Abstract

Fundamental policy issues of how spectrum is allocated and assigned -- spectrum apportionment -- are increasingly the focus of attention within the Federal Government, including the National Telecommunications and Information Administration. Growing demand for the radio frequency spectrum, by both current users and proposed new services, requires national policies that ensure that spectrum use and management continues to be as efficient and fair as possible. The current spectrum management process performs reasonably well, given the large number of competing users and often conflicting goals. It is an "administrative" strategy that relies primarily on centralized government decisions to make apportionment choices. Alternative strategies giving more choice to users and relying more on features of a competitive market have been proposed, and in some cases, adopted, over the years. This paper explores current and proposed strategies for apportioning spectrum and examines, among other things, flexible use proposals, the effect of placing economic value on spectrum, and proposals to "lease" government spectrum to the private sector. The strategies may pave the way to a system of spectrum management for the 21st century.

Strategies for the 21st Century

Questions of spectrum availability and accessibility are emerging as some of the leading communications policy issues of the 1990s. These issues underlie debate surrounding more publicly prominent questions, such as whether and how to provide spectrum for Advanced Television (ATV) and personal communications networks, the degree to which the nation values services such as broadcasting, and whether the U.S. Government has surplus spectrum to make available to other users.

Fundamental spectrum management issues are being raised throughout the federal government. Legislation is pending that would require the federal government to identify 200 MHz of spectrum it now uses which could be reallocated to non-federal users, and which would establish a private sector advisory committee to review spectrum management. At the Federal Communications Commission (FCC), which carries the burden of non-federal spectrum apportionment, Chairman Alfred Sikes has identified spectrum as one of his top priorities. And at the National Telecommunications and Information Administration (NTIA), Administrator Janice Obuchowski considers issues of spectrum management of greatest importance; NTIA is reviewing these issues in a "Comprehensive Policy Review of the Use and Management of the Radio Frequency Spectrum." The authors are participating in that review as members of NTIA's domestic policy staff and will review some aspects of that study below.

The answers to the questions now being asked by NTIA and others will shape spectrum use for the 21st Century. Yet, to anyone familiar with the history of spectrum management, there is nothing new under the sun -- these same issues have plagued spectrum management from the beginning of radio, modified only by the specific context and the technology of the day. The issues have been addressed in policy studies of spectrum management conducted approximately every twenty years. One must ask whether we are repeating another cycle of spectrum management review followed by modest adjustment, or whether, as with the energy crises of the 1970s, increasingly heavy demand coupled with rigid national policies are moving us slowly toward a crisis in spectrum availability.

Historically, spectrum management policies were tuned to minimizing interference among radio systems and creating an efficient structure in which demand for spectrum could be met. Interference reduction and spectrum efficiency continue as the core of spectrum management and EMC today. In addition, however, spectrum management in the United States reflects an attempt to ensure that spectrum use meets the "public interest," and that basic spectrum decisions are fair.

Today, spectrum is a battlefield for competing interest groups vying for access. Many parties, particularly incumbent spectrum users, are satisfied with the present system and are interested primarily with retaining spectrum already within their control. Others have proposed changes in the way in which spectrum is apportioned. Many of these proposals involve moving away from an administrative system toward one in which users have greater effect on spectrum use. These proposals often involve granting some degree of additional rights to spectrum users, as well as placing a value on the spectrum itself.

The purpose of NTIA's Spectrum Study is to help determine whether current spectrum management practices need to change and, if so, which spectrum methods might best meet the goals mentioned earlier. This study is in the "analysis" stage, we are examining comments from more than 90 organizations and individuals, and numerous reply comments. What follows is a review of some proposed alternatives for apportioning spectrum that could be examined in the Spectrum Study.

Scenario for Change: Administrative Versus Market Strategies

In apportioning any scarce resource, there are a variety of ways to "slice the pie." All spectrum
apportionment decisions are a result of either explicitly or implicitly ranking applicants. Under any system, therefore, some applicants may get a large slice of pie, while others may get none.

Alternative approaches range from “administrative” to “market-based.” By administrative we mean planned systems that rely on governmental or quasi-governmental bodies to make apportionment choices. Conversely, a market-based system is one that relies on features of a competitive market to make such choices.

One way to visualize this distinction is by comparing spectrum management with the way land use is governed in this country. If you treated real estate the same way the government treats spectrum, there would be a “Federal Land Commission.” You could apply for a license to use a piece of land for one specific purpose -- growing corn, for example. If the demand for corn fell, but the demand for soybeans rose, you could not grow soybeans or wheat or tomatoes or anything else on the land without first going through a long administrative process. Nor would you be permitted to increase the land’s efficiency by engineering in an “agriculturally compatible” crop (along the land’s borders or between rows of corn).

This example may sound farfetched, but according to Ashton’s Economic History of England, half the arable land in England was held in “open fields” or village commons as late as the year 1700. By 1800, Parliament had transferred most of that land to private owners. While the motives involved were complex, one of the most important reasons was that common fields were too inefficient to feed the country’s agricultural economy not only fed a population that had grown by two-thirds in one century, it helped ignite the industrial revolution.

Of course, private property is not without regulation. Zoning and other land use laws, for example, ensure compatible uses within specified areas. Numerous bodies and procedures, ranging from block associations to courts of law, govern the compatibility of neighbors. And large tracts are set aside for socially beneficial uses such as parks and military reservations.

We are all familiar with the “public trust” concept of spectrum management, embodied in the Communications Act of 1934. Like a village commons, spectrum belongs to the people, who entrust it to selected “fiduciaries” who have licenses that set strict conditions for its use. The current system of spectrum management is “administrative” because domestic and international organizations generally determine what they perceive to be the most efficient and fair spectrum use through an administrative process. This system apportions spectrum reasonably well, given the number and complexity of issues to be determined.

Within this administrative structure, the practice of setting aside “blocks” for use by particular services has several benefits. Among other things, it allows relatively simple interference avoidance procedures, protects services considered to be socially desirable “public interest,” encourages national and international uniformity, and design certainty for manufacturers, and provides reserves for future use. These positive attributes come at a cost: The same factors that ensure certainty also create rigidity. In a rigid allocation scheme, spectrum efficiency is obtained only within the particular service or technology of a block. Users have little incentive to change, while new technologies and services may develop that do not satisfy the requirements of existing blocks. Although the current system is primarily administrative, it incorporates mechanisms to allow for greater flexibility.

A major question to be addressed in NTIA’s Spectrum Study is the degree to which a move to a less administrative and less rigid allocation and assignment system will benefit spectrum management. Proposals made over the past decades generally involve a combination of two factors, the degree to which spectrum users may decide how spectrum will be used, and the effects of placing an economic value on the spectrum. These are addressed separately below.

Allowing for More Flexible Use

To meet the needs of new technologies and services that may be incorporated into existing blocks, flexible use proposals focus on encouraging flexibility in spectrum use, without substantially overhauling the current spectrum management system. The FCC has been moving toward permitting greater technical flexibility within frequency blocks, while not changing the block allocation system in its entirety. It addressed some congestion concerns by permitting certain new systems that employ advanced technologies more flexible technical standards. For example, cellular radio providers may install cellular technology that is neither based on older technical specifications nor otherwise defined by the FCC’s regulations.

Other proposals would permit the operation of multiple systems in one frequency block as determined primarily by users. The FCC already allows broadcasters to offer “auxiliary services” on their assigned frequency when the primary services they provide remain unchanged. Thus, FM stations may use their so-called subsidiary communications authorization (SCA) for both broadcasting and other non-broadcast uses such as paging.

A 1985 proposal would have taken flexibility a step further by giving some UHF television licensees more choice in determining how to use their assigned channels. This proposal would allow licensees to decide whether to (a) maintain certain neighboring channels as “unused” for interference protection, (b) operate other services (such as land mobile) in those channels, or (c) allow others to operate on those channels. The proposal is on hold while the FCC completes its ATV inquiry. In a separate proceeding, the FCC has suggested granting AM broadcast licensees permission to reduce interference by mutual agreement.

Such “flexible use” proposals have a certain amount of intellectual appeal, because they would allow the market, at least in some limited ways, to guide the process of apportioning spectrum. Yet some have questioned whether such proposals are in fact workable, and even if so, whether their utility is limited to the circumstances of UHF television
broadcasting, where the FCC has made the most comprehensive flexible use proposals.

**Economic Methods of Providing Increased Flexibility**

Another method of increasing flexibility and user rights in allocating spectrum, and one with which this audience is obviously familiar, relies on the avoidance of interference as its apportionment criterion. This can be used to make the existing block allocation system more flexible by responding to the introduction of new technologies on the basis of whether they meet technical “interference limits.” For example, radio services could be allowed to operate within a given band of frequencies, with limitations only on emissions outside of the band or out of the user’s authorized geographic area. As long as any station in any service does not affect the spectrum in another service by more than a predetermined interference limit, that station would be acceptable. The system the New Zealand government is planning to adopt relies on such definitions of interference limitations.

An example of a system based on “interference criteria” is one that operates today for assignments in the Low Power Television (LPTV) service. Each new LPTV station is “engineered” into the existing assignments, with new locations defined on the basis of predicted desired-to-undesired (D/U) signal strength at the edge of the stations’ service areas. This provides more flexibility since the location of stations is not predetermined, but is designated to fit into the service areas of existing stations. Of course, this process would be somewhat limited since the technical characteristics of certain types of services may preclude the operation of other services within the same band. This could be accommodated in previously unavailable frequency bands.

**Effect of Placing Economic Value on Spectrum**

The essential feature of all proposals to manage spectrum through a market system is the attempt to establish spectrum’s economic value to the user, and use that as a criterion for apportionment. Under such proposals, decisions concerning spectrum use would be based, at least in part, on a user’s willingness to pay for spectrum, rather than on administrative determinations of what constitutes appropriate allocations for types of service or assignments for individual users.

**Incentives for Efficiency**

Under a market system, allocations of spectrum could increase for uses with the highest economic value to society and decrease for those with the lowest value. When users are paying for spectrum, they have incentives to employ the technology efficiently by not seeking more spectrum than they need and deploying cost-effective spectrum-conserving technology. This would add flexibility by allowing usage to change with technology and consumer demand.

Such a system could also be administratively less burdensome than comparative hearings, and under some proposals, could be self-regulating, requiring fewer management resources. Although there is some sense that a market-based process would be highly decentralized, some say that it could require greater resources than the present system to perform the basic tasks of spectrum management: limiting interference and protecting the rights of users.

Another factor that often affects discussion of market-based systems for spectrum allocation and assignment is that they could also produce significant revenues for the public Treasury.

Regardless of the revenue-generating possibilities, an immediate challenge, and one that is crucial to the operation of a market, is how to set a price for spectrum. Fees have often been proposed, but are at best an imprecise estimate of market value. One well-worn idea is to allow potential spectrum users to bid on available frequencies through auctions conducted by the FCC.

**Equity and Fairness**

Despite arguments emphasizing the efficiency of market-based systems, there are some who say use of market principles is not fair and effective and that, among other things, users with “deep pockets” would have an unfair advantage. There is also concern whether the “public interest” standard of the Communications Act would be satisfied if there were wholesale conversion to market principles as the basis for allocating spectrum or assigning frequencies. For example, comparative hearings for broadcast licenses consider “non-economic” public interest factors to promote social goals. Furthermore, the present system is designed to accommodate socially desirable uses such as public safety communications and remote sensing of weather that might not compete successfully in a market environment.

**Additional User Rights**

Proposals to apply market principles in spectrum management generally consider the concept of unambiguous and enforceable spectrum “property rights” that would help establish a “market” for spectrum, in which spectrum could be more or less freely transferred at a price, and purchasers would have at least some ability to determine spectrum use. Such transferrable rights, it is argued, would permit a true market in spectrum to develop in which the value of various parts of spectrum would be determined through their sale, initially by the government.

Currently, an FCC license grants no recognized property right in spectrum. A licensee may not “buy” or “sell” its license or spectrum rights. In actual practice, however, existing licenses have substantial monetary value on a “secondary market” among private users, and are bought and sold in what have been called “private auctions” because licenses are transferable. Some estimates are that over 65 percent of commercial television stations and 75 percent of commercial radio stations are not owned by the initial licensee, with similar turnover in the newer cellular and SKS markets. While such transfers are subject to FCC review and approval, it is rare for such a license transfer to be disapproved. The spectrum assignment represents a substantial part of the value of the overall transaction in such cases.

Recognizing spectrum’s economic value in the existing “spectrum market” could support arguments that the federal government has a legitimate role in recovering at least part of that value for the American people.
Although a case can be made that broad spectrum property rights are necessary to an effective market-based apportionment system, some object that instituting property rights for spectrum users would be a major and unwarranted departure from the traditional "public trust" theory of spectrum management. Issues include the fairness of such a move, which would alter the current status of license holders as "fiduciaries" of the public. FCC actions such as license revocations, refusal to renew, and denials of transfers of licenses although all rare, do occur and could deter behavior by licenses that is inconsistent with the public interest.

Leasing Government Spectrum

One novel method of exchanging property rights discussed in the NTIA study is the assessment of a fee for use of a particular portion of spectrum, in exchange for the right to operate on that spectrum for a defined duration -- in effect, a "lease" of spectrum.

Such an approach may be an appropriate way to make spectrum currently allocated for federal use available to the private sector, while maintaining the government's ability to reclaim the spectrum at a later date if needed. The process would be akin to Federal Government leases of various economic rights to resources, such as rights to oil, minerals, grazing land, timber, or water. If well-designed, these leases could permit economic use of a valuable resource by the private sector while preserving the rights and interests of the government in the underlying property, and could serve the interests of both the private and public sectors.

In the present context, federal leases potentially could provide spectrum for valuable commercial purposes while still allowing the government the right to reclaim the spectrum if future demands or critical public purposes, such as national defense or public safety, so require.

Leases might also provide an attractive alternative to innovators and entrepreneurs who find it difficult to obtain any spectrum under the present regulatory system, but who might not be able to afford "purchase" spectrum in an alternative system based on auctions.

Conclusion

It is apparent that each of these options to change spectrum apportionment strategies needs to be considered in full detail and will require considerable thought and input from the public. At a minimum, we hope to achieve a balanced set of recommendations on ways to evolve spectrum management techniques to accommodate changing spectrum needs. At a maximum, these recommendations would help pave the way for a system of spectrum management that would serve us well into the 21st century.


