

February 5, 2007

Via Electronic Filing

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: WT Docket No. 06-150
Written Ex Parte

Dear Ms. Dortch:

The enclosed report by Dr. Gregory L. Rosston explains in detail how a “constrained” package bidding system could be implemented in a relatively simple manner that would achieve the objective of having auction rules that promote efficient competition without making the auction so complex that it would raise issues of feasibility. The report by Dr. Rosston, “Implementing Package Bidding in the 700 MHz Band to Improve Consumer Welfare,” is submitted herewith for the Commission’s consideration and for inclusion in the public record of the above-referenced proceeding.

Sincerely,

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Implementing Package Bidding in the 700 MHz Band to Improve Consumer Welfare

Gregory L. Rosston

I. Introduction

1. In their comments, Access Spectrum, LLC (“ASL”) and Pegasus Communications Corporation (“Pegasus”) proposed package bidding as a way of promoting efficient competition by allowing bidders to pursue licenses that best suit their business plans and to have auction design cause minimal business risk. In addition, package bidding can promote new entry by reducing the risk that incumbents can block new entrants through auction strategy. Auction theorists and experimentalists have demonstrated that full package bidding can provide substantial benefits over the standard Simultaneous Multiple Round (SMR) auction when there are complementarities among licenses. The FCC has acknowledged the relative advantages of package bidding over SMR auctions in certain circumstances,¹ and has authorized the Wireless Telecommunications Bureau to implement package bidding.² While full package bidding would likely provide substantial benefits, it would add complexity. It may be

¹ See *Implementation of Section 309(j) of the Communications Act – Competitive Bidding*, Second Report and Order, 9 FCC Rcd 2348, ¶ 99 (1994).

² See *Amendment of Part 1 of the Commission’s Rules – Competitive Bidding Proceeding*, Order, Memorandum Opinion and Order, and Notice of Proposed Rulemaking, 12 FCC Rcd 5686, ¶ 16 (1997); see also 47 C.F.R. §§ 1.2103(a)(4) and (b). The Wireless Telecommunications Bureau adopted procedures that included package bidding for the upper 700 MHz auction (Auction 31), demonstrating that it saw complementarities among the upper 700 MHz licenses. See *infra* note 7.

possible to achieve many of the benefits while avoiding the complexity by using a limited package bidding system, although limited package bidding has not been tested. I have been asked by ASL and Pegasus to explain in detail how a limited package bidding system could be implemented in a relatively simple manner that would achieve the objective of having auction rules that promote efficient competition without making the auction so complex that it would raise issues of feasibility.

2. I previously submitted a report in this proceeding with Scott Wallsten. That report discussed the benefits of package bidding as well as the benefits from having a band plan that allows bidders to implement their choice of technology easily, and the problems arising from the unnecessary band manager and cellular restrictions.³
3. In this report, I elaborate on my earlier submission and on the comments of Paul Milgrom and Karen Wrege to show how a limited or “constrained” package bidding system could be implemented. A constrained package bidding approach would not have the full flexibility of an unconstrained package bidding system, but it would be likely to provide many of the benefits without the potential complexity of a full package bidding system. This approach could be a substantial improvement on the FCC’s standard SMR auction by removing much of the “exposure” risk, leading to

³ Declaration of Dr. Gregory L. Rosston and Dr. Scott Wallsten, appended as Attachment A to Comments of Access Spectrum, LLC, Columbia Capital III, LLC, Pegasus Communications Corporation and Telecom Ventures, LLC, WT Docket No. 06-150 (Sept. 29, 2006).

more efficient license assignment, and potentially more competitive entry for the provision of wireless services.

II. Package Bidding

4. There is an efficiency concern about the FCC's SMR auction because exposure risk can lead to bidders substantially reducing their willingness to bid or even participate in license auctions. A bidder with a business plan that either was predicated on serving a large geographic area or required a large amount of spectrum might be deterred from bidding because of the "exposure" risk – the possibility of overpaying for the set of licenses or ending up with a failed aggregation of licenses that is insufficient to implement the business plan profitably. Economists generally agree package bidding can solve this problem.⁴
5. Exposure risk increases with the number of licenses and differing preferences of bidders. However, as the number of licenses increases, package bidding can become very complex, both for the auctioneer and for bidders. While the FCC originally proposed 12 licenses for the upper 700 MHz band (C and D blocks, with 6 EAGs),

⁴ See, for example, the report of FCC contractors, Jacob K. Goeree, Charles A. Holt, and John O. Ledyard, *An Experimental Comparison of the FCC's Combinatorial and Non-Combinatorial Simultaneous Multiple Round Auctions* (July 12, 2006) (concluding that package bidding raises efficiency when there are large complementarities), available at: <http://wireless.fcc.gov/auctions/data/papersAndStudies/fcc_final_report_071206.pdf>. Other reports to the FCC describe exposure risk and the increased efficiency possible from using package bidding. See Charles River Associates Incorporated and Market Design, Inc., *Package Bidding for Spectrum Licenses* (Oct. 1997), available at: <http://wireless.fcc.gov/auctions/conferences/combin2000/releases/cr_2.pdf>; Cybernomics, *An Experimental Comparison of the Simultaneous Multi-Round Auction and the CRA Combinatorial Auction* (March 2000), available at: <<http://wireless.fcc.gov/auctions/conferences/combin2000/releases/98540191.pdf>>.

the Commission recently sought comment on license design, and numerous commenters support smaller geographic areas. Smaller geographic areas will lead to a greater number of licenses available in the auction. For example, ASL and Pegasus proposed using 52 MEAs and three 5.5 MHz blocks. This would lead to 156 licenses in the auction. With $2^n - 1$ different combinations, this would lead to 9×10^{46} different possible packages. This is far more than any bidder could ever hope to value or keep track of.

6. The nature of the wireless business and the desire of bidders to hold multiple licenses combine to produce exactly the type of situation that may cause exposure risk. Exposure risk may in turn cause bidders to hold back, and ultimately may lead to inefficient license assignment. In the 700 MHz auction, bidders may have substantially different preferences, just as bidders did in the AWS auction. In the AWS auction, bidders had different preferences for geographic aggregations and spectrum amounts in different areas, even for the regional licenses. The large number of licenses and differing preferences set the stage for exposure risk, which, in turn, can lead to inefficient license assignment. Inefficient assignment ultimately harms consumers.
7. In our earlier report, we surmised that the lack of package bidding caused the early exit of Echostar/DirectTV from the AWS auction. Subsequently, Echostar and DirecTV submitted comments in this proceeding verifying that conjecture. Had there been package bidding, Echostar and DirecTV presumably would have stayed in the auction longer to try to pursue their nationwide strategy. However, with the risk of overpaying or getting less than nationwide coverage, they made a premature exit from

the auction.⁵ As we noted in the earlier report, there were large differences in price between the REAG licenses and the BEA and CMA licenses, especially at the time of Echostar/DirecTV's exit from the auction, as well as at the end of the auction. These large discrepancies indicate that bidders considered the exposure risk in their bidding strategies. Many CMRS wireless providers have put together near nationwide coverage, and some, like Leap Wireless and Metro PCS, bought large amounts of additional coverage in the AWS auction to complement their existing holdings. At the same time, other bidders may have had different preferences, and faced exposure risk as a result.

8. In our previous report, we suggested that the FCC should incorporate package bidding for the 700 MHz auction. The FCC has been working on package bidding mechanisms for about ten years (including holding three different conferences with my institute, SIEPR) and has the requisite expertise to implement package bidding.⁶

⁵ It should be noted that SpectrumCo., a consortium of cable companies, was able to assemble a near nationwide 20 MHz coverage in the auction by assembling 136 BEA licenses and a Hawaii regional license. This does not mean that there was no exposure risk or that exposure risk was not important. First, SpectrumCo. may not have needed nationwide coverage for its plan whereas other bidders might have required nationwide coverage. In addition, the fact that a company is successful does not mean that there was no risk in pursuing the strategy. With package bidding, other bidders might have provided more competition for this aggregation of licenses by being better able to substitute between the regional, BEA and CMA licenses.

⁶ Commission conferences on package bidding include FCC-SIEPR-NSF Combinatorial Bidding Conference, May 5-7, 2000, FCC-SIEPR-NSF Combinatorial Bidding Conference, October 26-28, 2001, and FCC-SIEPR-NSF Combinatorial Bidding Conference, November 21-23, 2003. In addition, the Commission has developed internally the expertise to run package bidding auctions under a variety of different auction rules.

In fact, the FCC set out rules for package bidding for the upper 700 MHz auction in 2002.⁷

9. I will try to lay out in detail how a “constrained” package bid system might work that would be transparent, implementable, and understandable by building on the current Simultaneous Multiple Round auction. To do this, I expand on the comments of Paul Milgrom and Karen Wrege in this proceeding.⁸ I also discuss some of the necessary details to implement the package bidding system they outline and assume that the 2002 FCC package bidding rules would continue to apply.⁹
10. There are several criteria that a package bidding system should satisfy. It should:
 1. More efficiently allocate licenses
 2. Be computationally feasible (and safe) for the FCC
 3. Be comprehensible and implementable for bidders
 4. Result in the timely close of the auction
 5. Be seen as fair by all bidders
 6. Address the threshold (free rider) problem.
11. In the next section, I show how a constrained package bidding system would be easy to implement. The subsequent section discusses the benefits and costs of the constrained package bidding system relative to a standard FCC SMR auction and describes how the constrained system would be likely to generate many (but not all)

⁷ *Auction of Licenses in the 747-762 and 777-792 MHz Bands Scheduled for June 19, 2002; Further Modification of Package Bidding Procedures and Other Procedures for Auction No. 31*, Public Notice, 17 FCC Rcd 5140 (2002) (“*Package Bidding Public Notice*”).

⁸ WT Docket No. 06-150, Comments of Paul Milgrom and Karen Wrege (Sept. 20, 2006); Reply Comments of Paul Milgrom and Karen Wrege (Oct. 20, 2006).

⁹ *See Package Bidding Public Notice*.

of the benefits from a more general package bidding system without the computational and bidding complexity.

III. Implementing a constrained package bidding proposal

12. In their comments, Paul Milgrom and Karen Wrege propose two possible constrained package bidding options. The first option limits bids to predefined packages in a hierarchical manner. The second option is slightly less restrictive in that bidders can form their own packages subject to the constraint that packages comprise greater than 50% of the MHz-pops available, but more restrictive in that packages can be available only within non-overlapping aggregations.¹⁰
13. The predetermined package proposal would limit the number of possible packages and hence the number of computations that would be required. The FCC would need to specify allowable packages in advance of the auction. To illustrate this proposal, I will use Access Spectrum and Pegasus's proposed band plan and geographic areas – three 5.5 MHz (paired) spectrum blocks and 52 MEAs.
14. For example, the FCC could allow six regional packages within each 5.5 MHz block, a package for each entire block, and a “cross-block” package of all three blocks. In addition, the FCC could set up limited “cross-block” packages for 11 MHz as well.

¹⁰ In this report, I will focus only on the predefined package example, but the implementation issues are similar and I believe that the second option would also be implementable. To the extent that the FCC believes it has reasonably good information about likely desired packages, the predetermined package option may be better because it would allow desired packages to be available. With the build-your-own package proposal, the limitation to non-overlapping aggregations could cause conflict between desired packages.

While the addition of cross-block packages will increase the complexity, they could be limited to the regional and national levels which would increase flexibility and only slightly increase the computational complexity.¹¹ With cross-block packages limited to adjacent bands (*i.e.*, A and B, or B and C, but not A and C), there are two ways to combine two blocks and six regions, and regional cross-block packages would add 12 possible packages. There would also be three nationwide cross-block packages comprising two or three licenses. The table below illustrates the proposed predetermined packages.

Proposed Predetermined Packages

	MEA (52)	Region (6)	Nationwide (1)
3 x 5.5 MHz	Group #1 52 MEAs x 3 blocks = 156 licenses	Group #2 6 regions x 3 blocks = 18 packages	Group #3 1 nation x 3 blocks = 3 packages
5.5 MHz/11 MHz OR 11 MHz/5.5 MHz	n/a	Group #4 6 regions x 2 blocks = 12 packages	Group #5 1 nation x 2 blocks = 2 packages
1 x 16.5 MHz	n/a	n/a	Group #6 1 nation x 1 block = 1 package

15. Without the 11 MHz cross-block packages, there would be a total of 156 individual licenses and 22 possible packages. The limited 11 MHz cross-block packages as proposed would add 15 more possible packages.

¹¹ Adding more cross-block bidding flexibility (*i.e.*, allowing packages where “n/a” is noted in the chart) would be possible at the cost of additional computational complexity.

16. By limiting the number of possible packages, the FCC can ensure that the winner determination problem is relatively easily solved. Without the cross-block packages, the FCC would look at the individual MEA bids within each region on each block and compare them to the highest regional package bid on that block. The higher of these two (the regional package or the sum of the individual MEA bids) would then be added to the high bid set (individual or package) for the other regions in that block. The total would then be compared to the highest package bid covering the entire block. Finally, the high bids (individual, package or combination of package and individual) for the three blocks would be added and compared to the highest 3-block nationwide package bid to determine the overall high bid. With the addition of the cross-block packages, the FCC would have to make a few more comparisons, but the restricted nature would ensure that the problem did not become “combinatorial” and substantially more complex.

Example to determine provisionally winning bids for a block

Assume that there are \$100 bids on each of the MEA blocks individually in a round, and that bidders place the following package bids:

	<u>11 MHz Cross-block Bid</u>	<u>Package Bid</u>	<u>Sum of MEA Bids</u>
Region 1 (MEA 1-4)	\$900	\$500	\$400
Region 2 (MEAs 5-11)	\$900	\$500	\$600
Region 3 (MEAs 12-21)	\$2200	\$900	\$1,000
Region 4 (MEAs 22-30)	\$1500	\$800	\$900
Region 5 (MEAs 31-40)	\$2000	\$1,200	\$1,000
Region 6 (MEAs 41-52)	\$1900	\$1,000	\$1,200

In each region, the FCC would compare the sum of the individual MEA license bids to the package bids. With \$100 per MEA, this would result in package bids being higher in Regions 1 and 5 and the individual MEA bids being higher in the other four regions. It would then add the sum of these high bids to compare to a package bid for the national package for that block. This total would be \$5,400. If the national package were greater than \$5,400, it would be retained for the next step, a comparison of the high bids for all three blocks individually to the national package of all three blocks.

If the other two blocks also had \$5,400 high bids based on the same methodology, then the national package covering all three would have to be greater than \$16,200 to be the provisionally winning bid.

The next step would be to look at the cross-block bids. For purposes of the example, assume that the cross-block bids are only on blocks A and B. In Region 3, the cross-block bid on the two licenses would be greater than either the sum of the individual bids or the package bids. Thus, that bid would be retained and combined with the high bids in the other 5 regions for each of the blocks and the high bids for block C. In this example, the sum of the bids in Blocks A and B would now be \$11,000 and Block C would remain at \$5,400, so the overall package bid or sum of the non-cross-block bids would have to be greater than \$16,400.

17. One of the problems with predetermined packages is that bidders lose some flexibility in their bidding because they cannot determine their own packages, and because they cannot develop packages during the course of the auction that “fit” with other bidders’ actions. The FCC could allow bidders to “nominate” packages before the

auction subject to guidelines. The FCC would not have to accept these packages, but could take them as inputs to its decision. One concern might be that proposing packages in advance of the auction might tip off other bidders as to strategy. To counter this, the FCC might be able to maintain some discretion about revealing the package proposers, or also even keep the packages secret, allowing only bidders who proposed packages to bid on those packages. This would be consistent with the FCC's decision to withhold bidder identities in the AWS auction if eligibility had been low.

18. If the FCC decides to auction licenses of different sizes, it should make sure that the larger licenses are aggregations of the smaller licenses (*e.g.*, EAs, MEAs, and REAGs) and do not “partially overlap” (that is, it should avoid having some of the smaller licenses appear in multiple larger licenses). This appears to have been a problem in the AWS auction where the CMAs did not map into unique BEAs or regions, and bidders were not as easily able to substitute between license sizes.
19. The winner determination program in a constrained package bidding system is relatively straightforward. The ease of computation requires a tradeoff. There is some limitation on bidder flexibility relative to a full package bidding auction, but flexibility is increased relative to the standard FCC SMR auction.
20. There is also a possible tradeoff relative to the standard FCC SMR auction. Package bidding introduces the possibility of a “threshold” problem. The threshold problem can occur in cases where bidders on individual licenses together have a higher valuation than the package bidder, but because of limited competition for the individual licenses, the sum of the bids on individual licenses is lower than the

package bid. Each bidder would be willing to raise its own bid, but would prefer that other bidders do so to increase the sum of the bids on individual licenses.

21. The FCC considered the threshold problem in designing its earlier auction rules. It adopted a mechanism in the activity rules to try to force bidders to increase their individual bids and not to wait for other individual bidders to raise their bids so that the sum of the individual bids is greater than the package bid.¹² Another mechanism to reduce the threshold problem would be to require some premium for package bids.¹³ Neither of the two mechanisms should complicate the winner determination problem.

IV. Conclusion

22. A constrained package bidding system would reduce the exposure problem faced by bidders relative to the standard FCC SMR auction. While it would not give bidders the full flexibility of a pure package bidding system, a constrained package bidding system could provide many of the benefits without the attendant complications and complexity.

23. For some new entrants wanting to enter on a large scale to compete effectively with the large incumbent providers, the ability to place package bids may reduce substantially the risk of bidding in the auction. In addition, it may also reduce the ability of incumbent providers to bid strategically to increase the cost of new entrants.

¹² *Package Bidding Public Notice* at Section IV.A.3, 17 FCC Red at 5170-72.

¹³ As far as I know, there is no empirical evidence about the appropriate premium, if any, for spectrum auctions.

With constrained package bidding, it would be difficult for an incumbent to bid sequentially on different licenses to raise the cost to a new entrant. Without package bidding, the threat of such strategic bidding behavior is greater and may deter bidding and ultimately entry.

24. At the beginning of this report, I set out six criteria for a package bidding system to satisfy. The constrained package bidding proposal measures well against the six criteria. The exposure problem, which has been shown to be possibly significant in experiments that seem to mimic the complementarities of wireless service in the United States, as well as the experience in past auctions suggests that adding the possibility of package bids to mitigate exposure risk is likely to lead to a more efficient allocation. The addition of a premium for packages to alleviate the threshold problem would make this conclusion stronger.
25. The proposed constrained package bidding method is computationally straightforward. It would allow the FCC to return round results in a timely manner. Bidders would be able to understand the winner determination mechanisms and to formulate bidding strategies without having to determine the value of all possible packages. Because the FCC and bidders could follow the auction in a reasonable amount of time, the FCC should be able to run the auction in a reasonable time. Given that the package bids would increase the bidding activity relative to a standard SMR auction, I would expect that the auction would close in approximately the same number or fewer rounds.
26. Since the process would be transparent, and all bidders would have the ability to raise bids to try to win licenses, with full disclosure in advance of the auction (subject

possibly to allowing bidders to have undisclosed package options), there should be no grounds for objections to the auction process.

27. The constrained package bidding proposal would be an improvement for the FCC relative to the standard SMR auction, and would be substantially less computationally complex than a more flexible package bidding auction.