

Overlay Rights for Transitioning Spectrum Use¹

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This comment is in response to the NTIA Document “Development of a National Spectrum Strategy”. The demand to implement reforms facilitating smoother, faster transitions of spectrum use, including the opening of new opportunities for wireless innovations, is intensifying due to the proliferation and growth of spectrum-based business models, applications, networks, and technologies. This has clear implications for U.S. competitiveness and the health of the American economy. Crucially, superior spectrum allocation mechanisms will enhance the ability of the wireless sector to supply public services, enhancing social welfare.

This Request for Comments (RFC) poses the questions: "Are there market-based, system-performance based or other approaches that would make it easier for federal agencies to share or make spectrum available while maintaining federal missions? At the same time, what mechanisms should be considered to meet some of the current and future federal mission requirements by enabling new spectrum access opportunities in non-federal bands, including on an ‘as-needed’ or ‘opportunistic’ basis?"

Our short answers to these two questions are, respectively, “yes”, and “auctions for overlay rights”.

Centralized versus Distributed (Flexible-Use) Spectrum Allocation

Implicit in the discussion of the RFC is a top-down, centralized approach to spectrum management: NTIA seeks to catalog specific “use cases” to estimate the bandwidth needs of rival wireless applications, and to discern the “timelines” for deployments. Regulators would then examine submitted data to compare and contrast emerging technologies and access methods, judge contributions generated by each, and examine select bands for reallocation, augmenting or reducing frequencies dedicated to particular services. Decisions are ultimately based on assessments of the effectiveness of current assignments, utilizations, and prognostications for future alternatives.

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This administrative approach – *business as usual* – faces several major challenges that impede efficient, socially-useful spectrum allocations: the rapid and uncertain pace of evolving technologies and business models, changing demands (absolute and relative) for spectrum-related applications, and difficulties in collecting and evaluating reported spectrum needs by stakeholders who often have an incentive to distort their estimates while ignoring opportunity costs and regulatory transaction expense. It has been long observed that centralized management of spectrum resources has led to rigid rules, sub-optimal allocations, and long delays in making bandwidth accessible to valuable new technologies ([Rostow 1967](#); [Pool 1983](#); [FCC 2010, Chapter 5](#); [Hazlett 2017](#)).

We encourage the NTIA and other policy makers to consider methods for spectrum sharing based on decentralized decision making and a “bottom-up” approach in which stakeholders and new entrants negotiate directly for spectrum assets without having to obtain regulatory permissions. This type of market-based approach has been enabled in particular instances by a series of liberalization initiatives undertaken by federal regulators over the past several decades. Its key enabling characteristic consists of reforms that establish “flexible-use” spectrum rights, and assign them to responsible parties. While these parties have often been private firms bidding in license auctions held by the Federal Communications Commission (FCC), the institutional method is widely applicable and can accommodate a variety of organizational structures and rights formulations.

Flexible spectrum access rights distributed in the marketplace provide incentives for economic agents to develop technologies, products, and business models that assist in discovering emerging options and in then optimizing the use of spectrum resources. That has given rise to the entire cellular ecosystem encompassing technology suppliers, software and app developers, device entrepreneurs, service carriers, and government regulators (as in auctions). Spectrum rights-holders have the ability to collaborate with these players to enable gains from trade, price discovery, and cost-benefit analyses for optimizing resource utilization. Additional complements that enhance long-term returns derived from spectrum assets include the development of wireless network infrastructure, financing arrangements, and research and development. The creation of such institutions supports feedback loops that reward efficient innovations or operations while discarding alternatives.

The introduction of flexible-use, tradeable licenses has also enabled the complex evolution of mobile cellular networks, providing evolving services that have generated hundreds of billions of dollars in U.S. GDP. That has in turn driven technological, business, and social innovations that have dramatically increased spectral efficiency (data rate per unit bandwidth), network throughput, and decreased latency, enabling still

more gains within the wireless sector and throughout the economy. Flexible use licenses have accommodated experimentation and discovery, driven by market forces and price revelation, replacing centralized regulatory decisions [[Powell](#)].

Flexible Use via Overlay Rights

What lessons from the instructional social success of cellular networks can be applied to federal use? How can market mechanisms be exploited without compromising the mission of federal agencies?

We propose that the NTIA consider the widespread, systematic introduction of flexible overlay rights. Acquisition of an overlay right for a particular band, or set of bands, would enable the new licensee to strike voluntary deals with incumbent licensees, granting spectrum access to the entrant. The “overlays” specify the geographical, time, and frequency scope of new rights, as well as the incumbents’ rights “vested” and thereby encumbering the overlays. Winners possess secondary rights to utilize incumbents’ frequencies (in essence, negotiating rights with such licensees) as well as primary rights to unoccupied frequencies within the overlay (for example, guard bands between broadcast TV channels). A fairly generic approach to utilize such a policy is given in [Hazlett 2014](#).

A simple version of an overlay right might grant a particular incumbent flexible use of its spectrum, including the possibility of accepting a buy-out of their access rights, ending the incumbent’s operation in some or all of the band. At the other extreme, the incumbent could choose to reject any bid to share, and continue the status quo operation of the band. In between are a range of possibilities for dynamic coexistence across subsets of frequencies, time intervals, and locations. The important element is that property rights are defined such that multiple parties can effectively construct win-win opportunities, rather than fragmenting rights such that transaction costs block production coordination or defining the rights so narrowly as to force regulators to decide sharing rules.

Overlay rights can be assigned via encumbered licenses sold at auction; examples where forms of overlay rights were used to transition radio spectrum allocations to new, higher-valued uses are:

- The 1994 reallocation of the Emerging Technologies for Personal Communications Services (2G) (relocating microwave incumbents);
- The 2006 reallocation of Advanced Wireless Services following FCC Auction 66 (relocating numerous government users);

- The 2022 “overlay license” award of access rights in the 2.5 GHz band in FCC Auction 108.

In addition, flexible use rights played a key role in the following reallocations:

- 2016-17 “Incentive Auction”: bids for new flexible-use spectrum rights financed broadcast TV stations’ relocation from the 1952 TV Table;
- 2020-21 satellite C-Band reallocation in FCC Auction 107: bids for new flexible-use spectrum rights financed incumbent licensee measures to economize on bandwidth;
- Continual upgrades to U.S. mobile networks: flexible use licenses have allowed deployment of successive generations of 2G-5G technology.

Coordination of interested parties can occur both before official bidding begins and post-auction. In particular, bidders can form contractual coalitions with groups of incumbents to aggregate spectrum rights prior to bidding. The “Incentive Auction” approach pursued by the FCC in 2016-17 shows how the rules may be adjusted to reflect regulatory assumptions about transaction costs (see [Rosston & Skrzypacz 2021](#)).

We emphasize that the negotiations for spectrum access by the new entrant may or may not involve two-sided profit-seeking. In the case of a federal agency with assigned spectrum, the agency may not be able to capture monetary compensation. Rather, consideration to the federal user could take the form of in-kind contributions such as equipment upgrades, having the new entrant cover relocation costs, or a services contract guaranteeing the new wireless provider supply future services for the agency.

An example is the public-private FirstNet partnership, wherein a private mobile network (AT&T) supplies emergency radio communications to public safety organizations in exchange for a mix of spectrum rights, federal cash subsidies, and subscription fees paid by agencies using network services. It is also noteworthy that the classes of users receive different levels of priority. When first responders demand additional spectrum resources, as occurs in a natural disaster or terrorist attack, public safety organizations are automatically granted extra network capacity, while service quality for standard commercial users may be downgraded to supply such resources. This sharing of infrastructure and bandwidth delivers both mobile services to millions of ordinary civilian subscribers (whose support enables construction and maintenance of a state-of-the-art radio communications service) and simultaneously supports vital public safety radio.

Why Overlays with Flexible Use?

The primary rationale for overlay rights is that they allow market forces to determine if a band continues to support the same application, is transitioned to another use via clearing, or supports coexisting services and applications. Here we outline some of the associated benefits.

- *Allocations are determined by market forces.* By allowing stakeholders to bid on overlay rights, and negotiate directly with incumbents, allocations are determined by supply and demand for different types of spectrum assets. Stakeholders interested in a particular band will have an incentive to bid on or negotiate for use of a frequency space based on expected value. Furthermore, as mentioned, an auction for flexible overlay rights provides incentives for agents and stakeholders to bargain: pre-negotiations occur before the auction when a bidder wishes to aggregate disparate bands for a particular application (say, broadband access); post-negotiations can occur after the auction to bundle or otherwise coordinate assignments to create higher values across a range of possible applications.
- *Access methods and technology options are evaluated in terms of costs/benefits.* Overlay rights allow an incumbent and entrant to consider rival approaches for using a band including coexistence according to predefined rules, which may change dynamically. Those may encompass methods such as the three-tier coexistence approach of the Citizens Broadband Radio Service (CBRS) utilizing 3.5 GHz frequencies, along with different ways of dividing the band across time/frequency/locations combined with various priority rules. Cooperation then arises organically as the result of cost-benefit calculations by stakeholders, e.g., comparing the cost of moving the incumbent to the perceived benefits derived from less constrained use by an entrant. While a centralized approach may attempt to estimate such trade-offs, estimations are limited by incomplete information, rent-seeking interests, bureaucratic constraints, externalities, and the lack of reliable feedback mechanisms to evaluate marketplace results.

As an example, consider CBRS. A current dispute has arisen between parties pointing to rapidly increasing deployments of CBRS [[Federated](#)], [[TAC](#)] and those claiming the band is under-utilized [[CTIA](#)]. An alternative would have been to grant overlay rights that allow parties the ability to craft their own coordination mechanisms and to negotiate directly with priority incumbents (e.g., the U.S. Navy). In that way, alternative systems for radar services (saving 3.5 GHz band spectrum in whole or in part) could be considered, priced, and evaluated. Superior options may have emerged, given the incentives of multiple parties to discover opportunities and to split the gains. We note that other countries

deploying 3.5 GHz frequencies have overwhelmingly adopted distinct rule regimes, relying on standard flexible-use license rights. The utilization of those approaches can be examined and contrasted with the U.S. experience.

- *Flexible use rules enable economic calculations that account for opportunity costs of inefficient spectrum use.* Spectrum is typically one of several inputs used to accomplish a particular output objective. In general, there exist tradeoffs such that different combinations may be utilized; the search for efficiency pursues such options to find the optimal mix.

For example, a scientific user engaged in passive sensing is typically assigned a fixed band which is protected from interference. Flexible overlays would allow that user to trade spectrum for equipment upgrades, possibly shifting some activities to other bands where access rights were obtained via deals with primary or secondary rights holders. In this way the scientific user can maximize the benefit from its assigned spectrum by allowing coexistence at times and locations where its measurements will not be impacted. That provides an incentive for the scientific user to search for spectrum economizing possibilities, to evaluate the opportunity cost of spectrum relative to the benefits of equipment and staff, and to optimize its budget across these inputs. Furthermore, overlays in other bands provide the opportunity for a scientific user to consider the adoption of additional bands in its optimization process.

- *Overlays allow negotiations to limit adjacent channel interference.* Flexible overlays across neighboring bands allow an entrant interested in a particular band to negotiate with neighboring service providers to limit conflicts. Those conflicts potentially flow in either direction, that is, the entrant's desire to limit interference from transmitters in adjacent bands and the desire of incumbents in adjacent bands to limit interference generated by the entrant.

Transaction Costs

Overlay rights come with transaction costs, as do all mechanisms governing spectrum access. The question is: how do those transaction costs compare to the relevant alternatives? Flexible-use licensing has been seen by regulators to provide rapid transitioning to new applications and technologies that add substantial social value (see, e.g., [Kwerel and Williams 2002](#)). In contrast, regulatory procedures for centralized reallocations remain arduous and time-consuming. The FCC has itself estimated that delays of 6-13 years are standard under the standard spectrum allocation process [[FCC 2010, Chapter 5](#)].

The design of an overlay right for auction should anticipate transaction costs associated with multi-party negotiations, and help to mitigate them. An overlay right that covers multiple bands with different incumbents makes it easier for a service provider to aggregate spectrum for applications such as broadband access. However, that may increase transaction costs for partitioning the band later. Similarly, assigning separate overlay rights across many different bands increases transaction costs for aggregating the fragmented rights. Ideally, overlays can be defined to balance these offsets. Defining flexible overlay rights, assigned through auctions, is an evolving approach to facilitate coexistence through multi-party negotiations, recognizing the significant role economic agents play as key sources of information and innovation in spectrum use.

Summary

Overlay rights with flexible use would often support more effective use of spectrum resources by allowing for superior discovery of win-win coordination in reallocations; for incentivizing licensees and potential licensees to cooperate; and provide a flexible structure for expanding transactions to include commercial, private non-profit, and public organizations. The essential contribution would be to institutionalize platforms for coordination, allowing parties otherwise in regulatory conflict to imagine creative ways to optimize among the many choices available. Allowing market forces to play a major role in determining band use and technologies, including coexistence protocols, provides an alternative to centralized mechanisms lacking effective feedback mechanisms. Overlay rights have been used to transition spectrum to more effective uses with relatively low transition costs in multiple instances, and have proven a flexible format across numerous applications. When granted flexible-use spectrum rights, service providers gain incentives to efficiently develop and adapt emerging technologies. Overlays deserve a prominent role in any serious strategy for better enabling Spectrum Policy to serve the U.S. economy and the interests of the American public.