FIERCE Wireless

Lessons learned from the CBRS spectrum experiment — Rysavy

by Peter Rysavy | Apr 28, 2022

The vision for Citizens Broadband Radio Service (CBRS), when first conceived, was shared-use spectrum super highways in the bands occupied by the U.S. Department of Defense, a system that proponents said would multiply the capacity of federal spectrum by a factor of 1,000. What we have learned in the past eight years of the CBRS experiment is that no single sharing approach is available, or even being contemplated, that would successfully enable real-time spectrum sharing among users in all bands.

The U.S. wireless industry needs more mid-band spectrum if it is to remain competitive with other countries that continue to emphasize 5G mid-band operation. As a result, industry and government are now looking at the 3.1-3.45 GHz band. Given heavy Department of Defense use and the difficulty of moving some incumbent DOD military applications, some form of spectrum sharing may be necessary.

Does CBRS provide a solution, or is more work needed?

History of CBRS

The FCC allocated 3.55-3.70 GHz for CBRS, considering it a potentially useful exercise so engineers could devise an approach for commercial networks to share the same band as DoD operations.

Fast forward to 2022. CBRS now operates below C-band and above the recently auctioned 3.45-3.55 GHz band. Only the CBRS portion of mid-band spectrum requires spectrum sharing. And notably, only the U.S. requires spectrum sharing in any mid-band frequency. Other countries, including China and South Korea, have simply cleared the spectrum for dedicated 5G use.

The initial Notice of Proposed Rulemaking for CBRS was in 2012, and the FCC auctioned Priority Access Licenses (PAL) in 2020. That eight-year process demonstrated the difficulty of developing and deploying spectrum-sharing solutions.

CBRS was launched with hugely ambitious goals to address a wide range of use cases, ranging from small, private deployments to large-scale operator networks. The result, however, is a series of compromises that don't address any entity's needs exactly. For example, county-wide license areas require a large number of licenses for widespread coverage, but these areas are too large for universities, ports, factories and other entities considered potential target markets.

Moreover, significantly lower power limits for CBRS compared with conventional cellular networks result in at least seven times as many cell sites required for continuous-area coverage, as analyzed in my 2021 mid-band spectrum report.

CBRS users also must contend with the coordination complexity of interfacing with a Spectrum Access System (SAS) database; use radio channel assignments that can change, which complicates spectrum planning; and deal with capacity uncertainty because incumbents can force users to stop using the frequencies altogether.

The CBRS three-tier system also provides "free" spectrum to General Authorized Access (GAA) users for private purposes, but given potential competition from other users, there is no guarantee of the amount of spectrum available in any given location.

Enterprises are eyeing CBRS for private LTE and 5G networks. Cable companies are using it in some coverage areas to reduce their MVNO loads. WISPs are using it for fixed wireless access in discrete locations, particularly in rural areas.

Bottom line, compared with the nationwide 5G networks operating in other bands, CBRS, with its constraints, is relegated to niche solutions.

What now?

Applying a CBRS-sharing framework to other bands, including bands occupied by users other than DOD, is at best a complicated and uncertain prospect. A major component of CBRS is its environmental sensing capability (ESC), a network of receivers that sense the operation of U.S. Navy radar and report such use to the SAS so it can shut down commercial use. However, the ESC detects only radar systems, not other types of DOD systems operating in 3.1-3.45 GHz, and certainly not systems operating in other bands.

This and other ESC limitations led the National Telecommunications and Information Administration (NTIA) to propose an alternative approach called the Incumbent Informing Capability (IIC), a digital system by which DOD could securely inform the SAS directly of its intentions to use certain frequencies. IIC, however, is a long-term project, not even funded at this time, and not likely to become available until the second half of this decade.

The task of finding a path forward, especially for 3.1-3.45 GHz, has fallen on a task group called Partnering to Advance Trusted and Holistic Spectrum Solutions (PATHSS) that was established by the National Spectrum Consortium, which is a collaboration between government and industry. Some version of CBRS might ultimately be the result, but any solution would have to be adapted for the requirements of the incumbents in this band. This will not be a short-term process.

Another challenge is that many sharing situations, whether in 3.1-3.45 GHz or other bands, will require sharing to operate in real time. In contrast, CBRS frequency assignments today are semi-static.

As the CBRS experiment has demonstrated, real-time spectrum sharing among spectrum users in the same coverage area remains extremely difficult. Two other sharing solutions reinforce this conclusion: 5G has a capability called Dynamic Spectrum Sharing (DSS), a means for a cellular operator to share a radio channel for both 4G and 5G radios. But 5G DSS does not support sharing with any other type of system. Similarly, 5G New Radio Unlicensed (NR-U) enables 5G and Wi-Fi to share the same unlicensed radio channel, but again, the technology does not accommodate other types of users. Both DSS and NR-U took years to develop and show that spectrum sharing, at least today, requires solutions custom-tailored for the specific systems involved.

That other countries continue to clear spectrum for 5G networks is no surprise. Policymakers must be realistic about spectrum sharing, especially given the rapid increase in demand for 5G, which operates best on large, exclusive-use channels. Running spectrum experiments to determine a feasible sharing solution for different bands is a laudable and important objective; however, such experiments should be conducted in bands that won't interrupt a steady pipeline of prime 5G spectrum.

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