

Re: Request for feedback on the ITS report titled “The innovative spectrum sharing framework connecting Americans across the country”

United States Department of Commerce

National Telecommunications and Information Administration

Institute of Telecommunications Sciences

<https://ntia.gov/blog/2023/innovative-spectrum-sharing-framework-connecting-americans-across-country>

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High Tech Forum
Lakewood, Colorado
May 31, 2023

Overview

The ITS report in question answers the most basic question about the CBRS experiment: “Is anybody taking part?” It examines the state of the CBRS infrastructure and the sale of licenses. Finding significant growth, the report concludes in the affirmative. Now that we know a healthy experiment is underway, we should move on to the next step and determine how well CBRS actually works in both absolute and relative terms.

In order to make a meaningful evaluation of CBRS with respect to other approaches, it is necessary to examine usage data and alternative approaches in a larger context:

1. How much data has been transferred between CBSDs and associated endpoint devices?
2. How does the volume of data transfer over CBRS compare to alternative licensing schemes such as contention-based unlicensed and managed licensed spectrum?
3. How frequently does the government pre-empt civilian uses in order to support training exercises and military operations?
4. What fallback systems are employed by civilian users to cope with denial of service caused by preemption?
5. Given that CBRS is a system for preemption rather than real-time sharing of spectrum by government and civilian users, is it legitimate to describe CBRS as a “sharing” system?

6. How does the CBRS preemption system compare with technical approaches that permit real-time coexistence between military and civilian systems?
7. CBRS permits military training in a pristine spectrum environment in which military devices don't have to cope with interference from civilian systems. How well does training in this spectrum environment prepare warfighters to operate in real world conditions?
8. Is ITS satisfied that CBRS is the best it can do for achieving military/civilian coexistence or is it actively researching more technically sophisticated approaches?
9. Traditionally, unlicensed radio systems such as GAA, Wi-Fi, and Bluetooth have used low quality junk spectrum bands such as 2.4, 5.9, and ~6 GHz. Much of their value comes from reclaiming spectrum bands that are fundamentally unsuited for managed, licensed operation. The 3550–3700 MHz band used by CBRS is not such a band. Would the CBRS experiment be more or less valuable in a junk band?
10. When can we expect to see an authentic critical review of CBRS?

While the infrastructure data provided by the “The innovative spectrum sharing framework connecting Americans across the country” report is valuable as far as it goes, the data and the tenor of the report doesn't allow us to draw any conclusions as to whether CBRS should be regarded as a durable spectrum coordination solution or merely a stopgap to be used for a few years while we wait for the Pentagon to upgrade its RF spectrum systems.

Few spectrum experts regard preemption and denial of service as desirable in the abstract. Hence we need to know whether CBRS is to become a permanent feature of the spectrum scenarios of the future so we can work around it.

1. Intensity of Use

The report approximates intensity of use by counting CBSDs, grants, and channel widths. While this is good to know, it doesn't capture intensity of use as accurately as measurement of data transfer and channel occupancy do. Are companies securing grants in order to conduct experiments or to support real world applications? To the extent that the latter is the case, it's prudent to compare data transfers and channel occupancy to the corresponding figures for conventional licensed and unlicensed systems.

2. Comparative Effectiveness

The contingent nature of CBRS – it can only be used by civilians with permission – suggests that it is likely to serve as a carrier of overflow data on non-CBRS spectrum. Data on actual application use helps answer this question.

3. Impact of Preemption

Knowing how frequently the government pre-empts civilian uses in order to support training exercises and military operations puts the questions of intensity of use and comparative effectiveness in context. If CBRS is lightly used by the civilian sector, it would be helpful to know why this is the case. It could be that preemption is so rare that civilian operators ignore it, and it may be the case that it's so frequent that operators only use CBRS as a secondary option.

Using preemption as an ersatz sharing mode places significant burdens on the civilian sector while freeing the government sector of all incentives to make its systems robust and efficient. It is in the public interest for all users to strive for improvement.

4. Denial of Service

CBRS denies service to civilian users in order to enable military systems to operate in a clean spectrum environment. On its face, this is a dicey proposition that can only be welcomed when spectrum rights are scarce and demand is extremely high. ITS should seek to discover the frustration level of civilian users and operators with this unconventional approach. If frustration is high, alternative approaches are available.

5. Sharing vs. Denial of Service

Advocates of the CBRS approach from the Pentagon to the consortium of Pentagon contractors to the public interest sector tout it as a “sharing” system. While this is arguably a legitimate use of the term, it's not sharing in an equitable sense. In order to participate in CBRS, civilian users must employ frequency agile systems to work around preemption. This is not tremendously burdensome, yet the government systems that pre-empt seem to lack frequency agility. Why is sauce for the goose not good for the gander?

If the government systems protected by CBRS were upgraded to be at least somewhat frequency agile they would be more resilient. If the SAS managers can assume agility on the part of both parties,

preemption would be less common and less burdensome. If CBRS supported equitable preemption it would be at least somewhat legitimate to describe it as a true sharing system.

6. Real-Time Coexistence

Preemption is a very crude approach to coexistence. Unlicensed users coexist by cooperating with each other through contention protocols. Licensed users coexist by taking directions from the operators' scheduling equipment. Both of these forms of coordination are vastly superior in terms of reliability to the CBRS preemption system.

It's legitimate to describe CBRS as a coordination system. It is also legitimate to regard every coordination system as contingent until a superior system comes along. ITS should be looking for ways to coordinate with licensed and unlicensed networks without shutting them down. There are many dimensions of spectrum manipulation on the market and in the labs.

7. Training in Pristine Spectrum

When the US invaded Iraq, we weren't able to secure military spectrum by licensing it from Iraq or by issuing commands to a SAS. We did the next best thing by bombing the operations centers of Iraqi telecom providers. This proved to be a temporary solution; before long, the adversary was using radios to trigger explosives of its own. This prompted our military to up its game on device location and jamming.

Training in the absence of radio interference didn't help our military to achieve the level of radio quality needed to carry out its missions in Iraq and Afghanistan. If anything, it gave our military and civilian leaders a false sense of security. If the adage "you fight as you train" has any credence, military training has to take place in a challenging spectrum environment.

It may well be the case that preemption is necessary in order to simulate such a spectrum environment. But that case has never been made by advocates of preemption. ITS would do well to explain to the public, with clarity, why preemption models are more advantageous than sophisticated coexistence solutions.

8. Coordination Research

Obviously, ITS doesn't regard preemption as the greatest of all possible coordination schemes. And just as obviously, it sees a lot of runway for research on spectrum coordination and sharing. Government

spectrum use is more a political problem than a technical one. It would be wise for ITS to investigate ways to incrementally move military and other government radio systems incrementally toward greater efficiency and resilience. Research on near-term steps is probably more valuable in this context than is moon shot research. The research trajectory needs to span the range from where legacy systems are today to where they need to be in five to ten years.

9. Junk Bands

The typical case for spectrum coordination is low quality bands with many legacy users rather than high quality bands with no more than one incumbent. CBRS is therefore an outlier for spectrum experimentation. It would be useful to help government users to operate in the more challenging bands so it can relinquish its reliance on the very best bands for very mundane operations. New radar can work in low quality bands.

10. Critical Review of CBRS

All in all, the article adopts a cheerleader's tone toward CBRS. While CBRS is certainly novel, it's not innovative. Now that we know that a sizeable group is experimenting with CBRS, it makes sense to collect data from both the good and bad sides of outcomes. The question immediately on the table is whether CBRS is the best way to coordinate between government and public uses of prime spectrum or an outlier case. A critical review based on much more comprehensive data is clearly in order.

Conclusion

The title "The innovative spectrum sharing framework connecting Americans across the country" is public relations spin that displays premature satisfaction. The content of the report, limited to equipment purchases and grants, is a recipe for confirmation bias.

While it's understandable that ITS is very pleased with CBRS uptake, we shouldn't lose sight of the fact that CBRS is very much in a preliminary, experimental phase where success is easy to achieve. In reality we still have no idea whether CBRS is a long-term solution or simply a stopgap for working around obsolete government systems.

We need to see a critical evaluation that compares the performance and reliability of CBRS to more ambitious modes of coordination. We're glad to see the beginning of government's willingness to share spectrum in a meaningful way. We would be even more happy to see a commitment to equitable and efficient coordination that does more than mask deficiencies in the government's procurement model.