

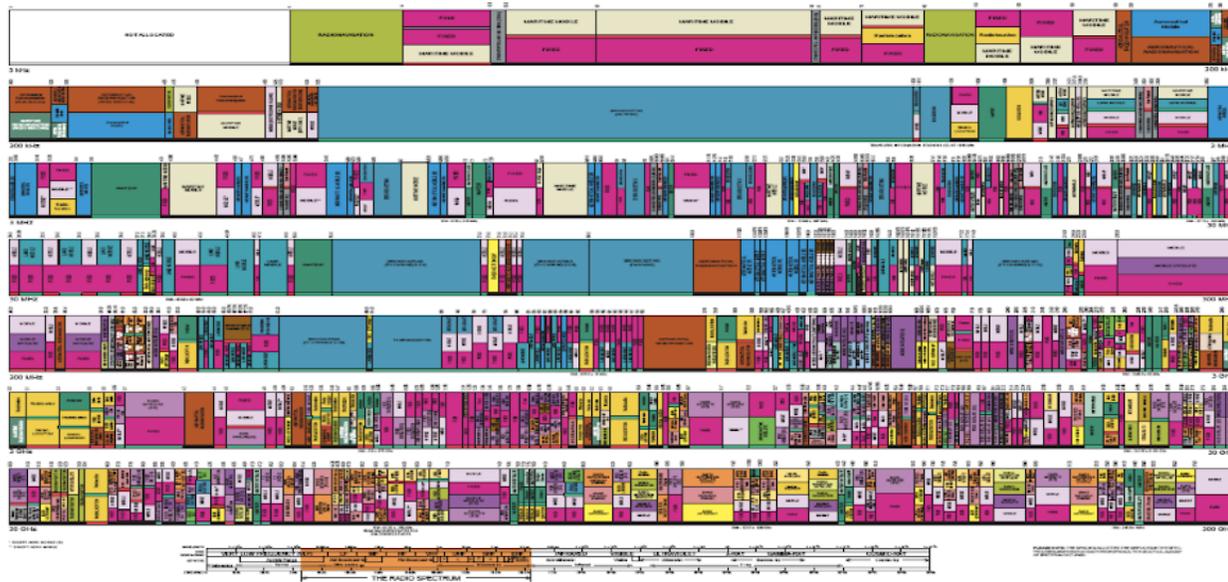
# WHAT IS SPECTRUM?

## A PRIMER ON THE PUBLIC RESOURCE THAT FUELS WIRELESS CONNECTIVITY

### WHAT EXACTLY IS SPECTRUM?

- **Spectrum** is the range of electromagnetic frequencies used for transmitting and receiving information.
- Spectrum – also known as the **public airwaves** – is a unique resource. It is owned and controlled exclusively by governments worldwide.
- Regulators (in the U.S., the Federal Communications Commission) divide spectrum into **bands** of frequencies and allocate them for various purposes (mobile, satellite, broadcasting, military, Wi-Fi/Bluetooth, etc).
- Regulators (**FCC**) then assign frequencies to particular users – mostly by auction, coordinated sharing, or by authorizing open/unlicensed use (such as Wi-Fi).
- Spectrum use is always changing. How carriers and other spectrum licensees use spectrum evolves with technology.
- **Spectrum is scarce but underutilized:**
  - There are a finite number of frequencies and wireless data demand is surging.
  - Yet most bands are underutilized, enabling more users and more efficient use through new dynamic sharing rules and tools.

### UNITED STATES FREQUENCY ALLOCATIONS THE RADIO SPECTRUM



## HOW DOES THE FCC ASSIGN SPECTRUM?

- Frequency bands are first **allocated** for one or more particular uses either on a licensed or unlicensed basis.
- Bands are typically **allocated** for a type of radio service (e.g., mobile, fixed, broadcasting) or compatible services. Allocations can be made on a primary or secondary basis.
- Spectrum is then **assigned to a specific user** (or users) on an exclusive basis or for shared use.
- Some services rely on **exclusive use licenses** (mobile cellular carriers, broadcasters), more recently called “flexible use” licenses.
- Other services rely on **coordinated sharing** among licensees (e.g., fixed wireless broadband, fixed satellite services).
- Licenses have fixed terms but typically renew automatically by satisfying build-out or usage requirements.
- The FCC also allocates **unlicensed** spectrum in some bands for shared public use. Unlicensed uses (e.g., Wi-Fi, Bluetooth) are required to operate at low power, accept the risk of interference, and not cause interference to licensed users.



*Our wireless future relies on opening more shared and unlicensed spectrum and not just more exclusively-licensed spectrum for mobile carriers. While exclusively-licensed spectrum has facilitated wide-area mobile coverage, relying on these networks for connectivity concentrates power among a few major companies. Unlicensed spectrum empowers homes, businesses and public entities to connect their own wireless broadband networks, enabling a more affordable, competitive and robust wireless ecosystem.*

## DYNAMIC SPECTRUM SHARING

- Spectrum sharing makes the best use of occupied but underutilized bands of spectrum.
- For example, **coordinated sharing** allows multiple providers to operate fixed wireless broadband networks on the same spectrum bands on a localized basis.
- The new **citizens broadband radio service (CBRS)**, in the 3.5 GHz band, reflects a landmark in progress on innovative spectrum sharing frameworks. Specifically, it helps facilitate localized networks and bolsters the wireless ecosystem in both urban and rural communities.

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- A geolocation database and sensors coordinate shared use while protecting incumbent U.S. Navy radar operations
- Both licensed and unlicensed users coexist with a **“use it or share it” rule** to encourage opportunistic use of unused licensed spectrum.
- The licenses cover smaller areas (counties) than traditional mobile licenses, in an effort to promote localized spectrum access for networks in schools, hospitals, factories, hotels and other venues.

## UNLICENSED SPECTRUM AND WI-FI

- Unlicensed spectrum allows many users to share a band of frequencies on a “best efforts” basis. There is no guarantee of protection from interference.
- Wi-Fi, Bluetooth and Zigbee are among the most popular uses
- Devices that transmit (e.g., home Wi-Fi routers and smartphones) must be certified under Part 15 of the FCC’s rules and operate at low power. Users do not need an individual license to operate.
- Once considered “junk bands,” unlicensed bands now carry far more mobile device data traffic than licensed mobile carrier networks. Wi-Fi carries 70 to 80% of smartphone data use and virtually all wireless data on laptops and tablets.
- The **TV white spaces** are a specific unlicensed band that allows free use of vacant TV channels in each market for rural broadband, school bus Wi-Fi and other uses. Unlicensed TV channels vary by market, but are most available and useful outside of major metropolitan areas.