The Brattle Group

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May 18, 2005

Honorable Joe Barton
Chairman
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Honorable John D. Dingell
Ranking Member
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Honorable Fred Upton
Chairman
Subcommittee on Telecommunications and the Internet
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Honorable Edward J. Markey
Ranking Member
Subcommittee on Telecommunications and the Internet
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Messrs. Barton, Dingell, Upton and Markey:

The Committee on Energy and Commerce is investigating ways to free up a potentially productive block of spectrum in the 700 MHz band that is now used to provide traditional broadcast television. To help inform the Committee's analysis, QUALCOMM Incorporated recently asked *The Brattle Group* to estimate how much revenue the U.S. Treasury would receive if the Federal Communications Commission (FCC) auctioned licenses for the remaining 60 MHz of spectrum in this band, which the FCC has allocated for commercial use.[1]

[1] The focus of attention has been on channels 52-69 in the 700 MHz band, which occupy 108 MHz of spectrum. Of that, 48 MHz are not available for auction (6 MHz comprise guard bands, 24 MHz have been designated for public safety, and 18 MHz have been licensed in previous auctions). The remaining 60 MHz, which are the focus of this letter, consist of Blocks C and D in the Upper 700 MHz Bandplan, and Blocks A, B and E in the Lower 700 MHz Bandplan. For bandplan displays, see:

SUMMARY

We use a market comparables approach to calculate the value of licenses in the 700 MHz band because there is a well-established market for equivalent assets. Specifically, we look at sales of broadband personal communications services (PCS) licenses, which use the 1.9 GHz band. The two major sales of broadband PCS licenses that have occurred this year, taken together, yielded a price of $1.60 per MHz-pop.[2] This is consistent with the FCC's 2004 estimate, itself based on market comparables, that 10 MHz of nationwide 1.9 GHz spectrum was worth $1.70 per MHz-pop. Thus, we take the simple average of these two figures ($1.65 per MHz-pop) as our base estimate of the value of nationwide spectrum in the 700 MHz band.

We then analyze two main arguments for adjusting that base estimate. Most important, we consider whether a potentially large increase in the supply of broadband spectrum will significantly reduce its price, as some people argue. We conclude that the prices paid for broadband PCS licenses in 2005 reflect the market's expectation that a significant increase in supply is imminent. Thus, there is no reason to believe that the FCC's planned auction of 90 MHz of 3G spectrum will cause the price of spectrum to drop significantly. There is greater market uncertainty regarding the 700 MHz spectrum, however, so price may drop somewhat if and when that spectrum becomes available for auction.

We also look at the technical features of the 700 MHz band (propagation characteristics and power limits) that make it superior to the 1.9 GHz band for providing broadband wireless services. Most important, these technical advantages allow for significantly lower infrastructure costs; the savings to a licensee building a nationwide network could be worth as much as $0.43 per MHz-pop. All else being equal, some bidders would be willing to pay $0.43 per MHz-pop more for 700 MHz spectrum than for 1.9 GHz spectrum to capture these savings.

In sum, our base estimate should be adjusted upward to reflect the superior technical features of the 700 MHz band, but some downward adjustment is also appropriate to take account of the impact of increased supply that the market has not yet anticipated. Since we do not have a rigorous basis for quantifying either factor, we refrain from making any adjustment, in effect, treating the two factors as canceling one another out. Thus, we conclude that *our base estimate remains our best estimate: an FCC auction of licenses for 60 MHz of 700 MHz spectrum will yield $1.65 per MHz-pop, or about $28 billion, assuming that the spectrum is unencumbered.*

Our estimate represents only the auction revenue (*i.e.*, Treasury receipts) that this 60 MHz of spectrum would generate if it were freed from current restrictions. Lifting the restrictions on this spectrum would also generate significant consumer benefits in the form of new services and lower prices, and these consumer benefits likely would exceed the auction receipts in value by a significant amount.

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http://wireless.fcc.gov/auctions/data/bandplans/700band.pdf; and
http://wireless.fcc.gov/auctions/data/bandplans/700lower.pdf.

[2] We express the revenue generated by a license auction or a secondary trade as the price paid per MHz of spectrum divided by the population (pop) covered by the licenses (price per MHz-pop).

I. VALUATION APPROACH

Economists use two basic techniques to estimate the value of spectrum licenses. The *income approach* is based on the assumption that the value of a spectrum license is equal to the expected future benefits (income) to the license holder discounted at a rate that reflects the time value of money and the risk involved. The *market comparable (or market) approach*, which has its roots in real estate, observes the prices paid for equivalent licenses in the market. The two approaches should yield similar results because the prices paid for comparable licenses reflect the present value of the future income stream that ownership of the license being valued would provide.

We use the market comparable approach to estimate the value of licenses in the 700 MHz band, because there is a well-established market for equivalent assets on which to base our analysis.[3] As described below, we look at sales of broadband PCS licenses in both the *primary* market (*i.e.*, auctions) and the *secondary* market over the last decade. The prices paid in several recent transactions give us a base estimate of the value of 700 MHz licenses. We then analyze three possible rationales for adjusting this estimate: technical advantages of the 700 MHz band; the growing supply of spectrum; and the potential for the 700 MHz licenses to be encumbered.

II. BASE ESTIMATE

A. Review of 1.9 GHz Transactions

1. Auctions

Since Congress authorized their use in 1993, the FCC has held 60 auctions of spectrum licenses, for applications ranging from direct broadcast satellite to paging to personal communications services (PCS). PCS systems, which were licensed originally to provide competition for cellular telephony, encompass a wide range of mobile wireless technologies for voice and data communications. Broadband PCS licenses, which use a 120-MHz portion of the 1.9 GHz band, have been assigned entirely through auction. Spectrum experts agree that, although the 700 MHz band has technical and cost advantages relative to the 1.9 GHz band, broadband PCS licenses offer a very good basis for estimating what 700 MHz licenses would be worth.

The FCC has held five major auctions of broadband PCS licenses, as summarized in Table 1. The broadband PCS spectrum was divided into three blocks of 30 MHz each (A, B and C) and three blocks of 10 MHz each (D, E and F).[4] Auctions 4, 5 and 11, which were held between 1995 and 1997, assigned all 120 MHz of this new spectrum. The two most recent auctions (35 and 58) reassigned licenses that had been cancelled or terminated—most as part of the NextWave bankruptcy. The results of the auctions were wide-ranging: the price per MHz-pop varied from a low of $0.33 (Auction 11) to a high of $4.18 (Auction 35). Moreover, individual auctions included hundreds of licenses; thus, the (weighted average) prices shown in Table 1 mask significant price differences *within* auctions.

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[3] The income approach is widely used by bidders to help determine the appropriate bid. However, in this case, it would require an analyst to estimate would-be licensees' costs and revenues, and the results would highly sensitive to key assumptions, such as the cost of capital. By contrast, the comparable approach is direct and transparent.

[4] Blocks A and B were initially assigned on the basis of 51 Major Trading Areas (MTAs). Blocks C, D, E and F were assigned on the basis of 493 Basic Trading Areas (BTAs).

Table 1
FCC Broadband PCS Auctions

Transaction	Block	Date	Spectrum	Geographic Service Area	Price / MHz-Pop
Auction 4	A & B	1995	1.9 GHz	National	$0.51
Auction 5	C	1996	1.9 GHz	National	$1.35
Auction 11	D,E & F	1997	1.9 GHz	National	$0.33
Auction 35	C & F	2001	1.9 GHz	National	$4.18
Auction 58	C, with A, D, E & F	2005	1.9 GHz	Regional	$0.98

Much has been written about the FCC's PCS auctions. Although there is no definitive explanation for the price differences, analysts point to at least four factors. Market conditions are one reason for price differences. Prices in Auction 5 (C block) were significantly higher than prices in Auction 4 (A & B blocks), in part because the intervening year saw major improvements in wireless communications technology and continued strong growth in consumer demand for wireless telephony.[5] In Auction 35, which occurred during a period of lofty investor expectations, bidders paid higher prices still for licenses; European carriers also bid unusually high prices for third-generation cellular licenses at around the same time.

Auction rules are another reason that prices differ. The FCC restricted participation in Auction 4 by existing cellular licensees in an effort to encourage new entry into the telecommunications market. The conscious tradeoff was that fewer bidders participated, which kept bids artificially low. In Auction 5, FCC rules—specifically, overly generous financing terms designed to encourage small business participation—had the opposite effect, attracting a large number of bidders and artificially inflating bids. According to the Congressional Budget Office (CBO), absent these incentives, Auction 5 would have yielded $0.80 rather than $1.35 per MHz-pop.

A third factor is the level of competition in the auction. As indicated above, the yield in Auctions 4 and 5 was directly related to the number of bidders, which in turn was influenced by FCC rules. Similarly, in Auction 11, the low yield ($0.33) was consistent with the small number of bidders (the eligibility ratio—a crude measure of the level of bidder competition—was only 1.7, compared to 6.7 for Auction 5 and 1.9 for Auction 4). This low participation rate was a reaction to the speculative bidding in Auction 5 and reflected a temporary dip in the telecommunications market—two factors that contributed to the subsequent bankruptcy of NextWave and the other C-block licensees.

Finally, characteristics of the licenses themselves help explain price differences. One important characteristic is the geographic scope of spectrum coverage. The first four auctions assigned licenses for every market in the country—in effect providing valuable nationwide spectrum rights. By contrast, Auction 58 consisted of a miscellaneous assortment of licenses, most of them in second and third tier markets, and did not provide the opportunity for nationwide

[5] Congressional Budget Office, *Where Do We Go From Here? The FCC Auctions and the Future of Radio Spectrum Management* (April 1997), at 19-22. Unless other indicated, the information in this section comes from this report.

coverage. The size of the spectrum block is another relevant characteristic. All else being equal, licenses in the 30-MHz blocks (A, B and C) are more valuable per MHz-pop than those in the 10-MHz blocks (D, E and F) because the larger blocks give licensees greater flexibility.

2. Secondary Market Transactions

Broadband PCS licenses have traded in the secondary market as well. Table 2 summarizes eight relatively recent secondary market trades. The list is not exhaustive. Rather, it consists of seven transactions that the FCC examined in 2004 as part of an unusual valuation exercise described below. Table 2 also includes a 2005 transaction in which Verizon Wireless purchased NextWave's PCS licenses in 23 largely metropolitan markets.

Table 2
Secondary Market Sales of Broadband PCS (1.9 GHz) Licenses

Transaction	Date	Seller	Buyer	Price / MHz-Pop
50 Licenses	2002	Northcoast	Verizon	$1.58
Spectrum in 34 Cities	2003	NextWave	Cingular	$1.66
62 Spectrum Licenses in 57 Areas	2004	Qwest	Verizon	$1.36
10 MHz, 3 BTAs (San Francisco-Oakland-San Jose, Sacramento, Las Vegas)	2004	Cingular	T-Mobile	$1.67
10 MHz New York BTA	2004	NextWave	Verizon	$4.74
10 MHz Sarasota-Bradenton BTA	2004	NextWave	MetroPCS	$1.37
10 MHz Tampa-St. Petersburg-Clearwater BTA	2004	NextWave	MetroPCS	$1.33
19 10MHz and 4 20MHz Licenses in 23 BTAs	2005	NextWave	Verizon	$2.80

These secondary market transactions reflect far less variation in price than the broadband PCS auctions, largely because the FCC selected them (or at least the first seven) as representative of the value of nationwide spectrum in the 1.9 MHz band. The two outliers are the 2004 and 2005 sales of NextWave licenses to Verizon, which yielded $4.74 and $2.80 per MHz-pop, respectively. These licenses commanded higher prices because they serve New York City and other large metropolitan markets. Such markets typically bring higher prices per MHz-pop because they are more densely populated, and thus less expensive to serve, and more affluent.

B. Selection of Comparable Transactions

1. FCC's Point Estimate

In a 2004 Report and Order, the FCC concluded that 10 MHz of nationwide spectrum in the 1.9 GHz band was worth $1.70 per MHz-pop.[6] This unusual finding (the FCC does not put a value on spectrum as a rule) was part of a complex regulatory proceeding that involved a dispute between Nextel Communications and Verizon Wireless over the value of that spectrum. The FCC analyzed competing valuations provided by experts for the two companies. These valuations, which ranged from $1.25 to $1.82 per MHz-pop, used both income and market approaches. However, the FCC ultimately based its estimate solely on market comparables.

[6] In the Matter of Improving Public Safety Communications in the 800 MHz Band, FCC, "Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order" (August 6, 2004).

Specifically, after reviewing the seven pre-2005 transactions summarized in Table 2, the FCC identified the first two (Northcoast-Verizon and NextWave-Cingular) as its benchmarks and calculated the average of the two prices ($1.62 per MHz-pop). The Commission then added a five percent premium to reflect the fact that the disputed spectrum (unlike the benchmark spectrum) would provide nationwide coverage. (The FCC limited the premium to five percent on the grounds that several carriers already had national footprints and thus would not be willing to pay as much for nationwide spectrum.) *The FCC's point estimate ($1.70 per MHz-pop) is a solid indication of what nationwide licenses in the 1.9 GHz band were worth last year, and it represents one comparable on which we base our valuation of licenses in the 700 MHz band.*

2. 2005 Transactions

As reported in Tables 1 and 2, two major sales of 1.9 GHz licenses have occurred this year, both involving the resale of NextWave assets:

- Auction 58, in which NextWave licenses that serve about 100 million people in mostly second tier markets sold for $2 billion, or $0.98 per MHz-pop.
- Verizon's purchase for $3 billion, or $2.80 per MHz-pop, of NextWave licenses covering 73 million people in more than 20 major markets.

Neither of these transactions, taken alone, represents a good market comparable. As reflected in their price, Auction 58 licenses cover markets that are lower in density (and therefore more expensive to serve on a per customer basis) and less affluent. By contrast, the private transaction covered a number of high-density, relatively affluent markets, including New York, Boston, Washington, DC, and Los Angeles. Collectively, however, the licenses cover more than 60 percent of the U.S. population. Moreover, taken together, these two transactions produced prices that are roughly equivalent to a nationwide average.[7] Using a weighted-average, *the combined price of spectrum licenses sold in Auction 58 and the 2005 NextWave-Verizon Wireless transaction is $1.60 per MHz-pop. This weighted-average price represents a second market comparable on which to base our valuation of licenses in the 700 MHz band.*

[7] To compare these two transactions to a nationwide auction, we did the following analysis. For each of three nationwide FCC auctions (Auctions 5, 11 and 35), we calculated the price of licenses in the subset of markets (basic trading areas, or BTAs) which were included in *either* Auction 58 *or* the 2005 Verizon-NextWave transaction. For each of those three auctions, we then compared the average price of licenses in the specified subset of BTAs to the (nationwide) average price for *all* licenses. For Auction 5, licenses in the specified subset of BTAs sold for $1.45 per MHz-pop compared to $1.35 per MHz-pop for all licenses. For Auction 35, the two prices were even more similar: $4.26 per MH-pop for the subset of licenses versus $4.18 per MHz-pop for all licenses. For Auction 11, by contrast, the subset price ($0.25 per MHz-pop) was unexpectedly low relative to the nationwide price ($0.33 per MHz-pop); however, a number of second and third tier markets in that auction produced higher bids than first tier markets, an atypical pattern that seems to account for that unexpected result. Overall, we concluded that the two 2005 transactions, taken together, produced prices equivalent to those of a nationwide auction.

C. Recap and Conversion of Our Base Estimate to Aggregate Revenue

To recap, the two major sales of 1.9 GHz licenses that have occurred this year, taken together, yielded a price of $1.60 per MHz-pop, which is remarkably consistent with the FCC's 2004 estimate that 10 MHz of nationwide 1.9 GHz spectrum was worth $1.70 per MHz-pop. Thus, *we take the simple average of these two figures—$1.65 per MHz-pop—as our base estimate of the value of the rights (licenses) to nationwide spectrum in the 700 MHz band.* Converting that to aggregate revenue, we estimate that an FCC auction of licenses to 60 MHz of such spectrum would generate about $28 billion.[8] If any portion of that spectrum were to be set aside for unlicensed use, and therefore made ineligible for auction, our estimate would need to be reduced proportionately.[9]

III. Analysis of Possible Adjustments to our Base Estimate

Our base estimate ($1.65 per MHz-pop) is a solid measure of the value of nationwide licenses for broadband PCS spectrum in the current market—namely, a highly competitive, spectrum-constrained market served by five national wireless carriers, most of whom nevertheless have acquired sufficient bandwidth to give them something approaching a nationwide footprint.[10] It reflects the expected future profits from broadband PCS license ownership, based on information available at the time of the transactions regarding market conditions (demand trends, supply expectations, number of competitors, *etc.*), technology, and other factors. However, there are three possible arguments for adjusting our base estimate as a measure of the value of 700 MHz licenses. First, an upward adjustment may be appropriate to take account of technical advantages of the 700 MHz band relative to the 1.9 GHz band. Second, changing market conditions—in particular, the potential for a large increase in the supply of spectrum—may require a downward adjustment in our base estimate. Finally, the possibility that the 700 MHz spectrum will be encumbered (*i.e.*, not cleared of the broadcasters) may require a downward adjustment.

A. Technical and Cost Advantages of the 700 MHz Band

The 700 MHz band has technical features that make it particularly well-suited to providing broadband wireless services. The fundamental laws of physics dictate that lower frequencies travel further at a given power level. Thus, providers need fewer antennas and less power to deliver services to a given area. Moreover, because TV frequencies can better penetrate walls, signals are not as dependent on line-of-sight transmission to outdoor antennas. Finally, under FCC regulations, the power limits for the lower 700 MHz band are substantially higher than for other broadband wireless spectrum, including the 1.9 GHz band.

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[8] This simple exercise involves multiplying the price per MHz-pop by the bandwidth that would be licensed (60 MHz) and by the size of the relevant population—in this case, total U.S. population. To be consistent with the FCC's 2004 valuation of the 1.9 GHz spectrum, we use the total year 2000 population for the United States including possessions, or 285.62 million. Actual calculations are: ($1.65 x 60 x 285,620,000) = $28.3 billion.

[9] For a recent economic analysis of the debate over unlicensed spectrum, see William J. Baumol, "Toward an Evolutionary Regime for Spectrum Governance: Licensing or Unrestricted Entry?," Working Paper, AEI-Brookings Joint Center for Regulatory Studies (April 2005). http://www.aei.brookings.org/admin/authorpdfs/page.php?id=1137.

[10] The five national wireless carriers are: Cingular-AT&T, Nextel, Sprint, T-Mobile and Verizon Wireless. Sprint and Nextel have announced plans to merge, which if approved would leave four national carriers. Approval of the merger would not alter our analysis.

These advantages are meaningful: a signal transmitting at 700 MHz covers roughly twice the area as one transmitting at 1.9 GHz, and thus needs only about half as many base stations.[11] According to Charles Townsend, the Managing General Partner of Aloha Partners, which is the largest 700 MHz licensee, the costs of building a nationwide network are directly proportional to the number of base stations: a 700 MHz nationwide network would cost about $3.6 billion compared to $6.8 billion for a 1.9 GHz network.[12] Moreover, with fewer base stations, a licensee's operating costs would be lower. Two caveats are in order: First, the savings would be less, although still significant, for an existing carrier that already has a nationwide network. Second, as network traffic grows, and an operator begins to split its cell sites, the advantage that comes from using the 700 MHz band will diminish. But, according to Townsend, the "crossover" point is three to eight years out in most markets.[13]

The propagation characteristics of the 700 MHz band are particularly advantageous for certain applications. For example, QUALCOMM bought encumbered spectrum in the lower 700 MHz band to launch its MediaFLO service, which will deliver multimedia content to wireless devices on a dedicated network. QUALCOMM will be able to provide this multicast application with just a fraction of the towers it would need if it were operating in a higher-frequency band.[14] Similarly, the relative ease with which 700 MHz signals can penetrate walls may enable more cost-effective provision of broadband wireless services to equipment used primarily indoors.[15]

In short, because of the superior technical features of the 700 MHz band, licensees will be able to provide the same service at lower costs (or higher quality), and some services may be feasible and/or cost-effective at the lower band but not at the higher band. All else being equal, bidders will pay more for a 700 MHz license to capture this economic advantage.

The Aloha Partners figures cited above give some indication of what this advantage is worth. Based on Townsend's estimates, the difference in the cost of building a (new) nationwide network for 700 MHz spectrum versus 1.9 GHz spectrum is about $3.2 billion ($6.8 billion versus $3.6 billion).[16] Assuming that a nationwide operation requires 20 MHz of spectrum, that figure translates into a per-MHz-pop cost savings of about $0.43—a substantial number.

All other things being equal, some if not all bidders would be willing to pay $0.43 per MHz-pop more for 700 MHz spectrum than for 1.9 GHz spectrum in order to capture those savings. Thus, one could adjust our base estimate ($1.65 per MHz-pop) upward by as much as that amount to

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[11] The 700 MHz spectrum offers a four-to-one advantage over the 2.5 GHz band, which is the current spectrum for WiFi and multichannel multipoint distribution services (MMDS). Chris Knudsen of Vulcan Capital estimated that it would require only one-third to one-fourth as many cell cites to provide wireless broadband service to the Seattle area using 700 MHz spectrum as opposed to the 2.6 GHz band. Similarly, an analysis by Intel found that the 2.5 GHz band would require four to five times as many base stations as the 700 MHz band to achieve equal coverage. Patrick P. Gelsinger, Chief Technology Officer, Intel Corporation, Testimony before the Senate Committee on Commerce, Science and Transportation (June 9, 2004).

[12] Letter from Townsend to Members of the House Committee on Energy and Commerce (April 27, 2005).

[13] Telephone conversation with Charles Townsend (May 11, 2004).

[14] QUALCOMM Incorporated, "QUALCOMM Subsidiary to Support Nationwide Delivery of Mobile Multimedia in 700 MHz Spectrum," Press Release (November 1, 2004).

[15] Testimony of Patrick P. Gelsinger, Intel Corporation, *op cit.*

[16] We calculated that number as follows: A $3.2 billion savings on a nationwide network represents a cost savings of about $10 per pop, where total pop, or U.S. population, is about 300 million. Assuming that a nationwide operation will require 20 MHz of spectrum, that savings equals $0.50 per MHz-pop—or about $0.43 in present discounted dollars. To get $0.43, we spread the savings over five years and applied a 10 percent discount rate.

take account of the technical advantages of the 700 MHz band. However, we stop short of making any formal adjustment to our estimate, because we have not done a comprehensive or rigorous analysis of potential cost savings or an income analysis of potential bidders.

B. The Growing Supply of Spectrum

The U.S. devotes only about 190 MHz of spectrum to fixed and mobile wireless communications services, and that figure has not grown since the mid-1990s. By contrast, European countries allocate 250-300 MHz on average for the same activities, and the figure is even higher in Germany (302 MHz), the Netherlands (355 MHz) and the United Kingdom (340 MHz).[17] Even among experts who disagree on telecommunications policy, there is general agreement that the United States is spectrum-starved.[18]

In response to widespread criticism from industry and elsewhere, officials in the Executive Branch and the Congress have tried to address this spectrum drought in two ways. These efforts should soon provide some relief.

One effort has focused on 90 MHz of spectrum in the 1.7 GHz and 2.1 GHz bands that may be used for advanced wireless services, including third-generation (3G) services. (Among other things, these bands correspond to the spectrum already used for 3G in many parts of the world.) Then-Chairman Michael Powell announced in December 2004 that the FCC planned to commence the auction of licenses in that spectrum as early as June 2006.[19] Powell's announcement marked the culmination of a four-year process, initiated by the Clinton Administration, through which government and industry examined spectrum needs and identified frequency bands that could be cleared to allow for the provision of 3G services. As a last step in that process (and just days before Powell's announcement), Congress finally enacted the Commercial Spectrum Enhancement Act. This legislation, which was approved a year earlier by the full House and the Senate Commerce Committee, provided for the use of auction revenues to compensate the Department of Defense and other federal agencies for the costs of clearing those bands—thus removing the final barrier to an FCC auction of this spectrum.[20]

The second, ongoing effort involves the 60 MHz of spectrum in the 700 MHz band that is the focus of this letter. In the past, efforts to reallocate this spectrum to general wireless use, in keeping with FCC bandplans, have lacked enough support in Congress to overcome broadcaster opposition. However, the tide has been gradually turning, in response to mounting criticism from industry, think tanks and the media, among other sources. A year ago, House Energy and

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17 Testimony of Thomas W. Hazlett before the Senate Committee on Commerce, Science and Transportation (June 9, 2004).

18 At a recent conference, panelists with alternative views on U.S. telecom policy expressed a strikingly common view as to the urgent need for spectrum. According to one of the experts, Thomas Hazlett, the shortage of spectrum has even driven consolidation in the wireless industry. AEI-Brookings Joint Center for Regulatory Studies and Stanford Institute for Economic Policy Research, "The Future of Telecom Deregulation: Two Alternate Visions," Washington, DC (March 24, 2005).

19 FCC Press Release, "FCC to Commence Spectrum Auction That Will Provide American Consumers New Wireless Broadband Services" (December 29, 2004).

20 The Act required the FCC to give the National Telecommunications and Information Administration (NTIA) 18 months notice of its intent to auction the 3G spectrum. Less than a week after President Bush signed the Act (and with the Christmas holiday having intervened), Chairman Powell sent a letter to NTIA providing the minimum notice. Letter from FCC Chairman Michael K. Powell to the Honorable Michael D. Gallagher, Assistant Secretary for Communications and Information, Department of Commerce (December 29, 2004).

Commerce Committee Chairman Joe Barton endorsed a plan that would force TV stations to return their analog spectrum to the federal government by the end of 2006, and Rep. Barton's intent to move legislation toward that goal has been widely publicized for months. Although impediments remain, and key Senate officials are seen as less enthusiastic, there has been a growing perception that the Congress is likely to enact legislation this year to clear the 700 MHz spectrum by a date certain.

Some observers, in considering the financial implications of these developments, have suggested that the pending auction of licenses to 3G spectrum will reduce what bidders are willing to pay for broadband licenses, including 700 MHz licenses. By this view, once the 3G spectrum reaches the market, an auction of 700 MHz licenses will yield prices significantly below those recently paid for broadband PCS spectrum. However, this seemingly logical observation about supply and demand becomes problematic on closer inspection.

In analyzing the impact of an increase (or decrease) in supply on the price of an asset, the triggering event is not the increase (or decrease) itself but rather the market's recognition that it is going to occur. Thus, to the extent that the pending increase in the supply of broadband spectrum was expected, the market should have factored it into recent spectrum transactions. As noted above, the FCC announced its intent to auction 90 MHz of 3G spectrum in December 2004, following a well-publicized, multi-year process that slowly but steadily removed the political and legal impediments to such a transaction. Although some uncertainty as to timing remains, the FCC's intent to begin auctioning the 3G spectrum at the earliest possible date has been known since late last year, and was anticipated to some degree long before that.

In sum, the prices paid for broadband PCS licenses in the two 2005 transactions that we observed, if not the earlier transactions, reflect the market's expectation that a significant increase in supply is imminent. Thus, there is no reason to believe that the increase in supply resulting from the 3G auction will cause the price of spectrum to drop significantly.

Similarly, to the extent that the market has already anticipated the increase in supply represented by the 700 MHz spectrum, that increase in available spectrum will not affect the price of broadband licenses. That said, considerable market uncertainty remains, in particular, as to the likely date by which broadcasters will be required to clear the band under final legislation. If and when legislation passes, and the 700 MHz spectrum is auctioned, that uncertainty will dissolve, and the price of spectrum may fall.

In sum, because markets are generally efficient, current spectrum prices reflect the best available information regarding the potential impact of future changes in supply, demand and other factors. By relying on recent market transactions, a comparable methodology takes advantage of this vast base of decentralized knowledge. Thus, the fact that 90 MHz of 3G spectrum will come on the market in the next few years is not a credible argument for adjusting our base estimate downward, precisely because recent broadband PCS license sales should have already taken that future development into account. For the same reason, Wall Street's projection that the demand for wireless data and voice services will see continued strong growth is not a basis for adjusting our estimate upward: recent transactions already reflect that expectation.

Because there is greater market uncertainty with respect to the 60 MHz of 700 MHz spectrum, it may be appropriate to adjust our base estimate downward to reflect the potential impact of that added supply. But recent transactions should have taken even that into account somewhat because of the gradual, tide-turning developments described above—in particular, Chairman Barton's well-publicized intent to free up the spectrum, which he signaled nearly a year ago.

C. The Potential for Encumbrance

The comparable transactions on which we based our estimate involved spectrum that either was unencumbered or was covered by clear rules that provided for the removal of any encumbrance (*i.e.*, other spectrum activities that might create interference). Thus, if any of the 700 MHz spectrum were to be encumbered, our base estimate would need to be adjusted downward. Moreover, the downward adjustment would need to be significant. Table 3 summarizes the results of two relatively recent FCC auctions of encumbered licenses in the 700 MHz band. Although the spectrum assigned in these two auctions is considered to be the best of beachfront property, licensees cannot use the spectrum to its full extent unless it is vacated by the current license holders, namely the broadcasters. As a result of this limitation, the licenses sold for only three cents per MHz-pop—a small fraction of the price that comparable, unencumbered licenses commanded in the transactions shown in Tables 1 and 2.

Table 3
FCC Auctions of Encumbered 700 MHz Spectrum

Transaction	Date	Spectrum	Price / MHz-Pop
Auction 44 (Lower 700 MHz Band)	2002	700 MHz	$0.03
Auction 49 (Lower 700 MHz Band)	2003	700 MHz	$0.03

We have no basis for predicting the probability that any or all of the 60 MHz of 700 MHz spectrum will be encumbered. Thus, we will not adjust our base estimate to reflect that probability. Instead, we will make our estimate conditional on the assumption that the spectrum will be unencumbered—*i.e.*, that it will be cleared of television broadcasters as of a date certain.

IV. FINAL ESTIMATE

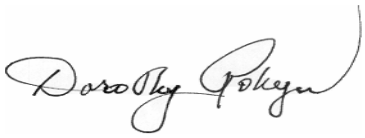
In section two, we used market comparables to calculate as our base estimate that licenses to 60 MHz of 700 MHz spectrum would be worth $1.65 per MHz-pop, or about $28 billion. In the last section, we analyzed three possible arguments for adjusting that base estimate. We concluded that our estimate should be adjusted upward, potentially by a significant amount, to take account of the superior technical features of the 700 MHz band; at the same time, some downward adjustment is appropriate to take account of the potential impact of increased spectrum supply that the market has not yet anticipated. Since we do not have a basis for quantifying either factor, we refrain from making any adjustment, in effect, treating the two factors as canceling one another out. Thus, we conclude that *our base estimate remains our best estimate: an FCC auction of licenses to 60 MHz of 700 MHz spectrum will yield $1.65 per MHz-pop, or about $28 billion, assuming that the spectrum is unencumbered.* If any portion of this spectrum were to be set aside for unlicensed use, and therefore made ineligible for auction, our estimate would need to be reduced proportionately.

V. CONSUMER BENEFITS ARE ADDITIONAL—AND SIGNIFICANT

Our estimate represents only the auction revenue (*i.e.*, receipts to the U.S. Treasury) that 60 MHz of unencumbered spectrum in the 700 MHz band would generate. In addition, the market allocation of this choice spectrum would result in benefits to American consumers in the form of new broadband services and lower prices for existing services. Although a calculation of these consumer benefits is outside the scope of our work, it is safe to say that they would be significant. Two prominent telecommunications economists have estimated that the consumer surplus (a measure of benefits to consumers) associated with efficient use of spectrum could be an order of magnitude greater than the auction value of spectrum licenses.[21]

We appreciate the opportunity to provide this information to the Committee.

Sincerely,



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[21] Gregory L. Rosston, "The Long and Winding Road: The FCC Paves the Path with Good Intentions," *Telecommunications Policy*, Vol. 27, No. 7 (August 2003), pages 501-515; and Thomas W. Hazlett, Coleman Bazelon, John Rutledge and Deborah Allen Hewitt, "Sending the Right Signals: Promoting Competition Through Telecommunications Reform," A Report to the Chamber of Commerce (September 22, 2004), page 69.

[*] *The Brattle Group* is an economic consulting firm that specializes in the application of quantitative methods in economics and corporate finance to the analysis of competition in network industries. William Zarakas heads *Brattle's* practice in telecommunications and Dorothy Robyn heads the firm's public policy practice.