Citizen’s Broadband Radio Service Overview And the Industrial IoT Usecase

Alan Ewing
CBRS Alliance, Executive Director
Overview

- History of CBRS and spectrum sharing the 3.5GHz in the US
- Industry Associations involved with CBRS
- How is the CBRS spectrum allocated?
- SAS’s and how they work
- Architecture of spectrum sharing
- Equipment approvals
- Example use cases
A Brief History of CBRS

- The National Telecommunications and Information Administration (NTIA) identified the 3.5GHz spectrum in 2010 for possible shared use
- The FCC proposed the Citizen’s Broadband Radio Service (CBRS) in December 2012, and finalized the proposal in April of 2014
- The CBRS Alliance was formed in mid 2016 to further the shared use of the 3.5GHz spectrum for 3GPP based deployments
- Spectrum sharing is codified under FCC “Part 96” (Code of Federal Regulation, Title 47, Chapter 1, Volume 5, Part 96)
- Wireless Innovation Forum (WInnForum) and CBRS Alliance work cooperatively to develop testing and certification schemes to support CBRS Band deployments
Industry Organizations with a Primary Focus on CBRS

- Standards Development Organization
- Radio technology neutral
- Functionality and architecture for SAS and ESC
- Requirements, processes, and methods for protection of incumbent users
- Interoperability requirements and protocol definition
- Common framework for FCC testing and certification

- Industry Alliance
- Evangelize LTE-based CBRS technology, use cases and business opportunities
- Develop technical requirements for CBRS use cases
- Establish an effective product certification program for LTE equipment in the 3.5 GHz band ensuring multi-vendor interoperability
CBRS 3-tiered spectrum sharing in the US

Opens up 150 MHz spectrum for new commercial use without impacting incumbents

Tier 1
Incumbents

Tier 2
Priority Access Licenses (PAL)

Tier 3
General Authorized Access (GAA)

Military radar: ship-based | ground based

FSS RX

WISP

Incumbents are protected from interference from PAL and GAA

PAL has priority over GAA, licensed via auction, 10 MHz blocks, up to 7 licenses

GAA can use any spectrum not used, yields to PAL and incumbents

Incumbents

Priority Access Licenses (PAL)

General Authorized Access (GAA)

3550 3600 3650 3700 MHz
Figure 1. The Three-Tiered Spectrum Access System (SAS)
CBRS Functional Components

- **Spectrum Access System (SAS)**
  - Centrally coordinates access to the shared spectrum, enforcing priorities and modeling the RF environment

- **Environmental Sensing Capability (ESC)**
  - Detects incumbent activity and informs SAS so that channels can be cleared of lower priority use

- **Domain Proxy**
  - CBSD aggregation and proxy function for large networks, can be integrated with an EMS / NMS or be standalone

- **CBRS Device (CBSD)**
  - Radio nodes operating in the CBRS band, must be centrally coordinated by a SAS in order to transmit

FCC Databases (FSS and WISPS)

Incumbent Detection (ESC)

SAS 1

SAS 2

Domain Proxy/Network Manager

3.5GHz CBRS Radios “CBSDs”
“We’re right now in the middle of the 5G wars where the U.S., China and other folks are trying to battle for leadership.” “That being said, I think a lot of these spectrum auctions are going to start slowing down. I don’t think there’s any more low-hanging fruit. As the airwaves continue to get more and more crowded, more spectrum-sharing is going to be the new normal.”

– Frederick Moorefield Jr., Acting Principal Director, DoD CIO’s Office, September 24, 2018

“Replacing static exclusion zones with Dynamic Protection Areas will maximize the commercial potential of this band while not losing the assurance that incumbent military radar systems will be protected. This is truly a win-win.”

– David Redl, NTIA Administrator, July 24, 2018 speaking about CBRS

“Collaboration among all of the stakeholders is excellent.”

- FCC Report to Congress, November 2, 2018
Equipment Approvals
FCC Equipment Authorization and WInnForum

- The CBRS Band equipment authorizations are governed by FCC Part 96 rules.
- WInnForum has developed technology agnostic tests against the requirements of Part 96.
- The FCC has deemed that successful completion of these tests provides sufficient evidence of Part 96 compliance for CBSD to SAS interaction.
- The FCC, thereby, provides equipment authorization to CBSDs via TCBs and testing performed by WInnForum authorized laboratories.
OnGo Certification

- CBRS Alliance licenses the WINnForum Test Specification and Test Code to allow CBRS Alliance to facilitate approval of test labs supporting its members to run the WINnForum testing.
- CBRS Alliance has taken the test code and developed a user friendly version of the Test Harness with GUI and extensible architecture
- Test labs approved by the CBRS Alliance will be reported to WINnForum to include on the master list.
- CBRS Alliance will require additional testing beyond what is required in Part 96 to be recognized as OnGo Certified.
What about User Equipment, SASs, etc.?

• Other network entities are not currently part of the OnGo™ Certification Program. These entities are not considered out of scope, but managed by other processes outside of CBRS Alliance.
• SAS and ESC Certification is handled directly by the FCC.
• UEs are tested for FCC Part 96 compliance and authorized accordingly. There is no OnGo™ Certification currently available for User Equipment.
OnGo: a Range of Use Cases

**MNO**
- Network Densification
- Capacity expansion

**MSO**
- Wireless MVNO Offload
- Smart Home

**Neutral Host/MSP**
- Cost-effective DAS alternative
- Venues, MDUs, Dorms

**Enterprise**
- Private LTE Networks
- Industrial IoT

**WISP**
- Incumbent band users
- Rural Broadband
The Imminent Impact of OnGo

Initial Commercial Deployments by Use Case*

*Sample data from one SAS Admin Proposal
The Imminent Impact of OnGo

Initial Commercial Deployments by Vertical Markets

- Hotels
- Shopping Malls
- Sports Venues
- Offices
- Restaurants
- Rural
- Education
- Energy
- Entertainment
- Seaports
- Smart Cities
- Urban

Powered by the CBR$ Alliance
## Industrial IoT Example – California Ports

### Port Rankings by Containers

#### Global Ranking (2016)

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#### North American Ranking (2017)

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5G Use Cases (for starters)

Localized Use Cases
- Home
- Healthcare
- Industry
- Hotspots
- Events

Highway Use Cases
- Truck platooning

Public Transport Use Cases
- In-vehicle infotainment

Dense Urban Use Cases
- Drones
- 8K Video Streaming
- VR/AR
- Hotspots
- Structural 5G deployment area
- 5G use case

OnGo
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Latency Performance Classes for Industrial Automation

- Remote Control (drones, vehicles, etc.): >200ms e2e app latency
- Tele-operation: 150-200ms e2e app latency
- Round Trip Networking Latency: 50-100ms e2e app latency
- Discrete Automation: 5-10ms e2e app latency
- Motion Control
- Process Automation: 100ms
- Discrete Automation: 50ms
- Discrete Automation: 15ms
- 10ms
- 5ms
- 1ms
- Tele-Protection
- Electricity Distribution
2019: Realizing the Vision

- **Real Deployments under Part 96 Rules**
  - Initial Commercial Services
  - Full Commercial Services
- **Ecosystem Readiness**
  - Infrastructure and Clients
  - SAS and ESC Certification
- **Continued Development**
  - CBRS Alliance Release 2 Specs
  - Roadmap to 5G NR
Learning the Lingo

• **Use “OnGo”**
  - When describing the use of shared spectrum technology. In the 3.5 GHz band: “OnGo enables connectivity without compromise.”
  - To describe the Certification Program: “Radios will be OnGo-Certified.”

• **Use “CBRS Alliance”**
  - When referencing the organization behind the OnGo brand: “The CBRS Alliance is exhibiting at Realcomm 2018, where the organization’s member companies will demonstrate the latest OnGo-ready technologies.”

• **Use “CBRS”**
  - To describe the band and/or the FCC ruling: OnGo will enable expanded business opportunities in the CBRS* band.
  - *Suggested use of “3.5 GHz” or “Band 48” as the preferred terminology, whenever possible.*
Thank You!

Additional information and resources (e.g. whitepapers, studies, videos,...) available at: www.cbrsalliance.org