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Who Owns the Airwaves?
FOUR THEORIES OF SPECTRUM PROPERTY RIGHTS

By J.H. Snider*

The Federal Communications Commission, with the support of Congress, is currently orchestrating a vast transfer of wealth from the public to the private sector. The wealth, in the form of spectrum (also known as the public airwaves), has been hailed as the lifeblood of the 21st century telecommunications infrastructure. For the most part, this wealth transfer consists of the government changing the bundle of rights granted to current spectrum licensees.[1] This transfer is analogous to paying the government for a one-year lease to graze cows on 10,000 acres of a 100,000 acre federal park and then, mid-way through the lease, winning changes to the lease terms that grant exclusive use of the entire park for all purposes for free *in perpetuity*. The current cost to taxpayers of this "rights giveaway" is in the range of $60 billion per year. Recent statements by FCC and Congressional leaders suggest that the rate of transfer is likely to accelerate in the next few years. The recipients of the giveaway are some of the largest companies and wealthiest individuals in the United States.

The stated rationale for the giveaway is innocent enough: "spectrum deregulation," a popular variation of what has been termed "spectrum flexibility." The FCC licenses bandwidths of publicly owned spectrum for limited durations and specific services. Spectrum was originally allocated, on an exclusive basis, for narrowband services such as radio broadcasting, TV broadcasting, satellite data transmission, and walkie-talkie like communication in specific industries (e.g., utilities, railroad, timber, and petroleum companies). Large swaths of spectrum were also allocated as "guard band" spectrum so that neighboring spectrum users would not interfere with each other.

A consensus exists among policymakers and industry analysts that this rigid, zoning-like allocation is inefficient. But how to transition from the existing allocation system to a more efficient one is highly contentious. Advocates of spectrum flexibility for incumbent license holders argue that consumers would be much better off if these incumbents could use their spectrum for what the market is currently demanding, including, most notably, broadband mobile Internet service.

The catch is that the right to use spectrum flexibly is worth billions of dollars. The federal government currently owns 27.3% of all U.S. land.[2] Imagine if all license holders of timber, mineral, and energy extraction rights on this land were suddenly given unlimited rights to the federal lands covered in their licenses. This "flexibility" would undoubtedly allow federal lands to fulfill many valuable new consumer needs, but it would also be recognized as a windfall worth hundreds of billions of dollars to incumbent license holders.

Spectrum, like federal land, has become extremely valuable. The going rate for 1 MHz of prime[3] spectrum across the entire United States is about $1 billion.[4] A MHz (short for megahertz) is a measure of information carrying capacity. For example, a single conventional TV channel uses 6 MHz while a single conventional FM radio channel uses 0.2 MHz (a TV signal requires about 30 times the spectrum of a radio channel in part because it requires more information to describe an audio-video signal than just an audio signal). Since approximately 3,000 MHz of prime spectrum exists, this suggests a total theoretical value of $3 trillion for prime spectrum alone.[5] In other words, spectrum has become more valuable than all the gold, silver, and gems ever discovered by mankind.[6]

Spectrum Politics: Bait & Switch

For many years, astute individuals and companies have recognized that once they get a spectrum license on some plausible public interest ground (e.g., HDTV, public safety, or public education), the U.S. government will never force them to vacate that spectrum unless they demonstrate gross political incompetence. The name of the game in spectrum lobbying has been to get your foot in the door and then slowly wiggle it open until full access (i.e., spectrum rights) is yours. This process has been happening slowly, spread out over a generation or more. Because

**J.H. Snider is a Fellow at the New America Foundation.*

of the slowness, this lobbying strategy is imperceptible to the public. However, even if spectrum rights are being transferred at a rate of only 2% per year of the total market value, 2% of $3 trillion is still $60 billion a year.

Examples of recent spectrum rights transfers include the flexibility of wireless cable TV Multi-channel Multi-point Distribution System operators (whose licenses were purchased by giant telephone companies) to provide interactive data services, the flexibility of analog cellular telephone operators to switch to digital services, and the flexibility of TV broadcasters to provide digital pay per subscription services. Even the government's track record of rarely, if ever, revoking a license (except for gross negligence or willful misuse) creates value by setting a legal precedent and sending a powerful signal to the financial markets that a FCC licensee (unlike other government licensees and in direct contradiction to the Communications Act of 1934) can be treated as *de facto* perpetual licensees.

The reason that spectrum incumbents can effectively pull off this property heist is that while incumbents clearly understand and are deeply interested in spectrum rights, the public does not understand nor care about these rights. Talk to the average American about spectrum policy and their eyes will immediately glaze over. Yet many of the shrewdest political minds in America are now working as lobbyists for incumbent license holders, trying to figure out how to transfer the spectrum equivalent of a mountain high pile of gold lucre into the hands of spectrum incumbents. The lucre, masked in the passage of obscure statutes and regulations that reduce "red tape," "unnecessary regulation," "government interference," "chilled speech," and "regulatory uncertainty," slip by under the public and the media's radar screen.

One way to look at this transfer of wealth is in brass knuckle political terms. Spectrum policy exhibits the classic formula for special interest politics: a vast amount of money at stake for a handful of politically powerful special interests combined with an apathetic and ignorant public. From this political reality, the transfer of wealth seems as inevitable as night following day.

Another way to look at this transfer of wealth is in public policy terms. Underlying the transfer of spectrum rights from the public to private entities are assumptions about who actually owns the relevant spectrum rights. Congress, the FCC, and spectrum lobbyists use certain assumptions to rationalize the wealth transfers as the elimination of irresponsible government regulations on the use of private property.

Four Theories of Spectrum Ownership

The assumptions can be divided into four theories of spectrum property rights: 1) License Theory, 2) Service Theory, 3) Spectrum Theory, and 4) Lebensraum Theory. The term "lebensraum" comes from the German word meaning "to spread out or expand to territory believed necessary for one's natural development."

Each of these theories varies in the proportion of spectrum rights retained by the public, with the license theory being least generous to incumbent spectrum license holders and the lebensraum theory being the most.[7] It is, of course, in the interest of incumbent license holders to claim maximum spectrum rights as well as disparage and fiercely lobby against any property rights theory (most notably the license theory, which takes a less generous view).

The **License Theory** holds that incumbents' rights to spectrum go no further than those specified in federal statute; specifically, the Communications Act states: "It is the purpose of this act…to maintain the control of the United States over all channels of interstate and foreign radio transmissions; and to provide for the use of such channels, but not the ownership thereof, by persons for limited periods of time under licenses granted by Federal authority."[8] All residual rights to spectrum, not explicitly allocated to a license, belong to the public. Accordingly, when the term of a license has expired, the public regains 100% of the rights to the use of that spectrum.

The **Service Theory** holds that regardless of the written duration of a license, incumbents have the right to keep their existing level of service *in perpetuity*. No one can take this right away from them, even after their license has expired, without full compensation (defined as the present value of all income streams derived from the license held *in perpetuity*). One common variation of this theory is that license holders have already paid for the use of this asset *in perpetuity* when they purchased the license from a previous license holder. They have done so with the understanding, and government's implicit promise as demonstrated by seventy-five years of practice, that a license will be renewed *in perpetuity* except, at worst, for gross negligence or willful misrepresentation. Another common variation of this theory is that when license holders need to be evicted from a band for a compelling public interest, they not only have the right to replicate their current level of service on another

band, but also have the right to be compensated for all moving expenses.

The **Spectrum Theory** holds that incumbents have full rights *in perpetuity* to their spectrum, including all residual rights, where the term residual means all rights to provide services not explicitly granted in the license. Since the economics of spectrum use is rapidly changing, the types of service appropriate at one time may not maximize consumer welfare at another time. The only rational and efficient course, therefore, is for license holders to have the rights to use their spectrum flexibly; that is, for any service, not just the one initially specified in their license.

The **Lebensraum Theory** holds that incumbents have full rights not only to their licensed spectrum, but to the guard bands surrounding the spectrum that protects their signals from interference. Next to their licensed spectrum is unlicensed guard band spectrum. For some services, such as broadcasting, the amount of guard band spectrum dwarves the amount of used spectrum. This helps explain why there are 67 channels allocated to TV broadcasting but even the largest and highest priority TV markets offer less than 25 channels while the average TV market offers only about 7 channels. The guard bands protect the signals of licensed spectrum holders from interfering with each other. As technology has evolved, the amount of necessary guard band spectrum has decreased. License holders of adjacent spectrum argue that this unlicensed spectrum rightfully belongs to them.

The Four Theories Applied to Broadcasting

Applied to local TV broadcasters, each theory of property rights would lead to a very different public policy for managing the transition to digital TV ("DTV"). [9] Each theory also results in a different allocation of the approximately $402 billion worth[10] of spectrum currently allocated to the broadcasting industry for delivery of TV channels over-the-air into homes (see Table 1).[11]

The License Theory. Broadcasters currently have an eight-year license term. Beginning in 1945, the license term was three years. However, in August 1981, the term was extended to five years and in February 1996, to eight years. In other words, the law provides that over an eight-year period all 402 MHz of the broadcasters' retail spectrum (i.e., all 67 broadcast channels)[12] could be returned to the public. Presumably, the average term would be expiring in just four years, so by 2006, 201 MHz (50% of 402 MHz) could be returned to the public at no public expense.

Some commentators have even articulated sound public policy reasons for making all broadcast spectrum available for other services as soon as feasible.[13] If over-the-air broadcasting becomes trivial, the License Theory (which tracks the statute) suggests that all 402 MHz would be reallocated to emerging services with no special compensation. The broadcasters, of course, would react with outrage to such a literal interpretation of their ownership rights.[14]

Table 1. Financial Consequences of Different Spectrum Rights Theories

Name of Property Theory	Amount of Returned Spectrum	Value of Public's Property	Value of Broadcasters' Property
License	402 MHz	$402 billion	$0 billion
Service	353 MHz	$353 billion	$49 billion
Spectrum	150 MHz	$150 billion	$252 billion
Lebensraum	0 MHz	$0 billion	$402 billion

The Service Theory. Broadcasters were originally given their licenses to provide one standard definition analog TV signal. With new digital technology, numerous standard definition quality TV signals can now be squeezed into the space previously allocated for a single standard definition quality TV signal. Using advanced compression techniques, a standard definition DTV signal currently requires about 1 MHz (or 3.25 Mbs) of spectrum.[15] Broadcasters currently provide an average of 13 standard definition over-the-air TV channels for any given local TV market.[16] To replicate this service, broadcasters would need an average of 13 MHz per market plus interference protection between markets. Assuming that twice as much spectrum (26 MHz) is needed for this type of interference protection than is required to broadcast the signals themselves (13 MHz), a total of 39 MHz of spectrum is necessary to preserve broadcasters' existing level of service in a digital world. In other words, 363 MHz of the broadcasters' 402 MHz of spectrum could be returned to the public.[17]

The Spectrum Theory. Broadcasters were originally given 6 MHz of spectrum to provide one standard definition TV channel. Instead of preserving their rights *in perpetuity* to provide one standard definition channel, they could be given rights *in perpetuity* to the entire 6 MHz of spectrum. This would allow them to provide twenty or more VHS quality DTV channels, six or more standard definition DTV channels, two high definition DTV channels, or any other service the market might want.

For example, broadcasters could divide their spectrum into cells and provide thousands of standard definition DTV programs in the space they could previously only fit one. Alternately, broadcasters could simply provide broadband Internet service, which could be used for any type of service and an infinite number of DTV programs on demand. With this approach, about 150 MHz of the broadcasters' 402 MHz of spectrum could be returned to the public. In other words, the second 6 MHz allocated to each broadcaster for DTV could be returned to the public. If the broadcasters were forced to "multiplex"[18] their spectrum within a given market (thus reducing the need for inefficient guard bands), the amount of spectrum returned to the public could increase to over 200 MHz.[19]

The Lebensraum Theory. In addition to 6 MHz of spectrum that provides one standard definition quality TV signal, broadcasters were also originally promised interference protection from neighboring TV stations. As the technology has improved, these guard bands surrounding the 6 MHz allocation are no longer necessary. Some of this spectrum can be acquired simply by expanding the power levels (thus expanding the geographic reach) of existing analog signals into previously unused guard bands in neighboring markets.[20] Nevertheless, it is also possible to add one additional 6 MHz channel for every current 6 MHz channel. This technology was used to facilitate the broadcasters' DTV transition. Each local broadcaster was "loaned" a second 6 MHz channel to offer DTV service in addition to its original 6 MHz analog TV channel. Licenses thus came to include twice as much spectrum, 12 MHz. In addition, some UHF broadcasters were allowed to both acquire a guard band and expand their power levels.[21] Under this theory, the broadcasting industry would return none of the spectrum to the public unless the public pays the broadcasters for the spectrum.

Broadcasters' Hidden Agenda

In the case of TV broadcasters, we can distinguish between the *de facto* and publicized Washington spectrum policy debate. By publicized, I mean the debate that members of Congress and the FCC have been willing to engage in publicly. By *de facto*, I mean the actual logic and execution of their policies.

The publicized debate largely revolves around the extent to which the second and third theory of property rights mentioned earlier should prevail. To my knowledge, no member of Congress or FCC commissioner publicly espouses spectrum lebensraum. Similarly, no political leaders are publicly advocating that broadcasters should be able to use their 6 MHz license with complete flexibility; that is, for its most profitable use: most likely, wireless broadband Internet service over the last mile. The public debate centers on the degree to which broadcasters should be allowed more spectrum flexibility and the conditions under which they might eventually have to return the second, and supposedly temporary, 6 MHz channel they were given to facilitate the DTV transition.

Today, even politicians and public interest advocates who originally opposed "loaning" broadcasters an extra 6 MHz for DTV on the grounds that spectrum flexibility would give broadcasters a huge windfall (e.g., by allowing broadcasters to provide ten channels where in the past they were only allowed to provide one), have grown to accept the notion that TV stations will control spectrum equal to their original 6 MHz allotment.

In contrast, the *de facto* policy debate largely revolves around the extent to which the third and fourth theory of property rights should prevail. The hard facts are that, all rhetoric aside, implementation policies currently lean in the direction of lebensraum. This has been the most elegantly executed with the local radio broadcasters' transition to digital radio. This transition is labeled "IBOC," for in-band on-channel digital radio. But it is actually an Orwellian label (as in "peace means war") for it defines in-band and on-channel to include guard bands.

In contrast, TV broadcasters framed their quest for guard band spectrum a little differently and not so cleverly. They called the spectrum for DTV a second channel, and they described it as a temporary loan. The actual terms agreed to by Congress, however, made it an interest free, indefinite loan, thus giving them what an economist would recognize as *de facto* property rights to the spectrum.[22] Nor was the collateral for the "loan," i.e., the spectrum to be returned at the end of the loan period, clearly specified. So if low value spectrum was returned instead of high value spectrum (e.g., a UHF channel instead of a VHF), or if much of the spectrum mysteriously disappeared (e.g., by granting existing broadcasters more power), no law would be violated.

Conclusion

In Washington telecom policy battles, the most interesting questions are the ones never asked. They are never asked because everyone who is anyone knows that telecom policy is largely driven by power politics, not policy considerations. So raising certain questions is recognized as pointless. After a while, people can no longer recognize that the questions even exist. They think they are arguing policy, but in fact they are arguing politics. Like the parable of the

Emperor's New Clothes, they are so steeped in the political practicalities of the moment, that they cannot see that the Emperor—in this case, spectrum policy—is all but shorn of true public policy concerns and can only pretend to be clothed in public policy considerations because Washington's brass knuckle political realities dictate that this be so.

At the center of the current debate over spectrum policy is the simple and obvious question: what rights do incumbent spectrum license holders have? And, if so, what remains of the public's ownership and control of our nation's airwaves? This fundamental question is rarely, if ever, asked because Washington's political elites know it would reveal a huge discrepancy between their avowed and *de facto* spectrum policies. It would mean acknowledging that they have been transferring tens of billions of dollars of public assets to fat cat special interests. And it would mean acknowledging that those same leaders view the current laws on the books as little more than a farce.

The handling of the broadcasters' digital TV transition vividly illustrates Congress's inability to ask fundamental questions about spectrum policy when a powerful interest group does not want them asked. A naïve member of the public might believe that laws (such as the limited duration of a TV station's license) should be taken seriously and that no public asset (such as the spectrum) should be given away without public compensation. To Washington's sophisticated policymakers, however, this theory of property rights represents a completely unrealistic premise for managing spectrum. If broadcasters have the political muscle to block reallocation to more productive uses, policymakers narrow options to buying them out. Moreover, because both statute and political rhetoric suggest a service theory of spectrum rights, broadcasters have been able to demand and receive additional rights—such as must-carry—in return for allegedly "free TV" and other "public interest obligations."

The time has come for policy analysts to clearly distinguish between what are political and public policy issues relating to the allocation of spectrum. Manhattan Institute's Thomas W. Hazlett, for example, is a renowned spectrum policy analyst. His economic analyses of the inefficiencies of current spectrum policy are masterful.[23] Nonetheless, it does not necessarily follow from the fact that because spectrum is currently used inefficiently, incumbent spectrum holders should be given full spectrum rights as well as lebensraum rights. The only way to draw this conclusion from his economic analyses is to assume that it is politically unrealistic to assume a license theory of spectrum property rights or even a service theory of property rights. Yet the difference between a license theory and spectrum theory of property rights, in our current world where spectrum sells for $1 billion/MHz, may be well over $1 trillion. Transferring that $1 trillion from the public to a handful of large companies and wealthy individuals should not be dismissed as a trifle afterthought of a serious public policy analysis. Such blackmail may be realpolitik, but it is not ordained by good economic policy.

It is the responsibility of policy analysts to lay out all valid policy considerations, regardless of political considerations. It is the task of politicians, not policy analysts, to face political realities. We all know that a rational re-election seeking politician, when faced with a mobilized special interest group and an immobilized general public, must choose to ignore the interest of the general public. However, the policy analyst can at least help to identify the public's interest, even if in the end, political power makes that interest unattainable. Who knows? Despite all odds, some political entrepreneur—policy analysis in hand—might discover a way to alert the public of its interest and thus change the power calculus.

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[1] See Howard Shelanski and Peter Huber, "Administrative Creation of Property Rights to Radio Spectrum," *The Journal of Law and Economics* Vol. 41, No. 2, 1998.

[2] U.S. General Accounting Office, *Land Ownership: Information on the Acreage, Management, and Use of Federal and Other Lands*, GAO/RCED-96-40, March 1996, p. 2.

[3] The value of spectrum, like the value of land, varies by location. Low frequencies, which can easily travel through objects such as buildings, trees, and cars, tend to be far more valuable than high frequencies, which can be blocked by common obstacles such as rain, snow, and even clouds. The FCC first allocated the low, "beachfront" frequencies. The very best of these frequencies are predominantly allocated to broadcasters and the U.S. military.

[4] Recent auctions for good, but not the best, spectrum (e.g., a nice suburban plot vs. a beachfront plot) attracted winning bids equivalent to $1 billion per national MHz of spectrum in the U.S., Germany, and the U.K. The weighted average price paid at the January 2001 re-auction of PCS licenses in the U.S. was on average, $4.18 per MHz per capita, according to the FCC, while the bids across the five European nations that auctioned 3G licenses (the U.K., Germany, Netherlands, Austria and Switzerland) averaged $3.51 per MHz per capita. The population of the U.S., according to the 2000 U.S. Census, is approximately 287 million. Multiplying $4.18/MHz by 287 million would provide a national value/MHz of $1.2 billion. See John Bensche, Courtney Kelleher and Andrew Gardiner, "U.S. Spectrum Auction Guide: A Look at the Changing Landscape of Spectrum Licensing," Lehman Brothers, Feb. 14, 2001, p. 22.

[5] The Department of Commerce's March 1987 U.S. Spectrum Frequency Allocations chart goes from 0 to 300,000 MHz, but the value of the MHz in the higher frequencies is minimal. $1 billion/MHz times 3,000 MHz equals $3 trillion. Media financial analyst Tom Wolzien and FCC Office of Plans and Policies Chair Robert Pepper have used similar methods to

calculate the value of large blocks of spectrum. See footnote 10. Obviously, $3 trillion is a debatable amount based on controversial supply and demand assumptions. One important supply assumption is that the spectrum would be sold in an orderly way over dozens of years. If all the office space in Manhattan were simultaneously put on the market, for example, the value of an individual office would plummet because of the change in the supply curve. This does not happen, however, because office space is put on the market in an orderly way. One important demand assumption is that the demand for spectrum would continue to grow roughly proportional to the increase in spectrum supply. To summarize, just as people generally calculate their asset values at the margin (that is, they extrapolate from recent, similar sales, where the impact of a given sale on the market is minor), I have done the same for spectrum asset values.

[6] As a point of contrast, the gold in Fort Knox, the United States gold depository, is only worth approximately $44.7 billion (147.3 million gold ounces times the current market price of gold, $303.40).

[7] Shelanski and Huber, *supra* note 1, provide a good typology and catalog of spectrum property rights. Unfortunately, their account is out-of-date and misses many valuable rights, such as FASB accounting rules for valuing spectrum and copyright rules regarding Internet retransmissions.

[8] 47 U.S.C. §301. See also, §303.

[9] For a good overview of the economics of broadcast licenses, see Thomas W. Hazlett, "The Wireless Craze, The Unlimited Bandwidth Myth, The Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's 'Big Joke'," *Harvard Journal of Law and Technology*, Spring 2001.

[10] Based on multiplying the broadcasters' 402 MHz of spectrum by $1billion/MHz. At a speech given to the NAB 2001 Futures Summit, Tom Wolzien, a Sanford C. Bernstein & Co. media financial analyst and former CBS executive, told broadcasters he estimated the market value of this spectrum at $367 billion. In a letter to Congress, Robert Pepper, chief of the FCC's Office of Plans and Policies, estimated in 1995 that the 80 MHz of spectrum "loaned" to the broadcasters for the digital TV transition had a market value of up to $70 billion if the $/MHz of the most recent PCS spectrum auctions were used as the benchmark. See Robert M. Pepper, letter to Sen. Joseph Lieberman, May 5, 1995.

[11] The broadcasting industry also has substantial rights to more than 1 gigahertz (1000 MHz) of spectrum for its own internal operations such as transmitting live shots from the field back to the TV studio. Most of this "wholesale" spectrum is at higher frequencies and thus, less valuable than the "retail" spectrum used to deliver TV programs directly to consumers. For an accounting of the broadcasting industry's wholesale spectrum, see the spectrum allocation chart, "Radio and Television Broadcasting Spectrum Usage," National Association of Broadcasters.

[12] There are 69 channels on the broadcast dial, but channels 1 and 37 are not in use, thus leaving a total of 67 channels.

[13] E.g., Nicholas Negroponte, *Being Digital* (New York, NY: Knopf, 1995); George Gilder, *Life After Television* (New York, NY: W. W. Norton, 1992); and Thomas W. Hazlett, "The U.S. Digital TV Transition: Time to Toss the Negroponte Switch," working paper for AEI-Brookings Joint Center for Regulatory Studies 01-15, 2001. http://www.manhattan-institute.org/hazlett/rahazl0111.pdf.

[14] To actually conduct an auction, as opposed to just take back the spectrum, Congress would have to appeal the broadcasters' exemption from spectrum auctions, which were granted to the broadcasters in 1993 when Congress began to use auctions for allocating spectrum. In practice, auctions have primarily been used to auction government spectrum; that is, spectrum not previously licensed for use in the private sector.

[15] In practice, the amount of spectrum required heavily depends on the type of program. The amount of spectrum needed is much greater for a sports program, with a lot of action, than for a "talking head" public affairs program. Thus, there might only be room for 4 standard definition sports programs but 12 standard definition public affairs programs.

[16] The average number of TV stations per TV market is only 7 but the average number of TV stations per household in each local market is 13. The discrepancy occurs because markets with large populations (such as New York City) are allocated more TV channels than markets with small populations (such as Lafayette, Lousiana).

[17] This analysis excludes the interests of low power TV stations, which are only common in less populated areas and until recently were, in many cases, expected to give up their licenses as part of the digital TV transition.

[18] Some programs and parts of programs require less spectrum than others to transmit without loss of detail. For example, a shot of a blue sky requires less spectrum than a shot of a football game shortly after the ball is hiked. Spectrum can be use used much more efficiently if these highs and lows can be averaged out or "multiplexed" across many programs. Both digital cable TV and direct broadcast satellite TV (which is entirely digital) make great use of this efficiency because many TV channels are sent within one spectrum band. However, with only one or two high definition TV channels within a broadcaster's 6 MHz spectrum allocation, this efficiency is harder to achieve.

[19] Current FCC policy envisages that 108 MHz will be returned to the public at the end of the broadcasters' digital TV transition. Prior to passage of the Telecommunications Act of 1996, the National Association of Broadcaster's (NAB) paid consultants wrote a report distributed to allies in Congress stating, as part of the analysis, that 200 MHz would be returned. See Charles L Jackson and John Haring, "Pitfalls in the Economic Valuation of the Electromagnetic Spectrum," report for the National Association of Broadcasters, July 19, 1995, p. 9. NAB President Eddie Fritts subsequently repeated this number in a letter to members of Congress.

[20] To my knowledge, the FCC has never catalogued all the power increases it has granted to broadcasters over the decades on a case-by-case basis. However, anecdotal evidence, such as a perusal of the archives of former Representative Al Swift, suggests the number of increases may be large.

[21] This was done in the name of spectrum "equity." VHF TV stations typically have greater power levels than UHF stations. UHF stations argued that the digital transition was an opportunity to achieve spectrum equity. Since most TV station groups include both UHF and VHF stations, the proposal for spectrum equity generated little opposition within the broadcasting industry. It was a bit like telling the government that since you own one mansion and one hotel, the government, in the name of equity, should finance the improvement of the hotel to the level of the mansion.

[22] The FCC's September 17, 2001 order on channels 60-69 acknowledged the reality of broadcaster lebensraum of the guard band channels. The order acknowledged that since the loan of the second channel was indefinite, the broadcasters would need to receive the lion's share of any spectrum auction of those channels in order to vacate them. The fiction of the spectrum theory was maintained by having the broadcasters privately negotiate the terms of sale for their spectrum with prospective buyers.

[23] Hazlett *supra* notes 9 and 13.