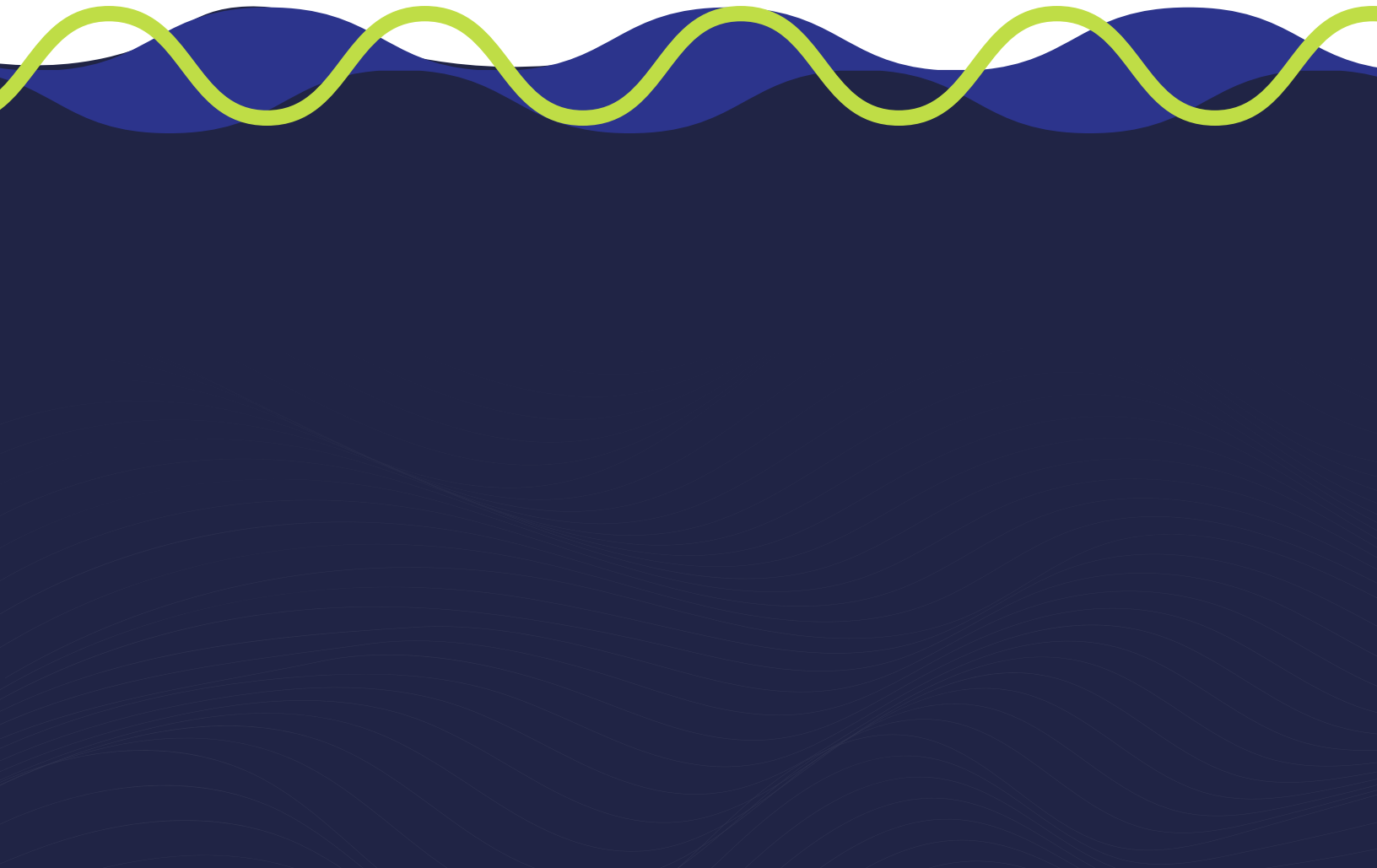
Spectrum Policy 101



What is Spectrum and Why is it Important?

"Spectrum" is radio frequencies over which data, video, and voice communications are transmitted wirelessly.

Today, **we use spectrum EVERYWHERE** – for cell phones, GPS satellites, radios, televisions, military radars, garage door openers, IOT devices, wireless connections for computers and tablets, and a host of other applications.

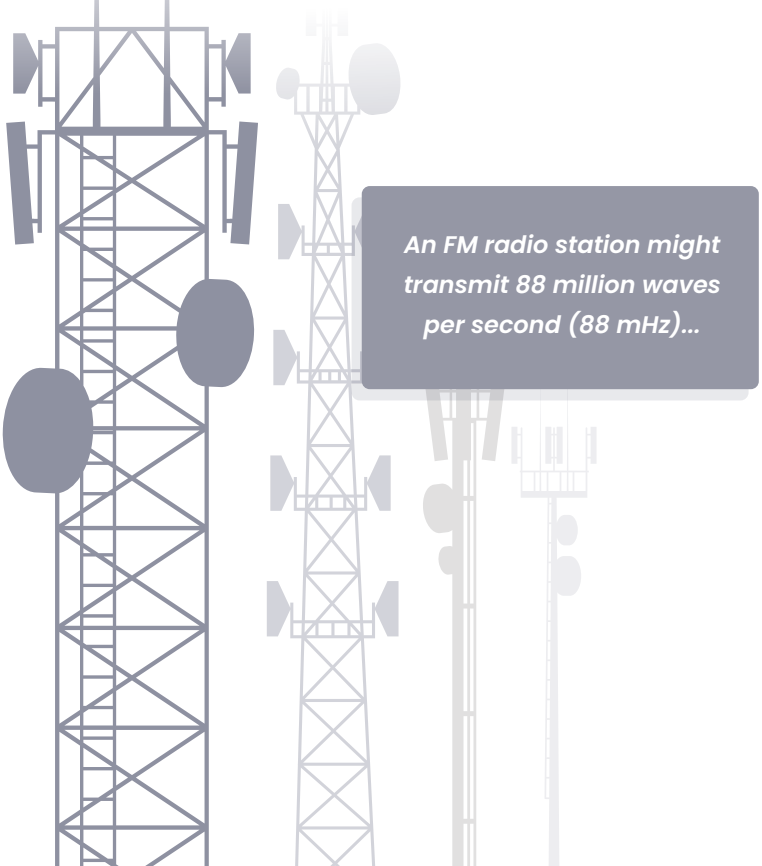
We're Advocating for the Spectrum Policy that America Needs to Compete and Win

Different technologies use different spectrum frequencies based on their unique characteristics.

Mid-frequency signals can **achieve both performance and coverage** – where speeds are better than low-frequency, but coverage and capacity is greater than with than high-frequency. Midband is used for 5G cellular service, as well as indoor networks, such as the Wi-Fi in a coffee shop or networks connecting robotic systems in warehouses and distribution centers.

Lower frequency signals **can travel great distances**, over hills, and through walls – but carry less information. That is why they are **used for outdoor, long-distance applications** like FM radio and broadcast television.

Higher frequency signals can carry larger amounts of data, but they only work well over very short distances with fewer obstructions. That is why they are used for **localized, high-data applications** like ultra-high-definition video streaming or augmented reality.



An FM radio station might transmit 88 million waves per second (88 mHz)...

...while the Wi-Fi antenna delivering wireless internet in a coffee shop might operate at 2.4 GHz – that's 2.4 billion radio waves per second!

So...

Who Gets Access to SPECTRUM?

- Spectrum is a **scarce, valuable national resource** that is managed by the government to serve the public interest.
- The growth of connected technology (i.e., Wi-Fi everywhere) means **spectrum is in higher demand** than ever, requiring higher speeds and lower latency.

Today's spectrum debate is focused on how to **best manage and allocate various frequencies of spectrum to meet the ever-growing demands** of a diverse range of technologies and to maximize benefit to the American public.

Technology + Demand

MEANS

SPECTRUM SCARCITY

Spectrum Policy Principles

Spectrum principles inform how spectrum is managed and used. **Guiding principles** for spectrum policy should:

1. Provide clear rules of the road to offer predictability and reliability — recognizing changing technology, demands, and limited remaining spectrum resources

2. Ensure sufficient bandwidth for mission-critical defense applications, air traffic control, weather monitoring, space-based telecommunications, and other government uses

3. Promote innovation, job growth, and economic competitiveness

Shared Spectrum is...

- An American innovation, developed to meet American needs, and led by American companies
- Utilizing emerging technologies, including 5G and 6G!
- Efficient use of limited spectrum resources
- Public and private sector interests advanced
- Increased access across industries – such as manufacturing, mining, and transportation
- More versatile and specialized networks
- More U.S. jobs and greater innovation and competition

Maximizing America's Spectrum Resources

Spectrum sharing technologies – both licensed and unlicensed – can help to:

- **Expand the spectrum pie by ensuring that bandwidth is made available for other users** when it may not otherwise be in use.
- **Allow multiple users to use the same spectrum bands simultaneously.**
- **Empower users to develop reliable networks that fit their needs**, while maintaining control of network and user data.
- **Create new opportunities across spectrum-dependent capabilities**, such as mission-critical national security systems, mobile wireless, and commercial satellite applications.
- **Enable tailored, localized solutions in smaller geographic areas without creating vast areas** of fallow spectrum.

Dynamic Sharing Case Study: CBRS (the 3.5 GHz band)

CBRS is a framework that utilizes dynamic spectrum sharing to boost mobile and 5G wireless network capacity, improve efficiency, fill rural connectivity gaps, and more. It allows locally licensed users to safely and securely share spectrum bands used by national security systems.

The success of CBRS demonstrates that sharing regimes can and should be deployed in other key spectrum bands. It's already being used to deliver wireless connectivity in:

- NFL stadiums
- Manufacturing facilities
- Airports
- Universities

Spectrum Yesterday, Spectrum Tomorrow

1920s
AM radio

1950s
TV broadcasting

1962
Satellite comms

1982–83
Cellular networks/ phones

1999
Wi-Fi introduced

2019
5G deployments begin

2024
Wi-Fi 7 deployments begin

The spectrum landscape has evolved. Spectrum policy must adapt to where and how we use spectrum **today.**

OLD TIMERS

Spectrum allocations focused on centralized forms of communication. Individual TV or radio broadcasters transmitted one signal to devices across a wide region.

THE 80s

Emerging cellular and satellite communications enabled us to connect over a wide area initially with voice but evolving to data in the 90s. The number of devices multiplied. Consumers could SEND and RECEIVE calls and information.

TODAY

The internet, and now the Internet of Things (IOT), means an entire ecosystem of connected devices – from smartphones and laptops to smart thermostats and factory equipment – transmit vast amounts of information. Indoor use cases blossomed with the advent of Wi-Fi in the early 2000s, and today indoor and outdoor localized networks using shared spectrum like Wi-Fi and CBRS are growing rapidly.

Today's technologies can be maximized using spectrum sharing, where multiple users can use the same frequencies seamlessly, without interference, using smart dynamic sensing technology. **And without this ability, the next generation of wireless communications will be severely challenged, if not impossible.**

Exclusive spectrum is stuck in the past.

SHARED SPECTRUM IS THE FUTURE.

Unlicensed Spectrum IS...

- Primarily used for Wi-Fi and Bluetooth
- Connects consumer devices and IoT
- Allows for new technologies
- Connects schools, hospitals, transportation hubs, and more
- Powered by U.S. and ally-built hardware and software

Unlicensed spectrum are bands that permit radio equipment to be deployed **without an FCC license and without exclusive use rights.**

Low-barrier-to-entry rules require **unlicensed users to coexist with one another.**

These same low-barriers-to-entry **increase competition, access, and affordability.**

According to a new Opensignal report, Wi-Fi remains the workhorse of the internet, **carrying up to 89% of all traffic on mobile devices across the five largest carriers** and supporting hundreds of millions of devices (a number that keeps on growing). But the Wi-Fi we rely on daily needs additional unlicensed spectrum to meet our ever growing needs into the future.

Exclusive Spectrum IS...

- A global hardware and software market **led by Chinese firms (Huawei, ZTE).**
- **Previous spectrum holders (i.e., national security systems by the U.S. military) must be cleared out.**
- **Spectrum left fallow if not built out by the single license holder.**
- **Decreased competition,** as a small number of companies already control most licensed mobile spectrum.

Exclusive spectrum is **sold through FCC auction to the highest bidder.**

The purchaser owns the **exclusive right to this spectrum** and protection from harmful interference.

Exclusive Spectrum IS NOT...

Synonymous with 5G technology!

5G is simply a technology standard referring to the "5th Generation" of mobile network technology, meaning a step up in speed, connectivity, and other metrics compared to previous generations. While carriers do use exclusively licensed spectrum for their 5G wireless service, the Citizens Broadband Radio Service, a low power, shared-license model, is also used to deliver 5G to a broad array of users and applications.

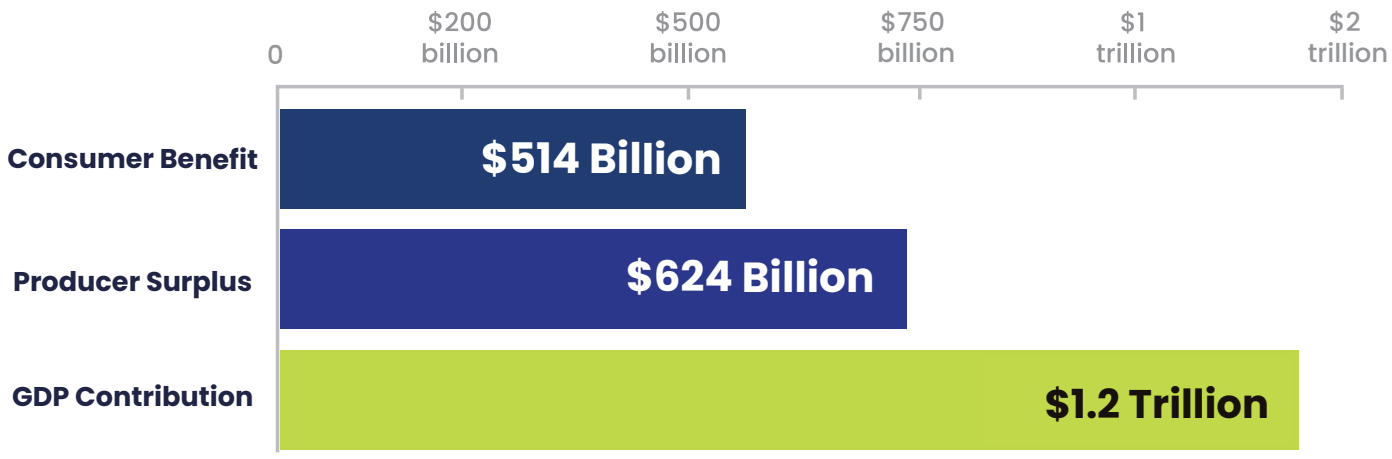
Economic Costs of an Exclusive Licensing Approach

KATZ STUDY

A 2024 study on the economic impact of Wi-Fi in the United States found that:

- The 2027 estimate of Wi-Fi's economic value includes a forecasted **$514 billion in consumer benefit, $624 billion in producer surplus, and $1.2 trillion in GDP contribution.**
- The FCC's 2020 decision opening the 6 GHz band to unlicensed use generated an estimated **$870 billion in incremental economic value** in 2023 and 2024.
- Opening the 7 GHz band for unlicensed use will generate at least **$79.62 billion in additional economic value** between 2025 and 2027 alone.

Unlicensed spectrum policy was charted by the FCC in the early 2000s. Now, **Wi-Fi has become the most important wireless technology for American consumers and businesses** – contributing hundreds of billions to the U.S. economy.

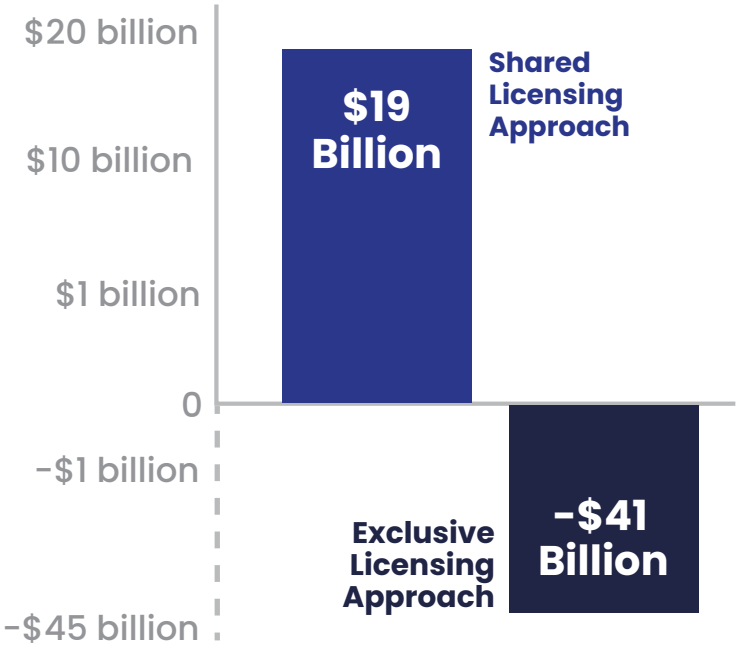


BRATTLE STUDY

A 2023 study comparing the economic benefits for shared and exclusive licensing in the 3 GHz band found that:

- A shared approach can **generate almost $19 billion in net revenue** for the American people to pay down the deficit or fund new priorities.
- In contrast, an exclusive licensing approach would **cause a net loss of over $41 billion.**
- Vacating the mid-band for exclusive use would **cost the Department of Defense at least $120 billion and take 20 years**, according to the Pentagon.

Projected Net Revenue



Data compiled by the Communications Technology Association (CTA) and ABI Research showed that the annual economic value of Wi-Fi is projected to reach $2.4 trillion in 2027, including an estimated $514 billion in consumer benefit, $624 billion in producer surplus, and $1.286 billion in GDP contribution.

Shared Spectrum for 6G and Beyond...

Shared spectrum is uniquely **necessary for the practical deployment of 6G and other critical technologies**, particularly for innovative use cases such as private networks and Industry 4.0 applications. Unlike high-powered, exclusively licensed spectrum, **shared spectrum allows for more users and efficiency, greater availability and flexibility.**

Equally important, **shared spectrum is better suited to delivering large amounts of information across multiple devices in a localized area.** Rather than compete over the same spectrum nationwide, spectrum sharing allows many users to leverage local spectrum where and when they need it. **These capabilities will be paramount to the success of data-intensive applications, such as augmented reality or AI-enabled devices.**

Spectrum Sharing is a Win-Win-Win for:

CONSUMERS

The current, **lower power sharing framework allows a wider diversity of users to access tailored connectivity options**, such as those offered by Wireless Internet Service Providers (WISPs) in rural areas.

A wider diversity of users also increases competition in the marketplace – leading to **lower costs, improved service quality, and greater innovation**, all of which benefit consumers.

NATIONAL SECURITY

Shared spectrum allows commercial and federal operators to use the same frequencies, **prioritizing and protecting federal operations like critical national security users**, and eliminating the need to clear, condense, or compromise them.

NEW ENTRANTS

A shared framework **lowers barriers to entry in the wireless market, as it reduces the high costs associated with acquiring licensed spectrum.** It also promotes innovation and competition by allowing smaller players to access necessary resources, creating a more dynamic and diverse marketplace.

Shared licensing models like CBRS provide **new commercial and enterprise users with the freedom to construct their own private wireless networks.** This helps local business thrive without having to wait on traditional wireless carriers to build network infrastructure to meet their needs.

National Security

- Wireless spectrum is **essential for U.S. military and national security systems** related to communication, radar, navigation, and advanced defense applications.
- With spectrum sharing, **sensitive military equipment used by the U.S. and its allies does not need to be compromised or relocated to new spectrum bands**, avoiding a costly, slow, and dangerous process.

"The last thing the Armed Forces should have to focus on right now is a potential drawback in their ability to protect our country. We face the most dangerous world in 30-plus years, with threats ranging from Russia to Iran to North Korea to China. ***Anything that diverts the military's attention right now ultimately endangers our national security.*** *One of the greatest challenges faced by military commanders is that of communications. Clear and concise exchange of information has always been vital to any successful military operation — even more so today.* ***Effective command and control is at the heart of leadership, and efficient use of spectrum allows it."***

General Keith Kellogg

U.S. Global Wireless Leadership and National Security

U.S. policymakers have created **unlicensed and shared-licensed frameworks** to maximize the utility and efficiency of scarce spectrum.

A lower powered shared spectrum framework **advances U.S. leadership in wireless technology and is a departure from an exclusive, high-power licensing model endorsed by the People's Republic of China.** Importantly, it allows multiple users (including the government and private sector) to share the same frequencies, a vital consideration given the lack of 'greenfield' spectrum available.

The Benefit of an America First Spectrum Policy

CBRS is a U.S. technology. Wi-Fi, similarly, was largely created by U.S. companies and remains dominated by U.S. intellectual property 25 years after it was invented. Both technologies address localized connectivity needs where U.S. citizens live, work, and play, as demonstrated by their popularity and growth. That is why an **America-first spectrum policy should focus on new unlicensed and shared spectrum bands.**

Learn More:

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Glossary

CITIZENS BROADBAND RADIO SERVICE (CBRS)
CBRS is a band of spectrum (3.5 GHz band) and a wireless communication framework that allows multiple users to share the band without causing interference.

SHARED SPECTRUM FRAMEWORK
A structure to efficiently use wireless communications channels by allowing multiple users to share the same frequencies.

- **I.e. – A shared framework is used in the CBRS band.**

FEDERAL COMMUNICATIONS COMMISSION (FCC)
Regulatory responsibility for the radio spectrum is divided between the FCC and the National Telecommunications and Information Administration (NTIA). The FCC administers spectrum for non-federal use (i.e., state, local government, commercial, and personal use).

THE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION (NTIA)
Manages federal use of spectrum with support from the Interdepartment Radio Advisory Committee. This includes establishing policies and regulations, assigning frequencies, ensuring spectrum availability for new federal telecommunications systems, maintaining spectrum databases, and providing technical expertise for spectrum assessments.

SPECTRUM AUCTIONS
Since 1994, the FCC has conducted auctions of licenses and permits for electromagnetic spectrum used to provide wireless and broadcast services. These auctions are open to any eligible company or individual that submits an application and upfront payment and is found to be a qualified bidder by the Commission.

WIRELESS DEVICES
Devices that can connect to a network or other devices without the use of physical cables – such as routers, cell phones, TV remote controls, GPS, radios, satellites, and more.

BANDWIDTH
The capacity of a network to transfer data, typically measured by the range of frequencies available to that network.

RELOCATION
A structure to efficiently use wireless communications channels by allowing multiple users to share the same frequencies.

FREQUENCY
Refers to the number of wave cycles that pass a specific point in a given amount of time and is a key characteristic of electromagnetic spectrum – including light and radio waves. It is inversely related to wavelength; higher frequencies correspond to shorter wavelengths, and lower frequencies have longer wavelengths.

INTERNET OF THINGS (IOT)
Interconnection, via the internet, of computing devices embedded in everyday objects, enabling them to send and receive data.

SPECTRUM
FOR THE FUTURE

WIFI FORWARD