

An Analysis of Allocation Phase Pricing and Clock Round Price Increases in the Canadian 600 MHz Auction

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1 Summary

The 600 MHz auction conducted by Innovation, Science, and Economic Development (ISED) in Canada was a Combinatorial Clock Auction (CCA) that used a spectrum set-aside to prevent three large national wireless providers—specifically, Bell, Rogers, and Telus—from winning the entirety of the spectrum at auction. The product space was divided into 16 geographic areas, and seven 2x5 MHz blocks were available in each area.

Within the context of the ISED consultation regarding auction design for the 3500 MHz tender, respondents have commented on certain aspects of the 600 MHz auction design as it relates to the set-aside and to price determination in the 600 MHz auction. The purpose of this paper is to provide interested parties with an accurate understanding of pricing in the Canadian 600 MHz auction of 2019. This paper does not take a position on any proposed design elements of the 3500 MHz auction in Canada.

We find that set-aside eligible bidders in the 600 MHz auction did not significantly affect the base prices that Rogers or Telus paid for 600 MHz spectrum.² In addition, an examination of clock round bidding behavior shows that open prices did not increase significantly due to bidding from set-aside eligible bidders.

2 Determining Allocation Phase Prices in the ISED 600 MHz Auction

The ISED 600 MHz auction was conducted as a combinatorial clock auction (CCA) with a generalized revealed preferences (GARP) activity rule.³ Under this design, prices are calculated according to a modified Vickrey pricing rule. The Vickrey rule specifies that, at a high level, prices are calculated as follows:

Price for bidder x = counterfactual for x – factual for x , where

- counterfactual for x = the sum of winning bids removing all of bidder x 's supplementary round bids from consideration, and
- factual for x = the sum of winning bids for all bidders but x .

Put differently, the price that any bidder pays is determined as the sum of opponent bids that the particular bidder in question displaced from the auction.

We have developed software tools that can be used to calculate Vickrey pricing and therefore determine the pricing in CCAs. This software is a flexible and fast winner determination and pricing program ideal for verifying Vickrey and core-consistent pricing results. It turns bids and auction

² Base price is the price a bidder pays for generic spectrum after the allocation phase of a CCA. Telus did not win any 600 MHz spectrum licenses.

³ ISED, *Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band*, available at: [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-002-18-600MHz-decision-e.pdf/\\$FILE/SLPB-002-18-600MHz-decision-e.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/SLPB-002-18-600MHz-decision-e.pdf/$FILE/SLPB-002-18-600MHz-decision-e.pdf).

configuration data into data files that display the winning allocation with both Vickrey and core-consistent prices (in accordance with standard CCA pricing rules, such as ISED's) that facilitate a transparent and user-friendly examination and verification of the results. This software has been thoroughly tested on both existing auction data and a library of purpose-built test cases, and it supports multiple backend solvers, providing an additional layer of internal verification.

Using these software tools and the bid data that ISED published for the 600 MHz auction, we were able to reproduce the prices that ISED announced for winning bidders in that auction. As part of this analysis, we uncover the break-down of individual prices to extract the specific bidders and bids that determined the prices that each winning bidder paid during the allocation phase of the auction. This analysis is provided below.

3 An Accurate Assessment of the Effect of Set-Aside Eligible Bidders on Open Prices

Here, we explain pricing in the 600 MHz auction. Some respondents in the 3500 MHz process contend that set-aside bidders drove up prices *for the open bidders* in the 600 MHz auction. This is generally untrue, as we explain below.

3.1 Explaining Prices for Rogers and Telus in 600 MHz

Rogers and Telus and academic research submitted on behalf of Telus all claim or intimate that set-aside bidders drove up spectrum priced that Rogers and Telus paid in the 600 MHz auction.⁴ This claim is incorrect. First, Rogers's and Telus's allocation phase winnings were almost entirely based on "counterfactual bids" from Bell, Rogers, Telus, and ISED.⁵ Analysis of the 600 MHz auction data confirms

⁴ See Rogers par. 17 (stating that the 600 MHz auction provides an example of set-aside eligible bidders either directly or indirectly driving up the price of open lots of spectrum, which exacerbates the price difference between open and set-aside spectrum). See also, Telus par. 83 (stating that the 600 MHz auction resulted in pricing discrepancies between set-aside and open bidders without explaining that open bidders paid higher prices due to competition from other open bidders rather than set-aside bidders). Finally, in research developed in support of Telus, Professor Michael Ostrovsky provides an example of how set-aside bidders inflate prices in the open segment of an auction. See Michael Ostrovsky, *Comments on the Outcomes and Design Issues in the 2019 Canadian Auction of Spectrum Licenses in the 600 MHz Band*, June 25, 2019 at par. 66-68.

⁵ The winning allocation is determined as the one that maximizes the sum of bids subject to the auction constraints (supply, set-aside, etc). As stated above, this solution is the "factual." To determine the price Rogers pays for its winning allocation, one takes the "factual" and subtracts Rogers's winning bid from it to get Rogers's factual. One then calculates Rogers's "counterfactual" by removing all of Rogers's bids from the auction and re-running the solution to see what the sum of winning bids would have been without Rogers in the auction. Rogers's price is then Rogers's counterfactual – Rogers's factual, or the amount of auction value Rogers displaced because it won.

that the price that Rogers paid for its winnings was determined almost entirely by Telus, Bell, and ISED (more than 93.5 percent).⁶ Table 1 below illustrates this point.⁷

Table 1: Analysis of the Price Rogers Paid in the 600 MHz Auction

Bidder	Counterfactual Bid (\$) (A)	Factual Bid (\$) (B)	Effect on Rogers's Price (A-B)	Effect on Rogers's Price Net of Reserve (\$) ⁸	Effect on Rogers's Price Net of Reserve (%)
Novus	60,304,000	0	60,304,000	35,251,000	3.26
TELUS	2,462,242,000	1,629,670,000	832,572,000	491,172,000	45.39
Freedom	1,196,965,000	1,032,157,000	164,808,000	70,000,000	6.47
SSi	580,000	0	580,000	381,000	0.04
SaskTel	125,000,000	125,000,000	0	0	0
Iris	6,474,000	6,474,000	0	0	0
Bell	571,702,000	0	571,702,000	479,456,000	44.31
Bragg	44,268,000	44,268,000	0	0	0
TBayTel	7,449,000	7,449,000	0	0	0
Vidéotron	749,089,000	737,544,000	11,545,000	5,427,000	0.50
Xplornet	49,656,000	47,243,000	2,413,000	345,000	0.03
Rogers	NA	2,849,219,000	(excluded)	NA	NA
ISED	97,912,000	16,830,000	81,082,000	0	0

The data in Table 1 also illustrate that ISED, Telus, and Bell were the auction participants that most affected Rogers's price net of reserves, i.e., after accounting for the reserve price for the spectrum in question (all bidders were required to pay at least the reserve price for all spectrum blocks won at auction). Rogers's price net of reserves was mostly affected by Bell (\$479 million) and Telus (\$491 million). In addition, set-aside bidders, Novus (\$35 million), Freedom (\$70 million), and Videotron (\$5.4 million), had non-trivial effects on Rogers's price net of reserves. This said, Bell and Telus together accounted for nearly \$1 billion of Rogers's price net of reserves whereas set-aside bidders accounted for only \$111 million. Therefore, to say that set-aside bidders increased prices for Rogers grossly misstates pricing in the auction. Rogers's price was determined by Bell and Telus, with set-aside bidders contributing a significantly smaller percentage.

Moreover, to the extent that a set-aside eligible bidder did price Rogers, that set-aside eligible bidder *also priced another set-aside eligible bidder*. For example, Novus bid \$60,304,000 for a single block of

⁶ Roger's base price for spectrum was \$1.725 billion. Net of reserve (which any winning bidder must pay) set-aside eligible bidders priced Rogers at \$70 million + \$5.4 million + \$35.3 million + \$354,000 + \$381,000 = \$111.4 million. Therefore, set-aside bidders accounted for slightly more than 10 percent of Rogers's price paid, calculated as $(111.4 / 1,725) \times 100 = 6.5$ percent. ISED's contribution to Rogers's price paid would then be 37.3 percent as the reserve price of Rogers's package was \$642,974,000. Bell and Telus, (combined) accounted for 56.3 percent of Rogers's price paid for spectrum.

⁷ We calculate the allocation phase base prices for each bidder using our proprietary software, discussed above, which we have calibrated to conform to the rules of the ISED 600 MHz auction.

⁸ This column is calculated as: $[(\text{Bid price of counterfactual}) - (\text{Reserve price of counterfactual})] - [(\text{Bid price of factual}) - (\text{Reserve price of factual})]$.

spectrum in British Columbia. This bid shows up in counterfactuals for both Freedom and Rogers. Similarly, the counterfactual for Videotron illustrates that Freedom’s bid also affected the price that Videotron paid *by the same amount* as it affected Rogers. Therefore, set-aside eligible bidders did provide some amount of pricing to Rogers, but they also passed that same pricing power off to other set-aside bidders. Similar data for Telus is provided in Table 2 below:

Table 2: Analysis of the Price Telus Paid in the 600 MHz Auction

Bidder	Counterfactual Bid (\$) (A)	Factual Bid (\$) (B)	Effect on Telus’s Price (A – B)	Effect on Telus’s Price Net of Reserve ⁹ (\$)	Effect on Telus’s Price Net of Reserve (%)
Novus	0	0	0	0	0
Freedom	1,062,157,000	1,032,157,000	30,000,000	16,197,000	2.33
SSi	0	0	0	0	0
SaskTel	125,000,000	125,000,000	0	0	0
Iris	6,474,000	6,474,000	0	0	0
Rogers	3,544,941,000	2,849,219,000	695,722,000	514,693,000	73.94
Bell	166,774,000	0	166,774,000	139,079,000	19.98
Bragg	44,268,000	44,268,000	0	0	0
TBayTel	7,449,000	7,449,000	0	0	0
Vidéotron	784,250,000	737,544,000	46,706,000	33,577,000	4.82
Xplornet	48,286,000	47,243,000	1,043,000	-7,485,000	-1.08
TELUS	NA	1,629,670,000	(excluded)	NA	NA
ISED	7,820,000	16,830,000	-9,010,000	0	0

Nearly 95 percent of Telus’s allocation phase price (also called “base price”) was due to Rogers, Bell, and ISED.¹⁰ The only significant amount of pricing power conveyed by set-aside eligible bidders to Telus (net of the reserve price) was \$49.8 million from Freedom and Videotron *combined*. This pricing came from bids for three blocks in Manitoba (Freedom) and two blocks in E. Ontario (Videotron). Notably, this same Freedom bid appears in the price calculation for Xplornet, and the Videotron bid appears in Freedom’s pricing calculation. Therefore, set-aside bidders that priced Telus also priced one another *to the same degree that they priced Telus*, and the pricing complaints from Telus and Rogers as they relate to set-aside bidders are misguided.

3.2 Open Clock Prices in the 600 MHz Auction

Insofar as claims regarding pricing in the 600 MHz auction refer to set-aside eligible bidders driving up clock prices rather than prices paid, they miss the point that clock prices in a CCA are only relevant to the extent that they allow some bidders to affect the prices paid by other bidders. As shown above, set-

⁹ Note: this column does not include \$3,000 of additional pricing that Telus incurred as part of the assignment phase of the auction.

¹⁰ Telus’s base price (before the assignment rounds) was \$931,235,000. The reserve price for this package was \$235,174,000, meaning that ISED contributed 25 percent to Telus’s base price. Rogers and Bell (combined) contributed 70.2 percent to Telus’s base price, meaning that the remaining 5 percent is attributable to bids from set-aside eligible bidders.

aside eligible bidders did not have a significant impact in this respect, regardless of how they affected clock prices. However, as further analysis shows, set-aside eligible bidders did not significantly affect the open clock prices either. Many of these clocks would have increased solely due to bidding from Bell, Rogers, and Telus. To examine the effect of bidding by parties other than Bell, Rogers, and Telus on open clock prices in the 600 MHz auction, we tabulated the rounds in which Bell, Rogers, and Telus expressed demand of four or fewer blocks in a service area and set-aside eligible bidders bid more than three blocks. These are the necessary conditions for set-aside eligible bidders to cause the open clock price to increase. In the entire auction, there were only 28 round-service area combinations (of 672 in total) in which this occurred. Moreover, 24 of those 28 instances were in Nunavut and the Yukon. In the other 4 instances, the set-aside price was lower than the open price, meaning that under the rules of the auction, the open price did not increase as a result of any demand from set-aside eligible bidders in excess of 3 blocks. Therefore, set-aside bidders did not drive up open clock prices. Open bidders drove prices up on other open bidders, and the data clearly demonstrate this.

We also examined markets in which Videotron bid as open rather than set-aside eligible. There were six rounds in which the open price clock in Alberta rose due to demand from an open bidder other than Bell, Rogers, or Telus; and there were two such rounds in British Columbia. Adding in a smattering of other such instances in the Maritimes and the North, there were 13 instances where an open bidder other than Bell, Rogers, or Telus could be deemed responsible for increasing a price clock in the open category. Again, to the extent that open price clocks rose, they rose primarily due to demand from Bell, Rogers, and Telus. By contrast, one cannot say that demand from set-aside bidders directly resulted in significant increases in open clock prices during the 600 MHz auction.