Lessons from the Canadian 700 MHz Auction

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Summary

As one of the architects of the recent Canadian 700 MHz auction and a consulting economist to the Canadian government, I have been asked by T-Mobile USA, Inc.[2] to review the Canadian auction results and comment on issues that may be relevant for the FCC's upcoming incentive auction. Elsewhere I have focused on the rationale for spectrum-aggregation limits, the overall experience with spectrum-aggregation limits, and the suitability of such limits in the FCC's upcoming incentive auction.[3] I have also examined the revenue impact of spectrum-aggregation limits in the 600 MHz auction.[4]

On 13 February 2014, the Canadian 700 MHz auction closed after 108 rounds of bidding. The auction assigned 68 MHz of spectrum in each of 14 service areas. Of the ten bidders, eight won spectrum. Canada's three nationwide operators, Rogers, Telus, and Bell, accounted for 95% of the auction revenues, winning 85% of the spectrum by MHzPop, including 100% of the most sought after blocks (A, B, and C). Four regional operators, Videotron, Bragg, MTS, and Sasktel, accounted for the remaining 5% of revenues, winning 15% of the spectrum by MHzPop. Auction revenue totaled CD$5.27 billion, resulting in an average price of US$2.28 per MHzPop, 60% above the average price of US$1.31 in the 2008 US 700 MHz auction in 2014 dollars.

Like the US market, the Canadian mobile market is highly concentrated with the Big 3 serving 92% of all subscribers. Subscriber shares as of 3rd Quarter 2013 are Rogers 35%, Bell 29%, and Telus 29%.[5] To foster competition in the industry, the Canadian auction included a spectrum-aggregation limit. No bidder could win more than two of the five paired blocks, and no large bidder could win more than one of the paired blocks unless it included the A block. The A block was initially viewed as inferior to the other blocks as a result of interference and interoperability problems, although by the time of the auction

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[2] T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

[3] Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes* (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013).

[4] Peter Cramton, *The Revenue Impact of Competition Policy in the FCC Incentive Auction* (Dec. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Dec. 6, 2013).

[5] See http://cwta.ca/wordpress/wp-content/uploads/2011/08/SubscribersStats_en_2013_Q3.pdf.

these issues were largely resolved. A larger bidder was one with 10% or more nationwide market share or 20% or more regional market share.

Rather than stifling competition, the spectrum-aggregation limit intensified competition on the most desired package, the AB combination. The three paired blocks (A, B, C) in the lower 700 MHz band were the most desired because they were consistent with the GSM-to-LTE technology path favored by all the Canadian bidders. The AB combination was the only way to win two lower blocks. The 12+12 MHz of contiguous spectrum offered both greater capacity and speed than any other combination. The C block was a clear second choice. Thus, the Big 3 competed fiercely for AB and then C. The weakest would be left with C1 or C2 in the inferior upper band.

Rogers as a result of a network sharing arrangement between Bell and Telus had the most to lose if it failed to get AB. Rogers competed aggressively for AB and won in all the major markets paying CD$4.32 per MHzPop, about twice the overall average auction price of CD$2.32. The C block also commanded a high price.

The spectrum -aggregation limit guaranteed that the four regional operators won a paired block in their core regions. In addition, one of the regional operators, Videotron, was able to substantially expand its footprint into other major markets. The regional operators paid much lower prices, but won in the much less desirable upper band that was a distant third choice for each of the Big 3.

The main lesson from the Canadian 700 MHz auction is that well-crafted spectrum-aggregation limits can succeed in encouraging valuable competition in the mobile industry without sacrificing auction revenues. Were the Canadian auction conducted without limits, it seems likely that the regional operators would have been pushed aside by the much stronger Big 3. Furthermore, revenues likely would have been reduced as competition for the AB combination would have been less intense, since the C1C2 combination would become a better substitute for AB, than C2 alone was.

In the US, the mobile market structure differs from Canada, although both are highly concentrated. In the US, the Big 2 have 67% market share[6] and hold roughly 80% of the low-band spectrum, which is best-suited to providing coverage within buildings and in more difficult terrain.[7] Were the Big 2 to dominate the 600 MHz auction, competition in the mobile broadband market would be harmed.

In setting competition policy for the incentive auction, the FCC must balance the gains from a more competitive auction outcome with the possibility of revenue effects. A modest limit on the Big 2 (two lots each) is apt to induce little or no revenue loss and could even increase revenue compared to an entirely unrestricted auction; however a more stringent limit of one lot may result in revenue loss. T-

[6] *See Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, 28 FCC Rcd 3700, ¶ 52 (2013) (hereinafter "Sixteenth Report").

[7] *Id.* ¶¶ 121-22.

Mobile has proposed a Dynamic Market Rule ("DMR") that would let the auction resolve this tradeoff.[8] The FCC can first conduct the forward auction with the more stringent limit and then relax the limit if the revenue requirement is not met. In this way, the FCC can foster greater competition in the post-auction market for wireless services, maximize the likelihood of a successful auction, and still generate considerable revenue for other public interest goals.

The auction setting

The Canadian mobile market has three nationwide operators with subscriber market shares as follows: Rogers 35%, Bell 29%, and Telus 29%. Together the Big 3 serve 92% of all subscribers.[9] Further, Bell and Telus have a network sharing agreement, so there are effectively two nationwide networks. The remaining 8% of subscribers is served from regional operators, Bragg in the East, Videotron in Quebec, MTS in Manitoba, and Sasktel in Saskatchewan, and the urban-centric operator Wind in Ontario and the West. Wind decided on the day before the start of the auction not to participate in the auction due to a lack of funding from its parent company.

Canada adopted the US 700 MHz band plan for the auction. The 68 MHz of spectrum up for auction included three 6+6 MHz paired blocks in the lower 700 MHz band, blocks A, B, and C, two 5+5 MHz paired blocks in the upper 700 MHz band, C1 and C2, and two 6 MHz unpaired blocks, D and E. These seven blocks were auctioned in each of 14 service areas using a combinatorial clock auction ("CCA"). In the CCA, bidders bid on packages of licenses and pricing is determined from the competitive bids of others, so called second pricing.

To encourage industry competition, the auction included a spectrum-aggregation limit. No bidder could win more than two paired blocks (i.e., two among A, B, C, C1 and C2). Moreover, large wireless providers could only win a single block among the prime paired blocks (B, C, C1 and C2). Large was defined as a provider with a market share of 10% or more nationwide or a market share of 20% or more in the particular service area. The A block was viewed as inferior to the other paired blocks as a result of greater interference from adjacent TV stations and the possibility of greater difficulty in the supply of handsets that support the A band. The handset issue appeared resolved before the auction when the FCC on 28 October 2013 ordered interoperability of the lower 700 MHz band.[10] The spectrum limit had a big impact on the structure of competition for the paired blocks, as I explain below.

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[8] Gregory Rosston and Andrzej Skrzypacz, *A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum Clearance*, attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).

[9] As of 3rd Quarter, 2013; see http://cwta.ca/wordpress/wp-content/uploads/2011/08/SubscribersStats_en_2013_Q3.pdf.

[10] See http://www.fcc.gov/document/fcc-takes-action-promote-interoperability-lower-700-mhz-band.

The auction outcome

Table 1 shows the auction outcome by company together with subscribers, so that incumbent market shares can be compared with the bidder payments and spectrum won. The quantity of spectrum won is measured in MHzPop, the number of MHz times the population in the particular service area. The price of spectrum is the ratio of the payment and the quantity of spectrum won.

Table 1. Subscribers and auction outcome by company

	Subscribers (millions)	Payment (million CD$)	MHzPop (millions)	Market share	Payment share	Spectrum share	Price (CD$/MHzPop)
Rogers	9.5	$3,292	762	35%	62%	34%	$4.32
Telus	7.8	$1,143	642	29%	22%	28%	$1.78
Bell	7.8	$566	536	29%	11%	24%	$1.05
Vidéotron	0.5	$233	280	2%	4%	12%	$0.83
Bragg		$20	31		0%	1%	$0.65
MTS	0.5	$9	12	2%	0%	1%	$0.73
Sasktel	0.6	$8	10	2%	0%	0%	$0.73
Feenix		$0	1		0%	0%	$0.26
Wind	0.6			2%			
Big 3	25.1	$5,000	1,941	92%	95%	85%	$2.58
Regional	1.6	$270	334	6%	5%	15%	$0.81
Total	27.3	$5,271	2,275	100%	100%	100%	$2.32

Source: Industry Canada, http://agora.ic.gc.ca/highlights_eng.cfm?p_auction_id=8.0; subscribers as of 3rd Quarter 2013, http://cwta.ca/wordpress/wp-content/uploads/2011/08/SubscribersStats_en_2013_Q3.pdf

Overall the Big 3 have 92% market share. The Big 3 won 85% of the spectrum and contributed 95% of the revenues. Rogers, the largest of the Big 3, bid the most aggressively on the most valuable spectrum. Rogers won more as a result and paid substantially more. Rogers' winning price of CD$4.32/MHzPop was more than twice as high as Telus' price of CD$1.78, and over four times as high as Bell's price of CD$1.05. Each of the four regional operators paid less than one-fifth of Rogers' price for their spectrum. Among the four regional operators, Videotron bid the most aggressively and as a result won spectrum in the major markets outside of its core region in Quebec.

The prices for all winners, with the exception of Feenix in the territories, were substantially above the auction reserve prices, indicating that there was competition for nearly all licenses.

Table 2 shows the winner of each block in each of the 14 service areas. In interpreting this table, it is important to recognize that the service areas differ substantially in size.

Table 2. Auction winner by service area and block

Service Area	A 12MHz	B 12MHz	C 12MHz	C1 10MHz	C2 10MHz	D 6MHz	E 6MHz	Population
Newfoundland & Labrador	Rogers	Rogers	Bell	Bragg	Telus	Bell	Bell	514,641
Nova Scotia & PEI	Rogers	Rogers	Bell	Bragg	Telus	Bell	Bell	1,061,846
New Brunswick	Rogers	Rogers	Bell	Bragg	Telus	Bell	Bell	749,942
Eastern Quebec	Rogers	Rogers	Telus	Vidéotron	Bell	Telus	Telus	1,668,394
Southern Quebec	Rogers	Rogers	Telus	Vidéotron	Bell	Telus	Telus	5,683,036
Eastern Ontario & Outaouais	Rogers	Rogers	Telus	Vidéotron	Bell	Telus	Telus	2,347,808
Northern Quebec	Bell	Bell	Rogers	Vidéotron	Telus	Bell	Bell	190,605
Southern Ontario	Rogers	Rogers	Bell	Vidéotron	Telus	Bell	Bell	10,090,766
Northern Ontario	Bell	Bell	Rogers	Bragg	Telus	Bell	Bell	774,775
Manitoba	Telus	Telus	Rogers	MTS	Bell	Telus	Telus	1,206,968
Saskatchewan	Telus	Telus	Rogers	Sasktel	Bell	Telus	Telus	1,039,584
Alberta	Rogers	Rogers	Telus	Vidéotron	Bell	Telus	Telus	3,640,395
British Columbia	Rogers	Rogers	Telus	Vidéotron	Bell	Telus	Telus	4,399,939
Yukon, NWT & Nunavut	Bell	Bell	Telus	IC	Feenix	Bell	Bell	107,215

Source: http://agora.ic.gc.ca/overview_eng.cfm?p_auction_id=8.0&p_round_no=0&p_color=yes.

Rogers won the AB combination in all of the major service areas. To do so Rogers had to displace both Bell and Telus. Bell or Telus were successful in winning AB in five of the smaller service areas, and won the C block in all other areas. Bell or Telus also won the C2 block in all areas but the territories, and won both unpaired blocks (DE) in all areas. This left C1 for the regional operators. Each regional operator won C1 in its region. In addition, Videotron expanded into the major markets of Ontario, British Columbia, and Alberta.

Understanding competition in the auction

In this section, I seek to explain competition in the auction and the formation of prices. My analysis is somewhat speculative, since information about the auction outcome is currently limited to the information in Tables 1 and 2. Sometime in April, after final payments have been made, Industry Canada will release all the bid data, which will allow a richer understanding of competition in the auction and the formation of prices. Nonetheless, Tables 1 and 2 together with the auction setting reveal a great deal about competition in the auction.

First and most important, the spectrum-aggregation limit meant that only one of the Big 3 would win two paired blocks, and by rule, this had to include the A block. The AB combination was the obvious

choice for any bidder winning two blocks: AB would result in contiguous blocks and therefore higher data rates, and the AB combination resides in the lower 700 MHz band, which is the most desirable eco-system, following the technological path of AT&T (GSM-to-LTE). Issues of handset interoperability on the A block were resolved before the auction, and the TV interference issues on A will be reduced or eliminated following the US incentive auction scheduled for 2015. This created intense competition for AB. Each of the Big 3 wanted AB and only the highest bidder would be successful.

For those unsuccessful in winning AB, there was a clear second choice, the C block. This was preferred to either C1 or C2, since C was in the lower 700 MHz band with the most desirable technology path. C1 or C2 in the upper 700 MHz band was the third choice, since most handsets supporting C1/C2 would follow the Verizon technology path (CDMA-to-LTE). Rogers network is entirely based on the GSM-to-LTE path, so handsets based on the Verizon technology path are not feasible, aside from the more limited and expensive "global" handsets that include GSM. Bell and Telus both moved away from CDMA, and also have a clear preference for the GSM-to-LTE technology path of AT&T. This is why C1/C2 is a third choice and a rather distant third choice for Rogers. The regional operators, especially Videotron, also favor the GSM-to-LTE technology path.

This structure, in which all of the bidders have the same preference orderings, makes the competition especially intense. All bidders are driven first to AB, then C, and then C1/C2. We can anticipate that the price paid for AB is apt to be high, followed by C, with much lower prices for C1/C2. This is exactly what happened.

To understand the prices, it is important to remember that the CCA uses second pricing—a bidder's payment is based on the competitive bids of others, rather than its own bids. Thus, the price that Rogers paid for AB was based on the bids of Telus, Bell, and the regional operators.

With this background, the final assignment suggests the following.

Rogers, the largest among the Big 3, bid aggressively for AB, pushing aside all competitors in all major service areas. Bell and Telus also bid aggressively for AB, setting the high price paid by Rogers for 90% of AB, and successfully winning the remaining 10%. Telus did manage to win AB in Manitoba and Saskatchewan; whereas, Bell won AB in Northern Ontario and the two smallest areas.

Winning AB was especially beneficial for Rogers. An AB win gives Rogers a speed advantage over both of its main rivals; whereas, if Bell or Telus won AB, the network-sharing arrangement would have meant that both Bell and Telus have a speed advantage over Rogers. Moreover, it was essential that Rogers win C if it failed on AB, since otherwise Bell and Telus would have had a large speed advantage over Rogers, since Bell/Telus then would have had 18+18 MHz of contiguous spectrum in the much preferred lower 700 MHz band with the GSM-to-LTE technology path that was most important to Rogers. Given the rather dire consequences to Rogers of losing in the lower band, it is not surprising that Rogers came to the auction "loaded for bear" and bid so aggressively for AB in all the key markets and for C in the others. The network sharing arrangement of Bell and Telus disadvantaged Rogers and Rogers' logical response was to bring lots of capital. In this case, a good offense was the best defense.

Bell and Telus surely understood Rogers' predicament and likely response. This meant that both Bell and Telus would need plenty of money, even to win AB in a small number of markets. Failure on AB would not be a complete loss as higher AB bids would cause Rogers to pay more. What is not clear is how much Bell and Telus competed with each other or whether the prices paid by Bell and Telus for the C winnings were driven by bids from the regional operators.

What is clear is that there was a set of service areas in which Telus was strongest and a set of service areas in which Bell was strongest. Telus was strongest in 60% of the country and Bell was strongest in the remaining 40%. The stronger bidder won a block in the lower band (and possibly two) and both unpaired blocks; whereas the weaker bidder won only C2.

An alternative outcome would be for Bell and Telus to bid aggressively for C1 and C2, so as to have 10+10 MHz of contiguous spectrum under the network sharing agreement. Bell and Telus could have bid in this way, but chose not to. Apparently, having contiguous blocks was less important than having a block in the lower band.

The spectrum-aggregation limit created an opportunity for the regional operators. In each service area one regional operator would win a paired license. Furthermore, given that Wind dropped out of the auction, there were several major markets, such as Southern Ontario, British Columbia, and Alberta, with no obvious winner. A resourceful regional carrier could potentially win these valuable licenses at or near the reserve price. The regional operators thus had every reason to bid full values within their regional footprints and consider expanding beyond their regional footprint. Videotron responded to the opportunity, winning Southern Ontario, British Columbia, and Alberta, the three largest markets outside their core Quebec market.

Aside from Feenix, all bidders paid a price well above the reserve price, which means that each bidder faced competition from the others. Clearly, the competition was especially intense for the AB combination and this was the primary reason for the high revenues.

In the CCA, bidders bid on packages of licenses and this results in payments for packages, rather than the individual license prices produced by a simultaneous ascending auction ("SAA"). Nonetheless, we can compute approximate linear prices for each block that fit the winner payments quite well. These are shown in Table 3. Although approximate, these prices are consistent with the discussion of competition in the auction. Winners of the AB combination paid on average about CD$4.20/MHzPop, nearly a ten-fold increase beyond the reserve price. The remaining lower band block, the C block, at CD$3.06 was less than seven times the reserve. Together the lower band was responsible for about 87% of the auction revenues. Competition on C1/C2 and DE was dramatically less and resulted in prices only slightly above the reserve price.

Table 3. Approximate linear prices that fit winner payments

	Block			
	AB	C	C1/C2	DE
Price (CD$/MHzPop)	$4.20	$3.06	$0.76	$0.38
Reserve price	$0.40	$0.40	$0.48	$0.22
Increase from reserve	951%	664%	59%	74%
Revenue share	64%	23%	10%	3%

A useful metric for comparing auction revenues is the US 700 MHz auction completed in March 2008. The average price in that auction in today's dollars was US$1.31, substantially less than the US$2.08 received in the Canadian auction. Canadian 700 MHz prices were on average 60% higher than the US prices.

Consequence of the spectrum-aggregation limit on the auction outcome

The spectrum-aggregation limit played an important role in the Canadian auction. Its biggest and clearest impact was on the assignment of spectrum. The spectrum limit guaranteed that one paired block would be available for a regional operator in each service area.

Without a spectrum limit, how would the spectrum assignment likely change? Given the dominance of the Big 3, it seems likely that the Big 3 would win nearly all the spectrum. Rogers likely would win two blocks in the lower band with Bell and Telus winning the remaining blocks. The exception to this is that the three strongest regional operators might win a block in their core regions—Videotron in Quebec, Sasktel in Saskatchewan, and MTS in Manitoba—but I view this as doubtful.

Thus, the major consequence of no limit would be a decline in competition in the mobile broadband market. The dominance of the Big 3 (with two nationwide networks) would be strengthened. This adverse possibility would appear to be the motivation behind the spectrum limit Canada adopted. The limit guaranteed that one paired block would be available for a regional operator.

The spectrum limits' impact on auction revenue is much more difficult to assess. Competition among the Big 3 for the paired blocks would remain the big driver of auction revenue. Each of the Big 3 has one of three choices: two blocks in the lower band, one block in the lower band, or C1C2. Two blocks in the lower band is clearly the first choice, but it no long confers a speed advantage relative to winning the two upper band blocks. C1C2 is a much better substitute for AB, than C2 alone was. As a result, the competitive advantage of winning AB is reduced and as such bidding on AB is apt to be less intense without a limit. Similarly bidding on C is apt to be less given the improved attractiveness of bidding in the upper band. The one source of revenue increase is the competition from the regional operators fighting for paired blocks in their core markets. This would increase prices on C1/C2 in the core regions of the regional bidders, covering about 36% of the country. Thus, without the spectrum limit, there is less intense competition for AB, but more competition for C1/C2 in part of the country. It is not clear whether revenues would increase or decrease without a spectrum limit. But on balance it seems a decrease in auction revenues would be likely.

Lessons for the US Incentive Auction

The Canadian 700 MHz auction makes clear that reasonable spectrum-aggregation limits can foster competition in the market for mobile broadband services without sacrificing auction revenues. The limits in the Canadian auction created an opportunity for the regional operators to acquire valuable 700 MHz spectrum in their core regions and even expand. The limits also intensified competition among the Big 3 for the most value spectrum blocks in the lower band. This head-to-head competition resulted in record auction revenues.

In an ex parte letter, Verizon asserts, "Canada's experience confirms that restrictions distort competition and can suppress revenue. Bidding in Canada's 700 MHz auction was more intense with respect to those licenses *not subject to the caps* (that is, the ones on which *all firms* could bid), whereas bidding for the licenses subject to the caps was less robust."[11] The Canadian restrictions did impact bidding, but in a way that was entirely consistent with the objective to foster competition for mobile services. The regional operators were able to win valuable spectrum, strengthening their competitive position. Overall they acquired 15% of the spectrum, the less desirable C1 block in the upper 700 MHz band. Regarding revenues, it is far from clear that the spectrum limits reduced revenues. The limits did enable the regional operators to win more and at lower prices, but at the same time the Big 3 paid more for the AB combination. Prices in Canada were highest for the most sought after spectrum, the lower band paired blocks. In the Canadian auction no bidder was excluded from bidding on any particular license.

Verizon also points to the earlier Canadian AWS auction in 2008. In this auction, the Big 3 were excluded from bidding on certain set aside blocks. The restriction in that case brought substantial additional bidders and money to the auction and substantially increased auction revenues as a result. The set aside intensified competition among the Big 3.

Finally Verizon asserts, "Remarkably, the companies pushing for auction restrictions have not cited a single international regulatory decision subsidizing certain nationwide incumbents at the expense of their competitors." In fact, such restrictions are commonplace. The most common instrument of competition policy is a spectrum-aggregation limit. Such limits favor the smaller companies (nationwide or regional) that are less apt to be constrained by such a limit. These limits are seen in virtually all of the 4G auctions conducted worldwide and generally treat the low-band spectrum as special. The recent UK 4G auction is an excellent example of a setting where the competition policy favored the smaller but significant nationwide incumbent, Three.

In the US, the market structure for mobile broadband differs from Canada. Rather than a Big 3, there is a Big 2, AT&T and Verizon, two smaller nationwide operators, Sprint and T-Mobile, as well as many regional operators. As in Canada, the market benefits from the disruptive competition that the non-dominant carriers bring. Competition policy in the upcoming FCC incentive auction should seek to foster this competition. Reasonable spectrum-aggregation limits that prevent excessive concentration of the low-band spectrum holdings are a valuable tool in promoting competition.

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[11] *Ex Parte* of Verizon, GN Docket No. 12-268 & WT Docket No. 12-269 (March 4, 2014).

AT&T recently published a blog post that argues that the Canadian auction should not serve as a model for the design of the US incentive auction.[12] I disagree. As an initial matter, AT&T errs when it argues that the Canadian auction included set-asides of spectrum for regional carriers and new entrants. Rather than reserving blocks of spectrum for smaller bidders, the Canadian auction imposed a limit on the quantity of spectrum that could be won by any bidder. The limit was dependent on the bidder's incumbent position in the market. Canada's policy goal was to encourage competition in the industry by limiting further low-band spectrum concentration, and to increase the access of regional carriers to this valuable spectrum.

AT&T's claim that T-Mobile and Sprint already have "robust nationwide spectrum footprints" and so should also be subject to spectrum-aggregation limits appears to mischaracterize the issue in dispute and misunderstand the nature of the rules in effect during the Canadian 700 MHz auction. The concern in the US market, as in the Canadian market, was not total spectrum aggregation, but dominance in the most useful and valuable low-band spectrum. To protect against excessive low-band spectrum concentration, Canada imposed tighter aggregation limits on those entities believed to hold market power.

T-Mobile's DMR proposal would include limits on the amount of low-band spectrum that AT&T and Verizon can acquire. This would encourage the participation of smaller carriers who might otherwise anticipate being foreclosed. However, the approach would not endanger auction revenue. The limits would be relaxed if revenue targets were not met.

Auction designs that encourage greater rivalry and competition during the auction among those with the greatest capacity to bid will tend to generate substantially more revenue than auction designs that allow for greater segmentation and differentiation to occur. Industry Canada's auction rules both stimulated competition during the auction and gave non-dominant carriers greater access to critical input resources they need to compete once the auction ended. Far from diminishing revenue, the Canadian auction design promoted competition among dominant incumbents to ensure bids accurately reflected the value of the licenses offered.

Conclusion

The Canadian 700 MHz auction provides yet another example that reasonable spectrum limits need not harm auction revenue. Given the high level of concentration in the mobile broadband industry and the especially high level of concentration in low-band spectrum holdings, the FCC should adopt spectrum limits in the 600 MHz auction that prevent the auction from cementing further concentration. The auction should promote improved competition and innovation in the wireless industry, not stifle it.

In setting the limits, the FCC must recognize the essential role of auction revenues in the incentive auction. Without sufficient revenues to compensate clearing TV broadcasters the auction will fail. The

[12] *See* Joan March, "More on Auction Limits," AT&T Public Policy Blog (Apr. 2, 2014), *available at* http://www.attpublicpolicy.com/public-safety/more-on-auction-limits/.

Canadian 700 MHz auction brings further evidence that by setting reasonable limits and using the DMR or other similar auction design features that stimulate competition among bidders, the FCC can promote competition both in the 600 MHz auction and in the post-auction market for wireless services. Effective limits will result in little or no revenue loss. The reason is that limiting the winnings of the Big 2 creates opportunities for other bidders. These opportunities motivate a higher level of participation from others and make the auction more competitive. More competitive auctions yield higher revenues. Absent a limit, potential competitors may fear that the Big 2 will dominate the auction, making participation a costly and risky bet.

References

Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes* (Aug. 2013), attached to *Ex Parte* Presentation of T-Mobile, GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013).

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Gregory Rosston & Andrzej Skrzypacz, "A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum Clearance," attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 31, 2013).