Property Owners Guide to Private Networks

CBRS / OnGo

Connectivity™
Wireless Solutions

Introduction

What exactly is CBRS? How is it different from Wi-Fi? Is CBRS a viable option for companies?

Are you a property owner that is looking for a more secure, privately-owned network solution? In this eBook, Connectivity Wireless will provide a detailed overview of what CBRS is, how CBRS works, and how it can be implemented in your own company.

Through this eBook, we aim to equip you with all of the information you need to understand CBRS networks and the benefits it could provide your business. In this eBook, business owners will learn:

The Basics
of CBRS

The Citizens Broadband Radio Systems is a band of radio wave frequencies that ranges from 3,550 megahertz to 3,700 megahertz, capable of carrying 4G, 5G and even non-3GPP technologies. This is a shared frequency band that is intended for "citizens", to provide a radio spectrum for private networks. CBRS is the first shared band of its kind and will enable enterprises to deploy private LTE networks in a shared spectrum. This band is intended to harmonize the usage between registered parties while optimizing the usage of the precious spectrum resource. Property owners can now leverage their own private network to guarantee coverage throughout their property without depending on carriers to provide broadband connectivity. Acclaimed for increased security, mobility, and quality over Wi-Fi, the CBRS band will spur innovation in connectivity and Internet-of-Things applications.

SPECTRUM ACCESS SYSTEM (SAS)

3MHz	30MHz	300MHz	3GHz	30GHz	300GHz
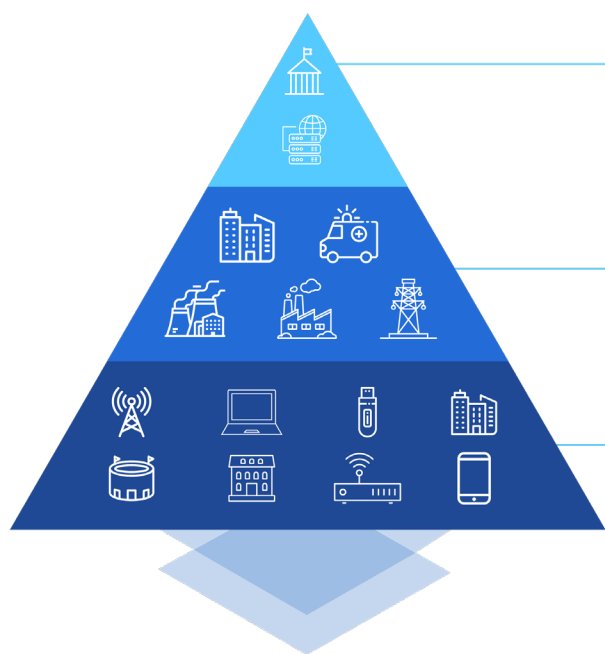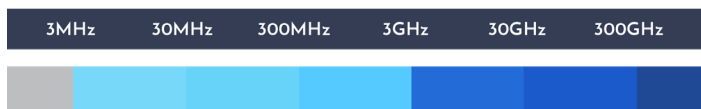
1 Incumbent

Incumbents – Incumbents have the highest priority in the CBRS system and are offered protections from users in the other tiers.
- **Navy radars** on these bands are only operational on a few ships and need protection when they visit harbors.
- Some **satellite earth stations** operate within the 3600-3700 MHz range.
- **Wireless broadband service** for enterprise users in the 3650-3700 range.
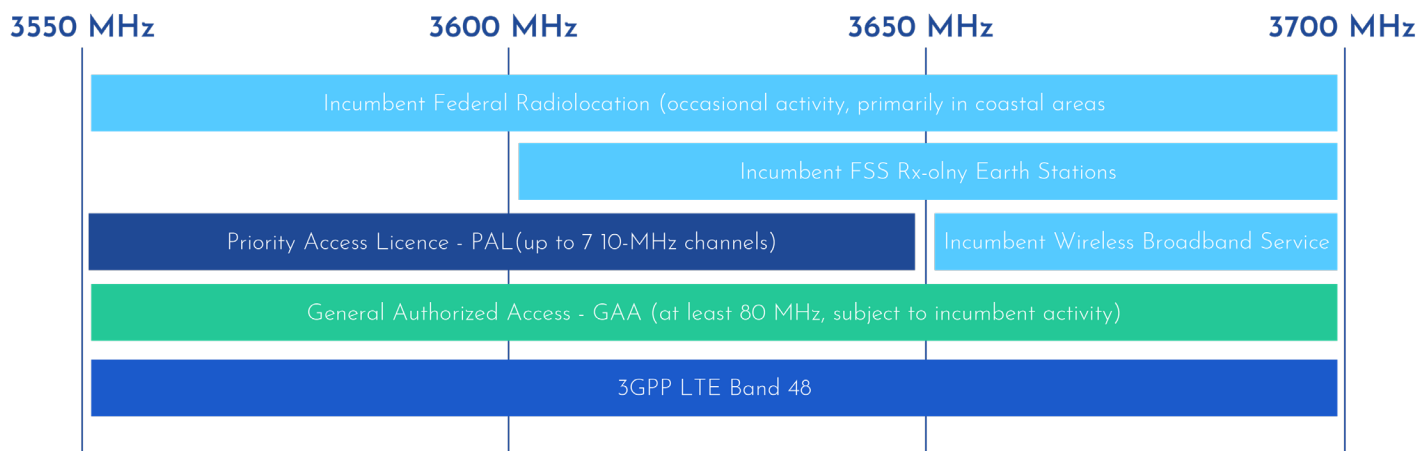
2 Priority Access

Priority Access Licenses – The Priority Access Licenses will be purchased by people in the middle of 2020. There are up to 70 MHz available as PAL within the 3550-3560 frequency range. The megahertz will be sold per county, and no one can by more than 40 per county. Each license is 10 MHz in bandwidth, and each lease term is 10 years.

3 General Authorized Access

General Authorized Access – General Authorized Access users must register for a small administrative fee within the 3550-3700 MHZ range. At first, the entire 150 MHz is available to general users, and any spectrum that wasn't purchased within the PAL spectrum will be offered to GAA.

CBRS SPECTRUM

3550 MHz	3600 MHz	3650 MHz	3700 MHz

Incumbent Federal Radiolocation (occasional activity, primarily in coastal areas

Incumbent FSS Rx-olny Earth Stations

Priority Access Licence - PAL(up to 7 10-MHz channels)

Incumbent Wireless Broadband Service

General Authorized Access - GAA (at least 80 MHz, subject to incumbent activity)

3GPP LTE Band 48

Components of CBRS

A CBRS is comprised of four main components: **Spectrum Access Systems, Environmental Sensing Capability, CBSD,** and **Domain Proxy**. Each of these components works together to make sure that the priorities of all the users are respected.

Spectrum Access System

The Spectrum Access System (SAS) is a software that sits in the Cloud and receives data from the sensors tracking all the spectrum usage of each incumbent. SAS allows for the secure commercial use of 150 MHz in a shared spectrum, while always leaving 80 MHz of spectrum available for GAA users. This software can dynamically allocate the spectrum to each user, depending on their access to CBRS. There are currently five certified SAS systems in the United States – Federated, CommScope, Google, Sony, and Amdocs.

Environmental Sensing Capability

The Environmental Sensing Capability within CBRS measures the signal in the CBRS spectrum band. ESC's are essentially just sensors that detect incumbent activities on the spectrum and inform the Spectrum Access System so that certain channels can be cleared of lower-priority use.

CBSD

Citizens Broadband System Devices are radio nodes operating the CBRS band. These radios emanate the CBRS signal and are the access points for CBRS. For these radios to transmit signal, they must coordinate and comply with a Spectrum Access System.
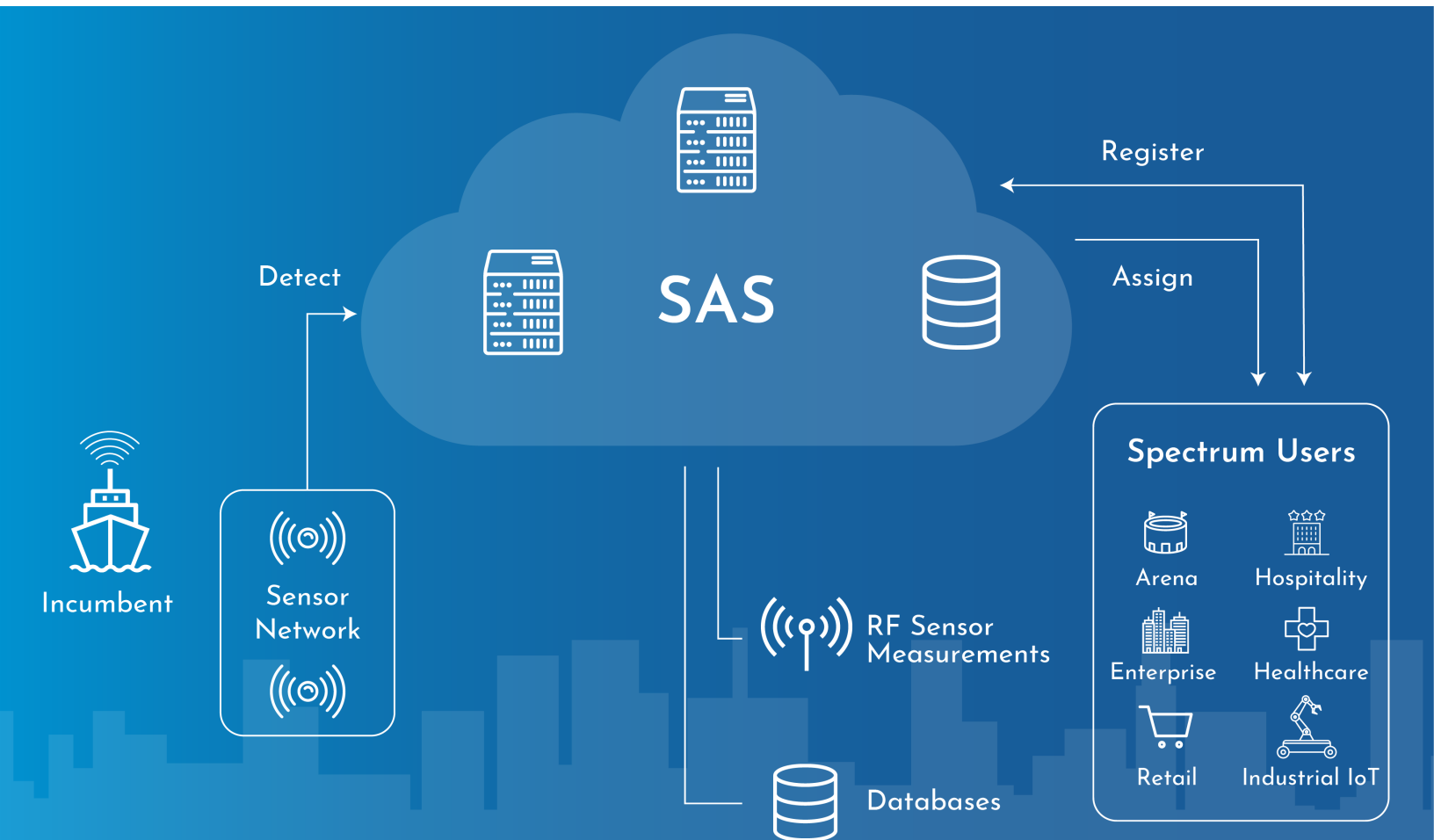
Domain Proxy

A domain proxy is when multiple radios are being used with your spectrum. CBSD aggregation and proxy functions are meant for larger networks. These devices can be integrated with an EMS/NMS or operate as a standalone device.
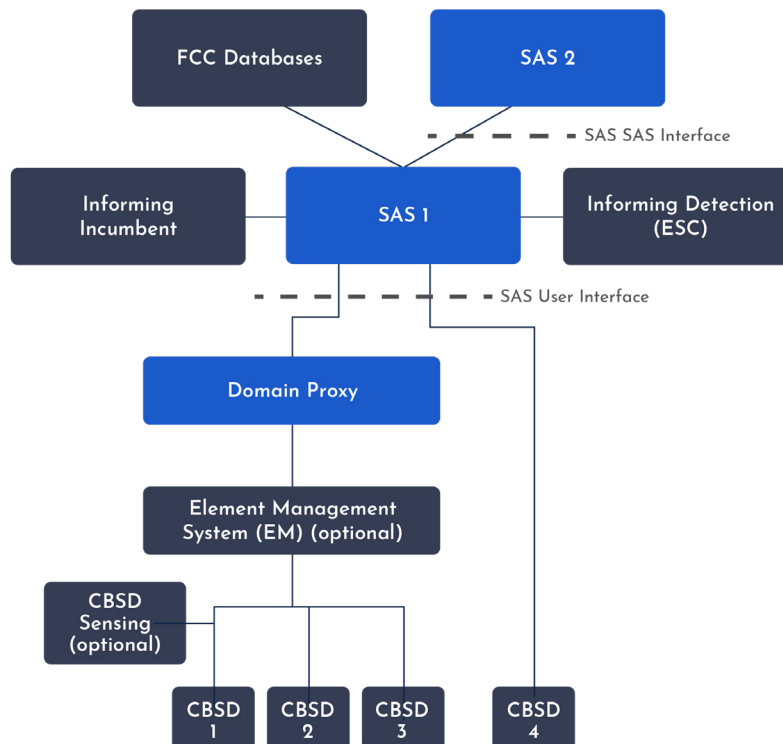
SAS
Breakdown

- SAS allows secure commercial use of 150 MHz shared spectrum

- Dynamically allocates spectrum to users

- SAS will charge owners of CBSDs
  - 80 MHz of spectrum always available for GAA
  - Up to 70 MHz for PAL
  - Unused PAL spectrum is used for GAA

- Detect Incumbents using ESCs

- Predict RF propagation based on EHATA and ITM propagation models

- Provide interference protection by:
  - Changing channel
  - Temporarily discontinuing service

- Cloud-based for scale

Detect

SAS

Register

Assign

Incumbent

Sensor Network

RF Sensor Measurements

Databases

Spectrum Users

Arena

Hospitality

Enterprise

Healthcare

Retail

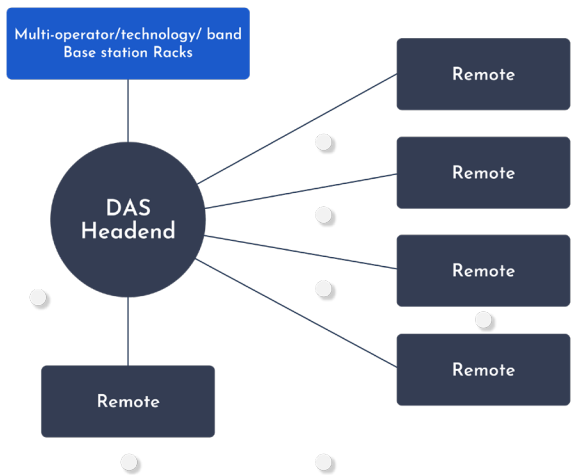Industrial IoT

The Enterprise Dilemma

Roughly 30 billion square feet of US commercial floor space has poor coverage. That equals out to about 70% of all commercial floor space in the United States that experiences coverage and connectivity problems.

Available Solutions:

- **Smaller to medium-sized venues** are relying on Wi-Fi or digital repeaters with a passive Distributed Antenna System. Unfortunately, Wi-Fi has low security and low quality of service. Also, most operators don't pay for a Distributed Antenna System, and these systems are often too expensive for property owners.

- For **larger venues**, base stations connect to an active Distributed Antenna System. Operators may opt to contribute or participate on these larger systems.
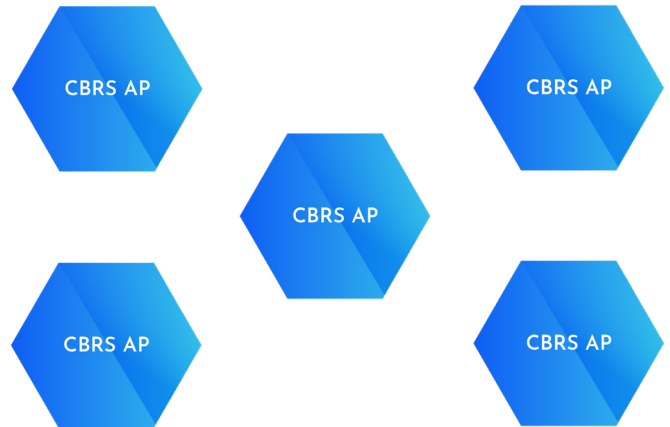
Active DAS
(Multi-operator / technology / band)

VS.

Multi-operator CBRS DAS

Multi-operator/technology/ band Base station Racks

DAS Headend

Remote

Remote

Remote

Remote

Remote

CBRS AP

CBRS AP

CBRS AP

CBRS AP

CBRS AP

CBRS provides an ideal coverage option for enterprises.

- All operators use the same CBRS band, so will all handsets
- Enterprise coverage is solved by a few inexpensive APs
- CBRS APs provide coverage and capacity similar to existing Wi-Fi
- AP connection to private network or service providers' core

How Can CBRS Be Used?

Enhanced Mobile Broadband
CBRS provides coverage enhancement for handsets and other smaller devices in covered areas, specifically indoors. There's also capacity for dense user scenarios, like shopping malls and stadiums. This extra chunk of the spectrum can make a big difference in providing connectivity in these areas.

Cable Operators
CBRS not only opens connectivity opportunities for businesses and private users, but it also opens a huge window of opportunity for cable operators like Comcast. Cable operators will have eMBB deployment in metro markets without needing to purchase spectrum for their devices.

Fixed Wireless Access
With a fixed wireless access offering, CBRS can supply vast amounts of new users with broadband internet. Essentially, CBRS allows wireless operators to extend their areas of service to unserved or underserved areas to supply wireless internet to those communities.

Private Network
CBRS can strengthen enterprise and industrial private networks to assure coverage, capacity, security and dedicated applications for businesses.

CBRS vs. Wi-Fi

CBRS and Wi-Fi are both private networks. These systems can be deployed as totally closed and private systems or systems that are open to other users. Private systems give the manager the freedom to run the type of applications that they deem necessary for their own, or their tenants', business.

Wi-Fi is an incredibly flexible and accessible service, available in nearly every indoor area and embedded in almost every device: phones, laptops, tablets, appliances, televisions, etc. With all of the practical capabilities of Wi-Fi, CBRS will never replace it. CBRS will simply complement all of the practicality of Wi-Fi.

While Wi-Fi might be easily accessible by everyone and everything, it was never designed with mobility in mind. Wi-Fi is inherently a device-based technology and can't sustain the mobility that a lot of users need. Additionally, Wi-Fi networks offer lower security and quality of service than CBRS. CBRS has full mobility with traffic management and controlled handovers, and it has very secure, standard-based connections between the nodes and the devices. Further, CBRS networks will enjoy the excellent performance of 3GPP networks with established quality of service parameters.

Connectivity™
Wireless Solutions

Private Network Vertical Use Cases

Private Network	Enterprise	Airport	Stadium/Venue	Convention Center	Hospitals	MDUs	University Campus
Business Sponsor(s)	Enterprise Authority	Airport Authority	Stadium Owner or Delegated to Lead Operator/Neutral Host	Convention Center Authority	Hospital IT	Portfolio Owner/Building Owner	Portfolio Owner/Building Owner
Customers	Enterprise Authority Tenants of Enterprise Enterprise Employees as End Users Guest to Enterprise	Airport Authority, IT Department, Airport Operations, Airlines, Tenant Enterprises	Airport Authority, IT Department, Airport Operations, Airlines, Tenant Enterprises	Center Facility Operations Tenant Services Organizations Exhibitors/Event	Nurse staff Visiting Doctors Hospital Operations Medical Equipment	Building Operations	Faculty, students, staff, operations, third party
Use Cases	Voice and Data private network communications Fixed Wireless broadband services IoT devices and Sensors Video Streaming services	1. Ground Crew communications 2. Pilot manual updates on tablets 3. Aircraft IoT (engines, parts, logs, etc.) 4. Aircraft entertainment updates 5. Onboard POS downloads 6. Retail POS and broadband connections 7. Operations communications 8. Security remote video cameras, security personnel communications	1. Patron broadband 2. Facility communications 3. Team communications 4. Retail/Tenant POS 5. Carrier offload 6. Security and public safety 7. Patron interactive services 8. Broadcast services	1. Visitor broadband 2. Facility communications 3. Event/exhibit services 4. Retail/Tenant POS 5. Carrier offload 6. Security and public safety 7. Asset tracking/logistics 8. Building management	1. Nurse Communications voice, video, data, text 2. Doctor Communications (requires dual SIM) 3. Medical Equipment IoT tracking, communications 4. Operations Communications 5. Security remote video cameras, security personnel communications 6. Patient location tracking and mobile monitoring	1. IoT for monitoring light and HVAC systems in common areas 2. Security remote video cameras and security personnel 3. Maintenance and operations data and voice communications	1. Operations communications throughout the campus (Voice and Data) 2. Security remote video cameras, security personnel, emergency call kiosks 3. IoT for indoor and outdoor communications for monitoring and control 4. Temporary outdoor event communications (POS, video, data, etc.) 5. Coverage inside and underground for faculty, staff and students 6. Campus wide pbx voice communications
Services (Data, Voice)	Data and VoLTE services	Support Private data and voice communications Support Enterprise tenant Private data and voice communications Support Guest access	Support private data and voice communications Support venue tenant private data and voice communications Support patron access	Support private data and voice communications Support tenant private data and voice communications Support visitor access	Support Private data and voice communications Support visiting tenants (Doctors and care providers) Private data and voice communications Support Guest access as NHN	Support private data and voice communications Support tenant NHNcommunications Support Guest access as NHN	Support private data and voice communications Support NHN
End User Devices	Support smart phones with Dual Identity Support fixed access and IoT SIM and Non SIM authentication	Video Cameras, embedded IoT modules, tablets, smartphones, data sticks, Sensors	Patron smartphones, facility/team communications, video cameras, embedded IoT modules, tablets, POS machines, data sticks, sensors, media broadcast elements	Patron smartphones, facility communications, video cameras, embedded IoT modules, tablets, POS machines, data sticks, sensors	Video Cameras, embedded IoT modules, tablets, smartphones, data sticks, Sensors, PTT voice devices, pagers	Smartphones, embedded IoT modules, video cameras	Video Cameras, embedded IoT modules, tablets, smartphones, data sticks, Sensors

*Source: CBRS Alliance

Times Square CBRS Trial

Times Square is one of the most iconic and heavily visited locations in the world. An international destination for retail and entertainment, Times Square attracts more than 330,000 visitors daily and supports more than 1 million visitors at the New Year's Eve ball drop each year. Each visitor is expecting a certain level of connectivity to make phone calls and post on social media, on top of the numerous operating businesses using a wireless connection. Because of the volume of people frequenting Times Square, stable connectivity is never guaranteed.

The Times Square Alliance's primary goal was to promote economic development in Times Square by leveraging cutting-edge technology, as well as provide reliable connectivity for digital technologies that keep visitors and residents safe.

By implementing a CBRS solution in Times Square, Connectivity Wireless was able to increase mobile and internet connectivity in one of the most densely populated tourists stops in the world. In addition to the increased connectivity for tourists and businesses, CBRS also provides the required connectivity to operate monitoring devices like security cameras and hand-held radios that keep Times Square safe.

Devices Tested and Results

- **Cellphone**
  Uplink speed: Up to 48 MBPS
  Downlink speed: 42 MBPS
- **Video / Audio App**
- **Push to Talk Radios**
- **Laptop Internet Connectivity**
  42 MBPS

Technology Partners for the Trial
- Commscope Ruckus
- Federated Wireless acting as Spectrum Access System (SAS) controller
- Athonet Enhanced Packet Core (EPC)
- Athonet Edge Node
- SkyConnect Networks

CBRS Trial Times Square Infrastructure
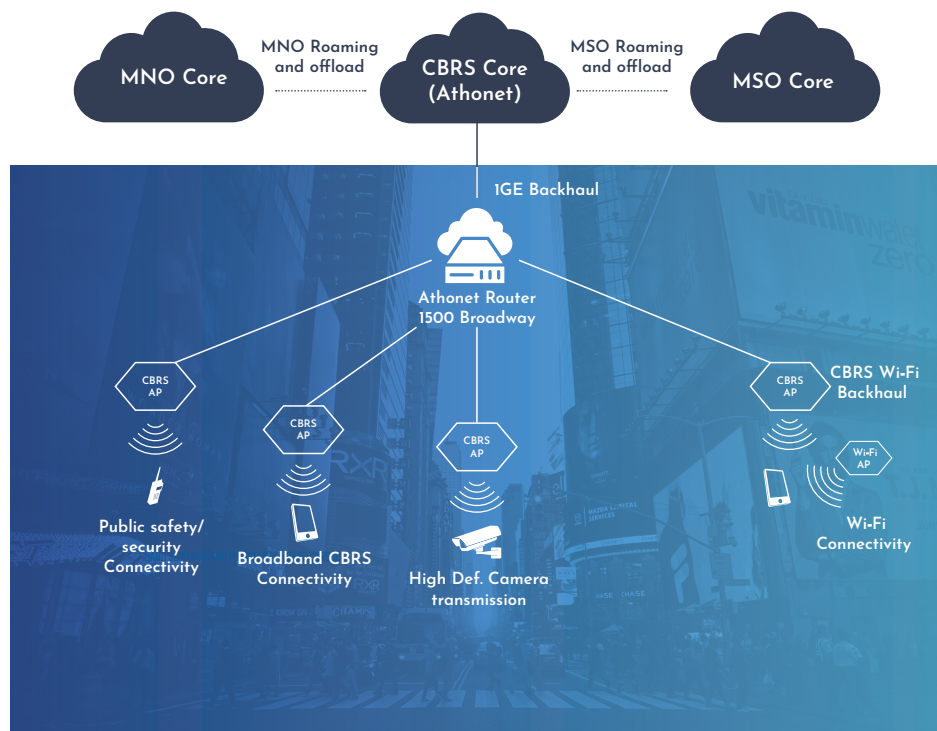
Angel Stadium CBRS Trial

Angel Stadium is an iconic Major League Baseball stadium, home to the Los Angeles Angels. This stadium supports 5 million visitors each year and up to 45,050 people per game. Fans expect uninterrupted connectivity to enhance their game-day experience and connect with other fans. In addition to massive crowd attendance, Angel Stadium has a number of concession operations, digital advertisements, and a box office all vying for a consistent level of connectivity.

The venue's primary goal was to leverage CBRS to power critical support systems such as retail tracking, POS systems, ticket/access systems, high-definition cameras, digital displays, and secure internal communications.

With CBRS, Connectivity Wireless was able to equip Angel Stadium with the necessary connectivity to achieve their goals, optimize POS and ticket systems, increase the reliability of their security measures, and synchronize digital displays.

Devices Tested and Results

- **Push to Talk Radios**
- **Digital Signage**
- **Wi-Fi backhaul**
- **Video Cameras / Surveillance**
- **Video / Audio App**
- **Laptop Internet Connectivity**
  75 MBPS
- **Cellphone**
  Uplink speed: Up to 40 MBPS
  Downlink speed: 120 MBPS

Technology Partners for the Trial
- JMA - XRAN 100% software baseband and Cell Hub radio system
- Federated Wireless acting as Spectrum Access System (SAS) controller
- Athonet Enhanced Packet Core (EPC)
- Athonet Edge Node
- SkyConnect Networks

CBRS Trial Angel Stadium Infrastructure
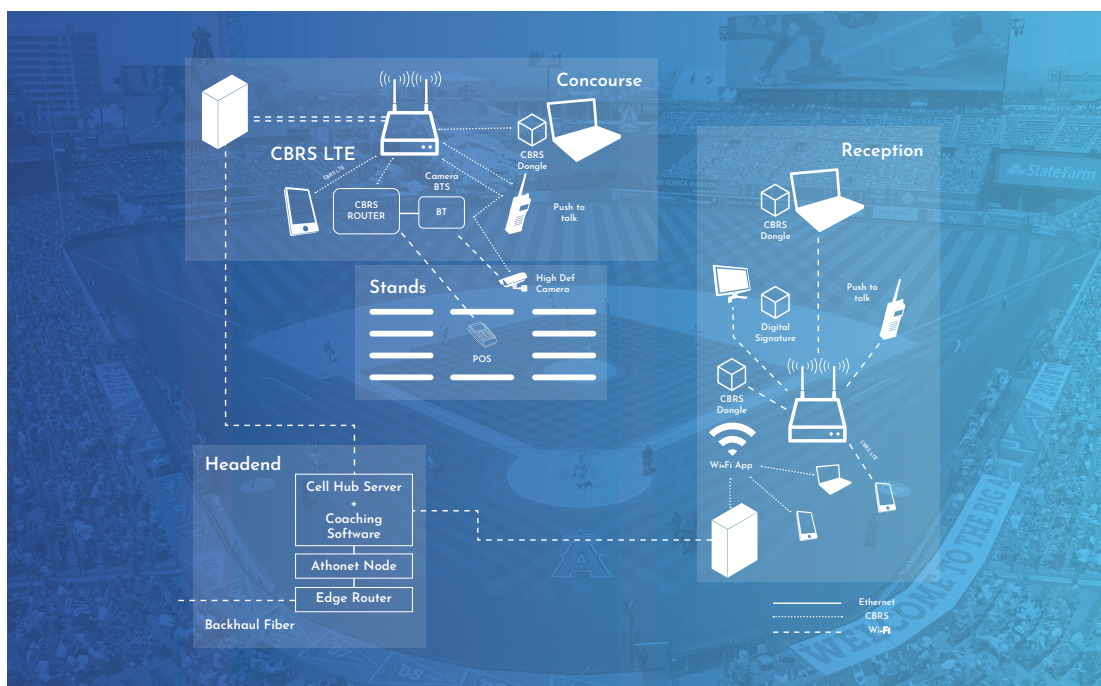
At Connectivity Wireless, we specialize in connecting venues, carriers, and their customer's future-proofed connectivity solutions around the United States. We leverage our team's operational and technological expertise for your business today.

People today expect to be connected to the world around them. In fact, their connectivity is often more important than a communal space or a gym. Did you know that 80% of all mobile data originates indoors? It's more vital than ever to provide a dependable wireless connection for your tenants. What you need is a partner that helps give you a competitive edge in the marketplace. Your connectivity is our mission, and we take our mission very seriously.

888.591.9428

info@connectivitywireless.com

www.connectivitywireless.com

Connectivity ™
Wireless Solutions