Testimony of

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I. INTRODUCTION

In the 700 MHz auction, the Federal Communications Commission licensed a large portion of America's so-called digital dividend. These frequencies are highly desirable. Any frequencies below about 3 GHz—those most suited for mobile communications—are generally sought after because overall insufficient spectrum is flexibly licensed for mobile communications. The 700 MHz frequencies are below 1 GHz and are considered the most desirable. They allow transmissions over greater distances with less power consumption and can penetrate buildings well. Consequently, lower infrastructure costs associated with this band make it particularly suitable for firms building new networks.

Unfortunately, the outcome of the 700 MHz auction was that the nation's two largest mobile phone providers—AT&T and Verizon—won most of the licensed spectrum. Now these two providers are poised to dominate the market for high capacity, ubiquitous wireless broadband services. The irony of this outcome is that the cellular firms that dominated the duopoly marketplace that existed prior to the first FCC auctions are the same firms that, after a series of mergers and acquisitions, make up AT&T and Verizon today.

This unfortunate outcome was caused by ill-configured spectrum license blocks and a poorly designed auction. The central problem was one of hubris. The FCC thought it could do too much—in fact, way too much—with the tools at hand. The Commission tried to promote rural build-out, create open access, encourage new entrants, increase broadband competition and, of course, provide a solution to the serious problem of deploying a nationwide interoperable public safety network.

In an attempt to accomplish all of these various goals, the 700 MHz auction was designed with an astonishing number of new, largely untried, features, including package bidding, high reserve prices, open access requirements, mixing of paired and unpaired spectrum, and a public-private partnership. The failure of the results were predicted: rural build-out will be hampered, Verizon—already committed to open access on its existing network—won a nationwide license on the cheap, there are no new entrants of note, there is increased concentration in the wireless broadband market and, of course, we are no closer to solving the problem of public safety interoperability.

There were many signs of inefficiency in the auction. Foremost, the patterns of prices within the auction were often nonsensical. Also the auction undoubtedly could have raised even more money than it did. As the FCC began shaping the final band plan and auction rules in early 2007, I argued that large C Block licenses would have an anti-competitive effect on the auction. As configured, the band is only attractive to large nationwide bidders and, as it turned out, Google was the only non-incumbent contender for this band—and they were never believed to be seriously interested in becoming a network operator. The majority of the remaining demand in the auction was channeled to the A and B Blocks, unnecessarily driving the prices of those bands out of reach for many bidders. This in itself thwarted the auction goals of promoting rural development and additional competition in the broadband wireless marketplace. Had the C Block been configured differently so that more substitution was possible between the A, B and C

Blocks, the auction could have raised as much as an additional $5 billion from bidders that were shut out.

As a result of this poor auction outcome, it is more important than ever to flood the market with additional licensed spectrum. This is necessary to mitigate the negative effects of concentration in spectrum holdings that resulted from this auction. Fortunately, there exists another reservoir of spectrum below 1 GHz that is available—namely, the TV white spaces. Clearly delineating the usable white spaces, creating overlay licenses, and auctioning them would allow the significant unmet demand from the 700 MHz auction to be satisfied, with the added bonus that such an auction would raise many billions of dollars in additional revenue.

As for the pending decisions about the D Block, the worst thing would be to leave it unused. Freeing it for unrestricted commercial use, configuring it as smaller geographic licenses, and then auctioning it would be best. This would have the benefit of adding more commercial spectrum under flexible license to the band, which would allow a portion of the significant unmet demand from Auction 73 to be met. This approach, of course, would require that the needs of the public safety community be met through other means. Many observers view this outcome as unlikely.

The more likely outcome appears to be that the FCC will preserve the public-private partnership with the central features that the D Block spectrum could only be used for commercial services that are interruptible, and will include a requirement to build-out and serve the public safety community. Any such policy should recognize the economic characteristics of spectrum for interruptible services. Namely, that it will come with the advertising slogan: "Guaranteed NOT to work when you need it most."

Spectrum such as this will be most valuable to network operators that have licensed spectrum in the same market that will not be interrupted, which allows them to continue to offer service during emergencies. It is uncertain whether another licensee would more effectively use this spectrum by integrating it with its commercial network or by purchasing access to it on a wholesale basis. Consequently, this outcome should not be predetermined and any wholesale-only restrictions should be abandoned.

Finally, the economics of a public-private partnership between a commercial wireless provider and public safety users is economically tenuous at best. If the D Block is re-auctioned with continuing public safety requirements, there should be no reserve price. Frankly, the FCC should count its blessings if it is able to find any provider willing to take on the commitments required of a D Block licensee.

II. HISTORY OF THE BAND

The frequencies available in the 700 MHz auction are a large part of the U.S.'s so-called digital dividend. These frequencies are finally available at the culmination of process to switch over-the-air broadcasts from an analog format to a more efficient digital format. The process, due to

be completed on February 17, 2009, took a generation. In addition to providing better quality[1] television with more choices, the transition to digital television will free up 108 MHz of prime radio spectrum—about one-quarter of the total dedicated to analog television broadcasts—for other uses.

The FCC began investigating advanced television services in the 1980s. Under direction from Congress, the Commission formulated an open-ended transition plan to introduce the new television technology and end the older analog broadcasts. The basic idea was that each broadcaster would receive a second digital channel in its market and simultaneously broadcast analog and digital signals until some later date (much later date) when no one would be relying on the analog broadcasts and they could be turned off. The nature of digital broadcasts would allow them to be spaced more closely together than analog signals, creating the possibility of reallocating a portion of the television band to other uses at the conclusion of the transition.

By the mid-1990s, with the first Broadband PCS auctions, the immense value of these reclaimed frequencies became clearer.[2] Some policy makers also noted the value of the second digital channel that would be assigned to existing broadcasters. Prior to passage of the Telecommunications Act of 1996, a debate developed about the relative merits of two different approaches to the transition. On the one hand, the FCC could sell the second digital channel immediately, endowing existing broadcasters with their then-current licenses and forgo clearing a portion of the band at the conclusion of the transition. On the other hand, the FCC could modify its transition plan to hasten the end date when the frequencies would be available. Congress's first intervention in this storied band of spectrum was, in the 1996 Telecommunications Act, to mandate that broadcasters receive the second channel for digital broadcasts at no cost to them.[3]

Congress's second intervention, in the Balanced Budget Act of 1997 (BBA97), was to set a deadline for the end of analog broadcasts—and, consequently, the availability of the reclaimed frequencies—of December 31, 2006 and mandate a series of auctions of the reclaimed frequencies. The 2006 deadline, however, had a glaring loophole—it made an exception for turning off the analog broadcasts in any market where less than 85% of homes could receive the digital broadcasts. Further, to be counted as part of the receiving public, a household had to either be capable of receiving and viewing at least one over the air digital channel or, in the event a household relied on a multichannel video distributor such as cable or satellite, it must receive *all* digital broadcasts in its market from its video provider. By 1999 Congress realized that the 2006 deadline was not going to be met and that the transition was once again an open ended affair.[4]

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1 Better quality in a technical sense. It is well beyond the scope of the current analysis to judge the quality of television programming today.

2 Groundwork was laid in an important paper by two FCC staffers. *See*, Evan Kwerel and John Williams, "Changing Channels: Voluntary Reallocation of UHF Television Spectrum," OPP Working Paper Series #27 (November 1992).

3 The 'no charge' requirement only applied to non-subscription video programming broadcasts. For any ancillary service for which the broadcaster earned revenues, a 5% gross revenue fee was imposed. Collections to date have been minimal.

4 Congressional Budget Office, "Completing The Transition To Digital Television," *CBO Papers,* September 1999.

Although the early auction deadlines imposed by the BBA97 were not met, the FCC did license and auction some of the frequencies. Starting in 2002 with Auction 44[5], the FCC sold two bands comprising 18 MHz of licensed spectrum. The existing broadcasters in these bands—those broadcasting on TV channels 54, 55 and 59—were protected, so the new licensees could only use the white spaces around those protected television broadcasters until the conclusion of the digital television transition, at which time the entire licensed band would be available. Without any definite date as to when the digital television transition would end and the protected broadcasters would vacate their channels, the early auction of those television channels raised only paltry sums—a total of only $146 million (or about $0.03/MHz-Pop) for the 18 MHz of radio spectrum.

Demand for the frequencies that would be reclaimed at the end of the digital television transition grew and so did a solution to the open ended nature of the transition. In early 2006, the President signed a deficit reduction act which set February 17, 2009 as the end date of the digital television transition and mandated that the remaining 700 MHz band frequencies designated for commercial users be auctioned by 2008. So as to not disenfranchise viewers who relied on over-the-air broadcasts, that legislation also set up a program to subsidize set-top converter boxes. Estimates of the value of the remaining 700 MHz spectrum to be auctioned were over $20 billion.[6] The Congressional Budget Office gave the legislation a score of $10 billion. The revenues for the auction were estimated to be higher than this—the score represented the expected *net* effect on the budget, including a reduction in revenues for the already planned AWS auction from the increased supply of licensed commercial spectrum that would soon be available.

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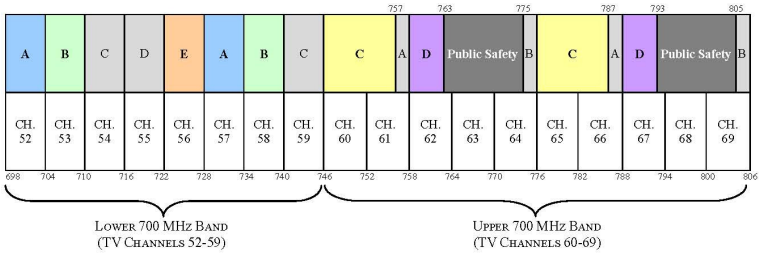
5 Unsold licenses were subsequently sold in Auction 49 and Auction 60.

6 Bazelon, Coleman. "Analysis of an Accelerated Digital Television Transition," Analysis Group. (May 31, 2005), p. 1. *See also*, William P. Zarakas and Dorothy Robyn, Letters to the U.S. House of Representatives Committee on Energy and Commerce and the U.S. Senate Committee on Commerce, Science and Transportation regarding the value of wireless spectrum in the 700 MHz band, May 18, 2005.

III. PROBLEMS WITH THE CURRENT ALLOCATION OF THE 700 MHZ BAND

Figure 1
The Current 700 MHz Band Allocation

Revised 700 MHz Band Plan for Commercial Services



Block	Frequencies (MHz)	Bandwidth	Pairing	Area Type	Licenses
A	698-704, 728-734	12 MHz	2 x 6 MHz	EA	176
B	704-710, 734-740	12 MHz	2 x 6 MHz	CMA	734
C	710-716, 740-746	12 MHz	2 x 6 MHz	CMA	734
D	716-722	6 MHz	unpaired	EAG	6
E	722-728	6 MHz	unpaired	EA	176
C	746-757, 776-787	22 MHz	2 x 11 MHz	REAG	12
A	757-758, 787-788	2 MHz	2 x 1 MHz	MEA	52
D	758-763, 788-793	10 MHz	2 x 5 MHz	Nationwide	1 *
B	775-776, 805-806	2 MHz	2 x 1 MHz	MEA	52

* Subject to conditions respecting a public/private partnership.

The blocks shaded above in gray (Lower 700 MHz Band C and D Blocks and Upper 700 MHz Band A and B Blocks) were auctioned prior to Auction 73.

Last reviewed/updated 9/5/2007.

A. C BLOCK IS TOO BIG

The central problem with the 700 MHz allocation is that too much of the available radio spectrum is tied up in the allocation of the large regional C Block licenses. The regional C Block licenses are large in both geographic scope—it takes only six to make up the continental U.S.—and spectrum bandwidth—the licenses are approximately twice the size of the other paired blocks allocated in the 700 MHz band. One-third of the total frequencies available were allocated in these large blocks, making them effectively unavailable to most bidders.

Smaller geographies would have more effectively met demand. Smaller licenses obviously meet the demands of bidders that have only smaller-sized demands for spectrum. However, as the AWS auction demonstrated, they can also be used as building blocks to meet the demands of

bidders with larger, but uniquely defined spectrum needs, as well as bidders with regional or national spectrum needs that could also have been met by REAG licenses.[7] In other words, smaller licenses provide bidders with the flexibility to create a package of licenses that best meets their individual needs—including needs for large amounts of licensed spectrum.

This flexibility from smaller licenses is further enhanced when multiple smaller licenses are available. Multiple licenses provide alternatives for meeting spectrum demands in all areas by many different types of bidders. Bidders with large demands can aggregate many licenses to assemble a near national footprint just as AT&T did in the 700 MHz B Block. But with multiple smaller licenses, opportunities would still exist for collections of bidders with smaller demands to meet their needs.

The FCC said, "the use of REAGs may meet the needs of carriers interested in creating a large regional or nationwide service area, which may be especially important for new entrants."[8] Although it is true that the larger licenses *may* meet the needs of bidders that *may* be entrants, the larger size will *certainly* block the needs of other bidders with smaller geographic ambitions, including non-national entrants.

The argument for the larger licenses rests on the belief that aggregating smaller licenses is problematic. The AWS and 700 MHz auctions both demonstrated that this concern is overblown. The higher prices paid for larger licenses in the AWS auction likely had more to do with specifics of how that auction unfolded than the larger size of the licenses.[9] And like SpectrumCo in the AWS auction, AT&T was able to assemble a large footprint of licensed spectrum from a collection of smaller licenses.

Some suggest that the potential cost of the added flexibility provided by additional smaller licenses instead of larger REAG licenses is the possibility of added aggregation risk associated with smaller license sizes. This is the risk that a bidder who requires a larger reach of licenses is dissuaded from bidding for those licenses because of the fear that they will not be able to complete their package. However, there is no conclusive evidence of the existence of aggregation risk in FCC auctions. Moreover, the ability of one bidder in the AWS auction—SpectrumCo—to aggregate a near national footprint from relatively small BEA licenses demonstrates that aggregation risk can be successfully managed.

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7 *See generally* Coleman Bazelon, "The Economics of License Sizes in the FCC's 700 MHz Band Auction" (submitted as an attachment to Letter from Michele C. Farquhar, Attorney for SpectrumCo, LLC, to Marlene H. Dortch, Esq., Secretary, Federal Communications Commission, WT Docket No. 06-150 (filed Jan. 8, 2007)).

8 Federal Communications Commission, "Second Report and Order." WT Docket No. 06-150 (Rel. August 10, 2007) ("Second Report and Order"), ¶ 81.

9 The sequential nature of how FCC auctions play out with larger, more expensive licenses reaching final pries sooner than smaller licenses means that if expectations of final license prices overshoot actual license prices, bidders for the larger licenses that reach final prices first will likely overpay. This seems to be what happened with the REAG licenses in the AWS auction. "Expect bids of $30 billion (range of $10-$50 billion); expectations hover near $15 billion." Tim VandenBerg, Leslie Aplerstein and Joe Lieber, "Issues to Watch: 109th Congress," *Washington Analysis,* May 24, 2006, at 7. AWS auction receipts were $13.7 billion.

Larger licenses do not always sell for a premium. The AWS auction exhibited both aggregation premiums and aggregation discounts.[10] In previous auctions of the Lower 700 MHz band spectrum, the larger EAGs actually sold at a discount to the much smaller CMA licenses.[11] In addition, the initial auctions of 30 MHz PCS licenses showed a significant premium for the smaller BTA licenses over the larger MTA licenses.[12] And in the 700 MHz auction, the C Block sold for much less than the A and B Blocks. Therefore, aggregation risk has generally not been determinative of pricing patterns in previous FCC auctions, and any such risk would have been mitigated if the FCC allocated an adequate number of smaller licenses in the 700 MHz band plan.

Moreover, a few commenters in the 700 MHz proceeding argued that some bidders would have large regional or national demands for spectrum in the 700 MHz band auction and, therefore, larger sized licenses would be needed to meet this demand.[13] This conclusion does not follow from its premise. Verizon, Cingular, AT&T Wireless (prior to its acquisition by Cingular), Sprint and Nextel (prior to their combination), and T-Mobile all created national mobile phone networks from licenses no larger than an MTA. Consequently, experience indicates that smaller sized licenses are enough to meet demand for small, medium and large spectrum needs.[14]

A further benefit of smaller license geographies is that they reduce the need for strict performance requirements. One way a firm will find itself holding spectrum that it does not intend to use is if it is forced to purchase licenses with large geographic coverage that encompasses areas the firm is not interested in. The smaller license sizes allow firms to purchase spectrum only where they need it and, consequently, reduces the likelihood of a firm finding itself with licensed spectrum in areas it does not intend to build out.

Smaller bandwidths would have more effectively met demand. The FCC divided the Upper 700 MHz band into one 22 MHz block (the C Block) and one 10 MHz block (the D Block). This division of the band severely limits the opportunities for this band to be efficiently assigned during the auction. Splitting the C Block into two blocks (as would have happened in Auction 76

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[10] The 20 MHz B Block EAs sold at a discount to the 10 MHz of the C Block EAs on a $/MHz-pop basis. The 20 MHz F Block REAGs sold at a premium to the 20 MHz B Block EAs. The 10 MHz D Block and E Block REAGs sold at a premium to the 10 MHz C Block EAs, but only at a fraction of the premium of the F Block over the B Block. The B Block sold for an average price of $0.43/MHz-pop. The C Block sold for an average price of $0.51/MHz-pop. The D Block sold for an average price of $0.58/MHz-pop. The E Block sold for an average price of $0.60/MHz-pop. The F Block sold for an average price of $0.73/MHz-pop.

[11] Combining the results of Auction 44 and Auction 49, the CMAs sold for an average price of $0.033/MHzpop and the EAGs sold for an average price of $0.026/MHz-pop.

[12] Final bids in Auction 4 of the 30 MHz A & B Block MTA licenses averaged $0.51/MHz-pop. Final bids in Auction 5 of the 30 MHz C Block BTA licenses averaged $1.35/MHz-pop. Even after adjusting the C Block results for the favorable financing terms afforded bidders, the prices bid are still estimated to be $0.80/MHz-pop to $1.10/MHz-pop—57% to 116% higher than the bids in the A & B Block auction. Congressional Budget Office, "Where Do We Go From Here? The FCC Auctions and the Future of Radio Spectrum Management," *A CBO Study*, April 1997, p. 19.

[13] *See, e.g.,* Joint Comments of DIRECTV, Inc. and EchoStar Satellite L.L.C., at 3-7 (filed Sept. 29, 2006); Comments of Verizon Wireless, at 4-5 (filed Sept. 29, 2006); Comments of Motorola, Inc., at 6-8 (filed Sept. 29, 2006); Comments of Qualcomm Incorporated, at 16-17 (filed Sept. 29, 2006).

[14] Furthermore, the Commission's decision to implement package bidding in the C Block completely negated the need to offer *any* licenses as large as an REAG.

if the block did not meet its high reserve price in Auction 73) would have created added flexibility that would have enhanced the chances of a successful auction. In the AWS auction, the FCC recognized that some bidders may want large amounts of spectrum in a given geographic market, but also acknowledged that larger license blocks eliminate the possibility of the band being assigned to more bidders with smaller spectrum requirements. Likewise, in the 700 MHz band auction, the extra license created by dividing the C Block into two licenses would have opened the possibility for more bidders to win licenses.

More licenses with less bandwidth each would have also reduced aggregation risk in the auction. The risk of a failed aggregation is lower if there is more flexibility for a bidder to achieve its desired aggregation. The added flexibility created by more licenses would bolster bidders' perceptions of the likely success of attempting aggregations. For example, a bidder that desires a nationwide footprint, but does not need large bandwidth in all markets, will have a higher probability of a successful aggregation—and consequently will be more likely to participate in the auction—if it is creating its aggregation from licenses in multiple smaller bands of spectrum.

B. OPEN ACCESS

For the first time, the FCC imposed open access requirements on a band of spectrum.

> Although we generally prefer to rely on marketplace forces as the most efficient mechanism for fostering competition, we conclude that the 700 MHz spectrum provides an important opportunity to apply requirements for open platforms for devices and applications for the benefit of consumers, without unduly burdening existing services and markets.[15]

As a general matter, proposals to compel a network owner to provide access to its network should be met with skepticism. The central concern is that in prying open a network, regulation reduces the returns to the owner from investing in that network and, consequently, less network investment is undertaken. This negative effect was seen in the wireline network under UNE-P regulations.[16] Sometimes regulation may be necessary, but given the likely costs, clearly identified benefits should be present. To justify regulatory intervention, there should be specific identified market failures that cause adverse outcomes that need to be corrected.

Evidence of anti-competitive restrictions by wireless network operators is sparse. The commercial mobile phone networks intensively share the spectrum they use with more than 250 million wireless subscribers in the U.S. Evidence of innovative new products is abundant. General Motor's OnStar system and Amazon's Kindle are just two well known examples of new

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[15] Second Report and Order, ¶ 195.

[16] Thomas Hazlett and Coleman Bazelon, "Regulated Unbundling of Telecommunications Networks: A Stepping Stone to Facilities-Based Competition?," paper presented at the Telecommunications Policy Research Conference (September 2005). *Also see*, Federal Communications Commission, "Declaration of Thomas W. Hazlett, Ph.D., Arthur M. Havenner, Ph.D., and Coleman Bazelon, Ph.D." WC Docket No. 03-157 (September 2, 2003).

devices and services implemented over the existing mobile phone network in cooperation with network owners.

C. MIXING OF HIGH POWER AND LOW POWER USES

The Lower 700 MHz band mixes low-power and high-power transmissions. The previously auctioned Lower 700 MHz D block and the recently auctioned Lower 700 MHz E block are both unpaired bands. As such, they are particularly suited for one-way broadcast transmissions. The FCC allows higher power levels because broadcasting services work more efficiently at higher power levels than most two-way cell-based communications systems. Placing a higher power service adjacent to a lower-power service can render a portion of the bandwidth dedicated to the lower-power service unusable. In the case of the Lower 700 MHz A Block, the E Block reduced the perceived amount of usable A Block spectrum by as much as one-third.

D. CHANNEL 51 PROBLEMS

Similar to the problem of the high-powered E Block broadcasts, television channel 51 broadcasts are also adjacent to the Lower 700 MHz A Block and can cause interference to the A Block licensees, making the effected licenses less valuable. These continuing television broadcasts are in 41 markets, including such important markets as Chicago. The effect of those broadcasts is to render the A Block spectrum around the broadcast tower largely unusable for two-way mobile communications. The total amount of population contained in a 20 mile radius around all of the channel 51 transmitters is approximately 7.3 million people or 2.6% of the total band.[17] Even if the value of the entire license that contains a channel 51 transmitter was rendered unusable (a gross exaggeration given that these licenses collectively received $2.3 billion dollars in bids), at most about 21% of the U.S. population would be affected.

E. D BLOCK WILL NOT SOLVE PUBLIC SAFETY'S PROBLEMS

The Upper 700 MHz D Block was set aside for a public-private partnership where the winner of the D Block would build a national network that would be available to public safety users. The goal was laudable: public safety users need both access to broadband networks and the ability to communicate across institutional boundaries. Unfortunately, the FCC did not have the tools (including appropriations) needed to properly address public safety interoperability. Furthermore, they left too much uncertainty for the potential D Block licensee by not having clearer rules for its relationship with the pubic safety community. Consequently, the Commission's insufficient attempt to solve public safety's problems through the licensing of the D Block failed.

[17] The spectrum affected by channel 51 interference issues is fairly representative of the value of spectrum nationwide.

The intent of the D Block rules was to strike a deal with a private company to enter a partnership with public safety users. The attraction for the potential D Block licensee was 1) access to an additional 12 MHz of frequencies allocated to public safety for broadband uses, including the ability to use these frequencies to sell interruptible services to commercial users, 2) access to the public safety community to sell interoperable broadband services, and 3) a likely lower price at auction, given the requirements associated with the band. In return, the D Block licensee would be required to build a national network relatively quickly and sell interoperable services to public safety users that could preempt the commercial services during emergencies. The D Block licensee would also be required to sell its commercial services on a wholesale basis.

The problem with this approach is that the inducement of less expensive spectrum is not sufficient to overcome the costs associated with obligations to the public safety community. These costs were exacerbated by the uncertainty related to just what the license requirements would entail in practice. Ultimately, the most likely D Block bidder, Frontline, did not participate it the auction.[18] The initial proposals for a public-private partnership solicited 30 MHz of spectrum—three times the 10 MHz available in the D Block—for free in exchange for providing an interoperable network to public safety users.[19] That may have been overly generous to the licensee, but the current package of obligations and inducements is apparently not sufficient to convince private capital to invest in the D Block scheme.

For the D Block to be successful it would have to be the case that the public-private partnership would be commercially viable except for the reduced price paid for spectrum. (Otherwise, a similar service could be provided with unrestricted commercial spectrum.) Spectrum license leases for non-interruptible service may value access to the spectrum in the range of 10% to 20% of service revenues generated from using the licensed spectrum. Consequently, for the D Block policy adopted by the FCC to be sensible, the public-private partnership with the current set of obligations would have to be *almost* viable using commercially licensed spectrum. The lack of any sincere bidding indicates that it was not even a close call.

F. BUILD-OUT REQUIREMENTS TOO STRICT

The build-out requirements for the licenses recently auctioned in the 700 MHz band were some of the strictest ever imposed by the FCC.[20] The Lower 700 MHz band blocks require 70% of the geographic area of the license be built out or the FCC will take back a portion of the unused areas after 8 to 10 years. The Upper 700 MHz C Block requirement is that 75% of the population be built out, again subject to loss of the unused territories after 8 to 10 years. The D Block requirements are even harsher—99.3% of population in ten years.[21] These contrast to the

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[18] Jeffrey Silva. "Frontline's demise leaves D Block, public safety plans in limbo." RCRWireless News, (January 10, 2008).

[19] Jeffrey H. Birnbaum. "Public Safety and Profit: On the Same Wavelength?" The Washington Post, (January 9, 2007).

[20] "In order to better promote access to spectrum and the provision of service, especially in rural areas, we replace the current "substantial service" requirements for the 700 MHz Band licenses that have not been auctioned with significantly more stringent performance requirements." Second Report and Order, ¶ 153.

[21] Second Report and Order, ¶ 437.

build out requirements of the previously auctioned portions of the Lower 700 MHz Band and the AWS licenses, which carry a much laxer "substantial service" requirement.

The geographic build out requirements of the Lower 700 MHz Band are draconian. Assuming a licensee builds the most densely populated areas first, a 70% geographic coverage requirement translates to a 96% population coverage for EAs and a 94% population coverage for CMAs. Conversely, a 75% population requirement can be met by building an average of only 23% of the geography of the licensed spectrum for EAs and 34% for CMAs.

The stated intent of these strict build out requirements was to promote rural broadband development. Unfortunately, these rules may slow that development. Due to the effect of discounting in spectrum license valuations, the stricter rules are unlikely to affect significantly bidders' valuations, largely negating the punitive effect of the requirements. Bidders who purchased licenses—especially the smaller licenses in the Lower 700 MHz band—will clearly build out the most populated areas that represent the lion's share of value of the licenses. The areas a licensee would not otherwise build are obviously the least valuable. If they do not build those areas themselves, the licensees will have an incentive to sell the remaining portions of their licenses, even at a loss.

The hammer of the pending relinquishment of unused areas can make those areas more difficult to disaggregate or partition and sell to parties interested in building in the more rural areas. Of course, the initial incentives to sell off unwanted portions of a license are strong. However, they are not much stronger than without the threat of loss of the territories. As time passes, a purchaser of rural frequencies has an increasingly short time to deploy a system. This further erodes the value of those unused frequencies, making reassignment of them more difficult. Absent reassignment of otherwise unwanted frequencies, a licensee may be forced to build an area that does not fit in its business model—a situation that cannot lead to efficient results.

IV. PROBLEMS WITH THE 700 MHZ AUCTION RULES

A. PACKAGE BIDDING DID FAR MORE HARM THAN GOOD

The FCC introduced package bidding for the first time in a major spectrum license auction. The purpose was straightforward—to allow a national entrant to purchase the entire C Block. The outcome was to allow a national incumbent to purchase the C Block at a discount.

As discussed above, aggregation risk is manageable in a well designed auction. All that is needed to minimize the risk of a failed aggregation is multiple bands for offer. An alternative approach to managing aggregation risk is to offer package bidding. A bidder whose needs require an aggregation of licenses faces the risk in an auction of purchasing only some of its required licenses, but not being able to afford the rest. This situation may be worse than winning no licenses at all. For example, suppose a firm had a business model to offer ubiquitous service along the north east coast. Its auction strategy would be to purchase the licenses that would allow it to offer that service. This may include BEA licenses for Washington, DC, Philadelphia, New York, and Boston. The problem occurs if the bidder holds the Provisionally Winning Bid (PWB) on these licenses, but is bid off of one of them, say the New York license, and to bid back

would require it to bid beyond its budget. Now the bidder would prefer to abandon its business plan and purchase no licenses. However, as the PWB on some licenses the bidder will now risk incurring a withdrawal penalty if it withdraws its bids and exits the auction. This risk of a financial penalty if it fails to successfully aggregate the licenses it needs may cause the bidder to bid less aggressively or not at all.

One solution to this potential problem is to allow bidders to place a package bid for the collection of licenses that it desires. In this case, the bidder will either win all of the licenses it bids on or none of them. This avoids the exposure problem and allows bidders to bid more aggressively. It must be emphasized, however, that if package bidding is used, it is nonsensical to use large REAG licenses containing large amounts of spectrum. The FCC used two redundant tools to advantage bidders with larger demands.

Similar to the arguments for larger license blocks, as discussed above, the arguments for package bidding are likely overstated because concern about aggregation risk is likely overblown. Managing aggregation risk within an auction is feasible. The cost of a failed aggregation is likely much higher for an entrant than an incumbent. Nevertheless, SpectrumCo assembled 91% of the AWS B Block licenses and AT&T was able to win 62% of the Lower 700 MHz B Block licenses. Further, the true but small benefits of avoiding aggregation risk must be balanced against the costs to the auction of package bidding.

The costs from the package bidding rules were high. As it turns out, Google placed a series of package bids on the C Block until the block met its reserve price and the open access rules were assured.[22] Verizon won the C Block by outbidding Google by only $30 million at a time when the bid increment for a bid on a package of licenses would have required an increase of $464 million. It accomplished this through deft use of the auction rules.

Each round, the collection of bids on individual licenses in the C Block is compared to the last package bid and whichever is greater is the PWB for either the individual licenses separately or all of the licenses collectively. If a bid is placed on an individual license, but the package wins the round, that bid remains active in the sense that it is considered in subsequent rounds when comparing the sum of individual license bids to the package bid. Two caveats apply: although the bid can lead to a PWB for the license it does not tie up any of the bidder's eligibility and a bidder can remove the bid from consideration. Verizon won the C Block through a collection of individual bids placed in over 4 rounds (rounds 27 through 30). It did this using only 159,886,000 bidding units, 121,230,000 less than the 281,116,000 required to place a

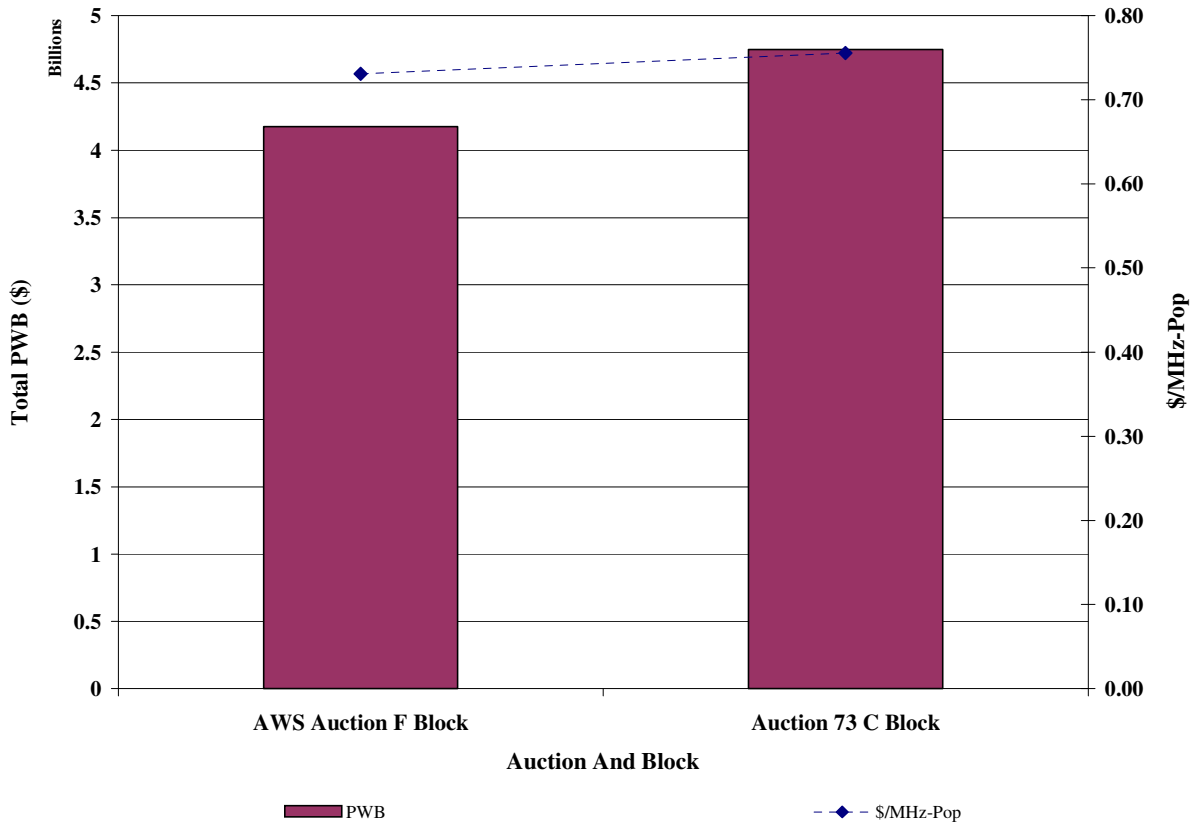
[22] It is interesting to note that the bid Google placed to push the block over the reserve price pushed the total bids for the band more than $78 million dollars beyond the reserve price. This is seems odd behavior for a serious bidder because it seemed to overpay. Google was not being seriously challenged for the C Block after about round 8 when bids on individual regions dropped off significantly. (There were only 3 scattered bids between rounds 8 and 27.) It therefore had a lot of flexibility in the timing of the bids it placed and significant control over the bid increments for the national package. In fact, Google could have pushed the C Block over the reserve in Round 14, but saved itself more than $151 million by waiting until round 17, but could have saved additional money by continuing to wait. Therefore, it was within Google's control to push the C Block over the reserve by only a few dollars instead of the more than $78 million it wasted in its last bid.

simultaneous bid on the same set of C Block licenses. An additional 121,230,000 bidding units would have tied up an additional $121,230,000 of Verizon's money in upfront payments.

Verizon's move to bidding in the C Block came relatively late in the auction. This meant that few other bidders would be able to have enough free eligibility to place any bids on the large regional licenses in the continental U.S. The smallest of the big six regional licenses is the Mississippi Valley license that required 28.7 million bidding units to place a bid. The next largest is the Central license requiring 40.0 million bidding units, followed by three licenses requiring about 50 million bidding units each and one even larger, the Great Lakes license. A bidder that might be interested in bidding on a C Block regional license later in the auction will have the challenge of freeing up enough eligibility to place a bid on one of those licenses. Each bidder may have some buffer of eligibility, up to 20% in the early part of the auction, and will likely be bid off of some licenses in each round, but it may take more than one round to bid on the largest licenses. Therefore, a bidder could use the smallest license—Mississippi Valley—as a stepping stone to bidding on the other C Block regional licenses. Verizon intentionally bid up the value of the Mississippi Valley license—a Mississippi Two-Step, if you will—by raising its own bid to extremely high levels—$1.6 billion or $2.36/MHz-pop—effectively blocking other bidders ability to enter the fray in the C Block by starting its bidding on that license. This was a sensible strategy so long as Verizon expected to win all or most of the large regional licenses because what it paid in a high bid in the Mississippi Valley was more than offset by the very low prices it paid for the other regional licenses. Overall, Verizon paid prices comparable to the AWS auction for the majority of its 700 MHz band licenses. See Figure 2.

Figure 2

AWS F Block Vs. Auction 73 C Block



B. BLIND BIDDING EXACERBATED OTHER PROBLEMS

Only limited information was available to bidders during the auction. Key to what was not available was the identities of other bidders. Information during an auction can serve two purposes. On the one hand, it can help the price discovery process and aid in finding an efficient allocation of licenses, especially if an auction is sufficiently competitive. On the other hand, it can allow bidders to tacitly coordinate bids leading to a reduction in auction revenues and a possible reduction in efficiency of the auction. This latter problem is exacerbated when competition in an auction is low. The FCC chose to limit information to squelch potential collusion.

This policy had many negative effects on the auction. It made it much more difficult for bidders interested in individual regional licenses in the C Block to coordinate their efforts to overcome the package PWB. It also made it much more difficult for bidders to assess how risky any strategy would be or how secure it was that its PWB would stick. Further, losing a desired market to another bidder can have different implications based on the other bidder's status as a

national incumbent versus regional entrant or that bidder's likely technology choices. All of these benefits of information during the auction were lost through blind bidding.

Blind bidding had other, perhaps unintended, consequences. After Verizon won the C Block in round 30, it had a deficit in free eligibility of negative 115 million units from its considered bids on regional licenses from previous rounds suddenly becoming PWBs. A very interesting side effect of Verizon's eligibility deficit was that it could not bid back on other licenses when it was bid off of them. Recognizing that this was likely the case, but not knowing which A and B Block licenses the new C Block PWB was winning, bidders would test the waters by bidding on a license and seeing if they were bid back. In an open auction, everyone would have known which licenses could be bid on without the existing PWB (Verizon) bidding back. Verizon's eligibility deficit—itself an undesirable consequence of the package bidding rules—ended the auction at negative 85 million. It would have been much smaller in an open auction. This would have likely been more efficient.

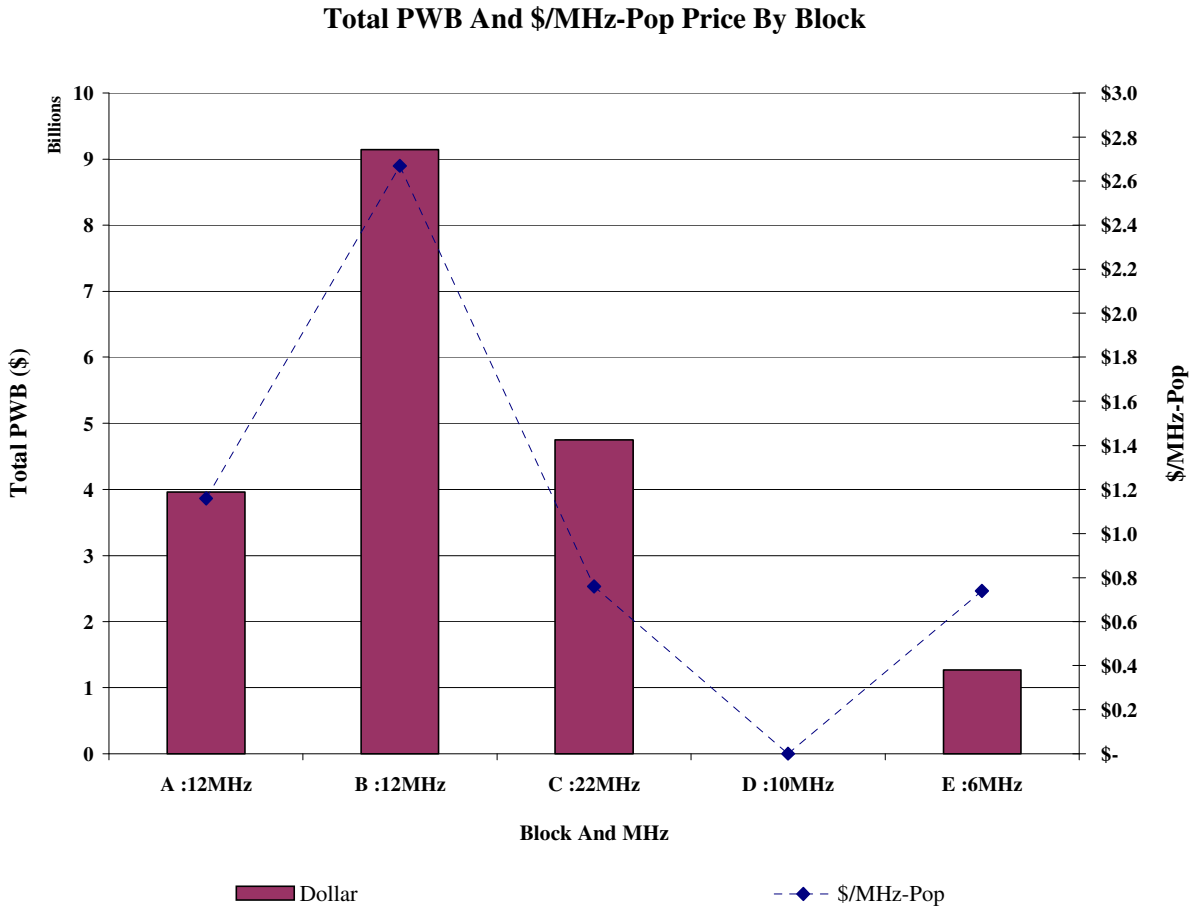
V. NET EFFECT OF AUCTION PROBLEMS

A. SIGNS OF INEFFICIENCY

There were many signs of inefficiency in the 700 MHz auction.

A, B and C Block price differences. The widely disparate prices for the three paired commercial bands—the A, B & C Blocks—seem much greater than would be expected given the differences in service rules for the three blocks. See Figure 3. The B Block was the least constrained of the three and can serve as a benchmark as the least encumbered spectrum.

Figure 3



■ As noted above, somewhere between 3% and 21% (10% seems a reasonable placeholder) of the A Block's value was unusable because of interference from Channel 51 broadcasts. Furthermore, uncertainty about the placement of the high-powered E Block transmitters potentially reduced the usable portion of the A Block by one-third.[23] These interference concerns may have led to as much as a 40% discount in value for the A Block compared to the B Block.[24] The A block sold for a 57% discount to the B Block.

[23] Like the Channel 51 interference, the problems from the high-powered E Block spectrum would be localized around the transmitter sites. Unlike the Channel 51 problem, it is not yet known where those transmitters will be located. Consequently, bidders had to consider the possibility of a high powered E Block transmitter anywhere.

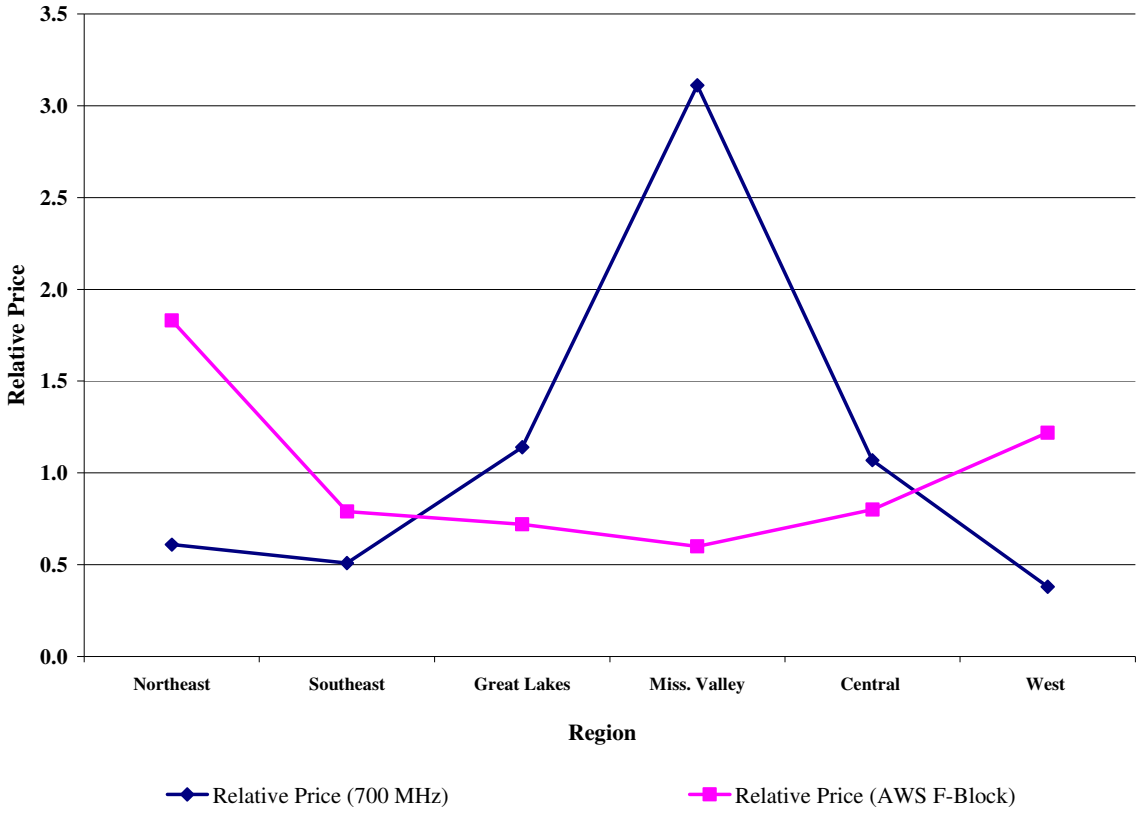
[24] Of course, many other factors go into translating the interference issues into valuation differences and the actual number could be higher or lower than 40%. For example, the experience from the AWS auction would indicate that the larger A Block BEA licenses should have sold for more than the smaller B Block CMA licenses. Overall, the likelihood that the net effect on value is much less than 40% is greater than it being much more than 40%. Consequently, 40% is a conservative (*i.e.*, too high) estimate.

The impairment in value of the C Block compared to the B Block that should have remained in a better designed auction would be the open access requirements imposed on the C Block. It is difficult to say how costly this constraint is to network operators. Verizon seemed to take on open access duties voluntarily on their entire network so they must not consider the requirements too costly. As it turns out the price discount for the C Block was 48% in total dollars and 72% on a per MHz-Pop basis. It is very unlikely the burden of the open access requirements account for anywhere near all of this price difference.

■ The price pattern of the C Block REAG license prices was nonsensical. As discussed above in conjunction with the negative effects of package bidding, the relative prices of the REAG licenses were not rational. Compared to AWS F Block, the relative prices of the licenses were almost inverted. See Figure 4.

Figure 4

Relative Price Comparison Of C Block Regions
Between AWS Auction And Auction 73



■ Including the D Block in the 700 MHz auction presented opportunities for parking eligibility. The one D Block bid by Qualcomm at the minimum opening bid amount was well below the reserve price for that band. So long as a bid for the D Block remained below the reserve price for the band, a bidder was in no danger of actually winning the license. In the first phase of the auction, when a bidder only has to be active on 80% of its eligibility, a bid on the D Block tied

up 128,210,000 bidding units, but the 20% buffer allowed the bidder to keep another 32,052,500 bidding units available without having to actively bid on them. The cost of this strategy would be tying up the upfront payments of $160,262,500 required for these bidding units. The amount of free eligibility maintained in phase two of the auction when the buffer was reduced to 5% was 6,747,880. Even 6.7 million bidding units is a significant amount of eligibility, enough to bid on any market except New York or Los Angeles.

B. SUMMARY OF REVENUE EFFECTS

It is impossible to know exactly what would be the outcome of an auction under different rules of a 700 MHz band that had been configured differently. Nevertheless, it is clear that the 700 MHz auction left a substantial amount of demand for spectrum unmet and likely also left a large amount of money on the table. The analysis below provides an indication of the value of demand that could have been met if the 700 MHz band had been configured differently and the auction rules were altered. There is no guarantee that the reported amounts of additional money would have been realized, but it seem likely that a better working auction would have raised additional billions.

Reconfiguring the C Block. The A and B Blocks had significant amounts of unmet demand that could have been met by a reconfigured C Block. The total exposure of all bids on the A and B Blocks peaked at over $18 billion in round 26—representing real money put on the table for those blocks—more than $5 billion more than those blocks ultimately sold for. Just four bidders—Alltel, Leap, MetroPCS, and King Street Wireless—showed through bids placed a willingness to spend more than $3 billion, but won less than $1 billion in licenses. See Table 1. In fact, virtually all of the licenses in the A and B Blocks had losing bidders that were willing to pay billions of dollars, but did not have their demand met.

Table 1
Maxium Exposure For Alltel, Leap, MetroPCS, and King Street Wireless
Auction 73

Bidder	Maximum Exposure
Alltel Corporation	$927,725,900
Cricket Licensee 2007, LLC	$400,624,000
MetroPCS 700 MHz, LLC	$674,394,000
King Street Wireless, L.P.	$998,530,000
Sub Total	*$3,001,273,900*
PWB	
MetroPCS 700 MHz, LLC	$313,267,000
King Street Wireless, L.P.	$400,638,000
Net Total	$2,287,368,900

Notes:
Maximum exposure is calculated as the sum of PWB from the previous round plus all bids placed in the current round across all bands for that particular bidder.

The amount of unmet demand in the A and B Blocks can be measured by examining the bids of the last bidder(s) to drop out of bidding on each license in those blocks. The analysis starts by calculating the bid of the first marginal bidder for each license. For example, AT&T won the New Orleans market in the B Block for $28 million in Round 21 when Alltel dropped out of the contest for that license. Consequently, Alltel showed a demonstrated demand of $25 million when it placed its last bid for that amount in Round 20. As shown in Table 2 below, the sum of these first marginal bidders totaled almost $12 billion for the A and B Blocks.

To calculate unfulfilled demand it is necessary to check that the first marginal bidder did not have its demand met by purchasing an alternative license. To do this it was necessary to create a pairing of the A Block BEA licenses with the smaller B Block CMA licenses by associating the largest CMA that falls within a BEA with that B Block license.[25] If the first marginal bidder for the A Bock license was the PWB for the associated B Block license, then that bidder had its demand met elsewhere and the second marginal bidder would be used for the calculation of

[25] To build a mapping of CMAs to EAs: If at least 50.1% of a CMA's population is located within an EA, that CMA is associated with that EA. If this population criterion is not met, the EA in which the CMA population is most concentrated is chosen.

unmet demand. Similarly, B Block CMAs are associated with A Block EAs[26] and a check on the first marginal bidder was performed. When this more careful calculation is done, the total unmet demand in the A and B Blocks totals $9.3 billion.

A plausible reconfiguration of the C Block would break it into one 10 MHz block that, had it been configured as BEAs, would have matched up with the A Block (given its associated E Block interference issues) and a 12 MHz license that could have been configured as CMAs and would have matched up with the B Block. Under this alternative scenario, an additional $9.3 billion in demonstrated unmet demand would have been met at the cost of foregoing the $4.7 billion received for the C Block. Had the auction captured this additional demand, the net effect on revenue from meeting this unmet demand would have been an additional $4.6 billion.[27]

Table 2
PWB, Marginal Bid Value And Unfulfilled Demand In A & B Blocks In Auction 73

	Block		
	A	*B*	*Total*
PWB	$3,961,174,000	$9,143,993,000	$13,105,167,000
First Marginal Bidder	$3,566,993,000	$8,384,935,000	$11,951,928,000
Unfulfilled Demand	$3,520,941,000	$5,825,500,000	$9,346,441,000

Notes:
If the first marginal bidder in the A block is the PWB in the B block the second marginal bidder is used. The same exercise done for the B block to calculate its total unfulfilled demand.

Scrapping the E Block. If as much as 35% of the value difference between the A Block and the B Block is accounted for from the potential interference of the E Block, then the existence of the E Block is responsible for a reduction of about $3.2 billion in the value of the A Block when compared to the B Block. The E Block raised less than $1.3 billion. Consequently, almost $2 billion in additional revenue may have been raised if the E Block was left fallow. Of course,

[26] To build a mapping of EAs to CMAs: Distribute the EA population over the CMAs within its geographic territory and associate the EA to the CMA which has the highest percentage of EA population.

[27] One sufficient requirement for a well working auction to capture the revenue from this demand would be if Verizon valued the A and B Blocks at least as much as the marginal bidders. It seems highly likely that Verizon would value a nationwide footprint of 22 MHz of spectrum at a minimum of $9.3 billion. If Verizon would have valued the reconfigured C Block at more than $13.1 billion (the PWBs for the A and B Blocks), then additional revenues would have been even higher. (This sufficient analysis is complicated by the fact that Verizon was the marginal bidder on many licenses.)

pairing it with the A Block for an asymmetrically paired band or selling it restricted to non-interfering lower powered uses could have raised additional funds beyond the $2 billion.

VI. THE CURRENT PROBLEM AND WHAT TO DO ABOUT IT

Given the outcome of Auction 73, two policy recommendations emerge for next steps in spectrum policy: flood the market with more licensed spectrum and get the D Block into private hands.

License the white spaces. Radio spectrum is an unnecessarily scarce resource. The high auction values seen for the 700 MHz band are a result of the limited amount of flexibly licensed frequency available to commercial users. The superior position that AT&T and Verizon now have in owning licensed spectrum—especially the most valuable frequencies below 1 GHz—can be mitigated by flooding the market with additional licensed spectrum. Fortunately, there exists another reservoir of spectrum with similar physical characteristics available—namely, the TV white spaces. Clearly delineating the usable white spaces, creating overlay licenses and auctioning them would allow the significant unmet demand from the 700 MHz auction to be satisfied, with the added bonus that such an auction would raise many billions of dollars in additional revenue.[28]

D Block. The worst thing to do with the D Block is leave it unused. Consequently, any action that will assign license(s) to the D Block is better than nothing. Freeing it for unrestricted commercial use, configuring it in smaller geographic licenses—CMAs or EAs—and auctioning it would be best.[29] This would have the benefit of adding more commercial spectrum under license to the band, allowing significant unmet demand from Auction 73 to be met. This approach, of course, would require that the needs of the public safety community were met through other means. Significant appropriations for a nationwide interoperable public safety wireless communications system would be required. Continuing to allow, but not require, a public-private partnership where the public safety community could barter access to its broadband spectrum for access to a commercial network—with the requirement of priority in service for public safety users during emergencies—would be sensible. This policy course, however, would require coordinated action by the FCC and Congress. It is widely viewed as unlikely.

The FCC seems more likely to preserve the public-private partnership with the central features that the D Block spectrum (and the public safety broadband allocation) could only be used for commercial services that are interruptible and some requirement to build-out and serve the public

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[28] Federal Communications Commission, "Comments of Charles L. Jackson and Dorothy Robyn." ET Docket No. 04-816, (January 31, 2007).

[29] The D Block is only 10 MHz, but if used in conjunction with the adjacent 2 MHz of the Upper 700 MHz A Block a combined A & D Block would provide a standard 12 MHz license. This possibility of an aggregation of the A and D block make this portion of the radio spectrum fully usable with currently anticipated technologies without access to the public safety bands.

safety community. Any such policy should recognize the economic characteristics of spectrum for interruptible services and the likely implication of those characteristics on the policy.

Use of commercial wireless communications services during emergencies is expected by all mobile phone subscribers. The ability of citizens to communicate in times of duress enhances public safety. Further, the 'in case of emergency' aspect of mobile phone service is an important part of its value to subscribers. A carrier that relied exclusively on spectrum with interruptible services would be unable to provide any service in times of crisis. Imagine the advertising slogan: "Guaranteed NOT to work when you need it most."

Use of spectrum for interruptible services in conjunction with other spectrum licensed for non-interruptible services in the same market poses a different value proposition. In this case, only a portion of the provider's total capacity for commercial mobile communications is lost during an emergency. In non-emergency times, the spectrum for interruptible services can act as useful additional capacity. The logic of the economic value of spectrum for interruptible services leads to one inevitable conclusion: it will be most valuable to the largest incumbent carriers, especially the 700 MHz carriers, namely AT&T and Verizon. Although they apparently show little interest in supporting this policy, the fact remains that either of those two carriers could make the most use of the D Block spectrum. Consequently, any wholesale-only restrictions should be abandoned. It is not obvious which of two economic models is most sensible—one carrier using the band for its own uses or a third party deploying a network to resell to multiple other carriers—and unnecessary to pick one now.

Finally, as discussed above, the economics of a public-private partnership between a commercial wireless provider and public safety users is economically tenuous at best. Consequently, if the D Block is reauctioned with continuing public safety requirements, there should be no reserve price. Frankly, the FCC should count its blessings if it can find any provider to take on the commitments required of a D Block licensee.