

Thorough Analysis of Package Bidding Procedures is Still Needed

Comment on DA 02-260,
“COMMENT SOUGHT ON ADDING TO AUCTION
INVENTORY AND FURTHER MODIFYING PACKAGE
BIDDING PROCEDURES”

by

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In our January 2001 comment¹ we identified at least two issues that are more important than the auction design questions raised here: (a) the FCC needs to decide upon an overall strategy for 3G wireless before selling off any part of the spectrum needed for use in 3G wireless, and (b) the FCC ought not to auction spectrum with other incumbent uses until it either clears the spectrum or rules that the current incumbents must move in return for compensation.

Since there has been no progress on these issues, it is likely that even fundamental changes of auction design will not save Auction No. 31 from failing to serve the public interest. In fact, it would not be surprising if, under current circumstances, bidders in this auction turn out to be unwilling to pay anywhere near the value of the unencumbered licenses less the cost of relocating or compensating the incumbents. Furthermore, but less importantly, the commission continues its policy of avoiding thorough discussion of proposed auction procedures.² We hope that the Commission will not misinterpret our comments on its proposed rule changes as a silent acceptance of the existing rules. With our hope that such a misinterpretation will not take place, we briefly comment on the modifications proposed in Public Notice DA 02-260.

¹ R.M. Harstad, A. Pekeč and M.H. Rothkopf, "Verizon is Right: Delay Auction No. 31." Comment on DA 01-143, January 24, 2001.

² The current rules were established in July 2000 and there has been plenty time for discussion of overall design.

Public Notice DA 02-260 indicates that the Commission is still experimenting with package bidding rules and is rediscovering fundamental problems with the auction procedure along the way.³

Fundamentally, the problems with the current auction design arise from:

Mutual exclusiveness of bids across rounds. Shortly after the current auction procedure was announced, it was noted that mutual exclusiveness of bids across rounds is one of the problematic cornerstones of the whole design.⁴ We are pleased that the FCC seems to be conceding our argument by seeking comments on Option 1 in III, which would, if implemented, do away with this restriction. We support that change.

Allowing bids on all combinations. Since bids on all combinations of licenses for sale are allowed, there is no hope for simple, transparent and fast algorithms, and the FCC has to account for the possibility of failing to properly determine provisional winners in a round of the auction, including the final round. While brute force methods would eliminate possibility of such failure when only 12 licenses are for sale, we wonder if the Commission can provide guarantees that such failures will not occur when the number of biddable combinations explodes to a whopping $2^{36}-1$. (Of course the real issue in deciding whether to add 24 licenses from lower 700MHZ spectrum is not of auction design but of policy: is there newly created potential for synergetic values; what are the implications regarding the incumbents on this spectrum – i.e., how will the FCC ensure that taxpayers do not *subsidize* current incumbents.)

It should also be noted that the biddable combinations are very much limited in the current design: they are described by six EAGs⁵ as well as particular frequency bands. Given such artificial constructions, it is strange that some other natural limitations on package bidding that would not restrict bidders in expressing sensible synergetic values (but would restrict them in using package bids for gaming and signaling purposes) and that would at the same time guarantee that whole auction design is implementable, have not been put in place.

Computational demands of the multi-round format. Any problems that one might encounter in a single round of bidding escalate in a multi-round format. It seems that the Commission has learned the hard way that even seemingly mundane tasks such as calculating minimum bid increases can become computationally unsustainable.⁶ The proposed change of the minimum bid increment calculation indicates that the commission

³ The auction procedure was established in July 2000. Serious concerns with the design were raised shortly thereafter. (E.g., A. Pekeč and M.H. Rothkopf, "Now There is Time for Serious Consideration of the Novel Auction Rules", Ex parte filing, , August 1, 2000.)

⁴ Pekeč and Rothkopf, "Now There is Time...". See footnote 3.

⁵ These might not represent the geographic areas of interest to the bidders. A bidder might well be interested in spectrum that covers a region that cannot be decomposed into a family of EAGs.

⁶ The importance of computational issues and the need of deep understanding of computational complexity and combinatorial optimization was noted in A. Pekeč and M.H. Rothkopf, "Making the FCC's First Combinatorial Auction Work Well", comments on DA 00-1075, June 7, 2000.

has finally taken these issues seriously and, judging by the quality of the appendix to the public notice, managed to ensure in-house expertise in combinatorial optimization. While the appendix provides an interesting model for calculating minimum bid increments, it is not clear what basic principles this model satisfies⁷ and why the proposed calculation might be the most appropriate one. In fact, the proposed calculation seems to be nothing more than a consequence of a choice of particular optimization method (LP) that was selected for solving the winner determination problem. In other words, the proposed calculation seems to be motivated by the method used to solve one technical problem in the auction procedure, and not by some general principle or a desirable auction property.

Further, the proposed calculation focuses on determining “shadow prices” on individual licenses that are in turn used to define shadow prices for packages by simply summing the “shadow prices” of all of the individual licenses in a given package. Such an approach ignores the very reason for package bidding in the first place: the value (shadow price) of a package might well exceed the sum of the values (shadow prices) of its elements.

However, given the unfortunate decision of allowing bids on all combinations, a serious computational burden is put on any attempt toward precise and meaningful calculations of minimum bid increments, so one has to settle for (low quality?) approximations. This goes beyond minimum bid calculations. For example, if one were toying with the idea of allowing more creative bids (such as the “OR” bids that were discussed in DA-1075 or some more involved formats such as bids with budget constraints or some of the “bidding languages” studied by computer scientists), the absence of a simple and fast algorithm for winner determination⁸ would create serious problems in determining which bids ought to be retained in the system (stopping short of an exponential explosion in their number) as well as in determining minimum bid increments in such cases.

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⁷ Some defining principles for calculating minimum bid increment are discussed in A. Pekeč and M.H. Rothkopf, “Combinatorial Auction Design”, working paper currently available at <http://faculty.fuqua.duke.edu/~pekec/PekecRothkopfCombAuctDesign.pdf>.

⁸ One is guaranteed to exist if bidding combinations are restricted properly, e.g., as proposed in DA-1075.