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Sharing Without Daring: Dynamic Spectrum Sharing With Certainty of Access

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The dichotomy between dynamic spectrum sharing and exclusive licensing is a false one. Reliable, full-power access is possible within a dynamic sharing framework if the FCC auctions super-priority rights to commercial users.

KEY TAKEAWAYS

- Dynamic spectrum sharing and exclusive licenses are alternative methods of commercial spectrum access, and each has its own benefits.
- The benefits of sharing and licensing are often thought to be mutually exclusive, but that is only true because commercial users have not been the highest priority users in spectrum.
- The CBRS band today provides reliable, full-power access to the federal government. In bands without federal incumbents, the FCC should auction those types of rights to commercial users while maintaining the other CBRS tiers.
- Changing the identity of the top-tier user preserves the benefits to lower priority users, so PAL and GAA can still perform the functions their advocates seek.
- Though there are potential downsides to this proposal, it would be an improvement over the status quo as long as the FCC clearly defines and enforces the priority tiers.
- The FCC should be mindful of geographic license sizes but, overall, seek to reduce transaction costs that enable secondary markets to partition or aggregate licenses as needed.

INTRODUCTION

As the wireless marketplace continues to develop, industries naturally seek spectrum access regimes that match their business models. Often, these preferences conflict.[1] Generally, traditional mobile network operators in the business of providing reliable, high-capacity access to wide areas prefer exclusively licensed spectrum. Traditional cable operators or companies just branching out into wireless services for bespoke private networks prefer dynamic sharing systems in which a centralized system coordinates different parties' uses of the same frequencies in the same location, often at lower power than that allowed for exclusively licensed spectrum. The central example of dynamically shared spectrum is the Citizens Broadband Radio Service (CBRS) in the 3550 MHz band.[2] A third camp, composed largely of Internet companies, prefers unlicensed spectrum in which any user can access a band with a device that meets technical requirements.

There are good reasons to like each of these allocations.[3] But the choice between them has come to be viewed as an either/or in a way that overlooks the ways in which, in many circumstances, the three are compatible. In short, with minor modifications, a CBRS-style dynamic sharing framework can also provide reliable access to full-power spectrum rights.

CBRS: THE PARADIGMATIC DYNAMIC SHARING SYSTEM

The following proposal takes the example of the CBRS sharing framework as the epitome of dynamic sharing. CBRS is, so far, the most advanced and direct example of dynamic spectrum sharing. It has three tiers of users with descending levels of priority for accessing the band.

The highest priority belongs to the federal incumbent: The band was and remains used by the U.S. Navy's radar systems. The federal government retains this top-priority position in the new system. A series of sensors detects when the Navy is using the spectrum and informs a spectrum access system (SAS), which can then kick off any commercial users that would be in the way of that federal use. From the Navy's perspective, CBRS has been a success. The federal government is always wary of giving up any rights to its spectrum, so CBRS has had to provide real certainty that the spectrum will always be available when the Navy needs it. Indeed, there have been zero reported incidents of Priority Access Licenses (PALs) interfering with incumbent federal systems.[4]

PALs give their owners first dibs on the spectrum when and where the Navy isn't using it. These PALs cover the geographic area of one county each and are subject to much lower power limits than those in bands traditionally used for mobile networks. PAL proponents like that the more limited rights conveyed by PALs mean that individual companies can have a license directly from the Federal Communications Commission (FCC) rather than having to incur the transaction costs of contracting for a piece of a more expansive license owned by someone else. For example, a hotel or factory may buy the PAL that covers its land and operate a neutral host network that connects to commercial cell networks rather than contracting with the cell networks directly to build a network customized to their venue.

Parties have debated the value of PALs relative to alternatives.[5] Dynamic sharing proponents think PALs are tailored to allow for innovative uses, as evidenced by the fact that companies not normally in the wireless business have bought PALs. They also argue that PALs are well suited for bespoke applications, such as private networks that may be used by an individual hotel or

factory. Exclusive license proponents think they are a waste, since being able to be preempted by the Navy at any time makes it impossible to rely on the CBRS band for reliable, continuous access needed to support wide-area, high-throughput mobile broadband. Likewise, opponents disdain the small license sizes and low power limits as encumbrances to realizing the full productive potential of the band.

The final tier of the CBRS framework is General Authorized Access (GAA). GAA is open to anyone whose devices meet certain technical requirements, including working with the same coordination system as PALs. GAA users, however, lack priority rights. They get access to the spectrum only when it is not being used by others. In this way, GAA is similar to unlicensed spectrum: It is cheap to access but there is no guarantee of usage rights.

EVERYONE CAN GET WHAT THEY WANT

Each type of wireless user has good reasons to want spectrum that meets their needs, so regulators have to weigh the trade-offs to find the most productive allocation. But it's not clear that a CBRS-style system would always force a zero-sum choice. Proposals to generalize a CBRS style framework usually take for granted the tradeoffs present in the current 3550 MHz CBRS band. But we should not confuse the particulars of that band with the principles of the dynamic sharing system. In a band with significantly fewer incumbency interests, rights amenable to proponents of exclusive, shared, and unlicensed spectrum can coexist within a dynamic sharing system with only a minor alteration: Instead of just protecting incumbents and auctioning PALs that are secondary to the incumbents' rights, the FCC should also auction licenses for the same type of rights the Navy has in the CBRS band. That is, a SAS would manage a three-tiered system in which super-priority licensees (SPLs) can operate at full power and preempt PAL and GAA users.

Table 1: Comparison of spectrum access regimes

Features	Exclusive Licenses	CBRS	ITIF Proposal
Full-power mobile use	✓	✗	✓
Reliable access at all times	✓	✗	✓
Cheaper, second-tier licenses available	✗	✓	✓
Use-or-share to prevent fallow spectrum	✗	✓	✓

This proposal gives everyone what they want. Of all parties, proponents of exclusive licenses see most clearly the sweetheart deal the Navy has in CBRS: Part of their reason for decrying CBRS is that it should hardly qualify as "sharing" when the federal incumbent retains the right to do whatever it wants whenever and wherever it wants. But that criticism is also a description of the characteristics of an exclusive license. Indeed, there have been no reported cases of the Navy experiencing harmful interference within the CBRS framework. Therefore, any party that thinks

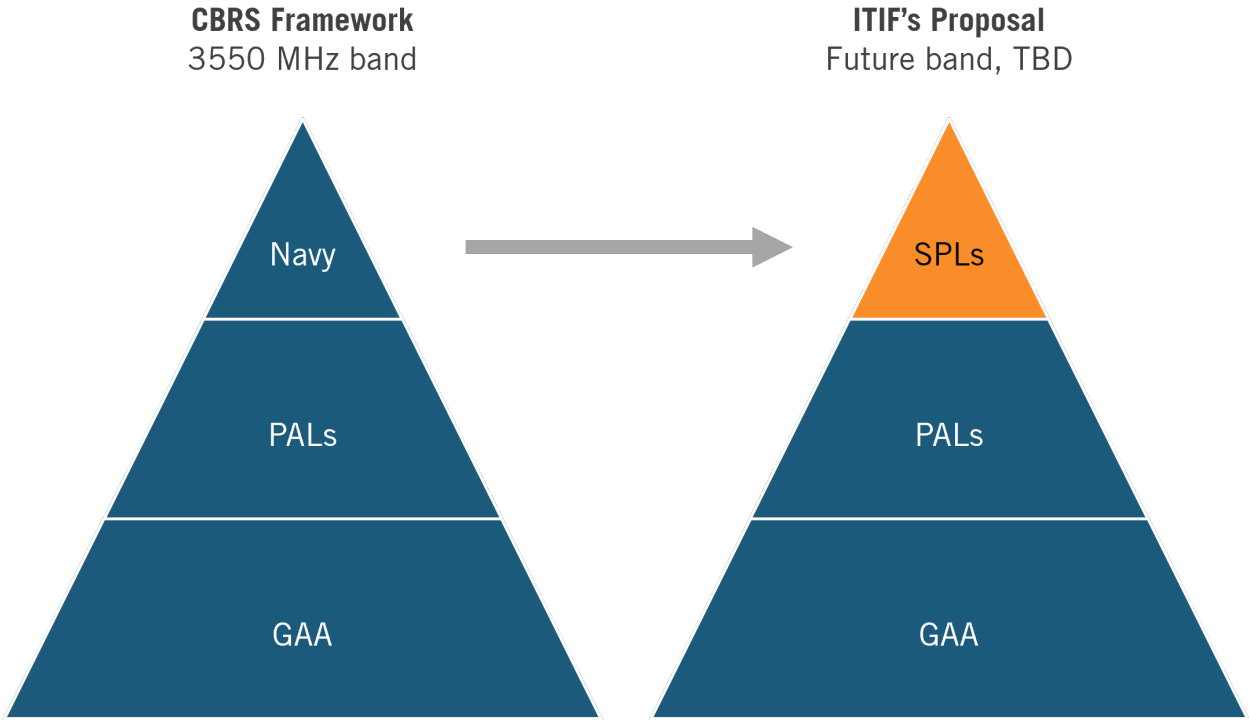
the Navy has reliable, full-power access in the current CBRS band should leap at the opportunity to get the same deal in another band.

Likewise, dynamic-sharing proponents keep everything they like about CBRS under this new proposal. They are adamant that PALs create net societal benefit even when they are subject to power constraints and a full-power super-primary user that could preempt PAL users at any time (often they even pitch those constraints as features of the system). That exact dynamic would persist with PAL users subject to a different top-tier user. These new PALs could also maintain their lower power limits in order to attract bidders that could not afford a more powerful license. Dynamic-sharing proponents are also typically aligned with proponents of widespread opportunistic use of spectrum or "use-it-or-share-it" frameworks.[6] A system in which PAL and GAA access is permitted when the super-priority licensee is not transmitting achieves the use-or-share outcome.

We should not confuse the particulars of the CBRS band with the principles of the dynamic sharing system.

There is, therefore, no contradiction between reliable, full-power access to spectrum and a CBRS-style dynamic sharing framework. Rather, the coexistence of those two states of affairs is a literal description of the CBRS band plan. The only aspect of the CBRS model this proposal changes is the identity of the operator at the topmost of the three tiers.

Figure 1: The CBRS framework vs. ITIF's proposal to designate super-priority licensees



It is true that the benefits of this proposal are inversely proportional to the scale of federal incumbency interests. But not every band has such encumbrances. Therefore, the FCC should consider this kind of framework as a primary option in relatively unencumbered bands, such as 13 GHz, and in bands that could be cleared of federal incumbents pursuant to the National Spectrum Strategy (e.g., 7 and 8 GHz).[7]

POTENTIAL DOWNSIDES OR PERVERSE INCENTIVES

Practical considerations always create complications in spectrum policy. For example, it could be that CBRS proponents like PALs in the 3550 MHz band specifically because the Navy rarely, if ever, preempts them in most locations. If the hypothesized nonfederal super-priority users under the previously mentioned proposal use their rights more intensively, perhaps the benefits of PALs would diminish. While possible, this scenario is no different from the rights of PAL holders today in the 3550 MHz band. The case for PALs being a viable arrangement for productive spectrum use assumes a higher priority user that can kick them off at any time. To the extent that the system breaks down if the Navy or another primary user is more likely to avail itself of those rights, that is an argument against CBRS in general, not against the proposal of this report in particular.

An opposite objection may come from new priority users that are worried that regulators lack the will to truly protect their right to preempt others. There is a history of sympathetic spectrum uses getting protection beyond what their legal status warrants.[8] For example, unlicensed users have no legal right to interference protection yet have been able to at least delay new uses on the grounds that they would have caused interference with Wi-Fi.[9] The recent C-band debacle is another example of spectrum users exceeding the boundaries of their band yet nevertheless blocking use by authorized users for an extended period.[10] This kind of history does create valid concerns that the FCC might cave if PAL or GAA users object to primary licensees exercising their rights. But there are also reasons to think these concerns are less likely to materialize when implementing the proposed system in a new band. For LTE-U and C band, the objecting users (Wi-Fi and airlines) were already active in the bands from which they sought extralegally to exclude others. That would not be the case in a newly created band plan. Since all the rights would be created at the same time, there should be no reliance interests or claims of unforeseeability when super-priority users preempt PAL or GAA users. The limitations on the rights of lower-priority users would be explicit in the rights themselves from the beginning. So while it is important that the FCC make everyone's rights clear at the outset and enforce them regardless of political pressure, there is more reason to think it will do so if it implements this proposal.

Our starting point today is one of gridlock and perpetual studies that remain unlikely to clear significant amounts of spectrum.

A third possible downside of the proposal is the downstream incentives it could occasion. The off-ramp of compromise could short-circuit investigation of whether a band would be more productive if entirely cleared rather than shared. For example, the costs of building and operating a sharing system could, in some cases, exceed the benefits of the additional uses it enables. But a federal user with only limited operations in a band may nevertheless jump at the chance to

preserve that use (by jumping into the super-priority tier) rather than suffer the risk of losing the band entirely. The political ease of a high-power sharing option would make this (potentially) less productive option more attractive. The unseen costs—the alternative uses of resources spent on operating a dynamic sharing system—are difficult for policymakers to prevent in the face of a "bootleggers and Baptists" coalition between federal incumbents and proponents of sharing for its own sake. This dynamic, however, is no different from any other spectrum debate. It is not as though completely clearing spectrum bands is now a common occurrence that this proposal would undermine. On the contrary, our starting point today is one of gridlock and perpetual studies that remain unlikely to clear significant amounts of spectrum. An off-ramp to higher-power sharing options should be viewed as an improvement over the status quo even by those whose first choice would have been truly exclusive access.

LICENSE SIZE

Besides the hierarchy of usage rights, the other primary determinant of who uses a CBRS-style band will be the size of the licenses. This determination stems largely from the fact that PAL and GAA users need empty frequencies in which to operate, which will be more available in places between individual private networks that CBRS proponents often proffer as the prize use case for midband spectrum.[11]

There is a positive correlation between PAL and super-priority license size and GAA availability. It would, however, be a policy failure for license sizes to remain unchanged.

This discussion has been mostly in terms of new primary users versus PAL users. But GAA would retain its benefits under this new proposal. Even under the current CBRS framework, GAA users are subject to the intensiveness of PAL use, so the fact that a different type of user can preempt the PAL licensees and GAA users makes little legal difference. There may be a more significant practical difference in that GAA has been more valuable in areas with few PAL users and no or infrequent Navy preemption. Such cases are partially a function of the county-sized CBRS licenses: The flagship uses of PALs have been pitched as private networks in venues such as factories and hotels.[12] These types of buildings are often large but much smaller than counties. This mismatch of size may make the PAL more expensive than the factory or hotel owner would like, but it also creates more empty frequencies in more geographic areas for GAA users. If, on the other hand, licenses were much smaller, perhaps census blocks as initially proposed for CBRS, the PAL users would likely take up a greater proportion of available frequencies in a license area at any given time.

In that sense, there would be a positive correlation between PAL and super-priority license size and GAA availability. This proposal, however, is compatible with a variety of license sizes and even with differing sizes between super-priority licenses and PALs. Indeed, the fact that PALs would not have to straddle compatibility with both private and commercial mobile networks could make small PALs nested within larger super-priority license areas a productive option.

It would, however, be a policy failure for license sizes always to remain unchanged once issued. The simplicity of uniform license sizes makes initial allocation easier but can result in inefficiencies down the road. The ability to partition, disaggregate, and lease portions of licenses is essential to the overall productivity of a band allocated nationwide. Diverse use cases will call

for customized license sizes, and the FCC should seek to lower transaction costs so that it is easy for parties to make such deals.

APPLICATION TO 13 GHZ

A good test case for this idea would be the 12.7–13.25 GHz band (13 GHz band), as it is a band without overly complicated incumbent interests.[13] Still, the record shows the traditional camps arguing for dynamic sharing or exclusive access rights for their own sake.[14] Rather than pick one or the other, the FCC should be able to protect or relocate/repack incumbents and still have significant wiggle room to craft a policy for new commercial use.

The band would be a good test case for this new proposal because it is close to being midband but higher than core midband spectrum (e.g., the 1–4 GHz range). Since higher frequencies propagate less far at a given power level, the propagation characteristics of this band mean it is less likely to be used for constant, wide-area coverage, at least with current technology. These factors mean that 13 GHz is an opportunity for all levels of the CBRS pyramid to play a role in maximizing its productivity, rather than the super-priority user being always on such that the cost of running the SAS never results in greater access. Given its shorter propagation, there is good reason to start with smaller license sizes than the counties used at 3.5 GHz. An experiment with this allocation regime in 13 GHz will provide data and experience with how the CBRS system works in this band, how the market reacts to the license sizes and different levels of priority, and how consumers and businesses use the capacity it makes available.

CONCLUSION

Since it is now likely that spectrum sharing will often be the best way to maximize commercial access to spectrum, the FCC should start experimenting with alternative sharing regimes to find those that best provide the conditions for productive spectrum use. Fans of dynamic sharing and exclusive licenses often perceive their preferences as unreconcilable, but the instant proposal is a way to provide the certainty of exclusive licenses with the lower-power, small-area PALs and GAA use that dynamic sharing proponents prefer. To be sure, there will always be room for improvement, and any new dynamic sharing system should take advantage of pending improvement to CBRS.[15] These incremental improvements will only increase the productivity of this proposal and push us further toward spectrum abundance, as opposed to zero-sum, win-lose allocations.

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ENDNOTES

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