

WIFI**FORWARD**




PRESENTS:

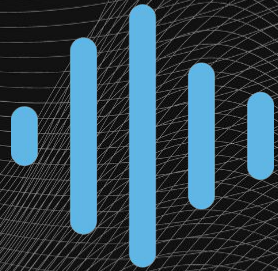
# SPECTRUM**101**

What You Need to Know about Our Airwaves



# Contents

-  What Is Spectrum & How Is It Regulated?
-  Why Are Unlicensed & Shared Spectrum Important?
-  Status of Key Bands



# What Is Spectrum & How Is It Regulated?



# What Is Spectrum?

- Radiofrequency spectrum, also called airwaves, is the infrastructure that carries all wireless communications signals, from radio to television broadcast, government radar, satellite, cellular and Wi-Fi
- Bands have different characteristics that make them well-suited for different technologies

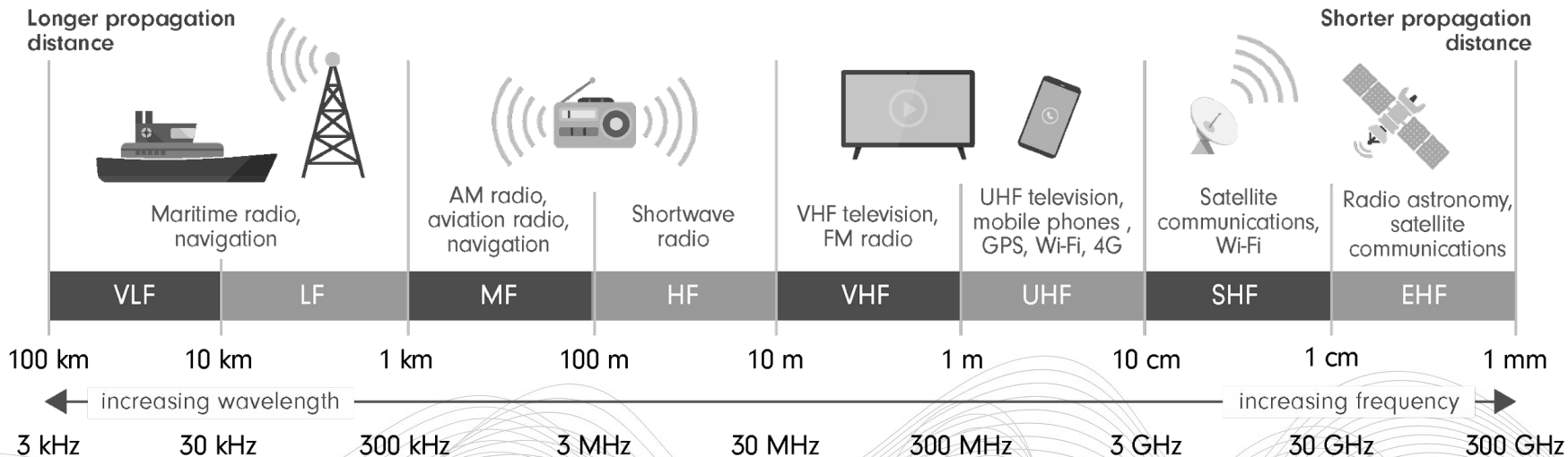
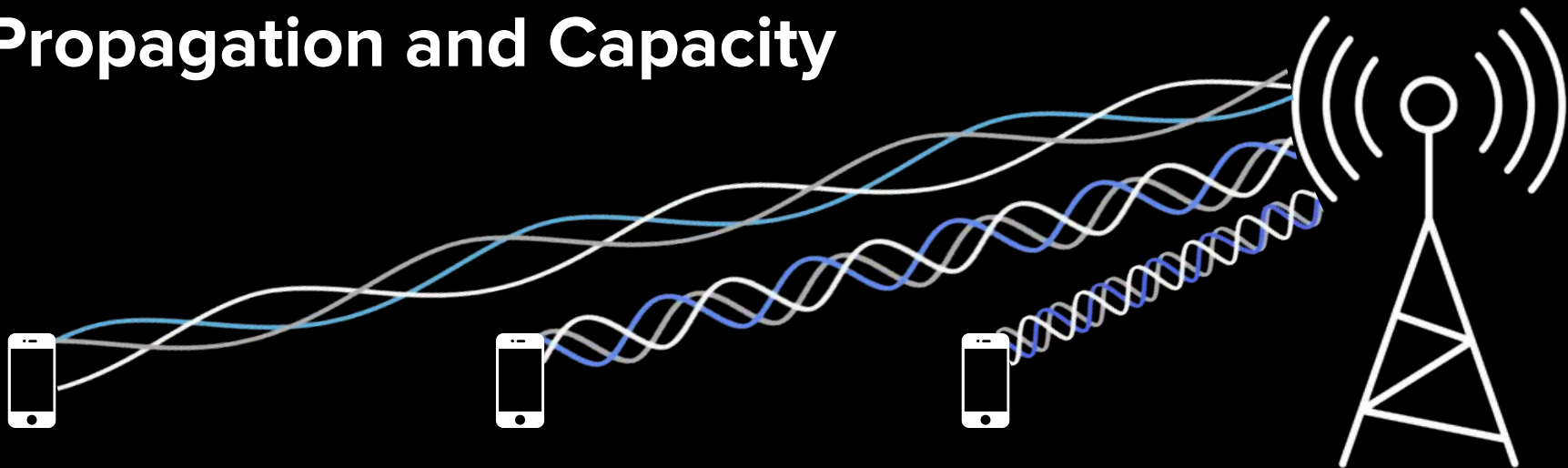


Image adapted from: [Encyclopedia Britannica, Inc.](https://www.britannica.com)

# Propagation and Capacity



## LOW-BAND

Below 3 GHz

Travels long distance  
at lower speeds/capacity

## MID-BAND

3 - 8 GHz

Mix of coverage  
and capacity

## HIGH-BAND

Over 8 GHz

Travels short distance  
at high speeds/capacity

# How Is Spectrum Regulated?

The government manages spectrum access to prevent harmful interference



**Federal  
Communications  
Commission (FCC)**

Manages non-federal,  
commercial use



**Department of Commerce,  
National Telecommunications and  
Information Administration (NTIA)**

Manages federal use



**International Telecommunication  
Union, Radiocommunication  
Sector (ITU-R)**

Makes recommendations on  
spectrum use through the World  
Radiocommunication Conference  
process

# How Is Spectrum Regulated?

Access to commercial spectrum can be granted in a variety of ways:



Granted to an individual company or user



Anyone is allowed to operate provided that their equipment conforms to certain technical rules



Coexistence rules facilitate sharing among different kinds of commercial users or commercial/government users in the same band



Class of users permitted to operate without the burden of obtaining an individual license





# Why Are Unlicensed & Shared Spectrum Important?



# Shared Spectrum Is a Shared Solution

- **There is no more greenfield spectrum**, so efficient sharing mechanisms that enable **multiple users** to rely on the same frequencies are increasing in importance.
- Users can share **across multiple dimensions** based on:
  - frequency
  - listen-before-talk
  - geography
  - databases
  - time
- In emerging systems like those in the **Citizens Broadband Radio Service (CBRS) bands**, new tech facilitates shared access among three tiers of users: (1) incumbent government operations, (2) priority licensees, and (3) shared users, like schools and libraries, that can operate whenever the spectrum is not in use.



# Wi-Fi Adds Economic Value

Unlicensed technologies contribute **hundreds of billions of dollars** annually to the U.S. economy:

Wi-Fi added

**\$995 billion**

to U.S. economy in 2021

(Source: [Wi-Fi Alliance](#))

It will add

**\$1.58 trillion**

to U.S. economy by 2025

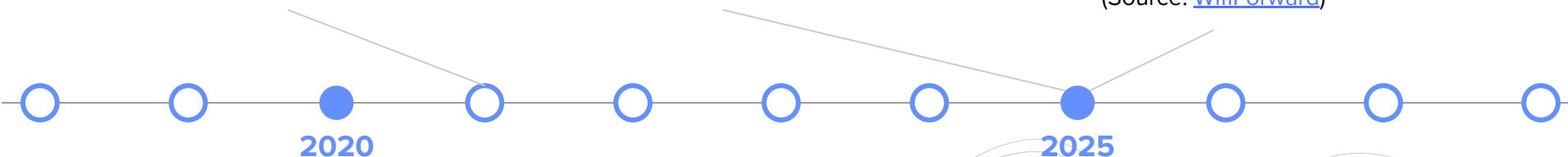
(Source: [Wi-Fi Alliance](#))

The FCC's decisions in the 5.9 and 6 GHz bands will add more than

**\$183 billion**

to the U.S. economy by 2025

(Source: [WifiForward](#))





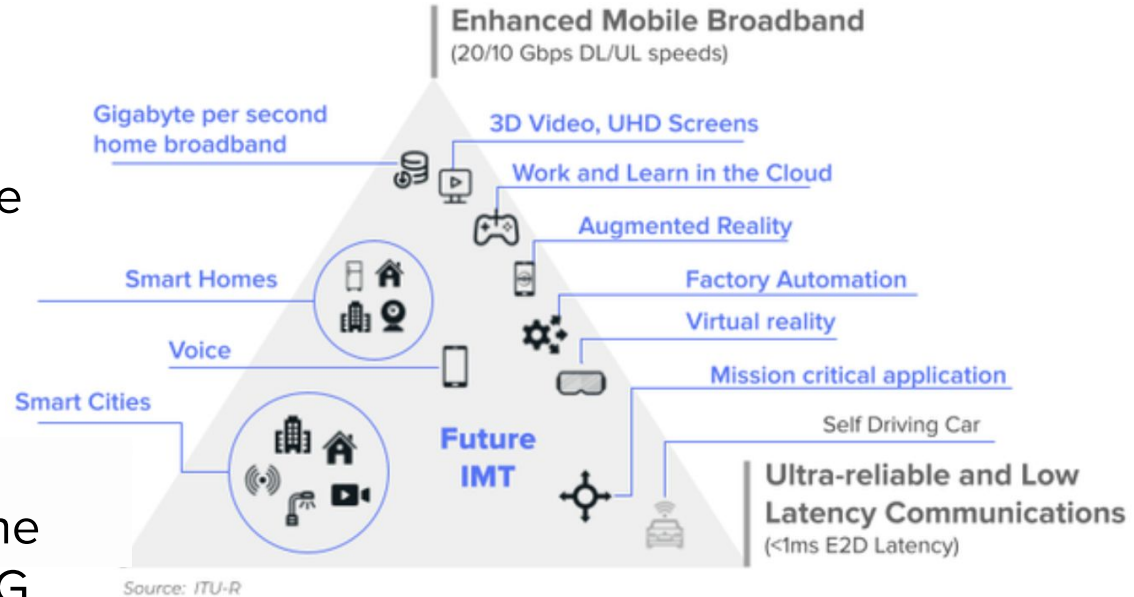
# 5G & IoT Need Unlicensed Spectrum = Wi-Fi

- Wi-Fi, which runs over unlicensed spectrum, is **how many Americans experience broadband**
- Wi-Fi speeds **must keep up with the wired Gigabit speeds** delivered to the home



# 5G Needs Unlicensed and Shared Spectrum

- 5G will **combine different spectrum bands** that are licensed, unlicensed and shared to give consumers the services they need
- **Unlicensed spectrum will play an important role** in next-generation networking, both for Wi-Fi as a stand-alone technology and to support 5G



# The IoT Runs On Unlicensed

## • Commercial Managed Wi-Fi

- Contactless check-in, keyless entry, touchless controls and entertainment
- UV disinfecting robots
- AR/VR, wearables
- Smart elevators and lobbies
- Location Based Services



## • Smart Home Applications

(2.4 GHz, 5 GHz; Wi-Fi & Zigbee)

- Home alarm systems
- Smart lights, locks, thermostats, and appliances



## • Low Power, Wide Area Networking

(including in 900 MHz; e.g. LoRa, SigFox)

- Smart cities/infrastructure
- Asset tracking
- Precision agriculture



## • Bluetooth

(2.4 GHz)



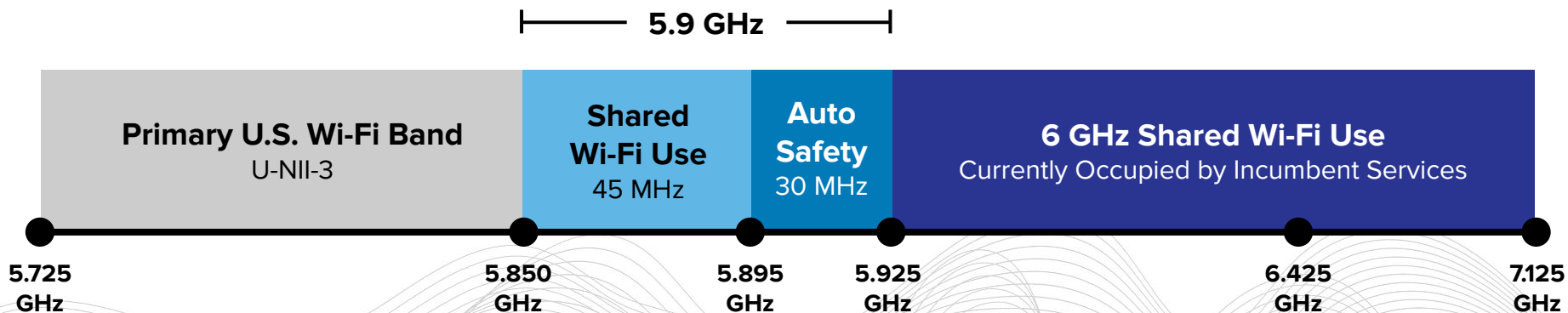




# Status of Key Bands

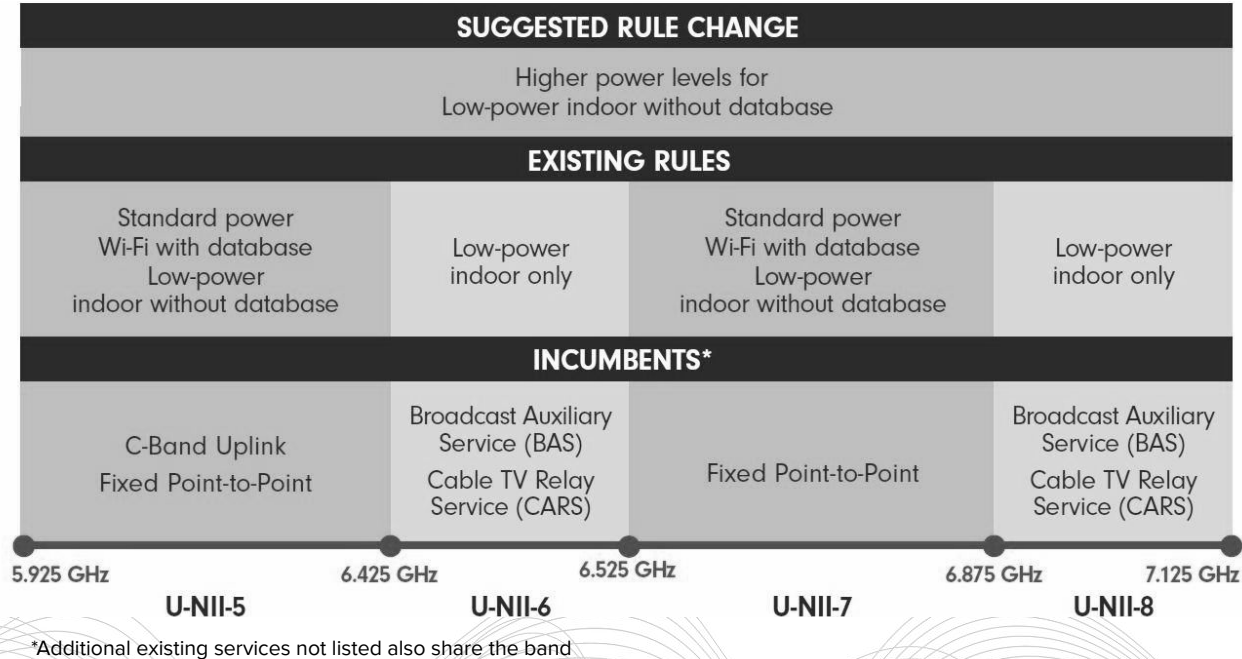
# 5.9 GHz

- In 2020, the FCC designated the **lower 45 MHz** of the 5.9 GHz band for shared indoor Wi-Fi use, enabling providers to bring a contiguous 160 MHz Wi-Fi channel online in existing devices
- **Still to be determined:** outdoor access to the band to foster a robust device ecosystem



# 6 GHz

- In 2020, the FCC opened **1200 MHz of spectrum** to shared unlicensed access in the 6 GHz band — spectrum that will double Wi-Fi speeds and cut latency in half compared to Wi-Fi 5
- **Still to be determined:** indoor power levels, which would improve coverage and throughput, and very low power access

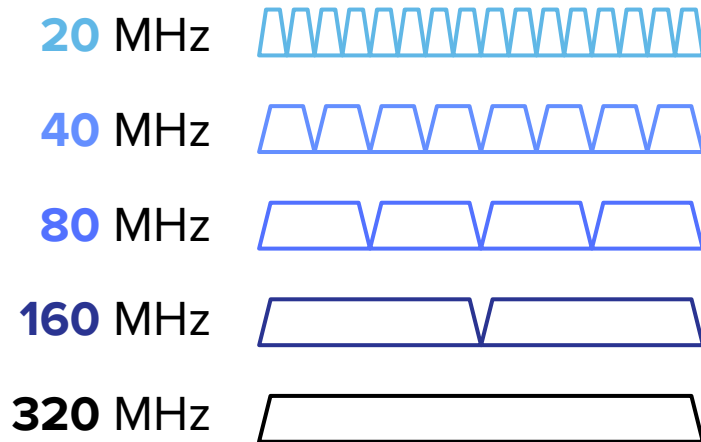




# 7 GHz

- Immediately adjacent to the 6 GHz band
- Currently allocated for federal government use, including fixed services
- Next-generation **Wi-Fi 7** standard will introduce **320 megahertz channels**, requiring more spectrum than currently available in 6 GHz to meet demand
- Shared unlicensed use on a non-interference basis would allow government users to **stay in place** while also facilitating **rapid commercial access**

## 320 MHz Channel



# 3.5 GHz

## *And Implications for 3.1-3.45 GHz*

- In July 2020, the FCC conducted a successful auction of the 3.5 GHz band
- This auction was unique:
  - First of its kind **shared spectrum model**
  - Small county-sized licenses
  - Attracted a record 271 qualified applicants, many of whom were **nontraditional players** like WISPs, utilities, tribes and equipment manufacturers
- The **3.1-3.45 GHz band** is currently allocated for federal use, but could benefit from a 3.5 GHz-like sharing framework