

Using Market-Based Spectrum Policy to Promote the Public Interest[‡]

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I. Introduction 88

II. Background 88

III. Discussion 91

A. Competitive Markets 92

B. Flexibility 99

C. Public Interest and Market Failure Considerations 103

D. Licensing and Fee Policies 107

E. Administrative Certainty 111

F. The Global Marketplace 112

IV. Conclusion 115

I. Introduction

Spectrum is a public resource that supports a variety of uses. A principal statutory responsibility of the Federal Communications Commission (FCC or Commission) is to maintain authority and control over spectrum in order to ensure that the spectrum is utilized for the benefit of all the nation's citizens and in a manner that serves the national defense and promotes the safety of life and property.¹ In recent years, this function has taken on increasing urgency and difficulty as technological, economic, and legal developments have increased both the demand for spectrum and the amount of usable spectrum within the Commission's jurisdiction. Furthermore, the Commission now has statutory authority to assign spectrum through the use of competitive bidding in many circumstances, thereby increasing its ability to rely on market forces to attain the best use of spectrum for the benefit of consumers.² Given these developments, it is timely to consider the Commission's overall spectrum policy objectives and how those objectives can best be promoted using the tools available to the Commission.

In this Article, the authors propose a series of principles and ideas that we believe should inform the Commission's future decisions regarding spectrum policy. As elaborated below, we believe the Commission should continue and expand upon the initiatives it has already taken to adopt spectrum policies that promote competition, allow maximum flexibility, encourage technical efficiency, promote innovation, facilitate seamless networks, and maximize the amount of spectrum available for use. In this way, the Commission can attempt to ensure that spectrum will be used to provide the greatest benefit to the public.

This Article is intended to stimulate discussion and critical comment both within and outside the Commission, with the ultimate goal of helping the Commission, spectrum users, the consuming public, and other interested parties to address current and future spectrum policy questions in the manner that best promotes the public interest.

II. Background

A principal reason that Congress established the Commission more than sixty years ago was to manage the radio spectrum so that the public could receive maximum benefit from its use.³ Prior to 1927, licenses to use radio spectrum

were granted by the secretary of commerce, who also had the power to designate frequencies for particular radio services. The courts held, however, that the secretary of commerce did not have the authority to deny licenses on the ground that they would cause interference, nor to limit licensees' power, frequency, or hours of operation.⁴ As a result, the airwaves became filled with interfering signals, severely compromising the ability of any spectrum user to make use of the spectrum.⁵ To remedy this situation, Congress enacted the Radio Act of 1927,⁶ the substantive provisions of which were later incorporated into the Communications Act of 1934,⁷ which established the Commission. Under the Communications Act, the Commission has broad authority, consistent with the public interest, convenience, and necessity, to license users of radio spectrum; impose conditions on their licenses; prescribe the nature of the services to be rendered by stations or classes of stations; and prevent interference with licensees' authorized uses of spectrum.⁸

In 1945, the Commission articulated a series of principles that guided its early spectrum allocation decisions.⁹ These principles reflected a paradigm under which the Commission actively determined the best use for each block of spectrum and assigned spectrum according to specific criteria. Thus, in determining which of several services would be permitted to operate over a particular frequency band, the Commission sought to evaluate whether any service would be better provided over wireline telecommunications facilities, which services were most important, how many people would benefit from each service, and which services would be most accepted by the public. In addition, the Commission considered the propagation characteristics of different frequencies, as well as the extent to which the industry and the public had already invested in equipment to use particular frequencies for specific services.

As a result of developments in technology, new services, such as two-way switched mobile voice communications, have become available that were barely imagined in 1945. Unlicensed devices, such as cordless phones and garage door openers, have proliferated. Global satellite systems that require an unprecedented level of international coordination are being offered. Technology has enabled services to be offered over progressively higher frequencies that were once thought to be unusable. On the one hand, digital and other technologies have made it possible to offer some services using ever narrower bandwidths, while on the other hand, new services are envisioned that require increasingly wide bandwidths. Spread spectrum technology has raised the possibility of several users, or even several services, independently sharing wide frequency bands without interference. Furthermore, technology and the market will continue to develop rapidly for the foreseeable future in ways that cannot reliably be predicted. The Commission's current spectrum policy decisions therefore should incorporate sufficient flexibility so as not to constrain these future developments or favor particular technologies.

Over the years, the Commission has recognized that its previously articulated principles are no longer adequate to guide spectrum policy, and it has moved away from the philosophy implicit in those principles toward an approach that is more attuned to the operation of market forces. In particular, the Commission has relied less on administrative efforts to determine the best uses of spectrum. Instead, it has allowed service providers increased flexibility to respond to incentives communicated by the marketplace for the efficient production of diverse services that consumers want and need. The Commission should make clear that it will follow this approach in a consistent manner and resist pressure from those who urge the Commission to restrict market forces in order to protect their private interests rather than to promote the public interest. The Commission has also sought and obtained the legal authority to award licenses by competitive bidding, and it has used that authority to assign licenses in an efficient, market-based manner. Additionally, on March 5, 1996, the Commission convened an en banc hearing to address spectrum policy issues. At that hearing, four panels of experts offered testimony regarding future spectrum demand, technology trends, spectrum allocation, and spectrum assignment.¹⁰ Finally, we should note that many of the proposals discussed in this Article reflect and extend ideas developed in prior research by Commission staff.¹¹

III. Discussion

The radio spectrum is a valuable natural resource with unique characteristics. Spectrum may be used more or less efficiently, but it cannot be created or destroyed. Unlike many natural resources, spectrum is inexhaustible over time; the manner or degree to which spectrum is used at one moment has no physical impact on the availability of spectrum at any other moment. At any given time and location, however, the amount of usable spectrum is finite. Thus, any use of spectrum necessarily precludes or affects, to a greater or lesser degree, some other simultaneous use of the same

spectrum. There is no known means by which spectrum can be made infinitely available to all who may wish to use it.

Pursuant to the Communications Act, the Commission's overriding mandate is to promote the public interest.¹² In order to achieve this end, Congress has made clear that the United States shall maintain control over spectrum within the nation's jurisdiction, and that a license to use spectrum shall not constitute ownership of that spectrum.¹³ We believe the public interest is best served by ensuring that the American people receive the maximum benefit from the spectrum resource. Therefore, the Commission's spectrum policy should advance the goal of ensuring that the full benefit of the spectrum resource accrues to the public and the goal of achieving the most beneficial uses of spectrum.

The public may benefit from the use of spectrum in a variety of ways. One form of benefit occurs when government agencies maintain control over spectrum and use it for public purposes, such as national defense or public safety. The public may also benefit when private users of spectrum are required to use that spectrum in ways that serve the public interest.¹⁴ While these uses may yield public benefits, these benefits may be lower than the benefits to be achieved from treating spectrum like other inputs in the provision of public and private services. As discussed below, mandated use in general may ultimately diminish the public welfare by preventing market forces from operating to yield the most valued services at efficient cost and competitive prices.¹⁵ We therefore believe that in most cases, the Commission can best promote the public interest by relying on competitive market forces and by implementing allocation, assignment, usage, and other policies that permit market forces to operate most effectively.

We believe that a well-conceived conceptual framework can make it easier for the Commission to reach sound, consistent, procompetitive spectrum policy decisions that maximize the public interest. If the Commission can establish a clear and consistent paradigm for approaching these issues, it will provide guidance and increased certainty to the market, thereby encouraging investment in new technology. This Article is intended to assist the Commission in developing such a paradigm.

A. Competitive Markets

In general, the public derives the greatest benefit from spectrum when the spectrum is used for services that the public values most highly and therefore is most willing to pay for. No government agency, however, can reliably predict public demand for specific services or the future direction of new technologies. Even if technology and the public's needs were unchanging, a central planner could only imprecisely evaluate the benefits of the myriad possible uses of spectrum and determine which frequencies should be used for each service. Given the rapid evolution of technology, moreover, the Commission cannot reliably predict what services will be available or which frequency range will be efficient for any service even a few years from now, much less what the public demand for each service will be and how to respond to changing demand. Therefore, even if the Commission could correctly identify the most economically efficient use of spectrum at any given time, it would be obliged continually to modify its allocations to reflect technological and economic developments. This reallocation process necessarily consumes substantial public and private resources, reduces certainty for users of spectrum, discourages investment, and delays the introduction of new services. This process also discourages innovation because it requires entrepreneurs to disclose their ideas to the public well in advance of their introduction, severely diminishing the competitive advantage from being first to market.

In recognition of these shortcomings of central planning, we believe the Commission should, wherever possible, rely on market forces to ensure economically efficient use of spectrum. In a perfectly competitive market, firms will produce the combination of goods and services most desired by consumers in the most efficient manner, and will offer these goods and services at competitive prices. In this way, the market achieves technological and allocative efficiency.¹⁶ Furthermore, entrepreneurs have an incentive to enter into, where feasible, production of goods and services that have been provided on a less than fully competitive basis, since these products tend to offer the greatest opportunities for profits. Thus, if reasonably competitive conditions exist and significant market failures do not occur, the market achieves economically efficient use of resources more quickly and more reliably than government regulation.

The Commission's spectrum policies, therefore, should both permit and promote the operation of competitive market

forces. In large part, the Commission can serve these principles simply by not interfering where it concludes that the judgment of the marketplace is sufficiently reliable. Thus, except in instances of substantial market failure or overriding public interest considerations, the Commission should avoid mandating that spectrum be used to provide specific services (e.g., two-way switched mobile voice, paging, or dispatch).¹⁷ The Commission should also endeavor to minimize regulations governing how services may be provided, which limit competition, obstruct innovation, and impede efficient investment, as discussed more fully below.

In addition to avoiding regulations that impede competition, the Commission should also affirmatively orient its policies, where possible, to create the conditions under which market forces can most effectively work. This principle should guide the Commission's practices both in allocating spectrum and in assigning it to particular users. Thus, in allocating spectrum, the Commission should strive to ensure that ample spectrum is available for services that the public demands. In addition, where spectrum is currently governed by rules that do not permit it to be used to its full value, the Commission should act quickly and effectively to expand service flexibility so that this spectrum can be used more efficiently, thereby increasing the value of spectrum to licensees and the public.¹⁸ Where possible, the Commission should also exhaustively license spectrum in bands that are now licensed on a site-by-site basis by issuing flexible, geographic-area overlay licenses and creating mechanisms for voluntary changes in spectrum use, including, where appropriate, procedures for new, geographic-area licensees and incumbents to negotiate compensated relocation of incumbents.¹⁹

The Commission should also be wary of unnecessarily reserving spectrum for future use. In most instances, the public is probably better served if spectrum is made available for use and that use is allowed to change as technological and market developments warrant, rather than if the Commission withholds spectrum from use indefinitely. The Commission should therefore make available for assignment any remaining large blocks of unassigned spectrum, and it should move quickly to reallocate spectrum to private sector use as it continues to receive authority over spectrum formerly reserved for the federal government. Moreover, to the extent that the best use for spectrum in some circumstances is for it to lie temporarily fallow, we believe that the competitive market can reliably identify those situations. Therefore, we believe the best practice ordinarily is for the Commission to allocate and assign spectrum, and to allow sufficient flexibility so that spectrum users may hold spectrum in reserve if they determine that to be the highest valued use of the spectrum.²⁰ That means that the Commission should refrain from imposing inefficient construction requirements in order to prevent anticompetitive warehousing or to achieve build-out to rural areas. Construction requirements do not necessarily solve these problems because licensees can typically satisfy such requirements without providing the service at issue, and they impose inefficiencies in the use of spectrum.²¹

The Commission can also help promote economically efficient use of spectrum by establishing the initial geographic scope and bandwidth of licenses in a manner that is sensitive to the different characteristics of different frequencies, as well as the different spectrum needs of various services. In general, the Commission should set initial allocations to approximate its estimate of the efficient use of spectrum. Because of transaction costs, sensible initial allocations are important to quickly achieving efficient spectrum use. For example, in order to afford potential providers wishing to offer services that require large bandwidths an opportunity to compete while minimizing potentially significant transaction costs to acquire contiguous spectrum from multiple parties, the Commission should make large frequency blocks initially available in some portions of the spectrum. Alternatively, the Commission could rely on simultaneous multiple round auctions, combinatorial bidding, or other mechanisms to facilitate the efficient aggregation of smaller blocks put up for bid at the same time. Furthermore, the Commission should attempt to designate these large blocks in frequency bands that, because of their propagation characteristics, are most likely to be suitable for efficient offering of broadband services. At the same time, the Commission must be aware that its estimate of efficient spectrum use is necessarily imperfect. It also must anticipate that technological developments will change the bandwidth necessary for many types of services, permit the introduction of new services with different bandwidth requirements, and increase the spectrum range over which services may be efficiently provided. Therefore, the Commission should avoid defining the specific services users may offer or the specific frequencies they may utilize for such services, and it should permit aggregation, subject to anticompetitive scrutiny, and disaggregation of spectrum into different size blocks. In this way, the Commission can allow the market to correct for the imperfections inherent in the initial allocation process, and it can ensure that allocations intended to further competition now do not inadvertently restrict competition in the future.

The Commission should also carefully consider the appropriate relationship among exclusive licensing, shared licensing, and unlicensed use. In most circumstances, exclusive spectrum licenses best promote efficiency and competition by giving each spectrum user maximum protection from interference. However, some uses of spectrum, particularly very low power uses, create such small potential for interference and have so little effect on the availability of the resource to others that they can be offered most efficiently and most competitively without licensing spectrum users. As a result, once the spectrum has been set aside for unlicensed use, the efficient charge for the use is zero. However, setting aside spectrum for unlicensed use does involve a cost—the spectrum cannot be used for high-power services. Comparing the benefits of low-power and high-power use is very difficult, but the Commission should endeavor to develop a framework for evaluating the benefits of setting aside additional spectrum for unlicensed use. These benefits could then be compared to the benefits of exclusive use, as indicated by the prices paid at auction for the rights to use spectrum with similar characteristics.

The Commission has authorized unlicensed use of very low-power devices on a secondary basis in most bands occupied by licensed services,²² authorized use of higher-power unlicensed communications devices on a secondary basis in some bands,²³ and designated certain blocks of spectrum exclusively for unlicensed personal communications services (PCS) devices.²⁴ The Commission should continue to consider the circumstances under which unlicensed uses of spectrum are appropriate, and in particular whether technologies such as spread spectrum may increase the potential utility of unlicensed devices. At the same time, the Commission should be aware that unlicensed users may have less incentive to use spectrum efficiently.²⁵ To address this problem in unlicensed bands, the Commission has adopted certain protocols, etiquettes, and power limitations. The Commission should also consider that with expanded flexibility and relaxation of build-out requirements, licensees may in some circumstances find it profitable to accommodate certain low-power uses within their licensed spectrum through contractual agreements with manufacturers, thereby leaving the determination of whether spectrum will be used for such purposes more fully to market forces.²⁶

Another alternative to exclusive licensing is licensing two or more parties to share a particular frequency band. The Commission must keep in mind that licensed spectrum sharing typically requires additional regulatory restrictions on users' operational flexibility in order to keep them from interfering with each other, especially where more than a very few users are involved, or else sharing is likely to result in lower service quality. Furthermore, as with unlicensed spectrum, users under a sharing arrangement generally have less incentive to use spectrum efficiently than exclusive licensees. The Commission should carefully consider in each case whether these costs outweigh the gains of opening the spectrum to more licensees. The Commission also should consider whether, in most cases, spectrum sharing can be effectuated by private arrangement between the licensee and another party. In general, we believe that spectrum sharing should be mandated only in rare instances where specific conditions, such as high transaction costs, would prevent entry into efficient private arrangements. Even with high transaction costs, sharing should be limited to circumstances where the Commission possesses very good information and a high degree of certainty about technology and future trends so that the benefits of reducing transaction costs will outweigh the costs of inflexibility and poor incentives.

Promotion of competition should also be a principal consideration motivating the establishment of rules for assigning spectrum to individual users. In particular, the Commission should strive to reduce barriers to entry by eliminating restrictions on eligibility wherever possible. The Commission generally should not impose eligibility restrictions unless they are clearly necessary to prevent a party from developing or retaining market power (i.e., the ability to control or significantly influence price).²⁷ Furthermore, whenever possible the Commission should consider less restrictive measures than eligibility restrictions to achieve this end. For example, allowing service flexibility across a wide range of spectrum and increasing the supply of spectrum available to the market would reduce both the barriers to entry and the need for eligibility restrictions.

At the same time, the Commission should be prepared to intervene directly in the market when necessary to preserve or promote competitive conditions. Market forces do not ensure economic efficiency or maximize consumer welfare in markets that are not competitive because a dominant producer or group of producers has market power. Thus, where market forces and antitrust law may be insufficient to prevent any party from developing or retaining market power, the Commission should consider measures such as spectrum caps to ensure at least a minimum number of

competitors.²⁸ In applying caps, the Commission should consider the range of spectrum available for a service as well as the availability of other technologies that do not use spectrum. For the most part, these measures will likely be needed only in service markets that have not yet completed the transition to full competition, as indicated by factors including the degree of concentration, pricing patterns and trends, the extent of barriers to entry, and the extent to which substitutable services can be provided.²⁹ Once a market has become fully competitive, the normal operation of market forces, supplemented by enforcement of antitrust laws, should ordinarily suffice to prevent competitors from exercising market power or engaging in anticompetitive activities. The Commission should consider whether additional reporting requirements are needed to help it determine when special measures are necessary to promote competitive conditions. In addition, increasing the number and variety of competitors in the market may help to develop and maintain robust competition.

B. Flexibility

In order for competition to bring consumers the highest valued services in the most efficient manner, we believe competing users of spectrum need flexibility to respond to market forces and demands. This flexibility includes the freedom to determine how they will use spectrum, how much spectrum they need, and the geographic area in which they will provide service. Flexibility eliminates artificial market entry barriers by enabling spectrum users to respond quickly to changing public demands for new and different services, as well as enabling users to introduce innovative services and technologies rapidly without administrative costs or delays. Furthermore, flexibility increases users' incentives to expand spectrum capacity by enabling them to profit from investments in more efficient use of spectrum, either by using spectrum for additional purposes or by transferring the authorization to use part of the spectrum to a party that values it more highly. Flexibility also can promote competition by increasing both the diversity of potential service offerings and the number of providers that can offer competing services.³⁰ In general, flexibility endows a spectrum license with certain attributes resembling private property rights, including the ability to transfer control with Commission approval, freedom to determine how the property will be used (subject to applicable technical requirements), and freedom to profit from use of the resource. As discussed above, the Commission legally cannot award perpetual or absolute ownership rights to spectrum.³¹ However, substantial replication of the freedoms inherent in property rights in the spectrum context will allow competition to function more effectively, much as it does in those sectors of the economy where the basic inputs are privately owned.³²

We therefore believe that the Commission's policies should strive to maximize spectrum users' flexibility in four dimensions. First, users should have substantial service flexibility—the freedom to use spectrum for services of their choosing. In several recent proceedings the Commission has acted to permit licensees extensive service flexibility in new services, such as PCS and general wireless communications service.³³ Similarly, the Commission has taken action to increase service flexibility in existing services. For example, the Commission has created additional flexibility for mobile services licensees to offer fixed services.³⁴ In general, this trend should continue, but some incumbent service providers may urge the Commission to limit flexibility in order to reduce competition for their services. Limiting the public benefits from newly available spectrum to protect the private interests of existing licensees does not promote the public interest. Although the Commission is required by statute to establish certain regulatory classifications, within those classifications the Commission has substantial leeway regarding the amount of flexibility it can afford. Maximum service flexibility will enable spectrum users quickly and efficiently to modify their offerings to provide the services that consumers demand and that technology makes possible.

Second, technical flexibility means that users should have broad freedom to choose the technologies and equipment that they will use to provide services.³⁵ Technical flexibility gives spectrum users the ability and incentive to develop and implement innovative, spectrum-efficient, low-cost, and consumer-responsive technologies for delivering their services without unnecessary delay or regulatory interference. In addition, technical flexibility will give different licensees the ability to try different technologies and to compete on the basis of their technologies. For example, some personal communications services providers believe that code division multiple access (CDMA) will be the best technology for their service, whereas others favor time division multiple access (TDMA) or the Groupe Speciale Mobile (GSM) standard. The competition between the different technologies as well as the competition between different systems should lead to innovation and new services for consumers.

Third, users should have flexibility to determine both the amount of spectrum they occupy and the geographic area they serve. As discussed above, when the Commission issues an initial license it must define that license, at a minimum, in terms of both spectrum block size and geographic area.³⁶ Once initial licenses have been assigned, however, licensees should ordinarily be free to disaggregate their spectrum and partition their service areas in order to operate within the parameters that they determine to be efficient.³⁷ Similarly, in those instances where the Commission's initial assignments are relatively constrained with respect to bandwidth or geographic scope, licensees should generally be able to aggregate additional authorizations in order to provide the services demanded by the marketplace. As a general rule, flexibility of scope should be limited only as necessary to promote specific procompetitive goals, or to preserve other specific public interest requirements. For example, where limits on aggregation of spectrum may appear necessary to prevent a party from developing or maintaining market power, the Commission should first consider increasing the supply of spectrum usable for a service, and impose spectrum caps only where it is impossible to create competition through additional spectrum.

Fourth, licensees should have implementation flexibility. To the extent it can legally do so, the Commission should generally eliminate requirements for licensees to build out their networks within a specified period of time. By permitting licensees to allow spectrum to remain unused where it is economically efficient to do so, the Commission can make it possible for market forces to govern the rate at which spectrum is developed, and eliminate the need to rely on administrative judgment regarding when spectrum should be released.³⁸ Furthermore, spectrum flexibility, including the flexibility to transfer authorization to use spectrum, will cause licensees to bear the full opportunity cost of allowing spectrum to remain idle. In addition, flexibility will allow additional licensees freely to enter any market, and therefore will reduce the ability of licensees that are already in a market to withhold spectrum for anticompetitive purposes.

In most instances, service and technical flexibility should be limited only by rules to prevent interference.³⁹ An authorization to use spectrum is of limited value without an expectation that one's legitimate use of the spectrum will be free from interference by others. Thus, each user of spectrum, like a user of land or any other resource, must sacrifice some degree of unrestricted use so that every other user can enjoy the benefits of spectrum utilization within that user's own defined bounds. The Commission should continue to define the extent to which each spectrum user may expect freedom from interference and enforce rules to protect those expectations.⁴⁰ The Commission can and should, however, perform this function in a manner that is minimally intrusive upon users' flexibility. Thus, rules to limit interference should ordinarily be output-based (e.g., limitations on emissions outside the licensed spectrum band and geographic area or sharing criteria) rather than input-based (e.g., specifying permissible services or technologies).⁴¹ So long as a spectrum user's emissions comply with objective numerical standards, it should ordinarily be free to offer any services by using any technologies it wishes. The Commission should also consider expanding spectrum users' flexibility to negotiate among themselves interference limitations that may differ from those specified in the rules.⁴²

Although we believe the Commission should generally attempt to minimize limitations on technical flexibility, it should consider whether, under narrow circumstances, its specification of technical standards may promote the effective operation of the market. In most cases, we believe that if a common standard is economically efficient for a product or service, market forces will lead producers to adopt the optimal common standard voluntarily. Under some circumstances, however, the market may fail to quickly produce a common standard because individual producers have interests in particular standards that are different from the public interest.⁴³ While it may be appropriate for the Commission to intervene under such limited circumstances, it should do so sparingly because prescribed technical standards can have substantial drawbacks. For example, the Commission may have difficulty selecting the most efficient standard, and any standard it selects may discourage or even prevent future innovation that would benefit the public. In addition, the process of formulating a single technical standard can seriously delay introduction of a service. Thus, the Commission should evaluate the circumstances in each case carefully so as not to unnecessarily override the market's natural response mechanisms.⁴⁴ Where a single standard is necessary, the Commission should encourage agreement on a standard, and it should preserve as much flexibility within the standard as is possible.⁴⁵ Furthermore, the Commission should actively explore sunseting any technical standards once the market has developed to the point where they are no longer necessary.

C. Public Interest and Market Failure Considerations

Although competition ordinarily is the most effective means of ensuring the production of a socially optimal mix of goods and services in an economically efficient manner, under some circumstances market forces will fail to produce outputs that maximize social welfare. For example, as discussed above, markets do not function effectively where a dominant producer has substantial market power.⁴⁶ Market failure also may occur when the production or consumption of an output exhibits significant externalities, that is, costs or benefits that consumers or producers are unable fully to incorporate into their decision-making processes.⁴⁷

The market also may fail to yield socially efficient output of public goods. Public goods are products or services that individuals can consume without purchasing (nonexcludability) and without detracting from other consumers' opportunities to benefit from the same unit of the good (nonrivalry in consumption).⁴⁸ The marketplace typically underproduces public goods because, lacking the power to exclude, producers are unable to collect a charge from every consumer of the good.⁴⁹ Many users of spectrum provide services that exhibit attributes of public goods. For example, national defense, public safety services, and basic scientific research are public goods that are often provided or funded by governmental units for the benefit of the public as a whole. It should be clear, however, that although the services provided in these cases are public goods, the inputs to these services are not public goods. Spectrum, like cars and radios, is an input to the provision of public safety.

The public interest is best served when public and private enterprises produce economically efficient types and quantities of public goods. In the case of some public goods that use radio spectrum, such as national defense and some public safety services, the Commission and the executive branch have agreed upon allocations of spectrum for federal government use to produce these outputs.⁵⁰ For other public goods, however, the Commission must consider how best to promote the public interest by ensuring that efficient quantities of the goods are produced. Some have argued that the best way to achieve this end is for the public to allocate direct financial subsidies to producers of public goods, who will use that money to compete for spectrum on the open market in the same way they compete for most other inputs.⁵¹ Others argue, however, that for historical and political reasons this approach may often be impractical and that spectrum should be reserved for such entities.⁵² We note in this regard that the *Public Safety Wireless Advisory Committee Report* identifies access to spectrum as well as funding and increased access to commercial services as inputs that are needed to maintain and improve public safety.⁵³ However, to ensure that the public gets the maximum benefit from the spectrum, in considering the reservation of spectrum for any service, the Commission should balance the value of spectrum in that service against its value for other uses. In general, explicit financial subsidies are preferable to set-asides because they are more narrowly targeted and their costs can be more easily evaluated. By contrast, it is difficult to determine the cost of reserving spectrum, and set-asides create disincentives for the adoption of possibly efficient tradeoffs between equipment and spectrum. Options such as redirecting some portion of auction revenues for public safety might prove to be a more efficient subsidy mechanism than set-asides because public safety agencies would realize the opportunity cost of their spectrum usage and make more efficient choices.

To the extent the Commission desires to take into consideration other public interest goals in allocating or assigning licenses and is unable to use explicit monetary subsidies as discussed above, it should do so by clearly stating the obligations on the license upfront and allowing the licensee flexibility in meeting those obligations. Licensees should be allowed to meet the obligations themselves, or to contract with others to meet the obligations for them in order to minimize the inefficiency of the obligations. Furthermore, any intervention should be narrowly tailored to the goal it is intended to promote, and the Commission should in every instance balance the public interest in intervention against the costs of interfering with competitive market forces.

Public interest concerns also may require some limitations on service or technical flexibility. The Communications Act and related statutes, for example, contain provisions that create specific public interest obligations for broadcasters, including the obligation to allow reasonable access to the broadcast airwaves by legally qualified candidates for federal elective office,⁵⁴ the obligation to provide "equal opportunities" to legally qualified candidates for public office,⁵⁵ the prohibition against charging legally qualified candidates for public office more than the "lowest unit charge" during a

certain period prior to an election,⁵⁶ and the obligation to air educational and informational programs for children.⁵⁷ Similarly, providers of direct broadcast satellite (DBS) service are required to reserve capacity for noncommercial educational and informational programming and make it available to national educational programming suppliers at reasonable rates.⁵⁸ The Commission has also proposed similar rules for digital audio radio service.⁵⁹ Some service rules may be needed to further the public interest in universal access to telecommunications services at just, reasonable, and affordable rates,⁶⁰ as well as services that are accessible to persons with disabilities.⁶¹ Some technical limitations may also be necessary in the interest of public health, safety, and environmental protection, including limitations on radio frequency emissions⁶² and rules requiring service providers to offer interoperable emergency services. As with rules intended to prevent interference,⁶³ however, it should be possible to achieve these ends in a manner that is minimally restrictive of users' flexibility, in large part by focusing on outcomes rather than means. For example, the Commission has required certain commercial mobile radio service providers to offer enhanced 911 services meeting defined performance criteria by specific dates, but it preserved flexibility by avoiding specification of the technology they must use.⁶⁴ The Commission's *Report and Order* regarding children's educational television similarly preserved broadcasters' flexibility in meeting their statutory obligation while providing clear guidance as to what will be considered satisfactory performance.⁶⁵

D. Licensing and Fee Policies

In order for the public to derive the maximum benefit from spectrum use, authorizations to use spectrum should be assigned in a manner that minimizes delay and inefficiency. When the Commission receives mutually exclusive applications for initial spectrum usage authorizations, competitive bidding is the most effective means of promoting this end.⁶⁶ Competitive bidding serves the public interest in several ways. First, a well designed competitive bidding approach is better able to get spectrum into the hands of those who initially value it most highly and to facilitate efficient spectrum aggregation than fragmented secondary markets. The auction process ensures that an authorization to use spectrum will be initially awarded to the party that places the highest value on the spectrum and therefore is willing to pay a market price for it.⁶⁷ Although secondary markets are useful to reassign spectrum as its value to different parties changes over time, relying on efficient auctions in the first instance reduces costs and delay in the initial assignment process. Second, users who are not required to pay market value may have an incentive to acquire licenses on a speculative basis simply to resell these licenses, thereby wasting valuable resources in rent-seeking. Indeed, this occurred on a widespread basis when the Commission awarded cellular licenses by lottery.⁶⁸ Although the Commission should not attempt to prevent authorized spectrum users from selling their authorizations for a profit, it better serves the public interest to require the party that is initially authorized to use spectrum to pay the value of that authorization to the public, rather than getting it for free simply because it is lucky enough to win a lottery. Third, auctions vastly reduce the delay involved in both resolving mutually exclusive applications for initial licenses and in getting those licenses into the hands of those who value them most highly, as compared to lotteries or comparative hearings.⁶⁹ The Commission's successful experience in conducting auctions confirms our evaluation that competitive bidding is ordinarily the preferred means for awarding initial authorizations from among mutually exclusive applications.⁷⁰

In some instances, however, competitive bidding is not an appropriate means for assigning spectrum use authorizations. First, auctions are not necessary in the absence of mutually exclusive applications because, if there is only one applicant, then there are no opportunity costs associated with granting a license to the sole applicant. Auctions also are not currently authorized under limited circumstances, including the licensing of public safety radio services and noncommercial educational broadcast stations.⁷¹ Furthermore, auctions may be problematic for services that have large economies of scope or scale and need to be provided on a transnational basis to realize those economies. In theory there is no reason that licenses for such services could not be awarded by competitive bidding, but there may be practical difficulties involved in conducting competitive bidding for transnational services. For example, it may be difficult for a single provider to obtain a set of complementary licenses from different countries, even though the licenses are most valuable as a set, if competitive bidding occurs in a sequence of auctions. The licensing process would also be delayed if an international organization would have to be formed or designated to coordinate or conduct a simultaneous auction.⁷² However, these concerns should not foreclose the possible use of auctions. Rather, they should be considered in comparing auctions to available alternatives, including the current process.⁷³

If Congress so authorizes, the Commission may collect fees for spectrum use. In general, the Commission should consider assessing fees that approximate the market value of spectrum where such fees will help to promote the economically efficient use of spectrum. For example, user fees for shared frequencies in the private land mobile radio services may help to alleviate a "tragedy of the commons" situation, in which use of the spectrum may become congested and users have little incentive to use that resource more efficiently because any privately initiated attempt to improve efficiency would confer benefits on all users of the shared spectrum, with only a fraction of these benefits accruing to the party undertaking the effort.⁷⁴ Where no such circumstances are present, however, the Commission should not assess user fees in a misguided effort to obtain revenue.⁷⁵ In general, user fees are appropriate only under limited circumstances where the spectrum user does not realize the opportunity cost of the use of spectrum. With exclusive use, flexibility, and the ability to transfer licenses, users realize the opportunity cost of using spectrum, and thus fees should not be charged. Where these conditions do not obtain, the Commission should consider whether restrictions on the license could be relaxed so that the user does realize the opportunity cost, rather than simply imposing fees.

In addition to using competitive bidding, the Commission should continue to take other actions to expedite the assignment of licenses. Thus, the Commission and its staff have reduced delays by automating and otherwise streamlining many licensing processes. For example, the Wireless Telecommunications Bureau has implemented "auto-granting" and electronic filing of authorizations for many services, and the International Bureau has reduced processing time for unopposed uncontroversial international section 214 applications to under thirty days after the public notice and comment period.⁷⁶ Similarly, the Commission has expedited the availability of service by relying on private spectrum coordinators in many cases.⁷⁷ The Commission should continue exploring additional initiatives along these lines.

The Commission also should strive to ensure that its licensing and fee policies accommodate the needs of all businesses. An increasingly market-based spectrum policy may require new tools to meet the goal of ensuring that small businesses are given the opportunity to participate in the provision of spectrum-based services.⁷⁸ Some attributes of a more competitive, demand-driven spectrum market will advance this goal. For example, the availability of larger amounts of spectrum and the grant of greater flexibility will reduce the scarcity value of spectrum, lowering its price and making it more affordable for small businesses. Eliminating use restrictions will encourage firms to allow others access to their spectrum for noninterfering uses. Small firms, who are often the proponents of new technologies, will not have to go through the expensive, time-consuming, and uncertain process of gaining Commission approval for a proposed use and then securing the allocation of spectrum for this use.

Flexibility in the scope of licenses, through rules permitting disaggregation of spectrum and partitioning of geographic area licenses, will make it easier for small businesses to acquire licenses suitable for their business plans and thus will serve as one method of eliminating market entry barriers. The availability of spectrum in the secondary market also can work to the competitive advantage of small firms since they do not have to reveal their technology and business plans to their competitors. On the other hand, as the Commission increasingly utilizes more market-based assignment mechanisms and allows licensees greater flexibility, small businesses may have difficulty obtaining information about and accessing spectrum or otherwise satisfying their communications needs. To mitigate these possible consequences to small businesses, the Commission should consider taking steps to facilitate small business access to information about available spectrum and spectrum-based services.

E. Administrative Certainty

An effectively functioning competitive market includes elements of both certainty and uncertainty. The very essence of competition is uncertainty of outcomes; competitive markets reward efficiency-enhancing behavior, but success is not guaranteed. In order to function effectively, however, a competitive market needs clear and firm regulations. If spectrum users and their financial supporters are not reasonably certain of the rules that will govern spectrum use, they will be less willing to invest in obtaining and developing the spectrum. For example, entrepreneurs likely will bid and invest greater amounts in spectrum if they know in advance that the use will be flexible and they are confident that it will remain that way. In the absence of such certainty, the spectrum may not be used to its full potential and the public

may fail to realize its full value.

For this reason, the Commission's spectrum policies should promote administrative certainty. Thus, before a use of spectrum is authorized or a service is initiated, the Commission should establish the rules affecting that use with as much certainty as is reasonable. For example, the Commission should set out in advance the interference rules, the full range of flexibility allowed, requirements concerning accommodation of preexisting users of the spectrum, and any other matters affecting the rights and obligations of licensees. Because of the value of flexibility, licensees regularly appeal to the Commission to increase flexibility *after* the award of their licenses, thereby generating opposition on equity grounds that might not have arisen if flexibility had been granted before the licenses were assigned. In order to avoid such debates, and to maximize efficiency in the initial award of licenses, the Commission should award maximum flexibility initially.

The principle of administrative certainty also affects many of the Commission's policies after initial authorization of a service. For example, a desire to provide certainty underlies the policy that licensees ordinarily have an expectancy of renewal when their license terms expire. Although the Commission awards licenses for fixed terms, due to the high renewal expectancy these licenses in many ways resemble *de facto* licenses in perpetuity. This policy encourages efficient investment in assets tied to a specific license because license holders retain the benefits of these investments.⁷⁹ Without confidence in their long-term rights, licensees would tend to underinvest in license-specific assets, especially as the end of the license period approached.

Furthermore, the Commission should exercise its jurisdiction to reallocate spectrum and change the rules governing use of spectrum with due regard for the reasonable expectations of incumbent licensees. No incumbent has a legitimate expectation of freedom from competition, but incumbents do expect that they will be able to continue using spectrum that they have been assigned without additional or unexpected interference, or major new service and technical restrictions. Although in some instances the public interest will require the Commission to act notwithstanding these expectations, it should do so only where necessary to promote clearly established public interest goals. Moreover, when it is necessary in the public interest to reallocate spectrum, the Commission should make every effort to ensure efficient and fair compensation for spectrum incumbents who are required to move. In general, the Commission should consider "overlay"⁸⁰ assignments, with the right to move incumbents if provided with equivalent replacement assets or service, as a method of ensuring that spectrum incumbents will be fairly and efficiently compensated for the value of their investments. Such efforts are not only a matter of common equity, but in the long run will encourage efficient investment by promoting certainty among spectrum users regarding the security of their investments.

F. The Global Marketplace

Finally, all of the Commission's spectrum policy decisions should reflect the international context in which spectrum usage occurs. Radio waves do not stop at national borders. Therefore, domestic policies must take into account the spectrum policies of other nations. The United States's spectrum policies should, among other things, support global systems and seamless international networks, in both satellite and terrestrial operations, where such systems promote the public interest. Consumers benefit from being able to communicate easily with persons in other nations and to move equipment readily between nations. For example, a global satellite system customer, or a customer of a system that is part of a worldwide seamless network, could use one transceiver in multiple nations to receive and send voice, video, or data service. At the same time, the effort to achieve worldwide seamless networks may exact costs, which the Commission should balance against the benefits.

It may be particularly important to coordinate the policies of the United States and other nations for satellite systems, which may serve multiple nations from the same satellite platform. Satellite systems in the future are increasingly likely to be global or regional systems. The new nongeostationary systems have constellations of satellites that move relative to the Earth. User transceivers are capable of communicating with these satellites and transferring calls to other satellites as they come into view. Constellations of nongeostationary satellites are capable of providing services anywhere in the world. In order to be profitable, these constellations need adequate spectrum in which to operate. Therefore, the Commission should promote measures to achieve efficient use of spectrum worldwide, including efforts to revise international administrative procedures that may create artificial orbit spectrum scarcity.⁸¹ For example, the

Commission may need to develop spectrum policies for the entry of foreign-owned satellite systems into the United States market. This is likely to require additional exchange of information with other nations to discuss harmonization of policies, including spectrum allocations for such systems.

United States consumers and producers can also potentially benefit from the development of worldwide seamless networks. Roaming agreements that permit customers of personal wireless services to make and receive phone calls easily while away from their home nations, and agreements that facilitate free circulation of communications equipment between nations, such as mutual recognition agreements for the type approval of terminals, can contribute to the development of such networks. In addition, policies that promote use of the same spectrum for the same services around the world may facilitate the development of global systems and seamless networks by eliminating the need for equipment that can operate on multiple frequency bands, as well as for protocols to convert international communications from one frequency to another. Furthermore, consistency in spectrum allocations among different countries may produce economies of scale for equipment manufacturers, thereby reducing prices for consumers. However, a system of worldwide spectrum block allocations has costs as well as benefits. As discussed above, restrictions on how licensees may use spectrum may prevent licensees from putting spectrum to its highest valued uses and from quickly introducing innovative services and technologies.⁸² Moreover, to the extent that government policy limits uses of spectrum and requires specific technologies, the market will be unable to test whether the benefits of worldwide seamless networks exceed the costs.

We therefore believe that the Commission should pursue policies that facilitate the development of worldwide seamless networks without precluding other uses and technologies. This end can be achieved by promoting policies that reduce the transaction costs, both in the United States and abroad, of participating in worldwide seamless networks. Specifically, the United States should support spectrum allocations in the International Telecommunication Union, domestically, and in other countries that would allow the same equipment to operate worldwide but would allow other uses as well. The Commission should also establish licensing band plans featuring spectrum blocks and service areas that are consistent with, or could be made consistent with, worldwide systems, such as facilitating aggregation of spectrum blocks and geographic areas in the licensing process where appropriate and permitting aggregation and disaggregation in the after market. If the Commission determines that the highest value of some frequency band is likely to be for a particular worldwide system, it should optimize the initial band plan for that system, but it should not foreclose other uses of that spectrum or prevent the market from reconfiguring the spectrum. We believe that such policies, which minimize the transaction costs for the market to configure the spectrum in the most economically efficient manner, will best balance the benefits of worldwide seamless networks and the benefits of flexibility.

Spectrum policy in the United States should be part of an international framework that facilitates the emergence of new technologies. In general, governments cannot reliably predict what innovative uses private companies will develop that require spectrum licenses, and these unpredicted, creative uses can contribute greatly to the development of global communications and a world economy. In the United States's experience, competition and flexibility promote innovation. Therefore, in addition to promoting competition and flexible spectrum use domestically, the United States should seek to encourage competitive markets and the creation of a flexible environment for spectrum worldwide.

Finally, global spectrum policies, like global wireline telecommunications policies, should seek to extend connectivity to citizens around the world. Intergovernmental satellite organizations such as INTELSAT and Inmarsat have been instrumental in bringing communications to the developing world and ensuring that all nations are interconnected to the global public switched network. As private nongeostationary and geostationary satellite systems are licensed, and the natures of INTELSAT and Inmarsat change, it is important that the United States's and global policy support expansion of competitive communications in developing nations.

In order to accomplish these goals, the United States must continue to take an active leadership role in international forums. This requires considerable coordination of domestic and international policies and priorities. Effective international spectrum management requires that the United States enter into various commitments with foreign governments, including multilateral agreements governing satellite communications and agreements with our immediate neighbors governing terrestrial spectrum usage.

IV. Conclusion

This Article proposes a policy framework under which the Commission would generally rely on competitive market forces and allow spectrum users maximum flexibility to respond to the market in order to achieve usage of spectrum that is of the greatest value to the public. This framework would continue and expand upon the initiatives that the Commission has already taken in these directions. We believe that the Commission's consideration of these principles as guidelines will help lead it to decisions that best serve the American people.

These principles imply a different and less activist role for the Commission than under other potential spectrum policy paradigms. Nonetheless, this Article identifies several crucial functions that the Commission should continue to perform in order for competitive market forces to work most effectively. First, the Commission should actively seek out instances in which spectrum is currently allocated or its use restricted in a manner that prevents it from being used to its full value, and it should remedy those situations. Second, when making spectrum initially available for a new service or use, the Commission should establish initial geographic areas and frequency blocks that reflect its best estimate of the most efficient uses of spectrum so as to reduce the need for immediate secondary market transactions. Third, the Commission should set and enforce minimally restrictive baseline rules governing interference and health effects. Fourth, the Commission should seek to maximize the amount of spectrum available to users. Fifth, the Commission should monitor the market and undertake targeted intervention to correct for significant market failures, when necessary, to ensure competitive conditions, or advance important public interest goals. Sixth, the Commission should act when appropriate to further the efficient use of spectrum in the public interest in the international context. Finally, in determining whether to undertake any intervention, the Commission should balance the benefits of intervention against the value of administrative certainty. We recommend that the Commission carefully consider whether, by following these principles, it will further its ultimate goal: the use of spectrum in the public interest.

[‡] A previous version of this Article was released in January 1997. The opinions and conclusions expressed in this Article are those of the authors and do not necessarily reflect the views of the Federal Communications Commission, any of its Commissioners, or other staff. This Article is intended to stimulate discussion and critical comment outside the FCC as well as within the agency.

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1. Communications Act of 1934, ch. 652, §§ 151, 301, 48 Stat. 1064 (codified as amended at 47 U.S.C.A. §§ 151, 301 (West Supp. 1997)).

2. 47 U.S.C.A. § 309(j).

3. *See generally* National Brdcast. Co. v. United States, 319 U.S. 190, 210-14 (1943) (explaining the necessity of regulation of radio communication).

4. *See* United States v. Zenith Radio Corp., 12 F.2d 614 (N.D. Ill. 1926); Hoover v. Intercity Radio Co., 286 F. 1003 (D.C. Cir. 1923), *appeal dismissed per stipulation*, 266 U.S. 636 (1924).

5. Thomas W. Hazlett, *The Rationality of U.S. Regulation of the Broadcast Spectrum*, 33 J. L. & Econ. 133 (1990).
6. Radio Act of 1927, ch. 169, 44 Stat. 1162, *repealed by* Communications Act of 1934, ch. 652, § 602(a), 48 Stat. 1064, 1102.
7. Communications Act of 1934, ch. 652, 48 Stat 1064 (codified as amended in scattered sections of 47 U.S.C. (1994)).
8. 47 U.S.C.A. §§ 301-303 (West Supp. 1997). The Commission's authority does not extend to stations owned and operated by the United States, except that it shall prescribe special call letters for such stations and that such stations shall conform to its rules designed to prevent interference when transmitting communications or signals not relating to government business. *See id.* § 305.
9. *See* Allocation of Frequencies to the Various Classes of Non-Govtl. Servs. in the Radio Spectrum from 10 Kilocycles to 30,000,000 Kilocycles, Docket No. 6651, *Report*, at 18-20 (Jan. 15, 1945).
10. *See Transcript, En Banc Hearing on Spectrum Policy Before the FCC* (Mar. 5, 1996) <http://www.fcc.gov/Reports/enbanc_spectrum.rpt.txt> [hereinafter *Transcript*]. Written comments and reply comments were also filed (on file with authors) [hereinafter *Comments*].
11. *See* Douglas W. Webbink, Frequency Spectrum Deregulation Alternatives (Office of Plans and Policy Working Paper No. 2, 1980); Evan R. Kwerel & Alex D. Felker, Using Auctions to Select FCC Licensees (Office of Plans and Policy Working Paper No. 16, 1985); Evan R. Kwerel & John R. Williams, Changing Channels: Voluntary Reallocation of UHF Television Spectrum (Office of Plans and Policy Working Paper No. 27, 1992); David P. Reed, Putting It All Together: The Cost Structure of Personal Communications Services (Office of Plans and Policy Working Paper No. 28, 1992); Evan R. Kwerel & John R. Williams, Moving Toward a Market for Spectrum, 1993 Reg. 2, 53 (1993); Reed Hundt & Gregory L. Rosston, *Spectrum Flexibility Will Promote Competition and the Public Interest*, IEEE Comm. Mag. 40 (Dec. 1995).
12. *See, e.g.*, 47 U.S.C.A. §§ 151, 302(a), 303, 309(a).
13. *Id.* § 301.
14. *See infra* Part III.C.
15. *See infra* Part III.A.
16. *See* Tibor Scitovsky, Welfare and Competition (1971); David W. Pearce, The Dictionary of Modern Economics 13-14 (1981).
17. *See infra* Part III.B.
18. *See infra* Part III.B.
19. For example, in the early 1990s the Commission created usable spectrum for personal communications services by establishing procedures for band sharing or negotiated relocation of fixed microwave incumbents. *See* Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecomm. Tech., *First Report and Order and Third Notice of Proposed Rulemaking*, 7 FCC Rcd. 6886, 71 Rad. Reg. 2d (P & F) 349 (1992), *reconsidered in part by Second Report and Order*, 8 FCC Rcd. 6495, 73 Rad. Reg. 2d (P & F) 777 (1993), *modified by Third Report and Order and Memorandum Opinion and Order*, 8 FCC Rcd. 6589, 73 Rad. Reg. 2d (P & F) 766 (1993), *reconsidered by Memorandum Opinion and Order*, 9 FCC Rcd. 1943, 74 Rad. Reg. 2d (P & F) 1042 (1994), *modified in part by Second Memorandum Opinion and Order*, 9 FCC Rcd. 7797, 76 Rad. Reg. 2d (P & F) 1043 (1994), *considered in* Association of Public-Safety Comm. Officials-Int'l, Inc. v. FCC, 76 F.3d 395 (D.C. Cir. 1996). Although this is an example of a successful and necessary reallocation, future similar adjustments should ideally be accomplished more quickly and efficiently. *See, e.g., Transcript, supra* note 10, at 17 (statement of Susan Mayer, MCI Telecommunications Corp.),

63-64 (statement of Tom Hazlett, American Enterprise Institute), 82-83 (statements of Peter Murray, UTAM, Inc. and Wireless Information Networks Forum, and Susan Mayer), 163-64 (statement of Charles Jackson, Strategic Policy Research) (explaining that auction results may help indicate where reallocation is appropriate); Peter Cramton, Evan R. Kwerel & John R. Williams, Efficient Relocation of Spectrum Incumbents, Paper presented at the Telecommunications Policy Research Conference, Solomons, Maryland (1996) (on file with authors).

20. Withholding service from a competitive market may be efficient, for example, if the licensee thinks a better technology may soon be available, just as some real property owners hold a vacant lot for several years before developing the property. So long as the licensee realizes the opportunity cost of holding the spectrum and therefore internalizes the tradeoff between providing service with today's technology and waiting to introduce service with future technology, allowing private spectrum users to make this decision is economically efficient. *See infra* text accompanying note 38.

21. As discussed below, anticompetitive withholding of service from the market is best addressed by a spectrum cap. *See infra* text accompanying notes 28-29. Availability of service to rural areas is probably best achieved through universal service subsidies rather than build-out requirements.

22. *See* 47 C.F.R. §§ 15.201-15.214 (1996).

23. *See id.* §§ 15.215-15.255; Amendment of the Comm'n's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Frequency Range, *Report and Order*, 12 FCC Rcd. 1576, 5 Comm. Reg. (P & F) 1120 (1997) [hereinafter *U-NII Order*].

24. *See* 47 C.F.R. §§ 15.301-15.323; *see also* Amendment of the Comm'n's Rules to Establish New Personal Comm. Serv., *Second Report and Order*, 8 FCC Rcd. 7700, paras. 79-92, 73 Rad. Reg. 2d (P & F) 1477 (1993) [hereinafter *PCS Second Report and Order*], *reconsidered and modified in part by Memorandum Opinion and Order*, 9 FCC Rcd. 4957, paras. 203-44, 75 Rad. Reg. (P & F) 491 (1994).

25. *See* Dennis W. Carlton & Jeffrey M. Perloff, *Modern Industrial Organization*, 121-23; Todd Sandler, *Collective Action: Theory and Applications*, 117-23 (1992); Garrett Hardin, *The Tragedy of the Commons*, 162 *Science*, December 13, 1968, at 1243-48 (1968); Durga P. Satapathy & Jon M. Peha, *Spectrum Sharing Without Licenses: Opportunities and Dangers*, in *Interconnection and the Internet* 49 (Gregory L. Rosston & David Waterman eds., 1997).

26. For example, a licensee or group of licensees with a nationwide footprint might lease authorizations to use spectrum to manufacturers for the operation of low-power devices with the cost of spectrum use, like other costs, being added to the price of equipment.

27. *See* Alexis Jacquemin & Margaret E. Slade, *Cartels, Collusion, and Horizontal Merger*, in *The Handbook of Industrial Organization I*, 450-66 (Richard Schmalensee and Robert D. Willig eds., 1990).

28. *See* Implementation of Sections 3(n) and 332 of the Comm. Act, *Third Report and Order*, 9 FCC Rcd., 7988, paras. 238-85, 76 Rad. Reg. 2d (P & F) 326 (1994); Amendment of Parts 20 and 24 of the Comm'n's Rules, *Report and Order*, 11 FCC Rcd. 7824, paras. 94-103, 3 Comm. Reg. (P & F) 433 (1996).

29. *See, e.g.*, Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, *First Report*, 10 FCC Rcd. 8844, paras. 65-83, 78 Rad. Reg. 2d (P & F) 1322 (1995); Implementation of Sections 3(n) and 332 of the Comm. Act, *Second Report and Order*, 9 FCC Rcd. 1411, paras. 250-252, 74 Rad. Reg. 2d (P & F) 835 (1994); *see also* Dennis W. Carlton & Jeffrey M. Perloff, *Modern Industrial Organization*, 331-80 (1994); Richard Schmalensee, *Inter-Industry Studies of Structure and Performance*, in *The Handbook of Industrial Organization II*, *supra* note 27, at 951-1010; Timothy F. Bresnahan, *Empirical Studies of Industries with Market Power*, in *The Handbook of Industrial Organization II*, *supra* note 27, at 1011-58.

30. *See generally* William J. Baumol et al., *Contestable Markets and the Theory of Industry Structure* (1982); Richard J. Gilbert, *Mobility Barriers and the Value of Incumbency*, in *The Handbook of Industrial Organization I*, *supra* note

27, at 475-536.

31. *See supra* note 13 and accompanying text.

32. *See* Douglas W. Webbink, *Radio Licenses and Frequency Spectrum Use Property Rights*, *Comm. & The Law* 4 (1987); Ronald H. Coase, *The Federal Communications Commission*, 2 *J.L. & Econ.* 1 (1959); Louis De Alessi, *The Economics of Property Rights: A Review of the Evidence*, in 2 *Research in Law and Economics* 1, 3-12 (Richard O. Zerbe Jr. ed., 1980); Jora R. Minasian, *Property Rights in Radiation: An Alternative Approach to Radio Frequency Allocation*, 18 *J.L. & Econ.* 221 (1975).

33. *See, e.g., PCS Second Report and Order*, 8 FCC Rcd. 7700, paras. 19-24, 73 Rad. Reg. 2d (P & F) 1477 (1993); *Allocation of Spectrum Below 5 GHz Transferred from Fed. Gov't Use, Second Report and Order*, 11 FCC Rcd. 624, paras. 6-28, 78 Rad. Reg. 2d (P & F) 1173 (1995). The Commission's policy permitting broad service flexibility in PCS was widely praised by many of the participants in the en banc hearing. *See, e.g., Transcript, supra* note 10, at 31-33 (statement of Tom Hazlett), 149 (statement of Charles Jackson, Strategic Policy Research).

34. *See* Amendment of the Comm'n's Rules To Permit Flexible Serv. Offerings, *First Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd. 8965, 3 *Comm. Reg.* (P & F) 1190 (1996).

35. *See, e.g., U-NII Order*, 12 FCC Rcd. 1576, para. 61, 5 *Comm. Reg.* (P & F) 1120 (1997); *PCS Second Report and Order*, 8 FCC Rcd. para. 23, 73 Rad. Reg. 2d 1477; A Re-Examination of Tech. Regs., *Report and Order*, 99 F.C.C.2d 903, 57 Rad. Reg. 2d (P & F) 391 (1984) [hereinafter *Technical Regs. Report and Order*]. We note that the Commission should continue, in conjunction with other government agencies, to ensure that users comply with appropriate health and safety standards.

36. *See supra* Part III.B.

37. *See, e.g., Geographic Partitioning and Spectrum Disaggregation by Commercial Mobile Radio Servs. Licensees, Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd. 21,831 (1996). In comments filed in connection with the en banc hearing, AT&T Wireless stated that it had been approached by local companies seeking to build out limited rural areas of AT&T's PCS territories before AT&T was able to reach those areas, but it was unable to accommodate those requests under the Commission's rules then in effect. *Comments, supra* note 10, Wayne M. Perry, AT&T Wireless Services, Inc., at 4.

38. *See supra* text accompanying notes 20-21.

39. *But see infra* Part III.C. (discussing appropriate public interest limitations on flexibility).

40. *See, e.g., Technical Regs. Report and Order*, 99 F.C.C.2d 903, paras. 10-13, 57 Rad. Reg. 2d (P & F) 391 (1984). We note that under some circumstances, this definition may consist of a determination that particular users will enjoy little or no freedom from interference. *See, e.g., 47 C.F.R. § 15.5(b)* (1996) (unlicensed devices must accept interference).

41. *See* Technical Flexibility in the Mobile Comm. Servs., *Notice of Inquiry and Proposed Rulemaking*, 101 F.C.C.2d 331 (1985); *Technical Regs. Report and Order*, 99 F.C.C.2d 903, paras. 10-12, 27, 57 Rad. Reg. 2d (P & F) 391 (1984).

42. *See, e.g., 47 C.F.R. § 22.912(b)* (Cellular licensees may negotiate service area boundary extensions with adjacent licensees.); *id.* § 24.237(d) (Operational fixed service licensees may agree to accept interference from broadband PCS licensees greater than that specified in rules.); *see also Transcript, supra* note 10, at 184-85 (statement of Peter Pitsch, Progress and Freedom Foundation), 192 (statement of Charla Rath, Freedom Technologies, Inc.); *but see Comments, supra* note 10, Lynn Claudy, National Association of Broadcasters, at 12-13.

43. *See* Stanley M. Besen & Garth Saloner, *The Economics of Telecommunications Standards, in* *Changing the Rules:*

Technological Change, International Competition, and Regulation in Communications 177 (Robert W. Crandall & Kenneth Flamm eds., 1989); Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. Econ. Persp. 93 (1994); Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 Am. Econ. Rev. 940 (1986); Jean Tirole, *The Theory of Industrial Organization*, 404-09 (1992); Stanley M. Besen & Joseph Farrell, *Choosing How to Compete: Strategies and Tactics in Standardization*, 8 J. Econ. Persp. 117 (1994); Stanley M. Besen & Leland L. Johnson, *Compatibility Standards, Competition and Innovation in the Broadcasting Industry* (1986).

44. In this regard, it has been proposed that governmental intervention to set standards may be appropriate only for a new service that is worthy of national investment, and not for an extension of an existing service. *See Comments, supra* note 10, John Stupka, SBC Communications, Inc., at 4-5; *Transcript, supra* note 10, at 160-61, 201 (statement of John Stupka, SBC Communications, Inc.); *see also Technical Regs. Report and Order*, 99 F.C.C.2d 903, paras. 27-28, 57 Rad. Reg. 2d (P & F) 391 (1984). Although we reach no conclusion here regarding the extent to which this guideline may be universally applicable, it is illustrative of the type of factors the Commission may wish to consider in deciding whether to intervene in the setting of standards in any particular case.

45. *See* *Advanced TV Syst. and Their Impact, Fourth Report and Order*, 11 FCC Rcd. 17,771, 5 Comm. Reg. 963 (1996).

46. *See supra* text accompanying notes 27-28.

47. *See* James Mitchell Henderson & Richard E. Quandt, *Microeconomic Theory* 296-307 (1980); Joseph E. Stiglitz, *Economics of the Public Sector* 178-97 (1986).

48. *See* Steven T. Call & William L. Holahan, *Microeconomics*, 455-56 (1983); Sandler, *supra* note 25, at 5-6; Stiglitz, *supra* note 47, at 99-119.

49. Even if producers can exclude some consumers, it may be inefficient for them to do so because each additional user imposes no significant additional cost.

50. *See* 47 C.F.R. § 2.106 (1996); *see also* 47 U.S.C. § 305 (1994), *amended by* 47 U.S.C.A. § 305 (West Supp. 1997). Other bands are designated exclusively for nonfederal governmental use, and still other bands are shared between federal and other users. We note that where spectrum is shared between federal and nonfederal users, that fact may limit the technical flexibility allowable to users who are subject to the Commission's jurisdiction.

51. *See Transcript, supra* note 10, at 34 (statement of Tom Hazlett), 165-66 (statement of Peter Pitsch).

52. *See, e.g., Comments, supra* note 10, Susan Mayer, MCI Communications Corp., at 2-3, Michael Amarosa, Association of Public Safety Communications Officials, Inc., at 2-4, Henry Geller, at 3-4, Lynn D. Claudy, National Association of Broadcasters, at 8-9, Jonathan D. Blake, Association for Maximum Service Television, at 16-18; *Transcript, supra* note 10, at 54-56 (statement of Philip Verveer, Public Safety Wireless Advisory Committee), 61-62 (statement of Peter Murray), 115-16 (statement of John Battin, Motorola Inc.), 189 (statement of Charles Jackson), 219 (statement of Wayne Perry, AT&T Wireless Services, Inc.).

53. Public Safety Wireless Advisory Committee Report, §§ 2.3-2.6.

54. Communications Act of 1934, ch. 652 § 312(a)(7), 48 Stat. 1064, 1086-87 (codified at 47 U.S.C. § 312(a)(7)(1994)).

55. *Id.* § 315(a); 47 C.F.R. § 73.1941(1996).

56. 47 U.S.C. § 315(b)(1); 47 C.F.R. § 73.1942.

57. 47 U.S.C.A. § 303(a)-(c) (West Supp. 1997); 47 C.F.R. § 73.671.

58. See 47 U.S.C.A. § 335(b).

59. See Establishment of Rules and Policies for the Digital Audio Radio Satellite Serv., *Notice of Proposed Rulemaking*, 11 FCC Rcd. 1, paras. 27-28, 6 Comm. Reg. (P & F) 2151 (1995).

60. See 47 U.S.C.A. § 254; see also *Comments*, *supra* note 10, Wayne M. Perry, AT&T Wireless Services, Inc., at 5.

61. See 47 U.S.C.A. § 255; see also Implementation of Section 255 of the Telecomm. Act of 1996, *Notice of Inquiry*, 11 FCC Rcd. 19,152 (1996).

62. See, e.g., Guidelines for Evaluating the Envtl. Effects of Radiofrequency Radiation, *Report and Order*, 11 FCC Rcd. 15,123, 3 Comm. Reg. (P & F) 1092 (1996), *modified by Second Memorandum Opinion and Order and Notice of Proposed Rulemaking*, WT Docket No. 97-192 (FCC Aug. 25, 1997).

63. See *supra* text accompanying notes 40-42.

64. See Revision of the Comm'n's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Syst., *Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd. 18,676, 3 Comm. Reg. (P & F) 967 (1996), *comment period extended by Order*, 11 FCC Rcd. 22,355 (1996); see also *Technical Regs. Report and Order*, 99 F.C.C.2d 903, para. 27, 57 Rad. Reg. 2d (P & F) 391 (1984).

65. See Policies and Rules Concerning Children's TV Prog., *Report and Order*, 11 FCC Rcd. 10,660, 3 Comm. Reg. (P & F) 1385 (1996).

66. Until recently, the Commission had the legal authority to use competitive bidding only where the expectation was that service would be provided to subscribers. See 47 U.S.C.A. § 309(j)(1)-(2) (West Supp. 1997). However, Congress recently extended the Commission's authority to all mutually exclusive applications for initial licenses or construction permits, except for public safety services, digital television service licenses given to existing terrestrial broadcast licenses, and noncommercial educational and public broadcast stations. See Balanced Budget Act of 1997, Pub. L. No. 105-33, sec. 3002(a)(1)(A), 111 Stat. 258-59 (amending 47 U.S.C.A. § 309(j)).

67. See Implementation of Section 309(j) of the Comm. Act—Competitive Bidding, *Second Report and Order*, 9 FCC Rcd. 2348, paras. 5, 70, 75 Rad. Reg. 2d (P & F) 1 (1994), *modified by Second Memorandum Opinion and Order*, 9 FCC Rcd. 7245, 75 Rad. Reg. 2d (P & F) 1178 (1994).

68. See John McMillan, *Why Auction the Spectrum?* 19 *Telecomm. Policy* 191 (1995); Gregory L. Rosston, *The Effects of FCC Regulation on Land Mobile Radio* (1994) (unpublished Ph.D. dissertation, Stanford University) (on file with authors); Kwerel & Felker, *supra* note 11.

69. See Improving Comm'n Processes, *Notice of Inquiry*, 11 FCC Rcd. 14,006, para. 11 (1996) [hereinafter *Commission Processes NOI*]; *Comments*, *supra* note 9, Henry Geller, at 2-3; Peter K. Pitsch, *Progress and Freedom Foundation*, at 7-8.

70. Since the Commission received auction authority from Congress in 1993, it has successfully conducted several auctions that have raised more than \$20 billion for the United States Treasury. As has been noted, however:

One of the greatest myths about the spectrum auctions is that the [amount] raised was the most important aspect of the process In monetary terms, the most important effect [of the auctions] to the economy is that . . . PCS license winners are now investing in the infrastructure that will permit them to offer wireless communications service in competition with each other and other providers such as cable and telephone companies.

Hundt & Rosston, *supra* note 11, at 40.

71. See Balanced Budget Act of 1997, sec. 3002(a)(1)(A) (amending 47 U.S.C.A. § 309(j)(2)).

72. Some have also argued that other services should not be auctioned. *See, e.g., Comments, supra* note 10, Mark E. Crosby, Industrial Telecommunications Association, at 4-5 (arguing that auctions should not be used for private wireless systems); *Transcript, supra* note 10, at 112-13 (statement of Paul Baran) (arguing that auctions should not be used where a large number of small service providers are operating in an unproven market because large up-front payments would discourage innovation). For the reasons discussed above, we believe proponents of such exceptions should bear the burden of overcoming a strong presumption in favor of using competitive bidding where legally authorized.

73. In addition, the Commission must consider whether under current law it retains the legal authority to use methods other than competitive bidding under such circumstances. *See* Balanced Budget Act of 1997, sec. 3002(a)(1)(A) (amending 47 U.S.C.A. § 309(j)(1)).

74. *See supra* text accompanying notes 25-26; Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services, *Report and Order and Further Notice of Proposed Rulemaking*, 10 FCC Rcd. 10,076, paras. 136-38, 78 Rad. Reg. 2d (P & F) 384 (1995), *modified by Memorandum Opinion and Order*, 11 FCC Rcd. 17,676, 5 Comm. Reg. (P & F) 999 (1996).

75. User fees, which are intended to recover from the user the market value of spectrum, are to be distinguished from application fees, which are fixed by statute, and regulatory fees, which the Commission is mandated to collect in order to recover its own costs. *See* 47 U.S.C.A. §§ 158, 159. Assessment of appropriate application and regulatory fees is generally both economically sensible and legally required.

76. *See generally Commission Processes NOI*, 11 FCC Rcd. 14,006 (1996).

77. *See* 47 U.S.C.A. § 332(b) (authorizing the Commission to utilize assistance furnished by advisory committees in coordinating the assignment of frequencies in the private mobile and fixed services); *see also* 47 C.F.R. § 90.175 (1996).

78. *See* 47 U.S.C.A. § 309(j)(4)(D); *see also id.* § 257 (directing Commission to identify and eliminate market entry barriers for small businesses).

79. Other license arrangements may also lead to efficient investment.

80. An "overlay" is a second assignment of already licensed spectrum, pursuant to which the overlay licensee must secure the original licensee's agreement either to vacate the spectrum or to accept interference before it may begin operations. *See, e.g., Transcript, supra* note 10, at 150-51 (statement of Peter Pitsch). *But see id.* at 186-88 (statement of Charles Jackson) (noting potential difficulties with overlay assignments in some circumstances).

81. *See, e.g.,* International Telecommunication Union Resolution 18, Kyoto (1994) (review of the ITU's Frequency Coordination and Planning Framework for Satellite Networks).

82. *See supra* Part III.B.