decades to evaluate hazards whose probabilities and consequences vary.

The process generally has four steps:

1. Identify significant interference hazards.
2. Define a measure for the consequences of each hazard.
3. Estimate each hazard's likelihood and consequences using realistic deployment densities, equipment-use patterns, and statistical propagation models.
4. Combine those results into a probabilistic assessment of risk.[78]

This method does not guarantee approval for a new entrant. It does, however, give regulators a fuller account of likely outcomes rather than allowing one extreme scenario to control the decision.

Risk-informed analysis is especially valuable for dynamic-sharing systems. Automated coordinators such as the CBRS Spectrum Access System and the 6 GHz automated frequency-coordination system must assign channels and manage interference in real time. They cannot resolve every potential conflict through an individual proceeding. They need objective criteria that account for both the probability and severity of interference.

Clear thresholds give incumbents and entrants greater certainty because the rules governing coexistence are established before deployment. Worst-case assumptions instead produce unnecessarily large exclusion zones and protection margins, wasting much of the capacity that sharing is intended to make available.

The FCC used probabilistic interference analysis when it opened the 6 GHz band to unlicensed devices despite incumbents' worst-case objections. The U.S. Circuit Court of Appeals for the D.C. Circuit upheld that approach as reasonable, confirming that quantitative risk assessment can provide a legally defensible basis for spectrum decisions.[79] The National Spectrum Strategy likewise calls for data-driven, risk-informed compatibility and coexistence studies.[80]

Regulators should make risk-informed analysis the default for reallocation and sharing proceedings. Agencies should develop internal expertise, publish their models and assumptions, and allow independent researchers and affected parties to test the results. Greater transparency would improve both the quality and credibility of interference assessments.

Artificial intelligence can strengthen this approach. One promising tool is the spectrum digital twin, a continuously updated virtual model of a real radio environment. Regulators, operators, and

---

[78] *Id.* at 3.

[79] *AT&T Servs., Inc. v. FCC*, No. 20-1190, at 15 (D.C. Cir. Dec. 28, 2021).

[80] Nat'l Telecommc'ns & Info. Admin., *National Spectrum Strategy*, *supra* note 75, at 16.

researchers can use such models to simulate electromagnetic systems under many operating conditions before making allocation decisions.[81]

A digital twin can represent environments ranging from a single building or industrial campus to a national network. Rather than producing one static worst-case estimate, it can run thousands of simulations across realistic combinations of device locations, power levels, traffic patterns, and propagation conditions. The result is a probabilistic account of interference risk that can also identify ways to improve spectrum use while protecting incumbents.

Risk-informed analysis does not discount catastrophic harms. Some systems support safety-of-life or national-security functions for which even a rare failure could carry grave consequences. A sound risk assessment weighs severity alongside likelihood and can impose stringent protections when potential harm is extreme.[82]

Its advantage lies in distinguishing those cases from ordinary disputes in which incumbents invoke remote hazards to delay competition. Protection should correspond to the actual risk posed by a proposed use rather than applying the same degree of caution across every band and service.

The consequences for AI, AR, and VR are substantial. Much of the mid-band capacity these applications need will depend on reallocation and sharing. Worst-case analysis can keep usable frequencies unavailable because of improbable combinations of events. A risk-informed standard would protect critical systems while allowing regulators to make more productive use of spectrum.

E. Strengthen U.S. Leadership in International Spectrum Policy

Spectrum policy does not stop at national borders. Every four years, the International Telecommunication Union (ITU) convenes the World Radiocommunication Conference (WRC) to revise the international Radio Regulations and coordinate how countries allocate frequency bands.[83] For AI, AR, and VR, this process matters for two reasons. It creates global economies of scale, and it has become an arena for strategic competition, especially with China.

When countries harmonize a band for the same use, manufacturers can design chipsets, devices, and base stations to a common specification. Producing equipment for a global market lowers costs, improves interoperability, and speeds adoption. Those gains can make AR and VR hardware more affordable and allow AI-connected devices to reach a broader market.

China has pursued a coordinated, state-backed effort to place its firms in leadership roles within standards bodies and incorporate Chinese technical proposals into 5G and early 6G standards. Its

---

[81] Serhat Tadik *et al.*, *Digital Spectrum Twins for Enhanced Spectrum Sharing and Other Radio Applications*, IEEE J. RADIO FREQUENCY IDENTIFICATION (2023), https://ieeexplore.ieee.org/document/10293151.

[82] Spectrum & Receiver Performance Working Grp., Fed. Commc'ns Comm'n Technological Advisory Council, *supra* note 76.

[83] Int'l Telecommc'n Union, *World Radiocommunication Conferences (WRC)*, https://www.itu.int/en/ITU-R/conferences/wrc/Pages/default.aspx (last visited June 9, 2026).

centralized regulatory system can reallocate prime bands more quickly than the United States. Chinese firms also hold roughly 40% of declared 5G standard-essential patents.

Patent-declaration counts provide an imperfect measure of influence. Firms often declare patents that later prove nonessential, independent reviews find that only a fraction of declared 5G patents are truly essential, and Chinese portfolios contain fewer high-value radio-access-network patents. Even so, the volume of Chinese participation reflects sustained public and private investment in shaping technical standards. China has also sought satellite-interference limits that could constrain U.S. LEO deployments.[84]

The United States and its allies rely more heavily on private firms and consensus-based institutions. That model can produce strong technical standards, but domestic disputes sometimes weaken the U.S. position. Disagreements between commercial and federal spectrum users have prevented the United States from advancing unified mid-band proposals at some WRCs.[85]

Technical standards also influence which vendors supply networks around the world. Standards shaped disproportionately by Chinese proposals may favor Chinese equipment makers. That creates supply-chain, espionage, and surveillance risks of the same kind that prompted U.S. programs to remove Huawei and ZTE equipment.[86] Those risks may prove especially acute in developing countries with limited resources to assess vendors or replace compromised infrastructure.

International proceedings must also protect U.S. defense needs. Bands reserved domestically for military systems may face pressure for identification as international mobile telecommunications spectrum. Resisting such proposals when they would impair assured military access is itself a national-security objective.

The 6 GHz band illustrates the broader commercial competition. The United States authorized the band for unlicensed use in 2020, supporting Wi-Fi and a growing market for unlicensed devices and infrastructure. China has favored licensed mobile networks and seeks broader international adoption of Chinese 5G and 6G equipment. Decisions about international harmonization can therefore influence whether future markets favor licensed cellular systems or the unlicensed technologies in which U.S. firms hold important advantages.

Sustained, coordinated U.S. engagement at the ITU and WRC is necessary to secure globally harmonized bands, protect critical federal operations, and promote technical rules that support competition. The United States must resolve domestic disagreements early enough to present

---

[84] Evan Grey, *The 200,000-Satellite Filing: When Commercial Loopholes Become State Weapons*, SATNEWS (Jan. 23, 2026), https://satnews.com/2026/01/23/the-200000-satellite-filing-when-commercial-loopholes-become-state-weapons.

[85] Jeffrey Westling, *Primer: World Radio Conference 2023*, AM. ACTION FORUM (Aug. 30, 2023), https://www.americanactionforum.org/insight/primer-world-radio-conference-2023.

[86] Secure and Trusted Communications Networks Act of 2019, Pub. L. No. 116-124, 134 Stat. 158 (2020) (codified at 47 U.S.C. §§ 1601–1609) (authorizing the Federal Communications Commission to prohibit the use of federal subsidies for covered equipment and to reimburse providers for removing Huawei and ZTE equipment).

coherent proposals internationally. Otherwise, other countries will shape the standards and allocations on which future AI, AR, and VR networks depend.

VI. Conclusion

Radio spectrum is essential infrastructure for the AI era, but it cannot support next-generation applications alone. Wireless capacity depends on fiber backhaul, edge computing, data centers, devices, and power systems developing alongside it. Spectrum policy must ensure that this communications layer keeps pace with the rest of the infrastructure chain.

The United States will need more than additional frequencies. It needs a layered mix of low-, mid-, and high-band spectrum, paired with licensed, unlicensed, and shared-access models suited to different technical demands. Terrestrial and satellite networks must complement one another. Exclusive rights must provide enough certainty to support investment, while unlicensed and shared bands preserve access for Wi-Fi, immersive applications, new devices, and smaller entrants.

Current institutions can frustrate those goals through accumulated delay and uncertainty. Divided authority between the FCC and the NTIA can slow federal reallocation. The Spectrum Relocation Fund can delay the studies it was created to finance. Worst-case interference analysis can block productive uses based on remote hazards. Domestic disagreements can also weaken U.S. influence at the World Radiocommunication Conference, where international allocations and standards shape equipment markets for decades.

These problems do not require rebuilding the entire spectrum-management system. Policymakers can improve it through sustained FCC-NTIA coordination, faster access to relocation funding, risk-informed interference analysis, transparent technical models, spectrum digital twins, and a coherent U.S. strategy at the International Telecommunication Union. Clear White House direction will be necessary to align agencies whose institutional incentives often diverge.

The OBBBA's 800 MHz pipeline provides a mandate, but its value will depend on implementation. Federal resistance could delay reallocation and shift pressure toward productive unlicensed and shared bands. Poorly designed sharing rules could discourage investment. Coordination frameworks that entrench early satellite entrants could restrict competition. Each decision should account for total economic value rather than auction revenue or incumbent protection alone.

Success would produce an integrated spectrum system in which licensed, shared, and unlicensed access serve complementary purposes, satellite networks extend terrestrial coverage, and U.S. proposals shape global standards. Failure would preserve underused federal assignments, expose productive bands to reallocation pressure, and leave new services waiting while agencies reopen old interference disputes. American leadership in AI, augmented reality, virtual reality, and wireless communications will depend in part on whether spectrum governance can move with the technologies it is meant to support.