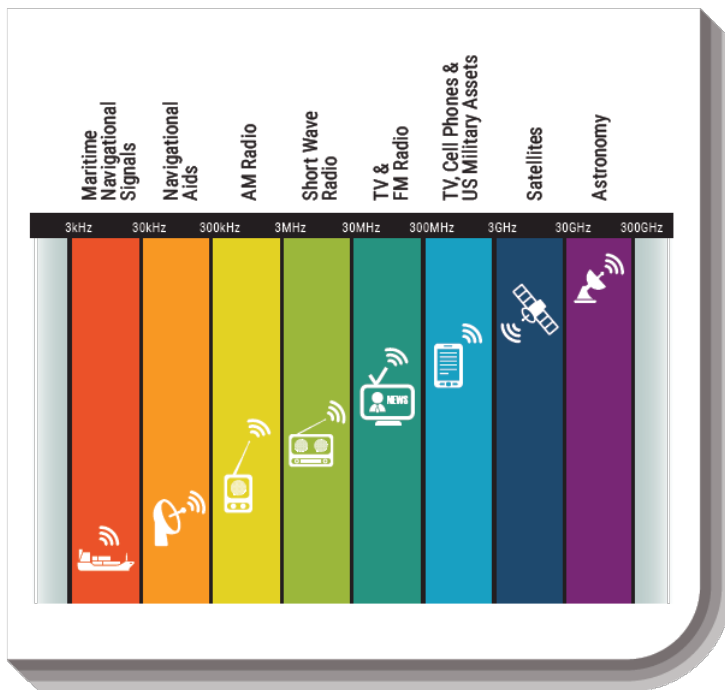


Citizens Broadband Radio Service (CBRS) Shared Spectrum: An Overview

The U.S. is at the forefront of innovation that will transform mobile communications globally: spectrum sharing. Spectrum refers to the range of electromagnetic radio frequencies utilized to transmit wireless signals throughout the world. Television and radio broadcasts, navigational GPS devices and satellite communications exploit spectrum to



carry their signals. All wireless telecommunication signals, including voice, data and video, travel through the air using these radio frequencies. As a result of its broad and necessary applications, U.S. spectrum is distributed between federal and commercial use. Ranging from 3 kHz to 300 GHz, spectrum is physically bound, meaning it cannot be produced, but rather must be reallocated.

Figure 1. US Spectrum Allocation

The Federal Communications Commission (FCC) administers spectrum for non-federal use, monitoring and managing allocation to local governments, commercial and private businesses, and personal users. The National Telecommunications and Information Administration (NTIA) regulates and administers the federal use of spectrum, including use by the Department of Defense (DoD).

However, spectrum is often used inefficiently – especially in bands being used exclusively by the federal government. On the other hand, mobile operators are reaching the limits of their allocated spectrum as mobile data usage grows exponentially each year.

The Solution

In an effort to develop better utilization and ensure that there is enough available spectrum to support the explosive growth of wireless data, the FCC has paved the way for the dynamic nationwide sharing of spectrum – starting with the Citizens Broadband Radio Service (CBRS) in the 3.5 GHz radio band. This is a recognition of the fact that in the past few years, spectrum management technology has advanced to the extent that spectrum can be dynamically shared to securely meet both public and private needs.

Today the 3.5 GHz band is used by the Department of Defense, Fixed Satellite Systems and some Wireless ISPs, but at any given moment only a fraction of the 150 MHz of available spectrum is being utilized. In order to securely share the spectrum in this band for government and commercial use, the FCC developed a three-tiered spectrum access framework that is administered and enforced by a Spectrum Access System (SAS). The SAS provides dynamic, secure and efficient allocation, management and sharing of spectrum resources in real time.

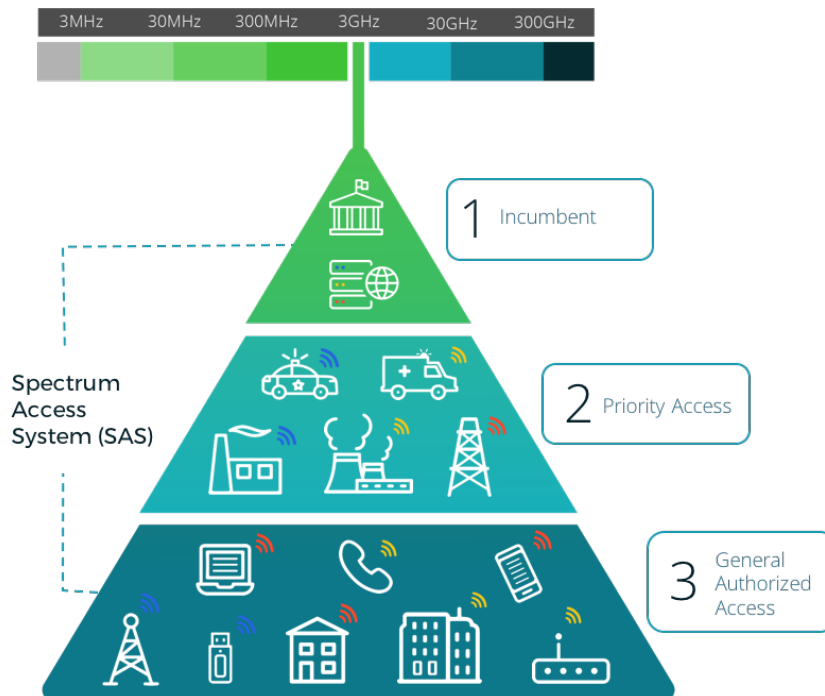


Figure 2. Spectrum Access System Three-Tiered Framework

The SAS ensures that spectrum is always available for military applications and for other incumbents at the time and place it is needed. Next, spectrum is allocated to commercial users who buy Priority Access Licenses for a specified location and period of time. The remaining spectrum can then be used for General Authorized Access (GAA). Per FCC specifications, the SAS will ensure that 80 MHz of spectrum will always be available for GAA use, and sometimes as much as the full 150 MHz will be available if none of the Tier 1 or 2 users need the spectrum. As a result, the SAS needs to manage spectrum in three dimensions – taking into account available bands at a given time in a given location – before granting access across multiple classes of users.

A critical element of spectrum sharing architecture is the Environmental Sensing Capability (ESC). When an ESC sensor detects a federal transmission, it activates a protection zone and informs the SAS to dynamically reallocate users in the area to other parts of the band. The ESC is a key component of the system since it opens the value of shared spectrum along U.S. coastal counties where [over 50 percent of the population lives according to NOAA](#). By using many sensors in a network, the ESC can assure high availability of wireless spectrum.



Figure 3. Environmental Sensing Capability (ESC) Forms Protection Zones

The innovative three-tier shared spectrum model adopted by the FCC is poised to provide benefits that far exceed those achieved with other wireless bands. It will increase the speed, capacity and adaptability of wireless networks, leading to a better mobile broadband experience for users and enabling wireless connectivity for a new range of applications including Industrial IoT, Private LTE and Smart Home/Building applications. Shared spectrum will be applied widely to enterprise and industrial applications, advancing manufacturing, energy and healthcare, and fueling the next cycle of wireless innovation and the growth of the U.S. economy. All the while, access to the band by federal incumbents is maintained, supporting their ongoing and essential national defense missions.

Federated Wireless has continued to advocate for the commercial use of the 3.5 GHz band and has contributed actively to the creation of the FCC's Report and Order establishing CBRS, to the development of shared spectrum specifications through the WINNForum, and to the establishment of a large and rapidly growing ecosystem through the CBRS Alliance. We believe that spectrum sharing will lead to future 5G applications through a massive increase in the reach, capacity, and resiliency of wireless networks.