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Spectrum Sharing Shows Promise for Broadband Access in Rural America

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Inside...

Key Points:

- Citizens Broadband Radio Service, or CBRS, has introduced a new spectrum sharing business model that will improve broadband coverage in rural America.
- A robust hardware ecosystem will help reduce capital costs and give operators time to market benefits.
- Spectrum sharing enables smaller operators to deploy "carrier grade" fixed wireless networks without having to invest in licensed spectrum.
- Deploying standards-based equipment will increase network valuations, improve throughput speeds, and make regional CBRS operators strategically attractive to tier-one operators looking to expand their coverage footprints.
- The CBRS band is an attractive option for CAF-II recipients to meet their buildout requirements.

Introduction

The wireless industry is embarking on a new unlicensed spectrum sharing business model that will help the likes of wireless internet service providers (WISPs), rural local exchange carriers (RLECs), and electric distributor co-ops build fixed wireless networks in rural America. Instead of having to acquire the exclusive rights to use pricey airwaves, spectrum sharing reduces the entry barriers for new market entrants to offer "carrier grade" fixed wireless service.

Prior to this concept, many WISPs were forced to use unlicensed Wi-Fi spectrum and equipment for fixed wireless service in rural America. This approach has two issues:

- Throughput speeds do not always meet the Federal Communications Commission's (FCC) definition of broadband (25Mbps/3Mbps), resulting in quality of service and coverage footprints being inferior to standards-based networks.
- WISP valuations are low, in part, because the network equipment and spectrum being used offers no acquisition synergies for larger operators. This is one of the reasons why the current WISP business model has struggled to profitably scale.

Building networks with unlicensed Citizens Broadband Radio Service (CBRS) spectrum in rural America will help address both of these issues.

Sharing Spectrum

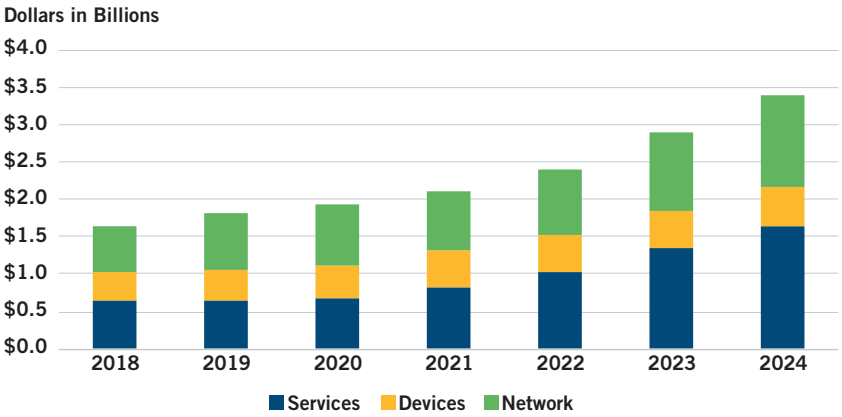
In 2015, the FCC established the CBRS for shared use of the 3550-3700MHz band. The band is bifurcated into licensed and unlicensed spectrum. 80MHz is earmarked for unlicensed use. The remaining 70MHz will be auctioned off for licensed use.

The CBRS band has several attractive characteristics that will help bridge the digital divide. These include:

- Widespread adoption (by tier one wireless operators, cable operators, private enterprise, WISPs, etc.) of the band will create a robust ecosystem of devices, chipsets, and infrastructure equipment. *(Exhibit 1.)*
- The amount of unlicensed spectrum, and the propagation characteristics of it, make it a good fit for rural fixed wireless coverage.
- For WISPs, adopting standards-based equipment and spectrum that's being used by tier one operators makes them a potentially attractive acquisition target for larger operators looking to expand their footprint.

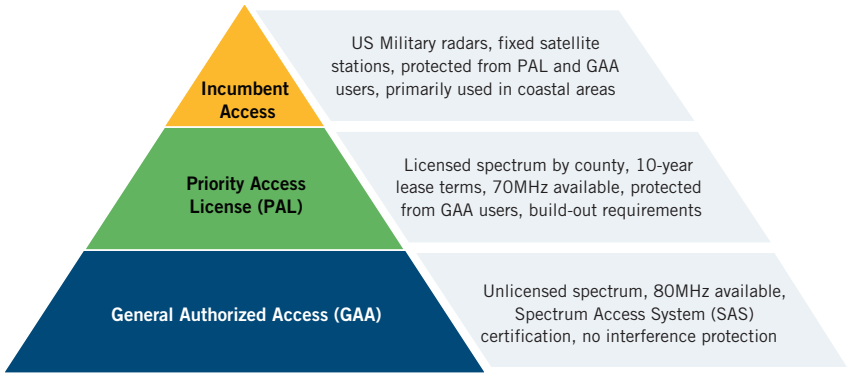
Prior to 2015, the CBRS band was exclusively used by the U.S. Navy and other Department of Defense members. To ensure that users of the unlicensed band do not interfere with military communication networks and licensed owners, the FCC required that there be a Spectrum Access System (SAS) administrator program established.

EXHIBIT 1: Global Private LTE Revenue



Source: Mobile Experts
NOTE: Private LTE networks will use shared spectrum such as CBRS.

EXHIBIT 2: Citizen Broadband Services (CBRS) Access Rules

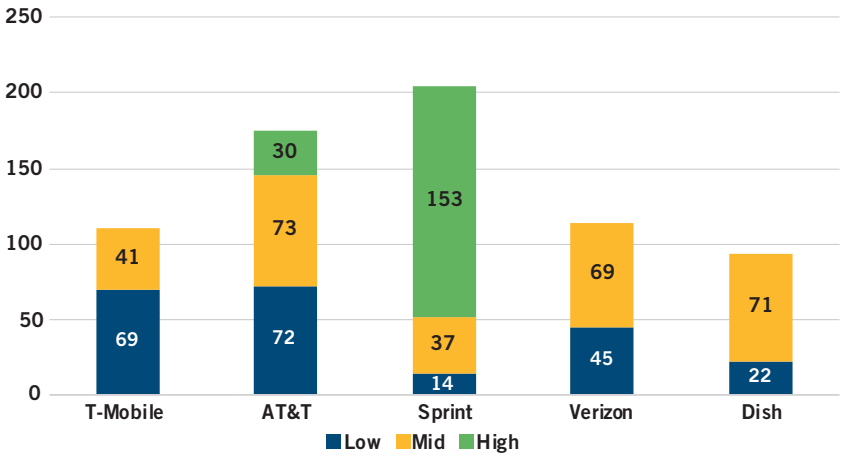


Source: CoBank

As illustrated in *Exhibit 2*, the CBRS band has three access tiers. The SAS administrator is tasked with ensuring that General Authorized Access (GAA) users do not interfere with Priority Access Licenses (PAL) users or the incumbents, and that PAL users do not interfere with the incumbents. Think of an SAS administrator as a traffic cop that directs traffic based on a predetermined hierarchy.

The unlicensed portion of the CBRS band is expected to go live in the summer of 2019, while the auction for the licensed portion is scheduled for the first half of 2020.

EXHIBIT 3: Mobile Carrier National Weighted Average Spectrum Depth (MHz) by Band Classification



Source: allnet insights and analytics

NOTE: This chart does not reflect Verizon's millimeter wave spectrum holdings.

- **High band spectrum**, such as millimeter-wave, supports a tremendous amount of data given the large channel sizes. However, the signals do not travel very far – roughly 500 to 1,000 feet – and struggle to penetrate obstructions like foliage and windows with UV protection.
- **Mid band spectrum** is where CBRS spectrum falls. This will be the cornerstone of next generation networks. Unlike millimeter-wave spectrum, it does not require line of sight to connect devices. And unlike low-band spectrum, it supports bandwidth-heavy applications such as fixed wireless.

Coverage and Capacity

CBRS spectrum does not require line of sight access, and the radio frequency (RF) signals travel much farther than unlicensed Wi-Fi spectrum in the 5GHz band.

The 80MHz of unlicensed spectrum is significant and provides rural operators plenty of capacity to support fixed wireless networks. To put this amount of capacity into perspective, 80MHz is just shy of T-Mobile's entire spectrum holdings that are currently servicing its 79 million customers *(Exhibit 3)*. As a result, speed and coverage footprints using the CBRS band will be noticeably better than many of the current WISP networks.

Spectrum bands are classified as low, mid, or high.

- **Low band spectrum** can travel over long distances, but lack capacity. This spectrum is ideal for network coverage in suburban and rural markets where large landmasses need to be covered. The downside to low band spectrum is that it doesn't support large amounts of data, which limits throughput speeds.

Deploying Networks

The off-the-shelf Wi-Fi networks that many WISPs have constructed for fixed wireless service are relatively straightforward to build and manage compared to LTE networks. Many WISPs lack the technical expertise to build LTE networks. For example, having to authenticate a user on multiple access points creates challenges for WISPs. Overcoming these technical hurdles is key for WISPs to deploy LTE/5G networks using CBRS spectrum, which will offer speeds and coverage footprints that are far superior to what they have today.

Google

Earlier this year at the WISPAmerica conference, Google outlined some of its initiatives to help WISPs deploy CBRS-based fixed wireless networks. These include:

- SAS administrator service.
- Training and certification programs around CBRS equipment installation.
- A network planning tool to help WISPs architect their fixed wireless networks. The web-based tool helps WISPs determine where their network access points should be installed by leveraging Google's geospatial data and advanced propagation models.

EXHIBIT 4: CAF II Auction Winners

Number of Bid Winners*	Type of Company	Approx. Amt. Won (Dollars in Millions)
16	Wireless ISPs	$750.0
15	Rural Electric Companies	$225.0
30	Rate of Return Telcos**	$125.0
1	Satellite Providers	$122.5
4	Price Cap Carriers	$28.5
37	Cable Companies, Competitive Carriers, Tribal Carriers, Others	$23.7

Source: Telecompetitor

*In some cases, two or more companies bid together, so the number of winning companies exceeds the number shown here.

** May be underestimated slightly, as we relied on name recognition in identifying these companies

Extra costs

Of course, none of this comes for free.

SAS providers charge operators a monthly fee to police the wireless traffic on the CBRS band. Additionally, deploying an LTE/5G standards-based network is more capital intensive compared to a Wi-Fi network. These extra costs could be problematic for some WISPs.

Google announced a $2.25/month/household SAS fee, in addition to one-time fees for their certification programs. Based on CoBank research, the $2.25 SAS fee is on the lower end of the scale.

While no one likes to incur new expenses, deploying a CBRS-based network will increase the coverage to access point ratio for WISPs. Providers may also be able to charge a premium for their CBRS fixed wireless networks over what they are charging today for Wi-Fi access.

Buy or build?

The other arguments in favor of deploying this architecture is higher asset valuation and a potential exit strategy.

As tier-one operators look to broaden their coverage footprints, they can do one of two things: Build the network themselves, or acquire an existing network.

If they choose to buy an existing network (and customers), the cost and level of effort to integrate the acquired network into the core network is of major consideration. Many WISPs have historically built non-3GPP (3GPP is the standards body that defines protocols for mobile networks) networks. Buying these types of networks offers no synergies as the acquiring operator will end up decommissioning it and moving all the customers onto a newly built network. Instead, the acquiring operator is better off overbuilding the market and acquiring the customers that way.

However, if WISPs built CBRS-based networks, the level of integration becomes much easier because the acquiring operator already supports the spectrum band and equipment. This strategy should help WISPs realize a higher enterprise valuation and give them an exit strategy if a tier-one operator wanted to expand its rural footprint with a buy versus build strategy.

Wireless ISPs were the big winners at last year's Connect America Fund II auction (CAF-II). *(Exhibit 4.)* Leveraging the CBRS band and the shared spectrum business model should help WISPs meet their CAF-II buildout requirements.

Licensed Versus Unlicensed

Operators need to decide if they want to acquire licensed CBRS spectrum to augment their use of the unlicensed portion of the band, or just use the unlicensed portion. Urban and rural markets, though, differ on fundamental challenges and opportunities.

Urban markets

Urban operators will certainly be required to buy licensed spectrum at next year's CBRS auction. The reason: In urban markets, there will be a large number of private CBRS networks fighting to use the unlicensed airwaves, which will create RF interference.

With RF interference comes a degradation in network performance. Operators such as Verizon and AT&T can ill afford this risk and, therefore, will want the lion's share of their CBRS traffic in urban markets to use licensed spectrum where interference is not a major issue.

Rural markets

For rural networks, the situation is different. Network operators using CBRS spectrum for fixed wireless service in rural America will not need to rely on licensed spectrum as much as their urban counterparts.

Unlike in urban markets, rural markets will have a smaller number of networks competing for the unlicensed spectrum resources. This ultimately means there will be less RF interference. And with less RF interference, rural operators should be able to offer a fast data connection using unlicensed spectrum. This has significant implications to an operator's cost basis because buying licensed spectrum is capital intensive.

Conclusion

The shared nature of the CBRS band and the amount of data capacity it can support offers some intriguing business models and a platform to expand fixed wireless coverage in rural America. The vast ecosystem of devices, infrastructure, and chipsets gives operators choice and time to market benefits. WISPs, RLECs, electric distributor co-ops, and rural cable operators should adopt the technology where it's not economically feasible to deploy fiber. This will help bridge the digital divide, and is a good way for CAF-II recipients to meet their buildout requirements. Lastly, it should make these networks more attractive to tier-one operators who want to expand their rural footprint through acquisition. ■

CoBank's Knowledge Exchange Division welcomes readers' comments and suggestions. Please send them to KEDRESEARCH@cobank.com.