Toronto Hydro-Electric System Limited
14 Carlton Street
Toronto, Ontario M5B 1K5

Telephone: 416-542-2517
Facsimile: 416-542-3024
gwinn@torontohydro.com

September 22, 2011

via RESS e-filing – signed original to follow by courier

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
PO Box 2319
2300 Yonge Street, 27th floor
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Toronto Hydro-Electric System Limited's ("THESL")
Interrogatory Responses
OEB File No. EB-2011-0120

Please find attached THESL's responses to selected interrogatories in the above-noted proceeding. The accompanying Index lists the schedule numbers of the responses that have been filed to date. We continue to work diligently to complete the responses and will provide those as soon as possible.

Yours truly,

[original signed by]

Amanda Klein
Senior Regulatory Counsel

:AA/acc

cc: J. Mark Rodger, Counsel for THESL, by electronic mail only
Applicant and Intervenors of Record for EB-2011-0120, by electronic mail only

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RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 5:

Reference(s): **City of Toronto Telecommunication Tower and Antenna Protocol, Section 4 C (a) Siting: A telecommunication antenna mounted on a high-rise building or structure such as an existing telecommunication tower, hydro transmission tower, utility pole or water tower, is to be explored by the proponent before any proposal is made for the construction of a new telecommunication tower."**

Has THESL consulted with the City of Toronto in determining whether wireless attachments should be accepted on its poles? If so, what effect does this consultation have on THESL's position in this matter?

RESPONSE:

THESL determined its position regarding whether and to what extent wireless attachments should be accepted on its poles independently. THESL has had discussions with various City staff who are aware of THESL's position on this matter. THESL has not received any substantive feedback or direction from the City of Toronto in this regard.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 6:

Reference(s): **Section 3 (a): "A preliminary consultation meeting between the proponent and the District Planning Consultant and/or City Planning Staff and Toronto Building Division staff is required for all telecommunication tower and telecommunication antenna proposals not exempted from consultation by Industry Canada, before a Telecommunication Tower Review Application and/or Building Permit application is submitted. The purpose of this meeting is to: determine if a Building Permit is required; determine emission levels in compliance with Safety Code Six and if applicable, explore preferred site locations and siting, design & co-location considerations in accordance with this protocol. For telecommunication tower and telecommunication antenna proposals exempted from consultation by Industry Canada, the proponents are requested to provide information to the City on: the nature of the proposal; the location of the proposal; and the emission levels of the proposal in compliance with Safety Code Six."**

To THESL's knowledge, were these requirements met by CANDAS, in case of each proposal involving attachment of CANDAS' antennas to THESL poles?

RESPONSE:

Whether or not CANDAS met these requirements is not within THESL's knowledge.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 7:

Reference(s): **Section 3D: Design and Landscaping: "All efforts will be made to decrease the size and visibility of all telecommunication antennas and telecommunication towers, so that they will blend in with the surroundings."**

To THESL's knowledge, are CANDAS applications for mounting of its antennas on THESL poles compliant with this guideline, particularly when they are alleged to increase the level of clutter on poles?

RESPONSE:

Whether CANDAS has made "all efforts" in this respect is not within THESL's knowledge.

RESPONSES TO ONTARIO ENERGY BOARD STAFF INTERROGATORIES

INTERROGATORY 14:

Reference(s): **Vol1/Exh 2: Affidavit of Adonis Yatchew Section C.4., pages 18 and 19**

Please clarify whether to your knowledge Crown Castle or American Tower, or any company offering similar services with respect to wireless antenna siting services is operating anywhere in Ontario.

RESPONSE:

Given the dominance of Crown Castle and American Tower in the market for wireless antenna siting services in the U.S., there is no reason to believe that a similar market for siting wireless antenna services could not develop in Ontario. Indeed, it is my understanding that Antenna Management Corporation offers sites in Toronto (See: http://www.antennamgt.com/potential-sites). SBA offers sites in Toronto and across Ontario (http://map.sbasite.com/). Please see the Affidavit of Mr. Starkey, page 32, lines 1-3.

RESPONSES TO ELECTRICITY DISTRIBUTORS ASSOCATION INTERROGATORIES

INTERROGATORY 1:

Reference(s): Evidence of Michael Starkey, President QSI Consulting

At pages 26 to 32, Mr. Starkey refers to potential co-location sites in Toronto. Why are these sites considered as potential co-locations sites? Are sites where there are already attachments typically available for use by other attachers? Is there mandatory sharing required for any of these sites? Are these sites, or some of them, controlled by resellers whose business it is to allow multiple attachers? Does Mr. Starkey know if the 25 Public Mobile locations are single or multiple user sites?

RESPONSE:

The evidence refers to thousands of antennas and, at a minimum, well over one thousand potential co-location sites. Industry Canada specifically requires radio spectrum licensees to facilitate sharing of antenna towers and sites, including rooftops, supporting structures and access to ancillary equipment and services and to refrain from causing or contributing to the exclusion of other radio communication carriers from gaining access to sites. [*see* CPC-2-0-17] Industry Canada also requires anyone who is planning to install or modify an antenna system, regardless of the type of installation or service involved, to consider sharing existing antenna systems and infrastructure. [*see, e.g., Industry Canada Client Protocol Procedures* CPC-2-0-03] Hence, all carriers are compelled to share sites where possible. Furthermore, antenna site management is a multi-billion dollar business with numerous management companies offering antenna site location and management services throughout North America, including Canada. Attachment MTS-03 identifies roughly 4,000 existing antenna arrays located within 25 KM of Toronto's city center.

RESPONSES TO ELECTRICITY DISTRIBUTORS ASSOCATION INTERROGATORIES

At page 30, lines 10-11 of Mr. Starkey's direct testimony, Mr. Starkey states that Industry Canada's ALS database shows Public Mobile has established antennas in 125 unique locations within 25 kilometers of the center of Toronto. Attachment A to this response provides a QSI analysis of the extent to which those 125 Public Mobile antenna locations are shared with another wireless carrier. As the summary table on page 6 of Attachment A indicates, at 40% of those locations (i.e., 60 out of 125), Public Mobile's antennas are collocated with antennas of one or more other wireless carriers. The average number of other wireless carriers sharing a location with Public Mobile is 1.6.[1]

[1] That is, there are 96 carriers with collocated antennas among the 60 Public Mobile collocated sites, thus 96 ÷ 60 = 1.6 as the average number of carriers collocated with Public Mobile at those 60 sites.

RESPONSES TO ELECTRICITY DISTRIBUTORS ASSOCIATION INTERROGATORIES

INTERROGATORY 1:

Reference(s): **Evidence of Dr. Yatchew, Prof of Economics, University of Toronto**

At page 22, Dr. Yatchew talks about the possibility of regulatory arbitrage. What information does Dr. Yatchew have regarding the market prices at which the applicants could sub-lease the attachment proposed by them? Is there some mechanism available to ensure that some of that spread goes to the pole owner and its ratepayers?

RESPONSE:

Market prices for the siting of wireless equipment vary depending on factors such as location, access to power and fibre, elevation, amongst others. As Mr. Starkey has indicated (Affidavit of Michael Starkey, page 55, lines 2-5),

> "prices … range from $500-$800 per month on the low side to $5,000 per month on the higher side for the more traditional tower and rooftop access. For example, the City of Chicago currently assess fess of $1,654 and $3,307 per pole, per year for use of light poles and traffic signals, respectively."

While THESL asked CANDAS for evidence regarding the market prices CANDAS expected to be paid for sub-leasing its system to its customers (such as Public Mobile and other Canadian Carriers), CANDAS refused to answer this interrogatory (See CANDAS' response to THESL IR#11(d)).

RESPONSES TO ELECTRICITY DISTRIBUTORS ASSOCIATION INTERROGATORIES

If the Board were to allow utilities to participate, unhindered, in the market for siting of wireless attachments, this would provide the most efficient mechanism to ensure that the appropriate portion of the DAS' owners "spread" would be allocated to pole owners and utility ratepayers.

RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION INTERROGATORIES

INTERROGATORY 5:

Reference(s): **Yatchew Affidavit, p.11**

Professor Yatchew states that "Power poles are therefore not an essential facility for the wireless industry."

a) Is the "essential facilities doctrine" an economic or legal conception?

b) Please confirm that the doctrine first arises from the US antitrust decision concerning competitor access train stations in "*United States v. Terminal Railroad Association of St. Louis*", 1912. Despite the Court's ruling that non-Association members must be given access, was it possible for an excluded railroad company to build its own terminal at nonexorbitant cost?

c) What economic criteria determine whether a facility is essential or not?

RESPONSE:

a) The "essential facilities doctrine" is a regulatory and legal concept rooted in economic reasoning. I understand from my discussions with counsel that:

> The essential facilities doctrine stems from the decision of the U.S. Supreme Court in *United States v. Terminal Railroad Association of St. Louis*[1], where exclusionary conduct by members of an association of railroad operators, whose members controlled all railroad terminal switching facilities in St. Louis, was held to be an illegal restraint of trade because they effectively precluded competition in the market. A leading modern U.S. case involving the essential facilities doctrine is *MCI Communications Corp. and MCI Telecommunications Corp. v. American Telephone and Telegraph Co.*[2], which sets out four elements necessary to

[1] 224 U.S. 383.

[2] 1982-83 Trade Cases, 65,137 (U.S.C.A. 7th).

RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION INTERROGATORIES

establish liability under the doctrine: (i) control of the essential facility by a monopolist; (ii) a competitor's inability practically or reasonably to duplicate the essential facility; (iii) the denial of the use of the facility to a competitor; and (iv) the feasibility of the owner providing access to the facility.

This formulation of the test has been adopted or cited with approval by many U.S. courts, which typically require that the facility in question be truly essential to competition. In particular, the facility must not be available from other sources or capable of duplication by the firm seeking access: "[A] facility will not be deemed essential if equivalent facilities exist or where the benefits to be derived from access to the alleged essential facility can be obtained from other sources."[3]

In Canada, the Competition Tribunal has not to date explicitly adopted an essential facilities doctrine, yet certain of its decisions may be characterized as having relied upon a similar concept pursuant to the abuse of dominance provisions under the Act.

The Bureau's most recent consultation draft of its updated Enforcement Guidelines on the Abuse of Dominance Provisions (which have not been published in final form) (the "Draft Guidelines") includes a discussion on the application of section 79 to a denial of access to a facility or service. The Draft Guidelines notes that "denial of access to a facility is a common practice that will raise issues under the Act only in limited circumstances", and only where the following conditions are present:

(i) A vertically integrated firm that has market power in the downstream (or retail) market for the market in which the facility is used as an input in the time period following the denial;

(ii) a denial of access to the facility has occurred for the purpose of excluding competitors from entering or expanding in the

[3] *Apartment Source of Philadelphia v. Philadelphia Newspapers*, Civ. A. No. 98-5472, 1999 WL 191649, at *7 (E.D. Pa. Apr. 1, 1999).

RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION INTERROGATORIES

downstream market or otherwise negatively affecting their ability to compete (to infer such a purpose, it must be difficult or impossible for those competitors to substitute to other inputs or to practically or reasonably duplicate the facility); and

(iii) the denial has had, is having or is likely to have the effect of substantially lessening or preventing competition in the downstream market.

First, where, as is the case with THESL, there is no vertical integration, the Draft Guidelines explain that "simply charging a market price for access to a facility, imposing conditions on its use, or choosing not to offer access to downstream purchasers at any price would not, by itself, raise concerns. If a facility owner does not compete in the downstream market in which the facility is used, the Bureau will not consider that supplier to have an incentive to affect downstream competition, and will not consider them to have downstream market power."

Second, a denial of access is an anti-competitive act only when "its purpose is to exclude or impede actual or potential competitors. To infer such a purpose, it must be difficult or impossible for those competitors to substitute to other inputs or to practically or reasonably duplicate the facility. The requirement that it is not practical or feasible for a competitor to duplicate the facility means that such an entrant would not find it feasible to enter, expand, or compete effectively if it had to self-supply the facility." The evidence put forth by CANDAS is insufficient to demonstrate that it is not practical or feasible for it to pursue alternative attachment options. By contrast, Extenet did find it feasible to enter into the Las Vegas market by self-supplying its own poles.

Third, the act must have "the effect of preventing or lessening competition substantially in the downstream market." The evidence put forth by CANDAS is insufficient to demonstrate any preventing or lessening of competition in the downstream market has occurred. By contrast, Public

RESPONSES TO ENERGY PROBE RESEARCH FOUNDATION INTERROGATORIES

Mobile successfully launched its wireless service in the City of Toronto without reliance on THESL utility poles.

b) It is my understanding that early use of the term is associated with the stated case. Please see the response to part (a) above. Regrettably, I am not in a position to independently assess the costs of railway terminal construction.

c) The most important threshold economic criterion in this case is whether THESL is a monopoly provider of sites for placement of wireless facilities. The presence of numerous sites in the Toronto area, owned by different parties, demonstrates that THESL is not a monopoly provider of such sites.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 2:

Reference(s): Byrne, paras. 3 and 5

(a) Provide a table that shows the breakdown, by pole type (i.e., cedar, various classes of concrete, steel, other), of the 140,000 THESL poles and the 40,000 THESI poles that are to be transferred to THESL, both referenced in paragraph 3.

(b) Do the statements on page 2, paragraph 5, pertain equally to the 40,000 THESI poles that are to be transferred to THESL?

(c) What is the average life span of a:

(i) Cedar pole

(ii) Steel pole

(iii) Concrete pole

RESPONSE:

(a) From THESL's asset records, the following is the breakdown by pole type, for all poles listed as THESL and THESI. Information on all the composition of all (current) streetlight poles is provided below. It is not possible with reasonable effort and within the given timelines to provide the composition of only those streetlight poles that will be transferred to THESL, and in any event, production of the information requested would be onerous and is not justified by the probative value of that information.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

POLE MATERIAL	**THESL**	**THESI**
Wood	101,710	3,096
Concrete	38,218	38,897
Steel	3,146	4,607
Missing Data	1,258	5,814
Aluminum	472	4,263
Fibreglass	27	43
Iron	7	21
TOTAL	**144,838**	**56,741**

(b) Streetlighting poles – currently THESI assets - were erected for a different purpose and have different physical characteristics than THESL's distribution poles, which carry primary voltage. THESL only received approval from the Board to transfer certain streetlighting poles from THESI to THESL in August 2011, and the related transactions have not occurred yet. Accordingly, THESL is currently in the process of transitioning these assets, including assessing the appropriate standards, safety, operational and other considerations that apply in respect of streetlighting poles. It would be premature for THESL to speculate on the considerations that would apply to those streetlighting poles. Further, streetlighting poles are not essential facilities for wireless attachers and the CCTA Decision does not apply to THESI.

(c) THESL uses the following approximations for pole life span:
(i) Cedar pole – 40 years
(ii) Steel pole – 50 years
(iii) Concrete pole – 50 years

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 3:

Reference(s): Byrne, paras. 3 and 5

(a) Does THESL provide services to THESI in connection with the maintenance and operation of THESI poles?

(b) Do the THESL-specific standards (as opposed to external standards such as ESA and CSA standards) that govern the construction, operation and maintenance of THESL distribution poles apply, *mutatis mutandi* to THESI poles?

(c) If the response to (b) is "no", describe how THESL standards differ from THESI standards in this regard.

RESPONSE:

a) THESI is not a party to this proceeding and therefore the information sought is not relevant, however THESL currently provides certain limited services to THESI in connection with the maintenance and operation of THESI poles.

b) No.

c) THESI is not a party to this proceeding and therefore the information sought is not relevant, however there are certain standards applicable to LDC primary distribution assets and a separate set of standards applicable to Streetlighting. The Standards for Streetlighting contain information specific to the poles used for Streetlighting that are not used for primary electricity distribution. Further, many THESL LDC Standards are not relevant to Streetlighting, such as the distribution standards for switches.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 16:

Reference(s): Byrne, paras. 19-20

The reference states that: "**[**P**]**rior to 2009, THESL had a group of four dedicated employees who processed NDA applications" and "**[**W**]**hereas in 2007 and 2008, we received 103 and 418 attachment requests respectively, in 2009 we received 1135 requests."

a) What percentage of the annual increase in applications received the period 2007 to present were in respect of wireless attachments? What percentage were in respect of DAS?

b) How many attachment applications were received annually, in the period 2007 to present, in respect of:

(i) NDAs

(ii) Other types of applications

(iii) Wireless attachments (please include a breakdown of different types of wireless attachments)

(iv) Wireline attachments

c) Given the increase in applications for NDAs between 2007 and 2009, why did THESL wait until 2009 to begin to augment staffing in this area?

d) What were the average times to process an attachment application, by type of attachment (i.e. wireless, wireline, etc.) in the period 2007 to present. Describe how these times have been calculated, including methodology and data collection methods.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

e) For each year in the period 2007 to present, provide the average time required to perform fieldwork (e.g. make ready work) to accommodate a permitted attachment.

f) How does THESL prioritize the processing of attachment applications, e.g. first in-first out, by application type, by complexity of the application, by entity requesting attachment, etc.?

RESPONSE:

(a) Please refer to the response in Tab 5.1, Schedule 27. THESL is not able to tell on the face of wireline applications which applications are to support wireless. The information provided by CANDAS in response to THESL IR 1.1 is that Cogeco submitted 303 applications between 2009 and 2010 for the wireline aspect needed for DAScom's wireless attachments.

(b) (i) THESL has incomplete data on total number of NDA applications it received annually, in the period 2007 to present.
(ii) not applicable
(iii) see answer to (a) above
(iv) Please see the affidavit of Ms. Byrne, at paragraph 32

(c) There were no set time frames in the applicable agreements within which attachment applications needed to be processed by THESL.

(d) THESL does not track processing time by type of attachment.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(e) THESL does not track average time required to perform fieldwork.

(f) THESL has historically used a first-in-first-out system, but clients are allowed to designate which attachments are to be processed within their positions in the first-in-first out queue.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 27:

Reference(s): Byrne, para. 34

Ms. Byrne states, “[T]he major distinction signified by the term “wireless” (as compared to wireline) is that the equipment being supported is not composed primarily of cable which must run contiguously between poles in order to function.”

a) Is it THESL’s position that the attachment of the wireline components of a wireless network is mandated by the CCTA Decision in the same manner as the attachment of the wireline component of a wireline network? If the response is “no”, explain why not.

b) Is it THESL’s position that the wireline connection required to support DAS networks is materially different than the wireline connection required to support CATV components? If “yes”, explain the reasons why.

RESPONSE:

a) THESL treats applications for wireline attachments equally. THESL does not know the ultimate purpose of the wireline application at the time of processing that application. It is THESL’s understanding that DAScom has entered into an agreement with Public Mobile (perhaps via Extenet, which is not a “Canadian carrier” as defined within the Telecommunications Act) to put up all of the attachments necessary to build Public Mobile’s telecommunications network, and that one or both of these parties has entered into an agreement with Cogeco to put up the wireline component of this network. Therefore, applications for the wireless and wireline portions respectively of the DAS network come from different entities, and the connection between them (if any) is not apparent to THESL.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

b) Yes. The material difference between “stand alone” wireline attachments telecommunications and those which support wireless systems is that in the case of the latter (i.e. wireline which is a component of wireless systems), but-for the wireless attachments, the wireline component is unnecessary. In the case of DAS, the need for the wireline component is dependent on the existence of the DAS wireless equipment, including the antenna(s) associated with those wireless mini-systems.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 39:

Reference(s): Byrne, paras. 47-50

a) Would an increase in the wireless attachment application fee assist THESL in the timely processing of these types of applications?

RESPONSE:

THESL denies that it has failed to process wireless attachments applications in a "timely" fashion. In the case of DAScom, THESL has honoured its commitments pursuant to the agreement between the parties dated August 1, 2009, which provides no set time periods for processing applications.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 1:

Reference(s): **Starkey, page 4, paragraph 2**

Mr. Starkey states that "[t]he Board's determination that 'power poles are essential facilities' was based on the unique characteristics of wireline attachments."

a) Mr. Starkey is referring to the CCTA Order in the above-noted citation from his Affidavit. Identify any Federal Communications Commission ("FCC") rulings in which attachments to hydro poles and other types of utility poles for purposes of providing wireless services or of establishing a wireless network has been considered. In each case, state the FCC's conclusions and briefly describe the basis of same.

b) If the FCC came to a conclusion that is different than Mr. Starkey's above-referenced view concerning the CCTA Order, explain the discrepancy identify anything specific to the US electric distribution market or wireless market that is inherently different from the corresponding Ontario markets that would explain such discrepancy.

RESPONSE:

a) The Federal Communications Commission's ("FCC's") most recent determinations regarding the attachment of wireless equipment on utility poles can be found in its April 7, 2011 Report and Order and Order on Reconsideration in WC/GN Docket Nos. 07-245/09-51 (FCC 11-50). Beginning at page 9 of that decision, the FCC provides substantial background regarding other rulings it has made regarding attachments to utility poles.

b) The FCC's decision speaks for itself as to its conclusions. The question assumes that some meaningful difference must exist between the Canadian and US electric

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

distribution and/or wireless markets that would explain a discrepancy between the FCC's decision and Mr. Starkey's testimony. That is not a valid assumption. Nonetheless, Mr. Starkey is not aware of any such meaningful, inherent discrepancy.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 2:

Reference(s): Starkey, page 4, lines 20 to 22

In Mr. Starkey's conclusions, he states that "Other carriers, including Public Mobile, rely on extensive networks already deployed throughout Toronto without the need for power poles to support DAS."

a) Confirm whether it is Mr. Starkey's contention that current macrocell deployments are in all cases sufficient to meet current and future coverage and capacity needs of mobile wireless providers in terms of:
   (i) Delivering adequate coverage for voice and data services
   (ii) Meeting throughput demands of customers
   (iii) Efficient and necessary spectrum reuse
   (iv) Cost efficiency
   (v) Other business and technical requirements.

b) Confirm whether in Mr. Starkey's view, DAS or other small cell deployment solutions constitute a direct substitute for macrocell sites.

c) Confirm whether Mr. Starkey agrees that limiting new entrant wireless carriers that are likely to have fewer or constrained spectrum assets as compared to the large incumbent carriers (i.e. Bell, Telus, Rogers), to macrocell site deployment, would in turn limit the former's ability to compete against incumbent carriers.

d) Given the experience in the United States with the establishment of DAS networks over the past several years, confirm whether Mr. Starkey agrees that the single largest impediment to the establishment of a functioning DAS network in the City of Toronto is THESL and THESI's refusal to permit wireless and wireline attachments on their existing pole infrastructure?

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

RESPONSE:

a) Denied.

b) Please refer to the response in Tab 4, Schedule 3.

c) Mr. Starkey has not recommended that "new entrant wireless carriers that are likely to have fewer or constrained spectrum assets as compared to the large incumbent carriers (i.e. Bell, Telus, Rogers), [should be limited] to macrocell site deployment." Instead, Mr. Starkey has provided an opinion that utility poles are not essential facilities for purposes of placing wireless antennae and support equipment because (a) alternative technologies which do not require the use of utility poles and (b) alternative siting options for DAS and other technologies exist in the marketplace.

d) Denied.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 8:

Reference(s): Starkey, page 9, lines 26 to 29

In regards [sic] to Mr. Starkey's entire response related to the question of, "Is it surprising the Board would not have considered wireless attachments….." Mr. Starkey answers, No.

a) In the period leading up to the CCTA Order, was wireless data available (other than for smartphones) in either the US or Canada?

b) Confirm that Mr. Starkey believes that the Board was unaware of the proceedings taking place at or around the same time in the US dealing with similar attachment issues.

c) Mr. Starkey is requested to advise whether, in preparing for his Affidavit, he reviewed the record of the proceeding that led to the CCTA Order. If so, can Mr. Starkey independently verify that included in the record of the CCTA Order were US and Canadian precedents that considered the requirement for wireless carriers to access utility poles.

RESPONSE:

a) The question is vague and ambiguous, particularly with regard to the specific meaning of the term "wireless data." Nonetheless, Mr. Starkey responds that data was being transmitted without wires (wirelessly) prior to issuance of the OEB's CCTA Decision.

b) Denied.

c) Mr. Starkey reviewed portions of the record of the proceeding that led to the CCTA Decision in preparing his Affidavit. Mr. Starkey does not recall that any portions of

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

the record he reviewed included discussions of attaching wireless equipment to utility poles, either in Canada or the US.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 11:

Reference(s): Starkey, page 10, line 8 to page 12, line 2

Under the heading 'Wireless Equipment Will Not Fit in the Communications Space,' when asked to 'Please Generally Describe Wireless Pole Attachments', Mr. Starkey states "In today's environment, DAS networks are generally used in combination with more traditional stand-alone wireless tower sites in areas where either high-traffic volumes or terrain (e.g., indoor areas surrounded by concrete and steel, densely populated outdoor venues, etc.) tax the traditional wireless infrastructure causing undesirable service deterioration (i.e. call blockage, dropped calls, low-bandwidth availability, etc.)."

b) Explain the typical permitting, siting and construction process for erecting a macrocell tower in Canada including the timing of each phase of the project.
   (i) List any typical or foreseeable difficulties regarding this process such as community pushback, municipal delay, etc.

c) For a residential neighbourhood in Ontario, describe the typical or average
   (i) Time frame to permit a macrocell tower
   (ii) The cost of the process
   (iii) Provide an estimate of the percentage of tower permit applications submitted that are constructed
   (iv) Provide the reasons why construction typically does not occur (e.g. failure to get approval from the local zoning or planning regulators).

d) Clarify whether the reference to use of DAS networks "used in combination with more traditional wireless tower sites" means the same thing as the alleged alternatives available for DAS that are referenced throughout this proceeding, such as wireless towers, rooftops, building sides, etc.

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e) If so, Mr. Starkey is requested to explain why DAS is used as opposed to using other "suitable alternatives" or "traditional wireless infrastructure".

f) Clarify how DAS may be effectively implemented if buildings or sides of buildings are

   (i) Not available for lease
   (ii) Not available in a contiguous pattern that would allow for ubiquitous coverage
   (iii) Or the use thereof meets with significant local opposition affecting the ability to secure attachment authorizations or permits

g) Regarding the use of DAS in "areas where high traffic volumes or terrain … tax the traditional wireless infrastructure," describe how DAS is beneficial in high traffic volume areas.

   (i) Does DAS network technology improve network capacity that traditional stand-alone tower sites at elevations higher than utility poles cannot provide or replicate?
   (ii) In urban areas where building heights exceed the heights of utility poles, do wireless antennas placed at elevations lower than rooftop or tower sites effect incremental improvements in network capacity and result in permitting more simultaneous calls in a given geography?
   (iii) In these same areas, would more or fewer antennas be needed to provide coverage as compared to with traditional sites?
   (iv) Assuming that more DAS nodes are needed to provide similar coverage (as opposed to capacity), would "undesirable service deterioration" be increased using the sides of buildings if as stated above "concrete and steel" causes undesirable service deterioration?

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(v) Would there be technical advantages that result from using antennas placed on utility poles as opposed to using the sides of buildings that block signal and cause undesirable service deterioration?

(vi) If Mr. Starkey does not agree that there would be technical advantages that result from placement of DAS antenna on utility poles, provide a full technical explanation justifying this conclusion.

h) Can Mr. Starkey provide examples of the deployment of outdoor DAS systems to provide basic mobile coverage by a wireless carrier in the US or in Canada? Please provide specific information as to which carrier, the size of deployment as well as when the deployment occurred.

i) Is it the opinion of Mr. Starkey that outdoor DAS technology cannot provide for basic mobile coverage for voice services in urban and suburban areas?

RESPONSE:

a) There does not appear to be a question related to (a).

b) Objection, it is not the intention of Mr. Starkey's evidence to list the typical permitting, siting and construction process for erecting a macro cell tower in Canada including the timing of each phase of the project. Mr. Starkey has not prepared the list requested and to create such a list would be unduly burdensome given its relative probative value (if any).

(i) Please see the response in (b) directly above.

c) Objection. Mr. Starkey's evidence is not intended to identify for a residential neighbourhood in Ontario the average time or cost associated with macro cell site

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development and installation as requested (subparts (i) and (ii)). Similarly, Mr. Starkey's testimony does not address the percent of tower applications that result in completed projects nor is it intended to provide a list of reasons why such projects may not be completed (subparts (iii) and (iv)). Mr. Starkey has not prepared the lists requested and to do so would be unduly burdensome given the relative probative value (if any) of such information. Notwithstanding these objections, Mr. Starkey answers as follows. THESL sought information related to subparts (i) and (ii) as it relates to Public Mobile's installation of macro cell site towers in, for example, interrogatory number 50, and CANDAS refused to provide all such information, claiming it did not understand the meaning of such requests and that the requested information was not relevant to the issues before the Board.

d) Objection. This question is vague and ambiguous. It is entirely unclear to which statement(s), by whom and in which context (application, evidence, response to interrogatory, etc) the phrase "means the same thing as the alleged alternatives available for DAS that are referenced throughout this proceeding, such as wireless towers, rooftops, building sides, etc" is intended to be understood.

e) Please see the response in (c) above.

f) Objection. It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use nor was it Mr. Starkey's intention to identify all potential locations DAS antennas may be installed in and around Toronto. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

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g) DAS, or other small cell technologies, can be used to "shape" available capacity to areas where high volume is using an inordinate amount of signal from macro-sites. This provides consumers in those high-volume areas better connectivity and service, while at the same time freeing capacity on the macro-site for other users.

(i) DAS, picocells, femtocells, Wi-Fi and other small site technologies can all be utilized to improve network capacity offered by a traditional, or macro cell site based network.

(ii) Yes, they can.

(iii) Objection. This subpart (iii) is unclear in regards to which "areas" would require more or fewer antennas. That said, where DAS, picocells, femtocells, Wi-Fi and other network technologies are used to compliment a macro cell site based network, it is typically the case that more antenna location are used by the complimentary technology than would typically be the case if the area in question was served only via traditional macro cell based antenna sites.

(iv) Objection. Please see the response in (f) above.

(v) Objection. Please see the response in (f) above.

h) Objection. Please see the response in (f) above.

i) Objection. The question is vague and ambiguous in it use of the phrase "basic mobile coverage." Mr. Starkey's evidence was not designed to survey the deployment of outdoor DAS systems to provide "basic mobile coverage," however that phrase is intended to be understood, by wireless carriers in the US or in Canada. The requested

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survey has not been conducted. That said, Mr. Starkey's understanding is that DAS, picocells, femtocells, Wi-Fi and other technologies are typically used to compliment wireless networks wherein the bulk of the coverage area under anyone network operators' control is supported by a more traditional, macro cell site network and these other technologies provide infill where required.

j) No.

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INTERROGATORY 13:

Reference(s): Starkey, page 13, line 8 to page 14, line 5

Mr. Starkey states:

It is important to note that while CANDAS discusses primarily DAS antenna attachments in its evidence, its application is not limited only to DAS, but instead, would appear to encompass any wireless telecommunications attachment that its members or, for that matter, any Canadian Carrier may elect to propose at any point in time.

a) Regarding Mr. Starkey's statement objecting to the breadth of CANDAS' application, state whether THESL or Mr. Starkey would change their position on any matter submitted into evidence or opposed in this application if the application was limited specifically to DAS.

   (i) If so, describe what positions would change.

RESPONSE:

a)

   (i) Objection, the question is vague and ambiguous, particularly with respect to how "the application would be limited to DAS."

   CANDAS takes the position that the *CCTA Decision* encompasses wireless attachments primarily because the *Decision* applies to any Canadian Carrier. CANDAS appears to oppose THESL's further reading which would limit the types of attachments a Canadian Carrier could force THESL to accommodate, to only those contemplated in the definition of "attachment" in the *Settlement Agreement* upon which the *Decision* was based. If CANDAS is right, and the

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CCTA Decision was intended to allow any Canadian Carrier to attach whatever it chooses to a THESL pole, and pay only the approved rate, how could the *Decision* then be read to limit such attachments only to DAS?

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INTERROGATORY 14:

Reference(s): Starkey, page 14, line 11 to page 15, line 2

From Mr. Starkey's observation and statement that "The City of Portland is somewhat unique in its documentation of wireless proliferation given the fact that Portland residents appear to have been particularly vocal about their objection to these types of attachments being located in their neighbourhoods or in close proximity to their homes."

a) Is it Mr. Starkey's understanding that local residents often object to wireless sites including towers, rooftops and other structures?
   (i) If it is Mr. Starkey's understanding that local residents do not often object to wireless installations in their neighbourhoods or in close proximity to their homes, Mr. Starkey is to cite studies or other evidence supporting this view.
b) Mr. Starkey cites the US for various reasons in his Affidavit (e.g. Portland). Does Mr. Starkey believe that the US context is substantially similar to the context in Ontario regarding pole attachments?
   (i) If not, explain and include a comparison citing the differences,.
c) Do new towers generally garner more or less public opposition than DAS deployments, particularly with regard to aesthetics and size of the towers?
d) Explain whether Mr. Starkey believes that the general public prefers having a macro tower placed near their home or a DAS node.

RESPONSE:

a) Mr. Starkey has not studied the regularity of consumer complaints in relation to wireless siting requests. However, Mr. Starkey believes complaints are relatively common.

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i) Not applicable.

b) The question is vague and ambiguous, particularly with respect to what is meant by "the US context is substantially similar to the context in Ontario...." Nonetheless, Mr. Starkey believes that there are similarities between pole attachment issues in the two different markets.

i) Not applicable

c) Mr. Starkey has not studied the issue with the particularity needed to answer the question as a matter of fact. Nonetheless, Mr. Starkey's general impression is that larger structures generally garner a larger number, and more vociferous complaints - though proximity to the complaining public is also a large factor (i.e., a large structure in a field far from any residential dwellings is likely to attract fewer protests than a smaller DAS structure very near homes or businesses).

d) Please see the response in (c) directly above.

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INTERROGATORY 20:

Reference(s): Starkey, page 20, lines 13 to 18

Mr. Starkey states "As I have previously discussed, the CCTA's expert described poles as support structures "that are used to carry or contain electrical power and/or communications wires and cables" and that users of poles would "attach a steel strand to the pole, and lash one or more communications cables to the strand." Hence, the CCTA clearly was not contemplating wireless attachments when it filed its original petition with the Board and its expert did not discuss wireless attachments when proposing a pole attachment rate."

a) Does Mr. Starkey rely on anything else in the CCTA Order to justify his conclusion that the Board did not contemplate wireless attachments? If so, provide any other references that may have assisted him in formulating this conclusion.

b) Referencing Mr. Ford's evidence previously mentioned, was Mr. Ford discussing the wireline elements only? Explain how CATV companies were supposed to attach their equipment to the messenger cable or where they were to place their equipment.

RESPONSE:

a) Yes, please see Mr. Starkey's Affidavit at pages 6 to 21.

b) Yes, it appears that Mr. Ford was discussing wireline elements only. For example, see pg. 1 where he states: "The term 'support structures' is used to denote facilities such as poles and duct (conduit) that are used to carry or contain electrical power and/or communications wires and cables." See response to CANDAS Interrogatory No. 19(h).

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INTERROGATORY 21:

Reference(s): Starkey, page 21, lines 5 to 9

Under the heading POWER POLES ARE NOT ESSENTIAL TO WIRELESS SERVICES and the question ARE WIRELESS ATTACHMENTS TO POWER POLES ESSENTIAL TO WIRELESS SERVICES AS SUGGESTED IN CANDAS' APPLICATION? Mr. Starkey again says, "No".

a) Does the CCTA Order clearly state that utility poles are "essential facilities" for Canadian carriers and give Canadian carriers access to these poles at the regulated rate of $22.35 per pole?

b) Has the definition of Canadian carriers changed since the CCTA Order was made?

RESPONSE:

a) The Board uses the term "essential facilities" only twice in its *CCTA Decision*. Both instances are found in the same paragraph on pg. 3 as follows:

> The Board agrees that power poles are essential facilities. It is a well established principle of regulatory law that where a party controls essential facilities, it is important that non-discriminatory access be granted to other parties. Not only must rates be just and reasonable, there must be no preference in favour of the holder of the essential facilities. Duplication of poles is neither viable nor in the public interest.

b) No.

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INTERROGATORY 24:

Reference(s): Starkey, page 23, lines 1 to 10

Mr. Starkey continues with his conclusion stating "Likewise, it is this relatively unique contiguous nature of a pole-route's design that creates "barriers to entry" which realistically limits the number of alternative forms of supply, thereby arguably creating market power which regulation is intended to combat. In the case of wireless communication attachments, however, the equipment at issue does not rely to the same extent upon the contiguous nature offered by a pole-route. Instead, wireless attachments rely upon utility poles primarily for elevation, and to some extent, strategically placed right-of-way. However, these attributes can be found in numerous alternative forms, e.g., buildings, stand-alone towers, billboards, commercial signage or nearly any other elevated structure. And, importantly, wireless providers have for some time taken advantage of these other alternatives."

a) Mr. Starkey uses the term "unique" or "unique contiguous nature of a pole route's design". If the pole line is unique, how do buildings, rooftops, towers or other alternative structures represent suitable alternatives to interconnect telecommunications facilities to provide wireless services?

b) Explain how the *unique contiguous nature of a pole route's design* differs from the required contiguous nature of a Greenfield wireless network design to provide for basic mobile service coverage in a given area.

c) Can fibre cables be strung overhead, from building rooftop, to towers, to billboards or alternate structures on anything other than utility poles?

d) Indicate whether Mr. Starkey would agree that the installation of wireless equipment on utility poles within 10 feet of the fibre optic cable is more commercially viable

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than attempting to attach to buildings, rooftops, towers or other structures, which will inevitably require fibre lateral engineering and construction from the pole line to the building?

e) Would the cost, increased administrative burdens, disruptive nature of underground construction, road and sidewalk restoration and other factors and costs in building a fibre network to reach an alternative location represent a barrier to entry to wireless carriers if wireless carriers were refused access to utility poles?

f) If not, provide an economic and operational assessment that demonstrates specifically what barriers to entry exist for wireline carriers that do not exist for wireless carriers having to use alternate structures.

RESPONSE:

a) See Section 3 of Mr. Starkey's affidavit. See also *Outdoor Distributed Antenna Systems and their role in the Wireless Industry*, Industry Report, LCC International, Inc., filed by EDA in this docket on September 2, 2011.

b) The contiguous nature of a pole route for wired communications requires physical attachment (and a physical circuit), without breakage, from point A to point B. One of the primary advantages of wireless technology is that it does not require this same physical, contiguous connection (indeed, that is the crucial and compelling difference between wired versus wireless services). Though it is true that antenna must be placed regularly throughout a geographic area to propagate radio signal sufficient to reach all relevant users, substantial variability in location, height, proximity and other factors can be overcome in wireless networks far more easily than they can in wired networks. This increased flexibility brings into play a substantial number of

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alternative sources of attachment, e.g., *see* response to CANDAS Interrogatory No. 24(a) directly above.

c) In some circumstances yes, though that it is not common nor always the preferred method.

d) Objection, the question is vague and ambiguous, particularly with respect to the party for whom "commercial viability" is being assessed. Assuming commercial viability solely for the wireless carrier placing the equipment is at issue, Mr. Starkey states that the commercial viability would depend upon relative costs associated with each alternative.

e) Objection, the question is vague and ambiguous and likewise, includes assumptions for which no support has been provided. For example, Mr. Starkey's testimony describes wireless technologies that do not rely solely upon fiber optic connectivity, but instead, use broadband connections generally available in most commercial settings. Further, the question is not clear as to the market for which relative "barriers to entry" are being assessed - though it appears that the question intends the respondent to consider barriers to the general wireless services. With that in mind, Mr. Starkey states: If all wireless carriers experience " cost, increased administrative burdens, disruptive nature of underground construction, road and sidewalk restoration and other factors and costs in building a fibre network to reach an alternative location," it is possible that no relative barrier exists for any entrant or group of entrants. Instead, those costs and difficulties are simply "costs of doing business" in

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the market in question and the supplier who manages them most successfully is likely to have an advantage.

f) Objection, responding to the question in its current form is unduly burdensome. Mr. Starkey has not compiled any such “operational assessment” and is not required to prepare one for purposes of responding to discovery.

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INTERROGATORY 26:

Reference(s): Starkey, page 25, lines 4 to 14

Mr. Starkey states:

… the predominate [*sic*] method of entering and expanding wireless service coverage in the wireless services market does not rely upon attaching antennae to utility poles. The primary method of providing wireless services in Toronto (and elsewhere) involve self-erected towers at elevation sufficient to serve a substantial geographic region, substantially larger than the region that would be served by a DAS location. These are generally referred to as "macro" sites (whereas DAS and other technologies are often referred to as "small" cell sites). For example, even Public Mobile was able to deploy a macro cell site-based network in which it placed numerous traditional macro cell sites throughout the city as a complete substitute for the DAS network it intended to build utilizing attachments to power poles. Public Mobile apparently uses this macro-site network to offer its wireless services throughout Toronto today."

a) Is Mr. Starkey aware of the proportion of shared towers versus self erected towers by new entrants in the Toronto market or in any other city in Canada or in the US over the last few years? If so, Mr. Starkey to provide the relevant details.

b) Provide evidence that new entrant carriers primarily relied on erecting their own towers in the Toronto area or in other Canadian or US cities over the last few years?

c) Focusing on "small" cell sites as referred to in the above-noted citation, define "small".

d) Does Mr. Starkey include picocells and femtocells in the category of "small" cell sites?

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(i) If not, describe the placement and coverage characteristics that distinguish picocells and femtocells, respectively, from small cell sites.

(ii) If Mr. Starkey does include picocells and femtocells in the category of small cell sites, justify this conclusion.

e) Focusing on the relationship between the typical elevation of a "macro" site and service to a "substantial geographic region", would Mr. Starkey agree that the coverage footprint of a macro site or tower, building or rooftop is larger than that of the "small" cell sites relating to "DAS and other technologies"?

f) If so and assuming a wireless carrier's network needs include these smaller cell sites, without using these macro sites or other "traditional" structures, what other facilities are available at the lower elevations needed to support small cell sites that offer all of the same characteristics of utility poles including:

(i) Density and availability of structures in a contiguous pattern.

(ii) Installations in the established public or utility rights of way.

(iii)Proximity to fibre optic facilities placed on utility poles or nearby man holes.

g) With increasing use of smart phones and increasing wireless data demand, indicate whether in Mr. Starkey's view, the major challenge for a wireless carrier is coverage or capacity?

(i) Which party, as between the wireless carrier and the owner of public rights of way and support structures, should determine which is the more immediate priority to the business?

(ii) How would that determination be made, *e.g.* what factors are considered?

h) Does Mr. Starkey agree that macrocell sites and DAS deployments offer different benefits and disadvantages? For example, indicate whether Mr. Starkey agrees

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(i) That macrocell sites offer the benefit of covering a larger population, but present the disadvantage of serving more users and traffic on a single antenna?

(ii) That DAS nodes offer improvements and efficiencies in spectrum utilization and network capacity?

(iii) That placement of DAS nodes on utility poles, where available, addresses both wireless and wireline siting needs and wireline transport needs?

(iv) To the extent that Mr. Starkey does not agree with any of the foregoing, Mr. Starkey is requested to provide the technical assessment used to qualify a negative response.

i) In the specific case of a new entrant wireless carrier with limited spectrum as compared to the incumbent wireless carriers, would Mr. Starkey expect a capacity challenge to be present immediately or in the future?

(i) Would a prudent network operator deploy its network to provide for just enough capacity to meet present demand or rather, for excess capacity to meet future demand?

(ii) If faced with a situation where the options were to not launch service or to deploy with just enough capacity for a few years, which option would Mr. Starkey recommend to a new entrant wireless carrier client?

j) In the specific case of a new entrant with limited spectrum, is it Mr. Starkey's opinion that given that a macrocell site covers a substantially larger geographic area than a DAS node, a new entrant could meet current and future demand using macrocell sites alone? Provide a detailed justification for the answer.

k) Does Mr. Starkey accept that there is an inverse relationship between the amount of spectrum available to a wireless carrier and the importance of DAS technology, *i.e.*

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new entrants with limited spectrum have a much greater need for DAS in order to be competitively viable?

l) Are macro sites available in all areas or is their availability limited? List any and all factors that constrain the availability of suitable macrocell sites.

m) List all issues that may be encountered by a new entrant mobile wireless operator when attempting to lease or site a macrocell tower.

n) Explain the technical constraints or deficiencies associated with a deployment involving macrocell sites alone, particularly as compared to a deployment involving a mixture of macrocell sites and DAS nodes.

RESPONSE:

a) Mr. Starkey has not undertaken a specific analysis to determine the percentage of antenna sites that comprise shared towers as opposed to self-erected towers in Toronto, Canada or the US over the last few years. In response to CANDAS interrogatory number 29(j), however, THESL provided data related to all wireless antenna sites located in Ontario. Furthermore, in response to EDA interrogatory number 1, THESL provided data demonstrating that 40% of Public Mobile's antenna locations within 25 km of the center of Toronto (i.e., 60 out of 125) are collocated with antennas of one or more other wireless carriers.

b) Please see the response in (a) directly above.

c) Mr. Starkey uses the word "small" in the referenced discussion to describe sites other than "macro" sites included in that same discussion. For additional information regarding small cells, see pages 32-43 of Mr. Starkey's affidavit.

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d) Yes.

(i) Not applicable.

(ii) Please see the response in subpart (c) above.

e) The question categorizes all buildings and rooftops together with macro cell towers. This is only accurate for some tall buildings and rooftops. All else being equal, for those tall buildings or rooftops, generally Mr. Starkey would agree. Many buildings and rooftops also have features similar to small cell sites, and all else being equal, would have a similar coverage footprint to small cell sites such as DAS.

f) Please see Section 3 of Mr. Starkey's affidavit. See also *Outdoor Distributed Antenna Systems and their role in the Wireless Industry*, Industry Report, LCC International, Inc., filed by CEA in this docket on September 2, 2011.

g) Objection, Mr. Starkey has not performed the requested analysis and to perform the requested analysis would be unduly burdensome give the probative value of such an analysis. Notwithstanding the objection, Mr. Starkey responds that each individual carrier likely faces its own unique challenges, with challenges for coverage being the primary issue for some, yet sufficient capacity being the primary issue for others.

(i) Objection, the question is vague and ambiguous and cannot be answered in its current form. Additional information about the parties being discussed and the objective (*e.g.*, economic efficiency, the private interests of the wireless carrier, the public interest, etc.) in mind would be required to draft a reasonable response.

(ii) Please see the response in subpart (g)(i) above.

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h) Objection. Mr. Starkey's evidence was not intended to compare and contrast the advantages and disadvantages of macro cell sites and DAS deployments. That said, Mr. Starkey agrees that in any particular setting provisioning wireless service via macro cell sites versus DAS networks may have both advantages and disadvantages as well as varying costs of performance. Please see the response in Tab 5.2, Schedule 31.

(i) Objection. The question appears to be a hypothetical and does not provide enough relevant information to respond to the request. For example, the question does not provide the coverage area and population characteristics of the macro site and DAS network being compared.

(ii) Yes. Mr. Starkey would agree that DAS deployments can offer improved use of network capacity.

(iii) Objection, the question is vague and ambiguous as it relates to whose "needs" are being addressed (e.g., the wireless provider, the municipality, the owner of the pole, etc.).

(iv) With respect to subpart (iii), there is nothing in the question describing the manner by which DAS placement on utility poles addresses wireline siting and transport needs as the question implies. Mr. Starkey is not aware of an technical assessment that demonstrates placement of DAS on utility poles addresses wireline siting needs and/or wireline transport needs. As such, Mr. Starkey cannot agree with this subpart. Moreover, while Mr. Starkey may agree that siting DAS on utility poles may "address" the specific needs of the wireless carrier and, to the extent transport is available at such locations may also "address" wireless

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transport needs, he does not agree that siting DAS on utility poles comprises the only possible siting location for DAS or that forcing pole owners to accommodate such attachments is in the public interest (or was addressed via the *CCTA Decision*).

i) Objection. The question poses a hypothetical for which insufficient facts are available to answer the question in a reasonable fashion. Mr. Starkey's evidence does not purport to identify the extent to which, for a new entrant with "limited spectrum" as opposed to incumbent carriers - who also have limited spectrum - a capacity problem will be presented. Mr. Starkey has not conducted the requested analyses.

(i) Please see subpart (i)
(ii) Please see subpart (i)

j) Objection. The hypothetical proposed in this question lacks sufficient detail regarding macro cell site capacity, current and future demand and cannot, therefore, be answered accurately. Notwithstanding that objection, the extent to which a macro cell site covers a larger area than an DAS node does not speak to the extent to which carriers can provide service via macro cell alone. That said, DAS, picocells, femtocells, Wi-Fi and other technologies are alternatives that can be considered to provide enhanced network capacity in cases where macro cell site deployment is insufficient to address increasing demand for voice and data services.

k) No. Mr. Starkey believes that DAS is one of many alternative technologies that may be useful to new entrants and/or incumbent carriers alike depending upon the specific circumstances at issue, current and projected demand, etc.

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l) Mr. Starkey is not aware of any circumstances in Canada where carriers have sought to provide services through the use of macro cell sites and be unable to do so. Mr. Starkey has not conducted an analysis designed to demonstrate the extent to which macro cell sites are "available in all areas" and to perform the requested analysis would be unduly burdensome give the probative value of such an analysis

m) Objection. The request is unreasonably broad and answering the question in its current form would be onerous and burdensome relative to the value of the response to the issues in this proceeding. Mr. Starkey's testimony was not intended to list <u>all</u> issues that may be encountered by a new entrant mobile wireless operator when attempting to lease or site a macro cell tower in Canada or elsewhere and to perform such an analysis would be unduly burdensome given the probative value of such information.

n) Objection. It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies - or combinations of technologies - nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies and siting options exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

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INTERROGATORY 27:

Reference(s): **Starkey, page 26, line 18 to page 27, line 5**

Mr. Starkey states:

> [Industry Canada's national database of radio frequency licenses] demonstrates that there are roughly 4,000 cellular/PCS/AWS antenna arrays currently operating within 25 kilometres of the center of Toronto. Moreover, the database also indicates that there are approximately 1,343 individual physical locations at which one or more radio communication carriers' antenna arrays are currently operating within the city of Toronto. <u>Each of these sites is a direct alternative to placing wireless antennae on a THESL utility pole for purposes of supporting the provision of wireless services</u>. [emphasis in original]

a) Of the "approximately 1,343 individual physical locations" as referred to in the above-noted citation, how many are
   (i) Macrocell sites
   (ii) Small cell sites as referred to at page 25, line 10 of Mr. Starkey's Affidavit
   (iii) Picocell sites
   (iv) Femtocell sites.

b) Is Mr. Starkey aware of any rules, regulations or policies that would be applicable in the City of Toronto that would
   (i) Preclude the proliferation of towers or poles for purposes of antenna

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siting. If so, list and describe same

(ii) Preclude the placement of antennae on or near residential or commercial buildings. If so, list and describe same.

c) Of the "approximately 1,343 individual physical locations" mentioned, how many have been qualified by Mr. Starkey as being available for lease and occupation?

d) Does the ability to lease or acquire these sites or the monthly recurring cost create any "barrier to entry" as Mr. Starkey uses that term herein?

RESPONSE:

a.) The ALS database relied upon by Mr. Starkey in developing the referenced information does not include a field identifying the type of site (i.e., macrocell, microcell, etc.). Mr. Starkey does not possess the information necessary to determine how many of the 1343 sites locations are of each type requested in the question.

b.) Mr. Starkey is not aware of any local rules, regulations or policies that would be applicable in the City of Toronto that would "preclude the proliferation of towers or poles for purposes of antenna siting." Mr. Starkey has reviewed Chapter 789 of the City of Toronto Municipal Code,[1] which addresses the installation of telecommunications network equipment, including utility poles, on or across city streets and public places. While this chapter requires any potential installer of such equipment to apply for a municipal access agreement and license, it does not appear to preclude the placement of new towers or poles for antenna placement, nor the placement of antennae on or near residential or commercial buildings.

[1] See http://www.toronto.ca/legdocs/municode/1184_789.pdf (accessed 9/16/2011).

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Mr. Starkey has also reviewed the City of Toronto Telecommunication Tower And Antenna Protocol, last amended by the City Council on January 28, 2009 (hereafter the "Tower and Antenna Protocol"), as posted on the City of Toronto website.[2] The Tower and Antenna Protocol is intended to "outline the local land-use consultation process and guidelines to be followed in evaluating telecommunication tower and telecommunication antenna proposals within the City of Toronto."[3] While it includes language that its objectives include "minimiz[ing] the number of new telecommunication towers" and "discourag[ing] new towers within or adjacent to Neighbourhoods, Apartment Neighbourhoods, Centres and other sensitive land uses," the Tower and Antenna Protocol does not preclude the erection of new towers. Moreover, as the City of Toronto planning Staff have stated, "Under the Radiocommunications Act, Industry Canada has the final authority to approve the location of telecommunication towers and antennae. Industry Canada consults with local municipalities on the location of telecommunication towers as part of their approval process."[4]

c.) Mr. Starkey has not "qualified" the extent to which one tower or another in the ALS database has remaining space available for additional equipment placement.

d.) To the extent a municipality or other organization limits the erection of new hosting facilities or limits additional placements on existing alternative facilities,

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[2] See http://www.toronto.ca/planning/telecommunications.htm#protocol (accessed 9/16/2011).
[3] *Id.* at p. 1.
[4] See memorandum from Toronto's Chief Planner and Executive Director, City Planning Division, October 21, 2008, "Correspondence from Industry Canada on the City of Toronto Telecommunication Tower Protocol," at p. 2. This document is available from http://www.toronto.ca/legdocs/mmis/2008/pg/bgrd/backgroundfile-16558.pdf (accessed 9/16/2011).

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those actions could lead to erecting or increasing barriers to entry for alternative placement of wireless equipment. However, any limitations on erecting new facilities or adding additional equipment to existing facilities that have been legally imposed by a municipality or some other governing organization (e.g., Industry Canada), were presumably based upon protecting the public interest. Simply ignoring the wishes of the municipal or other organizations by sidestepping their rules using utility poles, may tend to harm the general public interest even though it may erode barriers to entry. Simply put, when barriers to entry are erected by the public to protect their interests, eroding or dismantling those barriers for the benefit of a smaller constituency (e.g., wireless carriers) is likely to harm the public interest by definition (because the public may have decided that interests in economic efficiency are outweighed by other relevant factors such as aesthetics, health, quality of life, etc.).

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INTERROGATORY 28:

Reference(s): Starkey, page 27, lines 11 to 12

Mr. Starkey draws a conclusion that "To put this in perspective, there are on average, more than 2 potential co-location sites per square kilometre in the Toronto area."

a) How many collocation sites are actually available
   (i) For lease
   (ii) Are technically and functionally suitable as DAS node location hosts, and
   (iii)Technically and operationally equivalent to a THESL utility pole?

b) How many DAS nodes are required (per square kilometre) to create an ideally functioning DAS network?

c) If more than 1-2 nodes per square km are required, identify attachable infrastructure other than utility poles (hydro poles, lampposts and streetlights) that may be utilized to achieve the same technical and operational network.

RESPONSE:

a.) See responses to CANDAS Interrogatory Nos. 29(i) and 34(a)v. Further, the question is vague and ambiguous, specifically with regard to what is meant by "technically and operationally equivalent."

b.) The question cannot be answered as asked. The most reasonable response to the question posed is that the answer would vary depending upon numerous factors.

c.) *See Direct Testimony of Michael Starkey*, filed September 2, 2011 at Section IV. *See* also *Outdoor Distributed Antenna Systems and their role in the Wireless Industry*, Industry Report, LCC International, Inc., filed by EDA in this docket on September 2, 2011.

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INTERROGATORY 30:

Reference(s): Starkey, page 27, lines 6 to 9

Mr. Starkey states:

> Second, it is clear that Industry Canada and the City of Toronto work diligently to ensure that the wireless services market is as efficient as possible when erecting additional antennae sites. The Board should consider these efforts before providing wireless service providers relative carte blanche in accessing THESL poles for additional sites aimed at supporting a particular technology (DAS) that serves merely as a substitute for technologies already supported by existing sites.

a) Explain the benefits of a public policy that encourages new technologies and technological innovation, such as wireless v. wireline telecommunications and distributed antenna systems v. dedicated antenna systems.

b) Has the Canadian government, or the Board, or any other Canadian regulatory authority with jurisdiction over telecommunications services ever determined that reduced barriers to entry would promote the development of new technology.

   (i) If so, explain.

   (ii) State whether in Mr. Starkey's view, there is a correlation between current market rates of macro site leases, which are essentially a barrier to entry for new entrant wireless providers, and maintenance of the status quo favouring traditional wireline technology and incumbent carriers.

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RESPONSE:

a.) Objection. The question is vague and ambiguous as it asks Mr. Starkey to provide a treatise on topics he did not address in his evidence. Likewise, the topics to which Mr. Starkey is directed to provide such a treatise our far outside the scope of this proceeding as defined by the Board.

b.) i Mr. Starkey would not be surprised that Canadian regulatory agencies (including, perhaps the Board) have determined that reduced barriers to entry promote the development of new technology. However, it should be noted that the relationship between new technologies and barriers to entry is normally reversed from that assumed in the question. In other words, it is the development and deployment of new technologies that generally tends to erode existing barriers to entry. For example, reference Mr. Starkey's testimony describing the numerous wireless technologies that are being deployed without reliance on utility poles for placement. To the extent the Board has in the past determined that access to utility poles serves as a barrier to entry for wireline communications, the technologies described by Mr. Starkey and the alternative placement sites discussed by LCC in the CEA's evidence demonstrate how technology is used to overcome such barriers.

b.) ii Objection, the question is vague and ambiguous and likewise, includes assumptions Mr. Starkey is asked to accept without being provided the benefit of information that would support those assumptions.

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INTERROGATORY 31:

Reference(s): Starkey, page 30, lines 10 to 11

Mr. Starkey identifies information located in the public domain, specifically "[the Industry Canada] database shows Public Mobile has established 125 unique locations within 25 kilometers of the center of Toronto".

a) Indicate whether Mr. Starkey believes that 125 sites are sufficient to support both the coverage and capacity requirements of a wireless carrier in Toronto?

b) Assuming the 125 site figure is correct, as compared to the 790 nodes that Public Mobile intended to use in its planned DAS network, indicate whether it would be Mr. Starkey's opinion that both the coverage and capacity of the macro sites would be equal to or greater than the coverage and capacity that would have resulted from the successful implementation of the Toronto DAS network?

   (i) If so, provide the technical research and analysis that led to this conclusion.

c) Given the existence of established macrocell sites in Toronto, why in Mr. Starkey's opinion was it Public Mobile's preference to deploy its network using DAS and why in his opinion does Public Mobile continue to pursue it?

RESPONSE:

a.) Please refer to the response in Tab 5.2, Schedule 34 (a)v.

b.) i Please refer to the response in Tab 5.2, Schedule 34 (a)v.

c.) A fully developed and deployed DAS network would have certain advantages over networks built primarily around macro cell sites. Those advantages would include the ability to add capacity to focused geographic areas of high volume

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more quickly and, potentially, less expensively than would macro-site based systems. However, DAS systems require antenna and radio equipment at a substantially larger number of sites, and for that reason, can be expensive to install and maintain. This, in many circumstances, makes the economic analysis relative to DAS (or other small cell technologies) when compared to macro-sites, less appealing - resulting in many carriers choosing a combination of macro and small site applications. Public Mobile's desire to rely exclusively on DAS in support of its wireless service offerings throughout Toronto is, for those reasons, somewhat unique.

With the information above in mind, Mr. Starkey is convinced that the level of the pole attachment rate set by the Board in its *CCTA Decision* plays a large role in Public Mobile's (and ExteNet's and DAScom's) desire to rely on DAS. If Public Mobile can access hundreds of siting locations (i.e., THESL poles) at below cost rates, substantially lower than the siting market currently provides, it gains a substantial cost and technological advantage. Unfortunately, that advantage to Public Mobile comes at a cost to THESL rate payers from whom the economic value of the pole siting space has been transferred at rates never intended to help capture the relevant economic value. Likewise, municipal impediments to new antennae arrays, which are often imposed by municipalities and regulators (and in Toronto are strictly regulated by Industry Canada and the City of Toronto) could be sidestepped with the DAS network envisioned by Public Mobile. To the extent restrictions on new sites would not apply to attachments to THESL poles (which Mr. Starkey understands to be the case), that would, again, be advantageous to Public Mobile. However, the advantage to the public of Public Mobile

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sidestepping relevant municipal and/or regulatory impediments to new sites is not as clear given that those municipal ordinances were presumably approved because they protect the larger public interest.

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INTERROGATORY 34:

Reference(s): Starkey, page 34, line 20 to page 35, line 9

Under the heading 'Wi-Fi and Femtocells As Substitutes for DAS' beginning on page 34 of Mr. Starkey's Affidavit, Mr. Starkey describes the use of femtocells.

a) Generally speaking,

(i) Are femtocells capable of supporting multiple technologies?

(ii) Are DAS networks capable of outputting more power than femtocells?

(iii) Is it true that femtocells have no fibre connectivity or do not require fibre connectivity?

(iv) Are there any femtocell technologies that do require, or are capable of using fibre connections?

(v) On page 34, line 25, Mr. Starkey mentions femtocells that utilize a "broadband internet connection". For those femtocells, wouldn't LDC poles represent ideal sites, given the cost of having a wireline broadband connection delivered to each unit, assuming multiple locations are needed in a geographic area?

(vi) Are femtocells passive repeaters that simply amplify carriers' signals in a given area and do not provide any additional capacity?

(vii) Rather than providing additional capacities, do femtocells, in fact consume additional capacity from the macrocell network?

b) Focusing on indoor femtocell systems, describe

(i) The architecture of a typical indoor femtocell system

(ii) Coverage of a typical individual indoor femtocell

(iii) The number of voice and data users a typical indoor femtocell supports

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(iv) Whether it would be possible to cover and if so, how many indoor femtocells would be required to support current and future voice and data needs of users in the dense, urban core of a city like Toronto?

(v) The broadband requirements for a femtocell and confirmation that a femtocell would eventually require fiber to handle the end user bandwidth requirements

(vi) The differences between an outdoor DAS deployment and an indoor femtocell system in terms of coverage and capacity characteristics

(vii) The benefits of an outdoor DAS deployment versus an indoor femtocell system

(viii) The benefits of an indoor femtocell system versus an outdoor DAS deployment.

c) Focusing on outdoor femtocell systems, describe

(i) The architecture of a typical outdoor femtocell system;

(ii) Coverage of a typical individual outdoor femtocell and whether it is affected depending on whether the outdoor femtocell is sited on the side of a building or on pole or other street furniture

(iii) The number of voice and data users a typical outdoor femtocell supports

(iv) Whether it would be possible to cover and if so, how many outdoor femtocells would be required to support current and future voice and data needs of users in the dense, urban core of a city like Toronto?

(v) The differences between an outdoor DAS deployment and an outdoor femtocell system in terms of coverage and capacity characteristics

(vi) The benefits of an outdoor DAS deployment versus an outdoor femtocell system

(vii) The benefits of an outdoor femtocell system versus an outdoor DAS

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deployment

(viii) On buildings where femtocells are depicted in Mr. Starkey's Affidavit, indicate whether the existence of the building they are attached to dramatically reduces the effective range of the femtocell's in question.

(ix) In theory or in practice, wouldn't utility pole installation for femtocells provide much better coverage than femtocells attached to buildings, due to the 360 degree propagation and line of sight advantages of pole attachment?

A. If Mr. Starkey does not agree with the foregoing, explain the basis for his contrary view and include the technical assessment or engineering data to substantiate his conclusion.

RESPONSE:

a.) i While the various femtocell manufacturers' products differ and are continually evolving, femtocells generally support CDMA2000 and UMTS/HSPA+ network technologies. A few vendors have recently announced their development of femtocells that support LTE. Furthermore, certain femtocell manufacturers are beginning to package femtocells with Wi-Fi access points to provide the benefits of cellular and Wi-Fi technologies. Qualcomm, for example, recently announced a Femto-Wi-Fi design that integrates Wi-Fi technology with its enterprise femtocell chipsets.[1]

a.) ii Power output appears to vary substantially between residential, enterprise and metro femtocell deployments. Residential power output is likely to be in the neighborhood of 10-25mW while enterprise femtocells and slightly larger

[1] See http://www.qualcomm.com/news/releases/2011/09/12/qualcomm-announces-industry-s-highest-capacity-femtocell-solution-enterpris

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picocells may range between 100mW and 2W. Though power output for variuos DAS configurations also vary, it is not unreasonable to assume that DAS networks, in general, are capable of outputting as much or more power than individual femtocells.

a.) iii Femtocells may rely upon numerous backhaul options, including, for example, Cable, DSL, Ethernet, Fiber, satellite, WiMax, and others.

a.) iv Please see response in (a) (iii).

a.) v Objection. It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles. To the extent THESL asked interrogatories of CANDAS that were intended to allow its experts, including Mr. Starkey, to review the particular design alternatives proposed or considered by CANDAS, CANDAS simply refused to provide this information.

a.) vi No. As discussed in Mr. Starkey's evidence, femtocells are typically deployed to relieve the macro site based networks and to provide added voice and data carrying capacity, particularly in high traffic areas.

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a.) vii Please see response in (a)(vi) above.

b.) i Indoor femtocell deployments typically include one or more femtocell access points and one or more broadband routers that provide an internet connection over which voice and data traffic is passed between mobile handsets operating within the building and the mobile network operator's facilities.

b.) ii Smaller, residential femtocells typical have a range of approximately 10- 20 meters whereas larger, enterprise femtocells may have a range of approximately 100-300 meters.

b.) iii Residential femtocells generally support 2-8 users while enterprise femtocells may support as many as 32 users. In July of this year, Texas Instruments announced several new chips that support femtocells. Its 6612, for example, will support up to 64 active users while the 6614 will support up to 128 active users whether on WCDMA or LTE technologies.

b.) iv Please see response in a.) v above.

b.) v Please see response in (a) (iii) above.

b.) vi Please see response in a.) v above.

b.) vii Please see response in a.) v above.

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b.) viii Please see response in a.) v above.

c.) i Outdoor femtocell deployments typically include one or more femtocell access points similar to the Alcatel-Lucent device pictured at p.35 of Mr. Starkey's evidence and one or more broadband routers that provide an internet connection over which voice and data traffic is passed between mobile handsets operating within range of the femtocell access points and the mobile network operator's facilities.

c.) ii Outdoor femtocells like the one pictured at p.35 of Mr. Starkey's evidence typically provide coverage in the range of 100-300 meters when operated in an urban setting. When mounted high enough and operating in less densely populated areas, they may provide coverage up to 2 km.

c.) iii Outdoor femtocells can typically support between 16 and 32 users. Advances in femtocells, however, continue and multiple manufacturers are increasing the number of users supported by their products. Qualcomm, for example, has announced equipment that will support 64 and 128 users See also response to (b)(iii) above.

c.) iv Please see response in a.) v above.

c.) v Please see response in a.) v above.

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c.) vi Please see response in a.) v above.

c.) vii Please see response in a.) v above.

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INTERROGATORY 36:

Reference(s): **Starkey, page 35, line 12 to page 36, line 9**

a) Does any portion, and if so, what proportion, of SK Telecom's femtocell deployment provides outdoor coverage for both voice and data services. Provide all relevant details.

RESPONSE:

a.) SK's focus has been on the use of femtocell and Wi-Fi access points to offload data in high traffic areas. Toward that end, the company announced it would increase its total number of femtocells to 10,000 and its total number of Wi-Fi zones to 62,000 by the end of 2011.[1] It also announced that it would be deploying voice and data femtocells in smaller areas, but did not provide (1) the total number of voice/data femtocells, (2) total number of data only femtocells or (3) the percentage of femtocells that were installed indoor versus outdoors.

[1] http://www.sk.com/happychannel/news/news_view.asp?id=696

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INTERROGATORY 37:

Reference(s): Starkey, page 37, lines 3 to 13

When asked "ARE POWER POLES NEEDED TO MOUNT METRO FEMTOCELLS? Mr. Starkey answers "No"

a) Even if the technology were identical to DAS equipment, would utility poles be a benefit to installing femtocells?

b) Mr. Starkey indicates that metro femtocells can be attached to "building walls and street furniture".

   (i) Does Mr. Starkey include lamp standards as part of the definition of street furniture?

   (ii) Does Mr. Starkey include hydro poles as part of the definition of street furniture?

   (iii) Provide Mr. Starkey's definition of street furniture.

c) On page 37 and lines 11 to 13, Mr. Starkey indicates that "they rely on existing broadband infrastructure to backhaul traffic to the necessary network, without the need, or expense, of extending fibre-optic cables to antennae site." Explain the following in the deployment of an outdoor femtocell network to provide outdoor coverage:

   (i) In Mr. Starkey's view, which type of carrier or organization would own and operate the existing broadband infrastructure referenced in the above citation?

   (ii) Provide the specific excerpt from MTS-08 that Mr. Starkey refers to and relies upon in footnote 50 of his Affidavit.

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RESPONSE:

a.) Presumably the more attachment alternatives that exist, the more "beneficial" the environment is for the placement of wireless antennae (all else being equal). That said, Mr. Starkey understands the pertinent question to be whether utility poles are an "essential facility" with regard to wireless attachments such that THESL should be forced to allow such attachments for CANAS' benefit at regulated rates.

b.) i Yes.

b.) ii No.

b.) iii Mr. Starkey did not rely upon a formal definition of street furniture in his Affidavit. Indeed, the term "street furniture" as used in the cited portion of the Affidavit was taken directly from Alcatel-Lucent's promotional material describing its femtocell technology. That said, for examples of apparatus Mr. Starkey would generally consider to be street furniture, see CEA's evidence *Outdoor Distributed Antenna Systems and their role in the Wireless Industry*, Industry Report, LCC International, Inc., at pages 9, 14 and 26.

c.) i Ownership of the broadband infrastructure would depend upon many variables. However, it is likely that the most common broadband facilities would be owned by Canadian Carriers.

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c.) ii "Less expensive backhaul: you can use DSL to backhaul mobile internet traffic. And fibre, Ethernet, microwave, WiMax, satellite and so on. The range of backhaul options means there will always be something available."

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INTERROGATORY 38:

Reference(s): Starkey, page 37, line 14 to page 38, line 13

When asked "IN ADDITION TO FEMTOCELL TECHNOLOGY, ARE THERE OTHER ALTERNATIVES TO DAS NETWORKS, Mr. Starkey answers "Yes" and goes on to describe AT&T's Wi-Fi "hotzones" in New York City.

a) If a wireless broadband (Wi-Fi) connection is used, the spectrum used for Wi-Fi is unlicensed spectrum. Identify the limitations on their effectiveness in areas where there is high Wi-Fi usage competing for broadband access?
b) Explain how a Wi-Fi Hotzone network using unlicensed spectrum is equivalent to or a reasonable alternative to DAS networks. Specifically address
    (i) The technical capabilities and methods of each deployment technology for carrying data and voice communications
    (ii) The mobility capabilities of each
    (iii) The coverage of each
    (iv) The carrying capacity of each
    (v) The spectrum efficiency of each
    (vi) The use of spectrum of each
    (vii) Any other relevant comparisons that relate to Wi-Fi as a viability as an alternative to DAS.
c) Confirm that Wi-Fi may be used in conjunction with DAS or another wireless technology using licensed spectrum to help use the wireless network more efficiently.
d) Explain why the vast majority of DAS nodes do not include Wi-Fi capability.
e) Explain why carriers do not offer a material amount of wireless voice and data coverage to end users using Wi-Fi capability?

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f) Is Towerstream a cellular carrier?

g) Does Towerstream provide seamless indoor and coverage throughout Manhattan?

h) What percentage of cellular devices currently in use has WiFi capabilities?

i) How many of the over one thousand access points in the Towerstream network are located outdoors? And of these outdoor access points, how many are located on utility poles (hydro poles, lampposts and streetlights) or other outdoor furniture?

RESPONSE:

a.) Like any other wireless technology, the "effectiveness" of the radio signal is limited by physical inhibitors such as buildings, terrain and the availability of spectrum. The question appears to be asking whether Wi-Fi is particularly susceptible to the latter of these inhibitors because it relies upon unlicensed spectrum, rather than licensed spectrum that can be more actively managed. The answer to that question is "yes." Nonetheless, carriers like AT&T are actively using Wi-Fi to offload wireless demand from their macro- and other sites because there are other offsetting advantages.

b.) Wi-Fi hotzones and DAS networks both support wireless/mobile voice and data applications demanded by wireless service customers. As for the remainder of the questions, Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternative technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

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c.) Confirmed.

d.) Objection, the question is vague and ambiguous in that it includes assumptions for which no supporting information is provided. Notwithstanding the nature of the question, Mr. Starkey states that once a DAS node has been established for purposes of supporting wireless services in a particular geographic area, the addition of other wireless technologies in that same area would in many cases be redundant and capital would be better spent using those technologies in other areas.

e.) Objection, the question is vague and ambiguous in that the question is unclear as to what amount of wireless voice and data coverage might be considered "material." Further, the question includes assumptions for which no supporting information is provided. Notwithstanding the nature of the question, Mr. Starkey states that wireless carriers are beginning to use Wi-Fi to add capacity to existing systems, and that reliance on Wi-Fi appears to be growing.

f.) Though the definition of "cellular carrier" is somewhat vague (the closest precise term in the US is likely "radio common carrier"), Mr. Starkey would not generally consider Towerstream to be a "cellular carrier," primarily because they focus on data products and appear to utilize only public spectrum. Towerstream describes itself as follows:

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> Towerstream is a leading wireless service provider utilizing 4G Technology to deliver advanced, high-speed Internet access to businesses in 12 markets including New York City, Boston, Los Angeles, Chicago, the San Francisco Bay Area, Miami, Seattle, Dallas/Fort Worth, Philadelphia, Nashville, Las Vegas/Reno, and the greater Providence area where the Company is based.
>
> http://www.towerstream.com/Company.aspx

g.) Towerstream provides information regarding its New York coverage area using the following map (can be viewed at: http://www.towerstream.com/Area.aspx?service_area_id=1):

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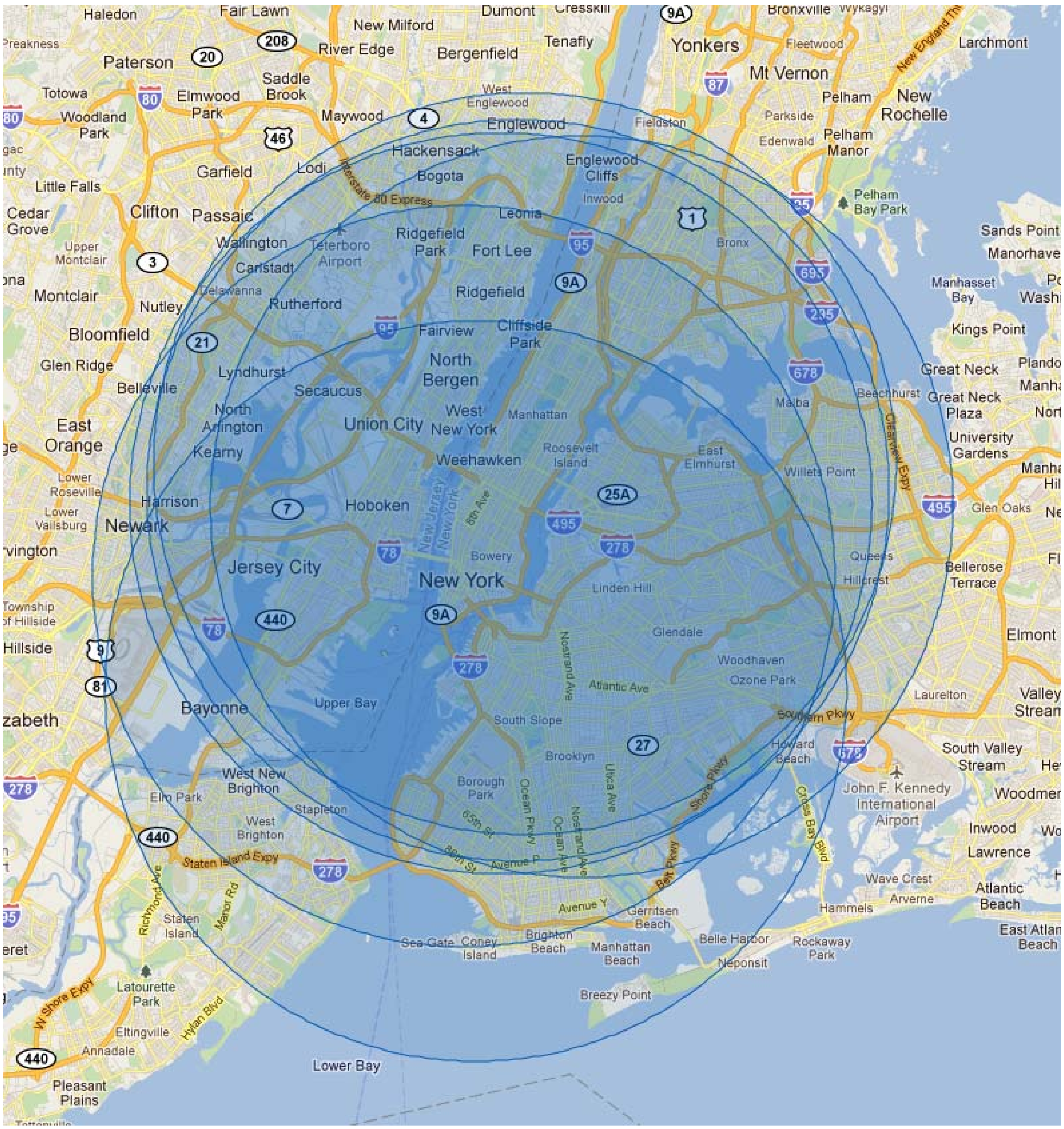

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The extent to which the coverage is "seamless" is unknown (though the coverage area above appears to be based upon concentric circles indicating that the coverage is at least intended to provide users access throughout the shaded areas).

h.) The number of hand-sets with Wi-Fi functionality shipped in 2009 was 139.9 million, an increase from 92.5 million in 2008.[1] Likewise, it is estimated that 78% of today's total global handset traffic is transmitted via smartphones with Wi-Fi capability. Those handsets generate 24 times more mobile data traffic than the typical basic-feature phone.[2] Cisco estimates that in 2011, approximately 23% of total smartphone traffic in Canada can be offloaded to Wi-Fi or femtocell platforms.[3]

i.) The information requested could not be found in the public domain. However, the following excerpt from a recent Bloomberg *BusinessWeek* article about Towerstream (May 26, 2011), provides some relevant information: " Towerstream representatives have fanned out in Manhattan, persuading landlords and building owners to let the company install the devices on their property. The company pays $50 to $1,000 per installation per month, depending on location." see http://www.businessweek.com/magazine/content/11_23/b4231036687850.htm.

[1] *Wi-Fi Spreading Fast Among Phones*, PC Word March 22, 2010. http://www.pcworld.com/article/192106/wifi_spreading_fast_among_phones.html.
[2] *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update*, 2010-2015, February 1, 2011, pg. 2.
[3] *Id*., pgs. 10-11.

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INTERROGATORY 39:

Reference(s): **Starkey, section III, pages 39-40**

Mr. Starkey describes AT&T's planned use of WiFi offload in New York City.

a) Focusing on indoor WiFi systems, describe
   (i) The architecture of a typical indoor WiFi system
   (ii) Coverage of a typical individual indoor WiFi access point
   (iii) The number of voice users a typical indoor WiFi access point supports
   (iv) The number of data users a typical indoor WiFi access point supports
   (v) Whether it would be possible to cover and if so, how many indoor WiFi access points would be required to support current and future voice and data needs of users in the dense, urban core of a city like Toronto?
   (vi) The broadband requirements for a WiFi access point and confirmation that a WiFi access point would eventually require fiber to handle the end user bandwidth requirements
   (vii) Whether WiFi access points are capable of supporting multiple technologies
   (viii) The differences between an outdoor DAS deployment and an indoor WiFi system
   (ix) The benefits of an outdoor DAS deployment versus an indoor WiFi system
   (x) The benefits of an indoor WiFi system versus an outdoor DAS deployment

b) Focusing on outdoor WiFi systems, describe
   (i) The architecture of a typical outdoor WiFi system
   (ii) Coverage of a typical individual outdoor WiFi access point and whether it is affected depending on whether the outdoor WiFi access point is sited on the side

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of a building or on pole or other street furniture

(iii) The number of voice users a typical outdoor WiFi access point supports

(iv) The number of data users a typical outdoor WiFi access point supports

(v) Whether it would be possible to cover and if so, how many outdoor WiFi access points would be required to support current and future voice and data needs of users in the dense, urban core of a city like Toronto

(vi) The broadband requirements for a WiFi access point and confirmation that a WiFi access point would eventually require fiber to handle the end user bandwidth requirements

(vii) Whether WiFi access points are capable of supporting multiple technologies

(viii) The differences between an outdoor DAS deployment and an outdoor WiFi system

(ix) The benefits of an outdoor DAS deployment versus an outdoor WiFi system

(x) The benefits of an outdoor WiFi system versus an outdoor DAS deployment

c) Can a WiFi access point be deployed on a utility pole?

d) As related to outdoor WiFi, provide any reports or studies that would support the view that buildings are better alternatives or are used more frequently than various utility infrastructures

RESPONSE:

(a) (i) Indoor Wi-Fi deployments are typically comprised of one or more Wi-Fi access points, one or more broadband routers and backhaul. Various routers, switches and cables are typically deployed along with the access points as well.

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(a) (ii) The coverage area of individual Wi-Fi access points can vary dramatically depending upon manufacturer, frequency, power output, reason for deployment, etc. Mr. Starkey has not surveyed all manufacturers' product lines to provide a precise figure in this regard. That said, it is expected that typical indoor Wi-Fi access points are likely to provide a range of less than 100m.

(a) (iii) The number of users supported by a single indoor Wi-Fi access point varies across manufacturers and within manufacturers across their product lines. Mr. Starkey has not surveyed all manufacturers' product lines to provide a precise figure in this regard. That said, it is reasonable to assume that indoor access points may support 10 or fewer users in a residential setting and 20-30 users in enterprise, or commercial settings. Some manufacturers offer devices that combine multiple radios into one unit and, as a result, can support hundreds of users from a single location[1]. Whether the users are "voice users" or "data users" depends upon the specific applications they have selected.

(a) (iv) Please see response in (a) (iii) above.

(a) (v) It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

[1] http://www.xirrus.com/products/arrays-80211abgn.php

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(a) (vi) Wi-Fi access points typically connect to switches and routers via Ethernet cables. Transport can - depending upon manufacturer - be provided by DSL, Cable, Fiber and/or wireless backhaul.

(a) (vii) Objection. This question is vague and ambiguous in that it does not define what is intended to be understood by the phrase "multiple technologies." Wi-Fi access points generally support various "flavours" of Wi-Fi (i.e., a, b, g, n), may operate in more than one band of spectrum and, in many cases, are integrated with indoor femtocells that support more traditional cellular services.

(a) (viii) It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

(a) (ix) Please see response in (a) (viii) above.

(a) (x) Please see response in (a) (viii) above.

(b) (i) Outdoor Wi-Fi deployments are typically comprised of one or more Wi-Fi access points, one or more broadband routers and backhaul. Various switches, routers and cables are typically deployed along with the access points as well.

(b) (ii) The coverage area of individual Wi-Fi access points can vary dramatically depending upon manufacturer, power output, reason for deployment, etc.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

That said, it is expected that typical outdoor Wi-Fi access points are likely to provide a range of 1000 feet (roughly 300m) or less.

(b) (iii) The number of users supported by a single outdoor Wi-Fi access point varies across manufacturers and within manufacturers across their product lines. Mr. Starkey has not surveyed all manufacturers' product lines to provide a precise figure in this regard. That said, it is reasonable to assume that access points are likely to support 30 or more users. Some manufacturers offer devices that combine multiple radios into one unit and, as a result, can support hundreds of users from a single location[2]. Whether the users are "voice users" or "data users" depends upon the specific applications they have selected.

(b) (iv) Please see response in (b)(iii) above.

(b) (v) It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles. Several cities across the globe, however, are covered by extensive Wi-Fi networks. There is no reason to assume Toronto could not be covered by Wi-Fi like many other cities should a vendor choose to do so.

(b) (vi) Please see response in (a)(vi) above.

(b) (vii) Please see response in (a)(vii) above.

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[2] http://www.xirrus.com/products/arrays-80211abgn.php

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(b) (viii) It was not the purpose of Mr. Starkey's evidence to redesign the network ExteNet and DASCom had developed for Public Mobile's use. Mr. Starkey has not studied design alternatives using other technologies nor has he studied comparative advantages or disadvantages (including costs) of one technology over the other in relation to Public Mobile's needs. Instead, Mr. Starkey provided information to the Board indicating that alternatives technologies exist to support wireless services and, indeed, those technologies are being deployed using infrastructure other than utility poles.

(b) (ix) Please see response in (b) (viii) above.

(b) (x) Please see response in (b) (viii) above.

c) Yes.

d) Mr. Starkey is not aware of any studies that measure the effectiveness of Wi-Fi relative to placement on utility poles versus buildings or any other structure.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 40:

Reference(s): Starkey, section III, pages 39-40

Mr. Starkey describes AT&T's planned use of WiFi offload in New York City.

a) Is Mr. Starkey aware of the deployment of WiFi offload networks in Canada by mobile carriers and if so, provide relevant details as to the identity of the carrier, the scale and scope of the WiFi offload network, and whether mobile voice and data connections are handed off seamlessly.

RESPONSE:

a.) Though Mr. Starkey has not done a formal analysis of Wi-Fi offload networks in Canada, he is aware that Rogers aggressively encourages its customers to offload traffic to Wi-Fi networks. The following is an excerpt from QSI's recent report entitled: *Promoting Sustainable Competition in the Canadian Mobile Wireless Industry Through an Equitable Auction Design*, April 2011 This report is identified at page 3 of Mr. Starkey's affidavit:

> In Canada, Rogers launched Canada's first special pricing plan designed to encourage Wi-Fi offloading for business customers in March 2011.[99] The plan is called "Wi-Fi Calling for Business" and allows business customers to place mobile calls from their smartphones over Wi-Fi networks registered on their devices. With the $10 per month add-on, customers can make calls over the Wi-Fi network that do not count towards monthly voice plan minutes. Rogers also currently offers Wi-Fi calling for residential customers for a fee.[100]
>
> [99] Rogers New Release, "Mar 11, 2011 - Rogers launches Canada's First Wi-Fi Smartphone Service for Business." Available at: http://www.rogers.com/web/Rogers.portal?_nfpb=true&_windowLabel=investor

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_1_1&investor_1_1_actionOverride=%2Fportlets%2Fconsumer%2Finvestor%2FshowNewsDetail&investor_1_1yearInSelection=2011&investor_1_1BusiUnit=RCI&investor_1_1NewsID=1903118235&investor_1_1selectedPageIndex=0&investor_1_1fromNewReleasePage=RCI&_pageLabel=IR_LANDING

[100] Rogers Calling Services description. Available at: http://www.rogers.com/web/content/addons/callingservices?tab1_content&submenu5

Likewise, Rogers describes "Wi-Fi" calling to its subscribers as follows:

> **What Is Wi-Fi Calling**
> Wi-Fi calling enables you to make and receive unlimited local (based on the area code of your phone number) or Canada-wide voice calls anywhere you have Wi-Fi access within Canada (i.e., on campus, at a coffee shop, at work, at home, etc.) on your Wi-Fi calling (UMA) compatible device. When subscribed to a Wi-Fi calling add-on, any voice minutes you use with Wi-Fi calling are not deducted from the voice minute allocation in your voice plan.
>
> Voice calls are seamlessly handed off between a Wi-Fi connection and the Rogers wireless network so if you start you call over a Wi-Fi connection and then leave the Wi-Fi connection, you can continue your call over the Rogers wireless network. Where there is no Wi-Fi connection, just use your mobile phone as you normally would.
>
> *see* http://www.rogers.com/web/content/add-ons/callingservices?tab1_content&submenu5

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 41:

Reference(s): Starkey, page 43, lines 14 to 15

Mr. Starkey states: "CANDAS states that it intended to attach the components of a DAS to 790 power poles in the City of Toronto in support of Public Mobile's wireless network."

a) According to Mr. Starkey, how many of the 790 locations were

(i) Hydro (LDC) poles

(ii) Street lamppost with overhead power lines (classified as distribution poles)

(iii)Streetlight poles.

RESPONSE:

a.) Mr. Starkey attempted to gather this information via interrogatories sent to CANDAS. CANDAS refused to provide the requested information. For example, see CANDAS' response to THESL Question 8 (c) as follows:

> The information requested is not relevant to the issues raised by the Application; moreover, production of this information would be unduly onerous relative to its probative value, if any.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 43:

Reference(s): Starkey, Section IV, page 46, line 21 to page 47, line 2

Mr. Starkey states:

> The company also deployed a 42 node DAS covering 16 square miles in Paradise Valley, AZ without using any utility poles. In this case, the company used a handful of traffic signals and dozens of new, decorative installations that were designed to conceal the wireless antenna equipment.

a) Does Mr. Starkey propose the deployment of fake palm trees as an alternative to wireless pole attachments for DAS in Toronto and in Ontario?

b) If not, does Mr. Starkey propose the deployment of new, decorative installations?

c) Were CANDAS forced to deploy in Ontario using new, decorative installations, where does Mr. Starkey propose that the new, decorative installations be placed?

d) Is Mr. Starkey aware of any rules, regulations or policies that would be applicable to the installation of, for example 790 new, decorative installations in or around the streets of the City of Toronto?

e) Provide a breakdown by city or location, of outdoor DAS deployments implemented utilizing

    (i) Utility poles (including hydro poles, lampposts and streetlights) alone
    (ii) Sides of buildings or rooftops alone
    (iii)a combination of the two.

f) In each instance where sides of buildings or rooftops alone were used (if any), state whether utility poles (including hydro poles, lampposts and streetlights) was available

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

and if not, state why utility poles were not available.

g) In each instance were a combination of utility poles and sides of buildings or rooftops were used, state the proportion of installations placed on utility poles on the one hand and sides of buildings or rooftops on the other.

RESPONSE:

a.) The alternatives proposed by Mr. Starkey are detailed in his evidence. See also CEA's evidence *Outdoor Distributed Antenna Systems and their role in the Wireless Industry*, Industry Report, LCC International, Inc.

b.) Please see the response in (a) above. Please also see the response in Tab 5.2, Schedule 34, (a)(v).

c.) Please see the response in (a) above. Please also see the response in Tab 5.2, Schedule 34, (a)(v).

d.) Please also see the response in Tab 5.2, Schedule 27 (b).

e.) Mr. Starkey was not able to locate publicly available information in answer to this question. Mr. Starkey did attempt to gain access to this type of information from CANDAS members, in part, via THESL Question 8. CANDAS provided some general information but stated that: " To the extent that detailed information beyond the forgoing is requested, it is not relevant to the issues raised by the Application; moreover, production of such detailed information would be unduly onerous relative to its probative value, if any."

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

f.) Please see the response in (a) above.

g.) Please see the response in (a) above.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 45:

Reference(s): Starkey, page 49, lines 4 to 11

Mr. Starkey states:

> My understanding is that municipalities, in this case the City of Toronto, can elect to permit vendors to install decorative poles and other municipal furniture which can be located near existing fiber conduits and used for wireless attachments and, potentially, for purposes of concealing wireless antenna equipment if requested to do so by the municipality involved.

a) Explain whether Mr. Starkey believes that constructing new poles in the ROW is a viable alternative to use of existing utility poles for wireless attachments.

b) If not, explain whether a Canadian carrier that has been denied the right to attach to utility poles should also be denied a right to place poles in the ROW.

c) Identify relevant rules, regulations or policies applicable in Ontario that articulate the aesthetic, resource efficiency, ROW clutter concerns with the establishment of new pole infrastructure in the public ROW that are mentioned in Mr. Starkey's Affidavit.

RESPONSE:

a.) Yes.

b.) Not applicable.

c.) *See* response to CANDAS Interrogatory No. 27(b). *See* also CPC-2-0-17 and CPC-02-0-03.

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INTERROGATORY 46:

Reference(s): **Starkey, page 1, line 21 to page 2, line 10 and Attachment MTS-01**

Mr. Starkey states:

> Throughout my career I have spent a great deal of time studying telecommunications networks, including substantial time and effort aimed at developing rational, efficient means by which competing communications carriers can effectively access dominant carrier networks for purposes of entering monopolized markets. I have also analyzed the underlying economic characteristics of communications networks and markets and have, on numerous occasions, provided expert testimony regarding the costs of providing various telecommunications functionalities and access, including those associated with wireless networks.

a) Describe in detail, Mr. Starkey's practical or theoretical experience with wireless networks generally including but not limited to
   (i) White papers and research
   (ii) Standards work
   (iii) Wireless network design
   (iv) Wireless network construction and deployment
   (v) Other relevant experience or expertise

b) More specifically, describe in detail, Mr. Starkey's practical or theoretical experience

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

with

(i) CDMA network design or deployments
(ii) GSM or UMTS network design or deployments
(iii) Wi-Fi network design or deployments
(iv) DAS network design or deployments
(v) Femtocell, Picocell or other small cell network design or deployments
(vi) Macro cell or network design or deployments
(vii) Combination (macro and small cell) network design or deployment
(viii) Design or deployments of wireless networks utilizing a high capacity ("all-you-can-eat") business model
(ix) Design or deployments of wireless networks for carriers who hold limited spectrum or non-ideal spectrum.

c) Identify and provide a copy of any written work product as well as transcripts of live testimony or depositions given by Mr. Starkey on wireless communications networks.

d) Identify and provide a copy of any written work product as well as transcripts of live testimony or depositions given by Mr. Starkey on access to support structures (i.e. pole, duct, conduit) and rights-of-way.

RESPONSE:

a.) i Please see page 3 and Attachment MTS-01 in Mr. Starkey's Affidavit.

a.) ii Mr. Starkey has not been involved in developing wireless standards.

a.) iii Mr. Starkey does not design wireless networks.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

a.) iv Mr. Starkey does not construct or deploy wireless networks.

a.) v *See* response to CANDAS Interrogatory No. 46 (a) directly above. Mr. Starkey's role in evaluating and researching wireless networks and technology is most often in consultation with individual clients. Mr. Starkey specifically, and QSI generally, stays abreast of market trends, technological progression and the capabilities of new wireless technologies for purposes of advising clients as they develop and deploy their own networks. Mr. Starkey and QSI are also often called upon to share their research and expertise with regulators (*e.g.*, *see* QSI papers cited by Mr. Starkey at page 3 of his Affidavit).

b.) Please see the response in (a)(v) directly above.

c.) Copies of the two papers discussed in Mr. Starkey's affidavit are attached hereto as Attachments 1 & 2. Mr. Starkey has provided live testimony *in camera* (including depositions) on wireless communications networks, unfortunately, that testimony is not public and is protected by relevant agreements which prohibit Mr. Starkey from disclosing it. *See, e.g.*, Attachment MTS-01 to Mr. Starkey's affidavit, particularly the following proceedings:

American Arbitration Association
Case No. 77 181 0289 MAVI
T-Mobile USA, Inc., Claimant, vs. Qwest Corporation (f/k/a US West Communications, Inc.), Respondent
On behalf of T-Mobile USA, Inc.

In the Circuit Court of St. Louis County, Missouri
Cause No. 01 CC-004454

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

St. Louis County, Missouri vs. AT&T Wireless Services, Inc., et al
On behalf of T-Mobile USA, Inc.

d.) Mr. Starkey has provided live testimony *in camera* (including depositions) on support structure (poles and conduit/duct), unfortunately, that testimony is not public and is protected by protective orders or agreements which prohibit Mr. Starkey from disclosing it. *See, e.g.*, Attachment MTS-01 to Mr. Starkey's affidavit, particularly the following proceedings (these are examples, there are numerous others):

Before the Michigan Public Service Commission
Case No. U-12287
In the matter of the application, or in the alternative, complaint of AT&T COMMUNICATIONS OF MICHIGAN, INC. against Michigan Bell Telephone Company, D/B/A, Ameritech Michigan
On behalf of AT&T Communications of Michigan, Inc.

Before the Illinois Commerce Commission
Docket No. 98-0396
Investigation into the compliance of Illinois Bell Telephone Company with the order in Docket 96-0486/0569 Consolidated regarding the filing of tariffs and the accompanying cost studies for interconnection, unbundled network elements and local transport and termination and regarding end to end bundling issues.
On behalf of AT&T Communications of Illinois, Inc. and McLeodUSA Telecommunications Services, Inc.

Before the Wisconsin Public Service Commission
Docket No. 6720-TI-160
Docket No. 6720-TI-161
Investigation Into Ameritech Wisconsin’s Unbundled Network Elements
On behalf of AT&T, Worldcom, McLeodUSA, TDS Metrocom, KMC Telecom, Time Warner Telecom, Rhythms Links

Toronto Hydro-Electric System Limited
EB-2011-0120
Interrogatory Responses
Tab 5.2
Schedule 46
Attachment 1
(42 pages)

IN-BAND AUCTION CAP

PROMOTING SUSTAINABLE COMPETITION IN THE CANADIAN MOBILE WIRELESS INDUSTRY THROUGH AN EQUITABLE AUCTION DESIGN

A report by:

April 2011

QSI CONSULTING, INC.
www.qsiconsulting.com

NOTE: This report was prepared by QSI Consulting, Inc. on behalf of Videotron G.P. ("Videotron"), a wholly-owned subsidiary of Quebecor Media Inc. and Shaw Communications Inc. ("Shaw"). This report expresses the views of QSI Consulting, Inc. and may not necessarily reflect the views of Videotron, Shaw or their affiliates.

QSI Consulting, Inc. is a consulting firm, headquartered near St. Louis, Missouri, specializing in utility and network industries, econometric analysis, convergence of network technologies and computer-aided modeling. QSI consultants provide services to a wide array of clients, including multi-billion dollar international communications firms, small start-up companies, lawmakers and government agencies.

QSI Contacts

Timothy Gates
Senior Vice President

Office (727) 372-5599
Mobile (727) 267-5762
tgates@qsiconsulting.com

Warren Fischer, C.P.A.
Chief Financial Officer

Office (303) 722-2684
Mobile (303) 883-9014
wfischer@qsiconsulting.com

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EXECUTIVE SUMMARY

The framework for the upcoming auction of spectrum in the band of 698-806 MHz (“700 MHz band”) in Canada will have a dramatic impact on the competitiveness and innovation in the Canadian mobile wireless industry. The exploding demand for mobile wireless services, the global scarcity of wireless spectrum, and favorable propagation characteristics of low-frequency spectrum cause the 700 MHz band to be particularly valuable to wireless service providers and consumers.

Some wireless providers in Canada currently hold low-frequency spectrum and some do not. As a result, some providers are currently better-situated than others to provide the types of mobile wireless services consumers demand, particularly in rural and/or low-density areas where the greater propagation characteristics of low-frequency spectrum are most beneficial. If the low-frequency “haves” are allowed to bolster their competitive advantage over low-frequency “have nots” due to an unrestricted 700 MHz band auction, further concentration in the Canadian wireless market will result, leading to less choice and higher prices for consumers. On the other hand, a heavy-handed regulatory approach to structuring the auction also runs the risk of stunting the competitiveness and efficiency of the Canadian wireless market. A proper auction framework must balance these industry, economic and societal considerations while understanding that efficient use of the available spectrum will be critical to addressing the global problem of spectrum scarcity no matter what framework is selected.

An in-band auction cap balances the need for sustainable competition in the mobile wireless industry without the risk of undue regulatory interference. Under the auction cap proposal described in this report, every interested wireless provider has the opportunity to obtain a block of spectrum in the coveted 700 MHz band. This holds true whether a wireless service provider currently holds no low frequency spectrum or holds a preponderance of the spectrum in lower frequency bands. The only limitations established by the auction cap are as follows: those providers who already hold low-frequency spectrum would be eligible to obtain up to one block of 700 MHz spectrum, and those who do not hold low-frequency spectrum would be eligible to obtain up to two blocks. The auction cap framework rules out auction outcomes that would result in significant concentration of 700 MHz spectrum, and low-frequency spectrum as a whole. It would also ensure that all wireless providers, whether or not they currently hold low-frequency spectrum, have the opportunity to acquire 700 MHz spectrum without being blocked by incumbents[1] who have the incentive and ability to foreclose competition through an unrestricted auction process.

The auction cap maximizes the chances that competitive forces trigger innovation and investment by those who hold low-frequency spectrum, rather than permitting the low-frequency “haves” to lock out the “have nots” and then rest on their laurels. The auction cap proposal also promotes roll-out to rural areas by fostering competition among providers in low-frequency spectrums that are ideal for serving such areas. A roll-out requirement can increase the likelihood that 700 MHz spectrum will be used to serve communities in urban and rural areas in

[1] “Incumbents,” as that term is used in this report, refers to the three largest wireless service providers in Canada – Bell Mobility, Rogers and TELUS.

a timely manner, and at the same time, avoid the concerns that incumbents have ascribed to other policy levers.

Deployment of mobile broadband is not impaired by the in-band auction cap. The incumbents currently operate on the advanced High Speed Packet Access (HSPA)+ standard, which data speeds are comparable with data speeds in Long Term Evolution (LTE) standard (a standard that the incumbents associate with the 700 MHz spectrum).[2] Vendors believe that the HSPA+ standard has more than enough capacity to handle future traffic forecasts. Current networks are underutilized, and operators can improve overall capacity utilization by delivering higher data rates from existing radio spectrum by using a combination of techniques, including advanced antennas, high level signal modulation, and increasing the number of site sectors from the typical three to six sectors. Cell densification is another method of increasing network capacity. Recent developments in lightweight radios such as Alcatel-Lucent's lightRadio™ may significantly reduce capital and operating cost requirements of cell densifications. "Intelligent" radios such as Nokia Siemens' Liquid Radio, introduced in March of this year, increase capacity by directing coverage where it is needed. Another effective method of increasing network capacity and coverage is augmentation of traditional macrocells with low power nodes, such as femtocells. Femtocells (not known to be used in Canada) quickly and efficiently serve various hotspots and coverage holes. Traffic offloading to Wi-Fi routers is another effective method of relieving the capacity of macrocells. According to Cisco estimates, the amount of smartphone traffic that can be offloaded in Canada today is 23%, increasing to 34% by 2015.[3] Yet, the actual amount of traffic offloading in Canada is likely less than the potential estimated by Cisco.

Furthermore, LTE deployment is not limited to the 700 MHz spectrum. Because LTE is operationally more efficient than current technologies, industry experts view it as a technology to which all networks will migrate. The incumbents have expressed skepticism that a Canadian provider can offer LTE over spectrum bands other than those used by the big U.S. wireless providers out of fear that vendors would decline to provide an adequate ecosystem for the dominant wireless providers in Canada. LTE is being deployed or is planned to be deployed in different spectrum bands of interest to incumbents, including the 800 MHz band in Europe, South Korea and Japan. Because there is general consensus in the industry that LTE is the next generation mobile network technology, it is inevitable that a robust multi-band ecosystem will develop for this technology, and LTE handsets will be multi-band handsets, just like the present day GSM/HSPA handsets. Technological innovations that increase spectrum utilization and network speeds and capacity combined with available low-frequency spectrum will not unduly restrict wireless service providers from providing the high-quality wireless services that consumers demand throughout Canada.

Given the limited amount of spectrum available in the 700 MHz band, the auction will not solve the industry-wide problem of low-frequency spectrum scarcity. It can, however, promote a more

2 See, e.g., Comments of Rogers' Communications Partnership, Gazette Notice No. SMSE-018-10 (February 28, 2011), p. 3 and Comments of Bell Mobility Inc., Canada Gazette Notice No. SMSE-018-10 (February 28, 2011) ("Bell Mobility Comments"), p. E9.

3 Cisco, "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010-2015" (February 1, 2011) ("Cisco White Paper"), p. 11, Table 7.

equitable distribution of spectrum, avoid outcomes of the auction that would lead to significantly higher concentration and market power in the Canadian mobile wireless industry, foster sustainable competition and provide incentives for spectrum holders to use existing and emerging strategies for utilizing low-frequency spectrum as efficiently as possible. The in-band auction cap proposal is the best option for meeting Industry Canada's objectives of "…encourag[ing] a competitive telecommunications marketplace…" and "…stimulat[ing] innovation and investment by the industry…"[4]

I. INTRODUCTION

The upcoming auction in the 700 MHz band represents a crossroads for the Canadian mobile wireless industry. If designed properly, the auction will foster competition in the industry and promote the roll-out of new and innovative mobile wireless services across Canada. A flawed auction design, however, could result in increased industry concentration and negative impacts on the development of competition.

The spectrum being auctioned is valuable not only because it is scarce, but also because it is low-frequency spectrum that has superior propagation characteristics and allows greater geographic coverage at lower cost. Indeed, a number of major wireless providers have announced plans to deploy Long Term Evolution or "LTE" based services over low-frequency spectrum in the 700 MHz band, and one provider, Verizon Wireless in the U.S., has started deployment of LTE in this band. For these reasons, the 700 MHz band is especially valuable to wireless service providers and consumers alike, and particularly important for deploying mobile wireless services to underserved and/or low density rural areas. Considering that only 58 MHz of this valuable spectrum will be available at auction[5] (50 MHz of which will be effectively used[6]) as well as the incumbents' incentives to foreclose competitors from acquiring 700 MHz spectrum, there is a strong chance that new entrants will bear the brunt of the scarcity dilemma absent a proper auction framework.

Industry Canada has initiated a Consultation on a policy and technical framework to auction spectrum in the 700 MHz band.[7] Commenting parties have made a number of proposals about proper auction design, which include:

4 Industry Canada "Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum," Canada Gazette Notice No. SMSE-018-10 (November 30, 2010) ("Consultation"), p. 1.

5 This does not include the upper D block. The upper D block is situated at 758-763 MHz / 788-793 MHz. There is currently uncertainty in the United States about whether any portion of the upper D block will be allocated for public safety purposes. As a result, commenters, including Videotron and Shaw, propose that the upper D block be held in reserve in Canada until the status of the upper D block is resolved in the United States.

6 If the 58 MHz of available 700 MHz spectrum is auctioned in five blocks as suggested in the modified U.S. band plan (by splitting the upper C block), it will involve four blocks of 6+6 and one block of 5+5. Equipment currently in this band uses 5 MHz and 10 MHz channel bandwidths. Consultation, p. 14. Therefore, 5+5 of each 6+6 block would be effectively used, or 2 MHz of each of the four 6+6 blocks (8 MHz of the total available paired spectrum) would not be effectively used.

7 See, Consultation.

- **Unrestricted auction:** The incumbent wireless providers (Bell, Rogers and TELUS) propose an unrestricted auction. Under this approach, there are no restrictions on the amount of spectrum any one provider may acquire.
- **Set-Aside:** Some new entrants propose a set-aside auction.[8] Under this approach, blocks of spectrum are set-aside for new entrants to the exclusion of incumbent providers.
- **In-Band Auction Cap:** Videotron and Shaw propose an in-band auction cap.[9] Under this approach, any provider that already holds low-frequency spectrum in a given service area may acquire up to one 700 MHz block in that service area, and any provider that does not already hold low-frequency spectrum in a given service area may acquire up to two 700 MHz blocks in that service area.[10]

QSI Consulting, Inc. has been commissioned by Videotron and Shaw to write a report commenting on the impact of the in-band auction cap on the upcoming 700 MHz spectrum auction in Canada, with a special emphasis on the claims by proponents of an unrestricted auction that any auction restrictions would impede their ability to deploy quality mobile wireless services.

Section II of this report first analyzes the differing incentives of auction participants. Understanding these incentives provides insight into how auction participants are likely to conduct themselves during the auction, as well as how that conduct may impact the outcome of the auction. The report then compares and contrasts the possible outcomes of the auction depending on whether an unrestricted auction or auction cap is adopted.[11] The differences between the possible outcomes of an unrestricted auction and the possible outcomes of an auction cap are identified to show the practical effect of adopting one framework over the other. The pros and cons are then weighed to determine which framework best promotes the public interest.

The primary concern that proponents of an unrestricted auction have ascribed to auction caps is that distributing the spectrum over more providers may not provide certain providers with the capacity they need to meet demand. These claims are examined in Section III of the report by putting the claims into context and exploring various existing and emerging methods of

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8 Globalive Wireless Management Corp. (WIND) Comments, ¶35; Public Mobile Inc's Response to Canada Gazette, Part I, SMSE-018-10, (February 28, 2011), ¶100; Comments of Mobilicity (February 28, 2011), ¶7; and Eastlink Comments (February 28, 2011), p. 21.

9 Submission of Quebecor Media Inc., on behalf of itself and Videotron G.P. (February 28, 2011) ("Videotron Comments") and Comments of Shaw Communications Inc., Gazette Notice No. SMSE-018-10 (February 28, 2011) ("Shaw Comments").

10 Videotron and Shaw propose the use of Tier 2 service areas. Videotron proposes in its initial comments that any mismatches between Tier 2 service area boundaries and traditional cellular license boundaries in certain parts of Canada would be resolved in a straightforward manner, such as through a rule whereby a 800 MHz license holder is deemed not to hold 800 MHz spectrum in a Tier 2 service area where its cellular license area covers less than one-half of the population of the overlapping Tier 2 service area.

11 The impacts of a set-aside are not evaluated in this report.

increasing network capacity that can be used to maximize the utilization of spectrum and increase network speeds to meet growing demand for mobile data services.

Section IV of the report discusses the positive impact of the auction cap on competition and services deployment in rural areas.

Based on some estimates, about ten times more spectrum will be needed in the next few years beyond what will be available in the 700 MHz band auction.[12] Therefore, the auction of 700 MHz spectrum will not likely solve the spectrum scarcity issue regardless of the chosen design. It will, however, have a dramatic impact on the level of competition in the Canadian mobile wireless industry, and the extent to which the 700 MHz spectrum will be used to deploy services to consumers across Canada. Therefore, it is important to maximize the chance that the auction outcome promotes competition and uses available spectrum as efficiently as possible. An in-band auction cap best suits these objectives.

II. THE AUCTION CAP AVOIDS THE NEGATIVE OUTCOMES OF AN UNRESTRICTED AUCTION

A. Incumbents and New Entrants Have Differing Incentives

The significant concentration in the Canadian mobile wireless industry is undisputable. Bell Mobility, Rogers and TELUS (collectively referred to in this report as "incumbents") dominate the wireless marketplace in terms of market shares, total revenues,[13] and low-frequency spectrum holdings.[14] This concentration affects the incentives of auction participants. Since the incumbents enjoy a superior market position relative to their rivals, they possess the incentive, based on their market power, to increase barriers for new entrants so as to maintain their dominance. One way to raise barriers and foreclose new entrants from the mobile wireless market is for incumbents to acquire all available spectrum at auction so that new entrants acquire none. In other words, incumbents have the incentive to acquire spectrum not only to expand their capacity but also to preserve their dominant market position. New entrants, by contrast, acquire spectrum in order to roll-out services to consumers, but do not have the added incentive to acquire spectrum to maintain a competitive advantage because they do not have a competitive advantage in the first place. Three economists summarized this issue in a paper written for a 2007 symposium held by the Antitrust Division of the U.S. Department of Justice addressing the

[12] Bell Mobility estimates that an additional 500 MHz of spectrum beyond the Canadian 700 MHz band is required to meet demand beyond 2015. Bell Mobility Comments, p. E8.

[13] As noted in Shaw's comments, the three companies held a combined 95% share of the national market, as measured either by number of subscribers or total revenues. Shaw Comments, p. 18, ¶55 (citing Canadian Radio-television and Telecommunications Commission (CRTC) 2010 Monitoring Report, p. 158, data for year 2009). Moreover, in every province but Quebec, the top two providers hold a combined market share (as measured in subscribers) of 79% or higher (Quebec's value is 72%), suggesting they have de facto duopolies. CRTC 2010 Monitoring Report, p. 159, Table 5.5.4 ("Wireless subscriber market share, by province – 2009").

[14] Consultation, Figure 4.1, showing Rogers, Bell and TELUS holding 95% of the spectrum in the 800 MHz band.

Federal Communications Commission's (FCC's) then-pending auction of the 700 MHz band in the U.S.:

> Given the concentrated market structure, the participants in the auction for new spectrum have different economic incentives depending on whether they are new entrants or existing incumbents. An entrant that wins a license wants to operate so as to maximize the value of the license. In contrast, an incumbent bidding for a new license takes into account that new entrants can attract customers from its existing business and thereby jeopardize its profits and diminish the scarcity rents from its current licenses. As a result an incumbent is not neutral about how the spectrum is allocated and used, even if it does not win a new license itself. This is a major difference from auctions where all players start on equal footing. We argue that the dominant low-frequency incumbents' incentives to protect current profits are large, and could undermine the efficiency of the auction outcome. In particular, this distortion leads incumbents to value the new licenses more than the true economic value to society and thus is likely to lead to a misallocation of the scarce spectrum.[15]

The results of the unrestricted auction for 700 MHz spectrum in the U.S. support this view of the incumbents' auction incentives. By the time the U.S. auction concluded in March 2008, the two largest U.S. providers, Verizon and AT&T, had outspent all other auction participants by a ratio of greater than 6:1, and secured large new blocks of the 700 MHz spectrum. Verizon obtained a virtually nationwide footprint in the C Block (20 MHz covering 98% of pops nationwide), plus licenses for the A and B (10 MHz) Blocks covering many of the most important metropolitan areas (e.g. New York City, Los Angeles, Chicago). AT&T acquired some 227 B Block licenses (62% of pops), also covering many significant urban areas.[16] Other wireless providers participating in the auction generally acquired spectrum in second-tier areas, and none established an amount of spectrum close to a national footprint.[17] The end result was to reinforce the two largest providers' control over U.S. spectrum, as depicted by the following maps of Verizon's spectrum holdings before and after the U.S. 700 MHz auction:[18]

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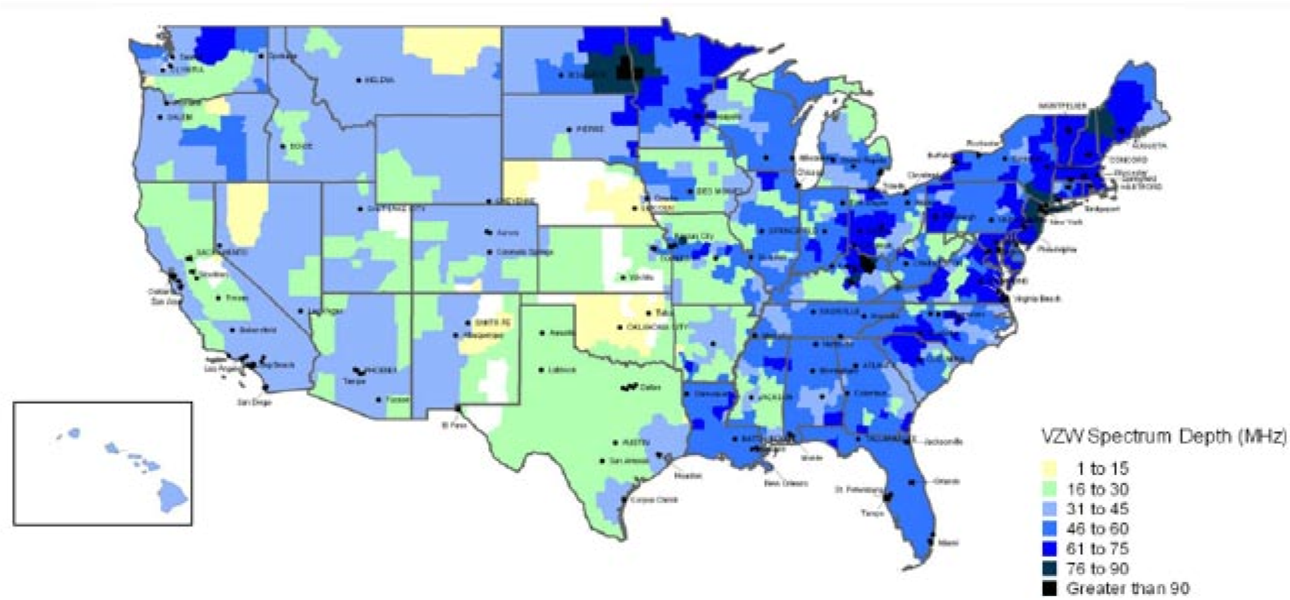
15 Cramton, Peter, and Andrzej Skrzypacz and Robert Wilson. "The 700 MHz Spectrum Auction: An Opportunity to Protect Competition in a Consolidating Industry" (November 13, 2007), pp. 2-3. Available at: http://www.cramton.umd.edu/papers/spectrum/

16 FCC Public Notice DA 08-595, "Auction of 700 MHz Band Licenses Closes, Winning Bidders Announced for Auction 73" (March 20, 2008). *See also,* Verizon Wireless Press Release, "Verizon Wireless Says Spectrum Additions From FCC's Auction 73 Will Further Company's Broadband Strategy" (April 4, 2008).

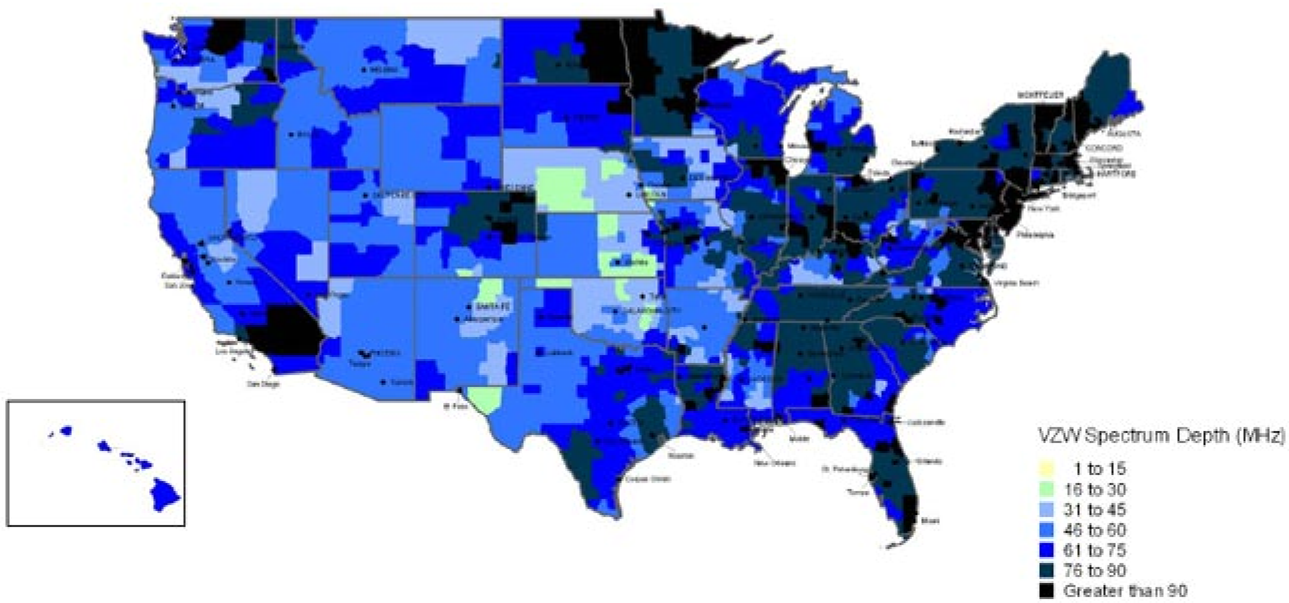
17 Echostar's affiliate Frontier Wireless successfully bid for most of the unpaired 6Mhz lower E Block licenses nationwide, but at that time such unpaired spectrum was limited to one-way communications, so this acquisition was viewed as likely to be an adjunct to Echostar's satellite-based direct broadcast TV services rather than to support two-way mobile wireless services in competition with AT&T and Verizon Wireless. *DSLReports*, "What's Echostar Cooking? Company grabbed $700 million in spectrum for mobile TV" (March 21, 2008). Available at: http://www.dslreports.com/shownews/Whats-Echostar-Cooking-92856

18 Source: Cellularmaps.com. Available at: http://www.cellularmaps.com/700_auction.shtml

Verizon Wireless Bandwidth Before the 700 MHz Auction:



Verizon Wireless Bandwidth After the 700 MHz Auction:



Industry Canada's existing framework for spectrum auctions relating to wireless services already acknowledges the anti-competitive nature of the incumbents' incentives.[19] The following section explains how the auction cap lessens the chances that incumbents will act on these incentives in the auction to the detriment of competitors and consumers.

B. Possible Outcomes: Unrestricted Auction Versus In-Band Auction Cap

The amount of 700 MHz spectrum that will be available for auction in Canada is limited. A total of 50 MHz of usable spectrum in the 700 MHz band will be auctioned,[20] which, according to industry consensus,[21] could properly be allocated among five, equally-sized 5+5 blocks.[22] The incumbents favor an unrestricted auction in which there are no limits placed on the amount (or number of blocks) of 700 MHz spectrum any bidder can acquire. Videotron and Shaw favor an in-band auction cap in which providers who already hold low-frequency spectrum in a service area[23] can acquire up to one block of 700 MHz spectrum and providers who do not hold low-frequency spectrum in a service area can acquire up to two blocks of 700 MHz spectrum. Under both an unrestricted auction and auction cap, there are a discrete number of possible outcomes associated with how the five blocks of spectrum may be allocated among providers. Comparing the possible outcomes of one approach versus another is instructive as it identifies the practical impact of adopting one auction framework over another.

The possible outcomes of an unrestricted auction versus an in-band auction cap differ in terms of the number of providers over which the spectrum blocks may be allocated. As the name suggests, in an "unrestricted" auction there are no limits on the number of blocks of spectrum any one provider can acquire. As such, under this auction framework, a single provider could acquire as few as zero blocks and as many as all five blocks of 700 MHz spectrum. By comparison, under the in-band auction cap, the blocks of spectrum will be allocated among as few as three providers and as many as five. These possible outcomes are illustrated below (with checks indicating the possible outcomes under each proposal):

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19 Industry Canada, Spectrum Management and Telecommunications, Framework for Spectrum Auctions in Canada, Issue 3 (March 2011), Section 4, "Competition Principles: Promoting a Competitive Post-Auction Marketplace."

20 A total of 58 MHz will be available, of which 50 MHz will be effectively used.

21 There is wide consensus that a modified U.S. band plan has merit, in which the upper C block is split into two paired blocks, resulting in five 5+5 blocks. This is the proposal of Videotron and Shaw. Rogers states that this "variant of the U.S. band plan should be seriously considered by the Department." Rogers Comments, p. 25. The Radio Advisory Board of Canada (RABC) states that this "minor deviation from the U.S. band plan…should be considered by the Department…" Response of RABC (February 28, 2011), p. 16.

22 With the potential for a sixth block depending on whether the upper D block is part of the auction.

23 Videotron and Shaw advocate using Tier 2 service areas.

	Auction Cap	Unrestricted
Total Available Blocks	five	five
5 block holders	☑	☑
4 block holders	☑	☑
3 block holders	☑	☑
2 block holders		☑
1 block holder		☑

The unrestricted auction could result in five 700 MHz block holders (each acquiring one block) or one 700 MHz block holder (all blocks acquired by a single provider), and all combinations in between. The auction cap eliminates two of these possible outcomes: an outcome in which two providers acquire all five blocks (60/40 split between two providers) and an outcome in which one provider acquires all five blocks (100% of the 700 MHz spectrum). These two outcomes are eliminated by the auction cap because the maximum number of blocks any provider can acquire is two (40% of total 700 MHz spectrum), and as a result, the five blocks must be divided between at least three providers.

The possible outcomes of each approach also differ in terms of the amount of 700 MHz spectrum that may be concentrated among providers that already hold low-frequency spectrum. Low-frequency spectrum (below 1 GHz) is important to providers due to its superior propagation characteristics, and the existing low-frequency spectrum holdings in Canada are highly concentrated among the incumbents.[24] In recognition of these facts, the in-band auction cap turns on whether or not a bidder for 700 MHz spectrum currently holds low-frequency spectrum.

There is no limit on the amount of spectrum a low-frequency spectrum holder may acquire under the unrestricted auction; a low-frequency spectrum holder could acquire as little as 0% and as much as 100% of the available 700 MHz spectrum. Likewise, if there are two primary low-frequency spectrum holders per service area (which is the typical case in the 800 MHz band), those two providers could, together, acquire up to 100% of the available 700 MHz spectrum. By comparison, under the auction cap, each low-frequency spectrum holder may acquire up to 1 block (20% of available 700 MHz spectrum). This means that in service areas with two or three low-frequency spectrum holders, they can together acquire up to 40% and 60% of the available 700 MHz spectrum, respectively. The auction cap, therefore, eliminates the possible outcomes in which existing holders of low-frequency spectrum in a service area, either individually or as a group, acquires all or a vast bulk of the low-frequency spectrum in the 700 MHz band in the same service area.

There are six potential auction outcomes in terms of the concentration of 700 MHz spectrum among existing holders of low-frequency spectrum. Those six potential outcomes are as follows:

24 Consultation Figure 4.1, showing Bell, Rogers and TELUS holding 95% of the 800 MHz band.

1. Zero blocks (0%) acquired by low-frequency spectrum holder(s).
2. One block (20%) acquired by low-frequency spectrum holder(s).
3. Two blocks (40%) acquired by low-frequency spectrum holder(s).
4. Three blocks (60%) acquired by low-frequency spectrum holder(s).
5. Four blocks (80%) acquired by low-frequency spectrum holder(s).
6. Five blocks (100%) acquired by low-frequency spectrum holder(s).

All six of these outcomes could occur under the unrestricted auction. Under the auction cap, outcomes 1 through 3 could occur in each Tier 2 service area because there are at least two holders of low-frequency spectrum in each Tier 2 service area.[25] These possible outcomes are illustrated below (with checks indicating the possible outcomes under each proposal):

Percent of 700 MHz Spectrum That May Be Acquired By Existing Low Frequency Spectrum Holders		
	Auction Cap	**Unrestricted**
0%	☑	☑
20%	☑	☑
40%	☑	☑
60%		☑
80%		☑
100%		☑

Outcome 4 (60%) shaded in the above table could also occur under the auction cap in service areas served by three low-frequency spectrum holders. Thus, existing holders of low-frequency spectrum can acquire up to 40% of the available 700 MHz spectrum in service areas with two holders of low-frequency spectrum, and up to 60% in service areas with three low-frequency spectrum holders. This has the effect of eliminating the outcomes associated with the unrestricted auction in which existing holders of low-frequency spectrum acquire 100%, 80% or 60% (in some instances) of the available 700 MHz spectrum.

The elimination of these possible outcomes, in turn, impacts how low-frequency spectrum (as a whole) may be allocated as a result of the 700 MHz auction. By way of example, Rogers and Bell (or Rogers and TELUS) split 50/50 the low-frequency spectrum in the 800 MHz band in a majority of Tier 2 service areas. If an unrestricted auction is adopted, the low-frequency incumbents in a service area (Rogers and Bell in this example), either individually or collectively, could acquire 100% of the available 700 MHz in that same service area. As a result, the low-frequency incumbents would hold all low-frequency spectrum in both the 700 MHz and 800 MHz bands. Under the auction cap, the low-frequency incumbents may acquire up to one block (20%) of 700 MHz spectrum each, resulting in total incumbent holdings of 40% of the

[25] Consultation, Figure 4.1(b), showing at least two holders of 800 MHz spectrum in each Tier 2 service area.

low-frequency spectrum in the 700 MHz band and 100% of the low-frequency spectrum in the 800 MHz band in the same service area. The auction cap has the effect of eliminating three possible outcomes in this regard. It eliminates the possible outcomes in which low-frequency incumbents hold: (1) 100% of the low-frequency spectrum in both the 700 MHz and 800 MHz bands, (2) 80% of the low-frequency in the 700 MHz band and 100% of the low-frequency in the 800 MHz band, and, in some instances, (3) 60% of the low-frequency spectrum in the 700 MHz band and 100% of the low-frequency spectrum in the 800 MHz band.

C. The Auction Cap Avoids Outcomes That Are Contrary To Sustained Competition

There are a number of key observations that can be drawn from the above comparisons:

1. There are a limited number of 700 MHz spectrum blocks (likely five) that will be available at auction. As a result, there are a limited number of ways the five blocks can be distributed among different providers and categories of providers – i.e., there are a limited number of possible auction outcomes.

2. Comparing the possible outcomes associated with an unrestricted auction versus an in-band auction cap shows that the auction cap rules out those outcomes that result in substantial concentration of 700 MHz spectrum holdings and low-frequency spectrum holdings as a whole.

3. The auction cap provides the opportunity for an additional wireless provider to acquire low-frequency spectrum in the 700 MHz band. Whereas the unrestricted auction would allow one or two providers to acquire all 700 MHz spectrum in a service area, the auction cap ensures that at least three providers have the opportunity to acquire 700 MHz spectrum.

4. The auction cap avoids outcomes in which existing holders of low-frequency spectrum acquire all or a majority of the low-frequency spectrum in the 700 MHz band.

D. The Benefits Of The Auction Cap Outweigh Any Potential Disadvantages

There are a number of benefits of the auction cap. First, it is fair and equitable to all mobile wireless providers interested in acquiring spectrum in the 700 MHz band. ***All*** wireless providers have the opportunity to acquire spectrum in the 700 MHz band. No blocks are reserved for certain groups of providers to the exclusion of others, and providers who enjoy market dominance or currently own low-frequency spectrum cannot leverage those advantages to acquire all available 700 MHz spectrum and preclude competition. The auction cap preserves the interests of all providers by ensuring that a single competitor cannot acquire all or most of the available blocks of spectrum. The in-band auction cap is a pragmatic middle ground between the unrestricted auction that could result in an effective duopoly in low-frequency spectrum throughout Canada, and other available policy levers, such as aggregate spectrum caps or set-asides, that may preclude certain providers from acquiring blocks of 700 MHz spectrum.

Second, the auction cap is the best way to promote sustainable competition for mobile wireless services in Canada. The in-band auction cap which ensures that a rival has the opportunity to compete with dominant low-frequency incumbents has a better chance than an unrestricted auction of creating an environment in which investment, innovation, efficient spectrum utilization, service deployment and lower prices result. Because access to spectrum is a major barrier to entry for new entrant wireless providers, incumbents have the incentive to not only acquire the spectrum they need, but also acquire spectrum they may not need so as to maintain barriers to entry for their competitors. This is particularly true for the auction of 700 MHz spectrum which provides low-frequency incumbents, who already own 95% of the low-frequency 800 MHz band, the opportunity to corner the market for low-frequency spectrum. The auction cap lessens the chances that incumbents will act on the incentive to hoard 700 MHz spectrum to the detriment of competition because it ensures that they cannot acquire all available 700 MHz spectrum under any auction outcome. Incumbents are less likely to acquire 700 MHz for the purposes of raising barriers to entry if they know from the outset that they cannot block new entrant access to low-frequency spectrum altogether.

Third, the auction cap holds benefits for consumers in rural areas. Absent the auction cap, there is a real possibility that incumbents will hold a vast majority of all low-frequency spectrum – spectrum best-suited for serving unserved and underserved rural areas. This places consumers in rural areas in a situation in which they must depend solely on the low-frequency incumbents, acting as duopolists, to roll-out services in their area. By preventing the incumbents from acquiring all low-frequency spectrum, the auction cap ensures that a rival has the opportunity to serve rural consumers and serve as a market disciplining check on the incumbents. To provide additional assurances that the presence of a rival will, in fact, spur service deployment using low-frequency spectrum in the 700 MHz band, the auction cap proposals are accompanied by deployment obligations for 700 MHz spectrum holders.

Fourth, the primary concerns that have been raised about other policy levers, such as aggregate spectrum caps and spectrum set-asides, do not apply to the in-band auction cap. For example, the auction cap does not permit the "gaming opportunities" that incumbents have raised about set-asides. And because the auction cap turns on whether a provider currently holds low-frequency spectrum, it avoids the dispute over the proper definition of "new entrant." Likewise, because any provider may acquire 700 MHz spectrum under the auction cap regardless of current holdings in other bands, it allows every wireless provider the opportunity to address increasing demands for network capacity by adding spectrum. And because the auction cap applies only during, and for a certain time period following, the auction, its impact is of limited duration. The 700 MHz spectrum could be re-allocated on the secondary market if market forces dictate a different distribution following the auction. For these reasons, an auction cap is the preferred policy lever of some providers whose primary recommendation is an unrestricted auction. Even though Rogers advocates for an unrestricted auction, it states a preference for an auction cap over other policy levers and recognizes that the auction cap is far less disruptive and avoids numerous concerns Rogers has with spectrum aggregation caps and set-asides.[26]

[26] Rogers Comments, pp. 86-87.

Fifth, an auction cap does not add to concerns about scarcity for low-frequency spectrum in the 700 MHz band. There will be a total of 50 MHz of usable spectrum available at auction. According to some forecasts, significantly more spectrum is needed to address future demand than will be available in the 700 MHz band. For example, Rysavy Research estimated in 2010 that in the busiest markets, an operator's spectrum requirements would increase from approximately 25MHz in 2010 to over 200 MHz in 2016.[27] If these forecasts prove accurate, the auction of 700 MHz spectrum will not solve spectrum scarcity no matter how the blocks are divvied up. Permitting low-frequency incumbents to acquire all or most of the 700 MHz spectrum may *postpone* spectrum exhaust for one or two incumbents, but it would not solve the overall spectrum scarcity issue and would negatively impact the competitiveness of the mobile wireless industry in Canada by significantly raising barriers for rivals who would have no low-frequency spectrum holdings.

In sum, the "pros" of the auction cap proposal outweigh any potential "cons" of regulatory intervention. The "pros" include the following: the auction cap proposal allocates a valuable resource in an equitable manner; promotes sustained competition for mobile wireless services, particularly in rural areas; promotes roll-out of competitive services in rural areas; promotes efficient use of assigned spectrum; avoids concerns about other types of regulatory intervention; and the impact is of limited duration. The primary "con" attributed to an auction cap by proponents of an unrestricted auction is that increased fragmentation of the available spectrum may not provide a particular wireless provider the capacity it needs to meet demand for mobile wireless data services. However, any benefits of an auction framework that permits one or two providers to corner the market for low-frequency spectrum so that those providers can accommodate increasing consumer demand to the exclusion of potential rivals are offset by the reduction in consumer welfare caused by a lack of competition. There are existing and emerging methods for maximizing the efficiency of a provider's low-frequency spectrum holdings and increasing network capacity, and the selected auction framework should provide incentives for 700 MHz spectrum holders to explore those methods as a means of addressing spectrum scarcity. These methods are discussed in the following section.

III. THE AUCTION CAP DOES NOT RESTRICT DEPLOYMENT OF MOBILE WIRELESS BROADBAND SERVICES

Proponents of an unrestricted auction claim that they will not be able to acquire the amount of spectrum they need unless the auction is unrestricted. These claims are analyzed in this section by putting the claims about spectrum scarcity in context and examining the existing and emerging strategies and technologies that can be employed to maximize the capacity of mobile networks.

[27] Rysavy Research, "Mobile Broadband Capacity Constraints and the Need for Optimization" (February 2010), chart on p. 15.

A. *Putting Mobile Wireless Demand Trends and Spectrum Scarcity in Context*

There has been a great deal of industry discussion in Canada, the U.S., and elsewhere concerning the ongoing rapid rise of mobile users' demand for high-speed data services in the context of LTE and other 4G network deployments, and the consequences for mobile operators' use of radiofrequency spectrum.[28] Various mobile usage statistics and demand forecasts paint an alarming picture that the spectrum available to support mobile services will be rapidly exhausted and result in a "spectrum crunch" that will adversely impact mobile services' quality and availability. Bell Mobility states that, "the industry faces a pending spectrum crunch in the very near future."[29] Rogers contends that it will need an additional 200 MHz of spectrum on top of the 100+ MHz it already possesses.[30] Likewise, Cisco Systems' latest mobile traffic forecast update reports the following trends at a global market level:[31]

- Global mobile data traffic will increase 26-fold between 2010 and 2015. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 92 percent from 2010 to 2015, reaching 6.3 exabytes per month by 2015.
- Two-thirds of the world's mobile data traffic will be video by 2015. Mobile video will more than double every year between 2010 and 2015.
- Data-intensive consumer devices including smartphones, tablets, and laptops are rapidly proliferating, and they create far more demand per user than traditional cell phones. For example, in 2010, the typical smartphone generated 24 times more mobile data traffic (79 MB per month) than the typical basic-feature cell phone (which generated only 3.3 MB per month of mobile data traffic). In turn, in 2010, mobile data traffic per tablet was 405 MB per month, more than five times more traffic than the average smartphone.

Of course, the details of such forecasts can be debated, and many uncertainties exist with respect to their underlying assumptions and input parameters. The FCC's National Broadband Plan observes that most major industry participants have stated that more spectrum is needed, but that in the context of future uncertainty, their specific estimates range widely, from 40 to 150

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28 Consultation, p. 11. *See also*, for example: Federal Communications Commission ("FCC"), "Connecting America: The National Broadband Plan" (rel. March 16, 2010) ("FCC National Broadband Plan"), pp. 76-79 (Chapter 5.1, The Growth of Wireless Broadband), available at http://www.broadband.gov/plan/ ; FCC, "Fourteenth Commercial Mobile Radio Services (CMRS) Report" (rel. May 20, 2010) ("FCC 14th CMRS Report"), ¶¶181-184 (Chapter V.D.3, Mobile Data Traffic (Non-Messaging)), available at http://wireless.fcc.gov/index.htm?job=reports ; and Ramsay, Maisie, *Wireless Week*, "Have We Been Faking the Spectrum Crunch?" (February 4, 2011), available at http://www.wirelessweek.com/Blogs/Wireless-Week-Blog/Have-We-Been-Faking-Spectrum-Crisis/.

29 Bell Mobility Comments, ¶ E7.

30 Rogers Comments, pp. 23-24, ¶60.

31 Cisco White Paper, pp. 1-2.

megahertz per operator.[32] Nevertheless, it is safe to say that Canada has been and will continue to be impacted by these industry and social trends.[33]

These demand trends, however, do not tell the entire story. If they did, then the inevitable conclusion would be that any finite amount of spectrum added to mobile wireless operators' resources would be insufficient, as they would quickly become exhausted by those exponentially-rising trends. Consider, for example, the finding by Rysavy Research that:

> With multiple users simultaneously accessing streams in the 1 to 2 Mbps range, it only takes a relatively small number of users to reach sector capacity. For example, eight users each with 2 Mbps will consume the capacity of a 10+10 MHz LTE carrier. To put this into perspective, in an urban area there may be 3,000 subscribers per cell site, translating to 1000 subscribers per sector. Eight users represent a tiny percentage of the subscribers.[34]

Taken at face value, this implies that if only half of the subscribers in the sector (i.e., 500) were to access 2 Mbps data streams at the same time, the operator would need a total spectrum bandwidth of at least 1,250 MHz.[35] This is an order of magnitude more spectrum than wireless providers typically have licensed today[36] and many times more spectrum than will be available at the 700 MHz auction. Yet, according to Cisco, Canadian mobile operators will offer average data speeds exceeding 2 Mbps in just two years' time (2.9 Mbps by 2013),[37] which means that even 1,250 MHz per provider may be insufficient to keep pace with demand if Rysavy's forecast is accurate.

This does not mean, however, that the sky is about to fall on wireless services. It is simply unreasonable to focus only on demand growth for LTE/4G-driven services without also taking into account a host of other economic, technological, and market considerations that impact those services and how the underlying networks will be implemented. These additional factors

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32 FCC National Broadband Plan, p. 84.

33 For example, Bell Mobility has reported that the average monthly data usage by smartphone users on its network rose from 15 MB to 300 MB between 2008 and 2010, a 1900% increase. Bell Mobility Comments, p. 7, ¶19.

34 Rysavy Research, "Operator Spectrum Requirements for Mobile Broadband" (February 26, 2011), p. 13 (attached to Rogers Comments) (hereafter "Rysavy Report").

35 That is, if 8 users consume a 10+10 MHz LTE channel (i.e. 20 MHz total) as Rysavy assumes, then 500 users simultaneously accessing 2 Mbps streams will consume 500 ÷ 8 = 62.5 times as much bandwidth, i.e. 62.5 X 20 MHz = 1250 MHz.

36 SeaBoard Group, "Over the Rainbow: Thoughts on the Canadian 700 MHz Discussion" (February 2011) ("SeaBoard Report"), p. 11, Exhibit 6 ("Comparative Spectral Holdings, International Markets - Canada, by Major Markets"). It shows the dominant Canadian wireless operators holding in excess of 150 MHz total, with other countries' dominant providers holdings generally in the 60-90 MHz range. The 1250 MHz required in this example represents 20.8 times more than the lower bound 60 MHz figure (i.e., 1250 ÷ 60 = 20.83) and 8.3 times more than the upper bound 150 MHz figure (1250 ÷ 150 = 8.33).

37 Cisco White Paper, p. 13, Table 8 ("Projected Average Mobile Network Connection Speeds (in kbps) by Region and Country").

are essential to understanding what Canadian wireless providers' spectrum needs will be in the coming years. They include the following:

- More granular understanding of mobile demand characteristics, such as the distribution of data services demand across users' locations, devices, and ages;
- Available technologies for increasing efficiency of spectrum use, increasing network capacity and mitigating their spectrum requirements; and
- Canadian wireless companies' existing spectrum resources.

Each of these areas will be discussed below.

B. Countervailing Characteristics of Mobile Data Demand

When considering how wireless providers will respond to the demand trends associated with LTE/4G-driven services, it is important to recall at the outset that not all users are the same. This is a point of departure from traditional voice-oriented mobile services, for which end users were limited to largely homogeneous handsets with limited features. The advent of 3G networks and high mobile data speeds spurred the proliferation of new mobile devices including smartphones, tablets, pads, wireless-enabled laptops, and more, and the migration to LTE/4G continues this trend. The users who adopt these high-speed data-intensive devices will have distinctly different usage characteristics than other users. For example, Cisco reports that the top one percent of mobile data subscribers generate over 20 percent of mobile data traffic, and their average monthly data usage is some 24 times higher than that of the average data user.[38] The top 10 percent of mobile data subscribers generate approximately 60 percent of mobile data traffic, with monthly usage levels roughly six times higher than the average data user.[39] While these sharp peaks in usage profiles may change somewhat over time as more subscribers join the early adopters of new devices, they suggest that one strategy available to wireless providers seeking to gain control over the demands faced on the radiofrequency portion of their networks will be to apply tiered pricing plans or find other ways to encourage those subscribers to make more use of technological options that divert (offload) their data traffic from the mobile wireless network.

Another aspect of mobile data demand that is often overlooked is that a significant portion of it is not "mobile" in the traditional sense of being incurred while physically moving. Cisco's Internet Business Solutions Group (IBSG) conducted a survey that determined that about 35% of mobile data use actually occurs while "on the move,"[40] while 40% occurs within the home (e.g., accessing the Internet from a mobile device), and the remaining 25% occurs at work.[41] This circumstance can be leveraged to reduce the burdens placed on the radiofrequency portion of wireless providers' networks, by offloading this data traffic to the fixed wireless networks in the home or office whenever high-speed data links are required.

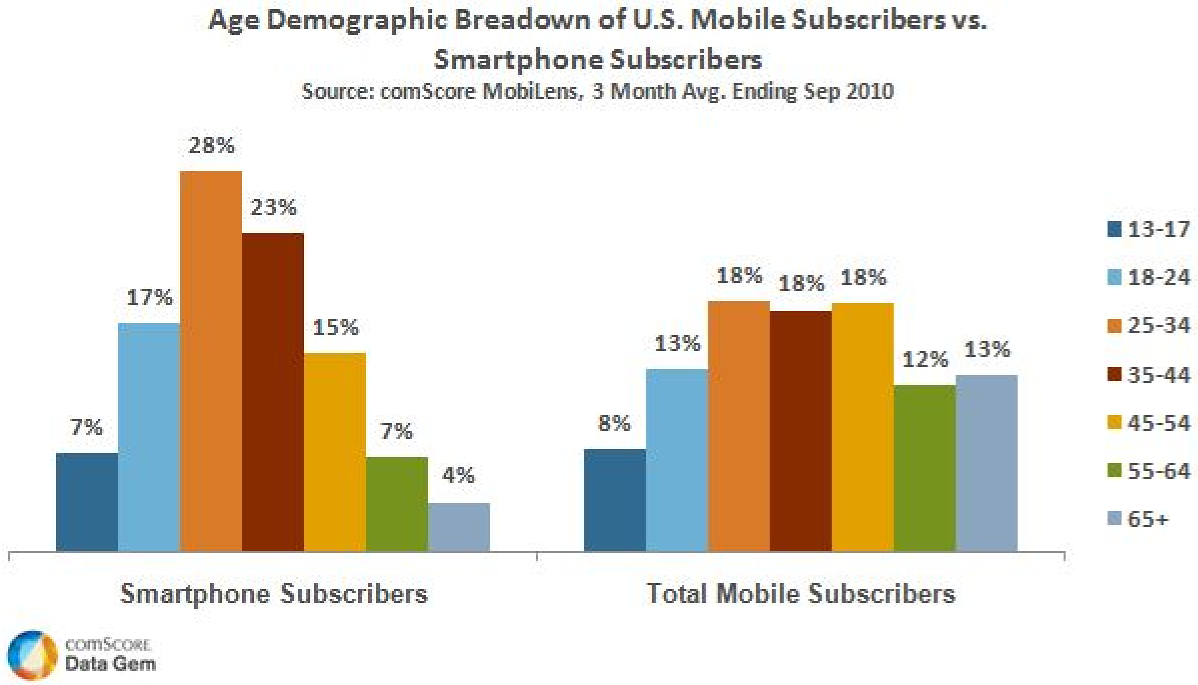
38 *Id.*, pp. 1 and 24-25.

39 *Id.*, pp. 1 and 24-25.

40 *Id.*, p. 10.

41 *Id.*, p. 10.

A final characteristic of mobile demand to consider is its "generational dimension": that a disproportionate share of data-intensive mobile devices is in the hands of younger users. For example, a recent market study by comScore found that "U.S. Smartphone subscribers skew towards persons ages 25–44," with the highest percentage of smartphone subscribers (28%) in the age 25-34 band, more than half of the total (52%) below age 35, and three-quarters (75%) below age 45. The following chart from comScore presents this data, and compares it to the much flatter age distribution found for subscribers of all mobile phone types.[42] These trends are confirmed by Nielsen's findings that 55% of Android users and 47% of iPhone users are under the age of 34.[43]

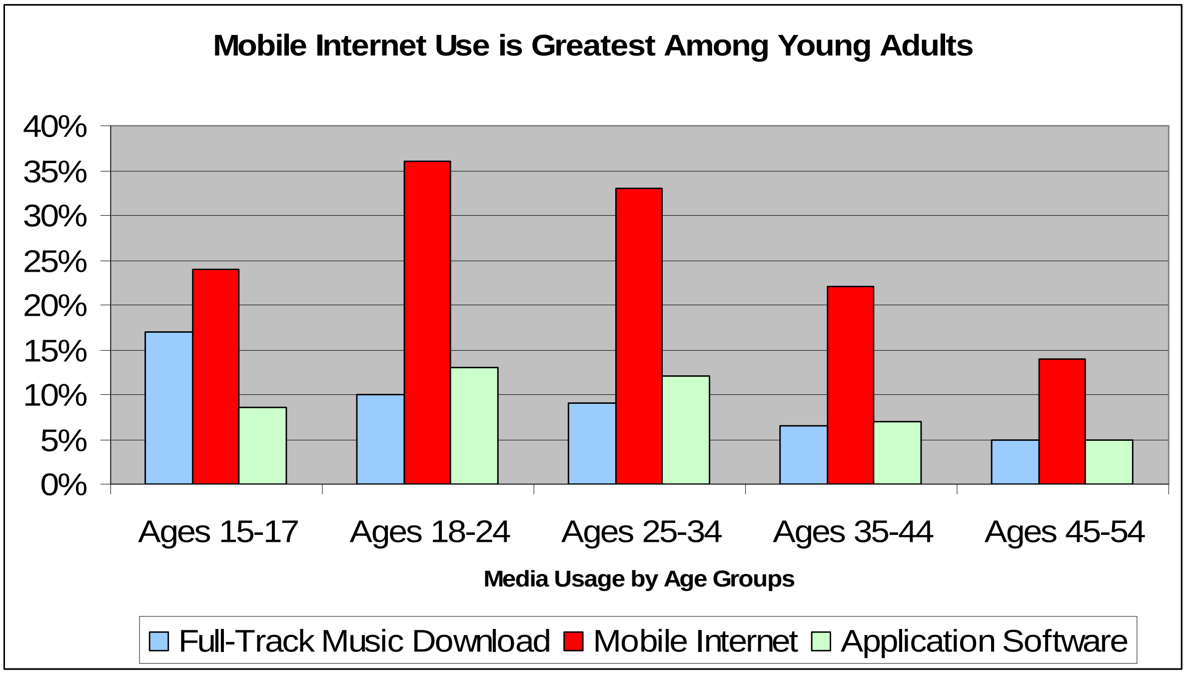


Similarly, the highest rates of mobile Internet use are for the age bands of 18-24 and 25-34 years, as shown in the following chart of Nielsen data:[44]

42 ComScore Inc., "Age Demographic Breakdown of U.S. Mobile Subscribers vs. Smartphone Subscribers" (November 1, 2010). Available at: http://www.comscoredatamine.com/2010/11/age-demographic-breakdown-of-u-s-mobile-subscribers-vs-smartphone-subscribers/ ComScore describes its on-going consumer panel methodology at http://www.comscore.com/About_comScore/Methodology.

43 Nielsen Company, "iPhone vs. Android" (June 4, 2010). Available at: http://blog.nielsen.com/nielsenwire/online_mobile/iphone-vs-android/

44 "Five-minute interview: Edward Kershaw, Vice President Mobile Media, EMEA, Nielsen Online" (January 9, 2011). Available at: http://mobithinking.com/interview-transcripts/five-minute-interview-edward-kershaw-nielsen



These demand trends can have important implications for LTE/4G deployment in the rural regions of Canada. For example, Bell Mobility states that its "wireless data traffic is growing in rural and remote areas as fast as it is in urban centres."[45] However, this statement is not supported by statistics showing that young adults – the age group most likely to demand data-intensive mobile services – make up a smaller percentage of the rural population compared to the urban population. According to Statistics Canada's report entitled "Urban and Rural Canada: the Difference is Young Adults":

> In all metropolitan areas combined, more than one person in three (35.7%) was between 20 and 44 years of age in 2006, a much higher proportion than in rural areas, where young adults made up only 27.7% of the population. The difference is primarily due to internal migration of young adults, who often leave rural areas in their late teens and early twenties to pursue their education or to find a job in urban areas.
>
> Rural areas also have a higher proportion of people aged 65 and over, and that proportion is growing faster than in urban areas. Between 2001 and 2006, the proportion of seniors increased by 1.1 percentage points to 15.5% in rural areas, compared with 0.7 percentage point to 13.3% in metropolitan areas.

While there are important social and economic policy reasons to promote access to LTE/4G services in Canada's rural regions, these demographic considerations suggest that LTE/4G-driven data demand growth in many rural areas (and the associated need for network capacity) may not increase as rapidly as in urban areas. In other words, there are relatively fewer individuals demanding network capacity in rural areas compared to urban areas. This factor, as

[45] Bell Mobility Comments, p. 8, ¶22.

well as the general low population density in rural areas, suggests that the need for spectrum capacity in rural areas is not the same as in urban areas.

In addition, forecasts made by incumbents about exploding demand do not take into consideration the pricing dimensions of these services.[46] A cogent example of this occurs in the Rysavy Report attached to Rogers' Comments.[47] The Report contains a description of a "spectrum demand model"[48] and lists over 20 input variables on which the spectrum demand model is based, including such variables as the number of subscribers, the number of cell sites, monthly data consumption for smartphones, growth rate for smartphone data, spectral efficiencies of various technologies, etc.[49] Notably absent from this list is the assumed pricing of those data services. The model does not take into account the impact of tiered pricing as a variable. The economic reality is that the ostensibly limitless rise in mobile data demand will eventually meet consumers' willingness to pay thresholds and reach equilibrium, as must occur in any well-functioning market. Any spectrum demand model that fails to take this into account suffers from a fundamental defect.

C. Deployment of Mobile Broadband by Incumbents is Not Impaired by Auction Cap

Ericsson, one of the leading vendors for mobile broadband, recently noted that networks that are in operation today are built for coverage rather than capacity.[50] Ericsson observed: "[t]he vast majority of radio sites use less than 5 percent of their capacity… and typically only 4 percent of radio sites are more than 50 percent utilized, even in the most developed mobile networks."[51] In Ericsson's opinion, the HSPA standard for mobile networks has more than enough capacity not only to handle the existing volumes of mobile broadband traffic, but also the most aggressive traffic forecasts.[52]

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46 The pricing data in the incumbents' comments is offered only in the context of competition issues (e.g., response to Industry Canada's Question 7-1).

47 Rysavy Report.

48 *Id.*, pp. 23-26.

49 *Id.*, pp. 24-25. The Report does not disclose publicly any of the values for the listed input variables, noting on p. 23 that "they represent the outcome of a considerable amount of research, and are considered proprietary." Obviously, any model is driven by its inputs, and without a disclosure of the inputs it is not possible to evaluate the merits of the model projections. Neither does the Rysavy Report provide publicly the results of the "spectrum demand model," i.e. estimates of the spectrum bandwidth required to meet growing demand. It only concludes that "the amount of spectrum that Rogers will require to meet escalating data demand depends on a number of factors including market trends such as fixed/mobile substitution and pricing" and "[t]here is a complex feedback loop from a modeling perspective between pricing and demand that the model simply cannot accurately anticipate." Instead of providing the estimates of Rogers' spectrum requirements, the public version of the Report only provides its generic projections of monthly data usage for smartphones and other mobile devices between 2010 and 2016. Rysavy Report, pp. 8-9, 14, 25-26.

50 Ericsson White Paper, "Capacity? HSPA Has Plenty" (July 2010), p. 3 ("Ericsson White Paper"). Available at http://www.ericsson.com/res/docs/whitepapers/hspa.pdf

51 *Id.*, p. 3.

52 *Id*.

HSPA networks are prevalent in Canada. In fact, the five largest providers (Bell, Rogers, TELUS, SaskTel and MTS) currently operate on a more advanced HSPA+ (evolved HSPA) standard.[53] As pointed out in a recent Lemay-Yates Associates Report,[54] no country besides Canada currently has three national HSPA+ mobile broadband networks with speeds up to 21 Mbps to the majority of their customers.

Data speeds in HSPA+ networks are comparable with data speeds in LTE networks. Simulations performed by Qualcomm showed that both HSPA+ and LTE offer similar performance – similar spectral efficiency, peak data speeds and round-trip-time latency – when using the same antenna configuration and spectrum bandwidth.[55]

There are a number of techniques operators can use, individually or in combination, to improve overall capacity utilization and deliver higher data rates from existing radio spectrum. MIMO (which stands for "multiple input multiple output" and is a technology that uses multiple paths and multiple antennas to transmit and receive wireless signals) is one way to increase data throughput and signal range without additional bandwidth.[56] Signal modulation schemes, such as 64QAM (Quadrature Amplitude Modulation with 64-point grid) is another technique. It became available in HSPA+ (which is HSPA Release 7).[57] These and other enhancements increased the speeds in HSPA+ networks up to 28 Mbps downlink.[58] Rogers was the first mobile operator in North America to commercially launch HSPA+ at 21 Mbps (in July 2009), more than doubling the speeds of its HSPA network.[59]

HSPA Release 8 (published in March 2009) included a capability of simultaneous use of 64QAM in downlink and MIMO.[60] Another method, which became available in HSPA Release

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53 4G Americas, "4G Mobile Broadband Evolution: 3GPP Release 10 and Beyond" (February 2011) ("4G Americas February 2011 Paper"), p. 185. MTS launched its HSPA+ network on March 31, 2011. "MTS Launches HSPA+ Network on March 31" (February 7, 2011). Available at: http://news.softpedia.com/news/MTS-Launches-HSPA-Network-on-March-31-182913.shtml . *See also*, MTS News Room, "Manitoba's new high-speed 4G wireless network" (March 31, 2011). Available at: http://www.mts.ca/portal/site/mts/menuitem.0290497802902f369e5e921031248a0c/?vgnextoid=beba250301c0f210VgnVCM1000002a040f0aRCRD&vgnextchannel=ed7c8dca20041110VgnVCM1000001342a8c0RCRD

54 Lemay-Yates, Associates Inc., "The Impact of 700 MHz Spectrum on LTE Deployment and Broadband in Canada" (February 28, 2011), pp. 57-58 (attached to Rogers' Comments).

55 Qualcomm, "How to Meet Spectrum Demand" (February 2011), p. 9. Available at: http://www.qualcomm.com/documents/how-meet-data-demand

56 Sharony, Dr. Jacob. "Introduction to Wireless MIMO – Theory and Applications" (November 15, 2006) Available at: http://www.ieee.li/pdf/viewgraphs/wireless_mimo.pdf . *See also*, Bergman, Johan and Dirk Gerstenberger, Fredrik Gunnarsson and Stefan Ström (Bergman *et al.*). Ericsson Review, "Continued HSPA Evolution Of Mobile Broadband" (2009), Issue 1, p 9. Available at http://www.ericsson.com/ericsson/corpinfo/publications/review/2009_01/files/HSPA.pdf

57 *See, e.g.,* Rysavy Research, "Transition to 4G. 3GPP Broadband Evolution to IMT Advanced." (September 2010), p. 20.

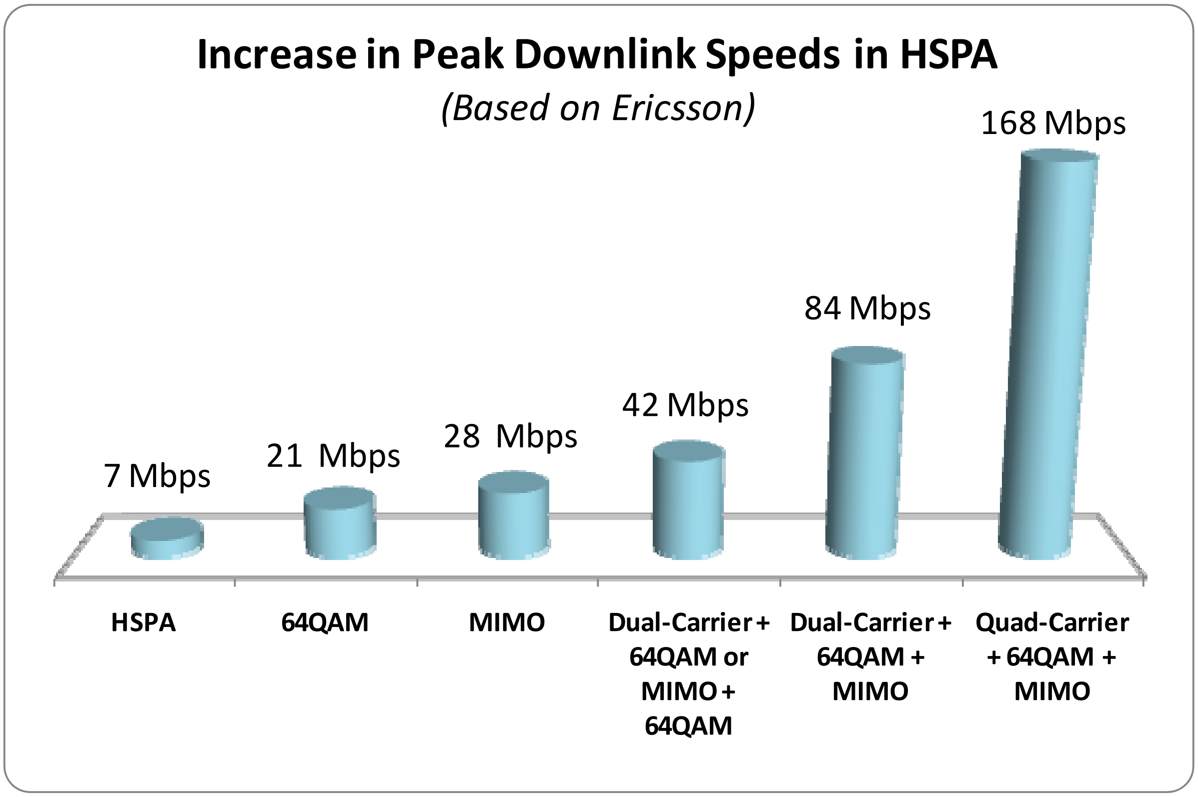
58 Bergman *et al*, Issue 1, p 7.

59 4G Americas February 2011 Paper, p. 15.

60 *Id.*, p. 9. *See also,* Rysavy Research, "Transition to 4G. 3GPP Broadband Evolution to IMT Advanced" (September 2010), p. 20.

8 is the use of dual carriers (referred to as dual-carrier or dual-cell), meaning that two 5MHz radio channels are combined to double the speeds. HSPA Release 9 (completed in March 2010) introduced the capability of downlink dual-cell deployments across non-contiguous frequency bands and the support of simultaneous MIMO and dual-cell operation.[61] For example, it is possible to combine two 5 MHz carriers from different frequency bands, such as one carrier on 2100 MHz and another on 900 MHz. Release 10 (under development)[62] extends this concept further, allowing the aggregation of up to four carriers from two separate frequency bands, such as carriers from bands 1900 MHz and 800 MHz in North America.[63]

Downlink speeds achievable using the above discussed enhancements are captured in the following chart based on Ericsson:[64]



[61] 4G Americas February 2011 Paper, p. 11.

[62] 3rd Generation Partnership Project (3GPP) website. Available at: http://www.3gpp.org/Release-10

[63] 4G Americas February 2011 Paper, pp. 63 and 65. *See also*, Nokia Siemens Networks White Paper, "Long Term HSPA Evolution Mobile Broadband Evolution Beyond 3GPP Release 10" (2010), p. 3.

[64] Ericsson White Paper, p. 8.

Ericsson demonstrated the downlink speed of 168 Mbps in HSPA+ using a prototype consumer device and commercial network equipment in January 2011.[65] At the same time, Ericsson also demonstrated that speeds of 42Mbps can be achieved by using a single carrier.[66] There is clearly significant room for improvement in spectrum utilization because HSPA operators today achieve slower speeds (42Mbps) using twice as much spectrum relative to the speeds and spectrum utilization that were shown to be achievable in Ericsson's demonstration.

As discussed above, one of the methods of increasing speeds in HSPA networks is the use of multiple carriers, including the commercially available dual-carrier. Because the dominant wireless providers in Canada own very large "chunks" of spectrum compared to new players or U.S. providers,[67] they are well positioned to use this method of increasing speeds. Incidentally, Bell and TELUS announced plans to deploy dual-carrier HSPA in the second part of 2010, ahead of the U.S. HSPA providers AT&T and T-Mobile.[68]

D. Additional Measures To Address Mobile Broadband Capacity Exist

The above discussion of the evolution of HSPA illustrates the continuity of technology improvements. These improvements have been increasing spectral efficiency (throughput per unit of spectrum), as illustrated by the following chart (based on a chart in a recent 4G Americas' Report[69]).

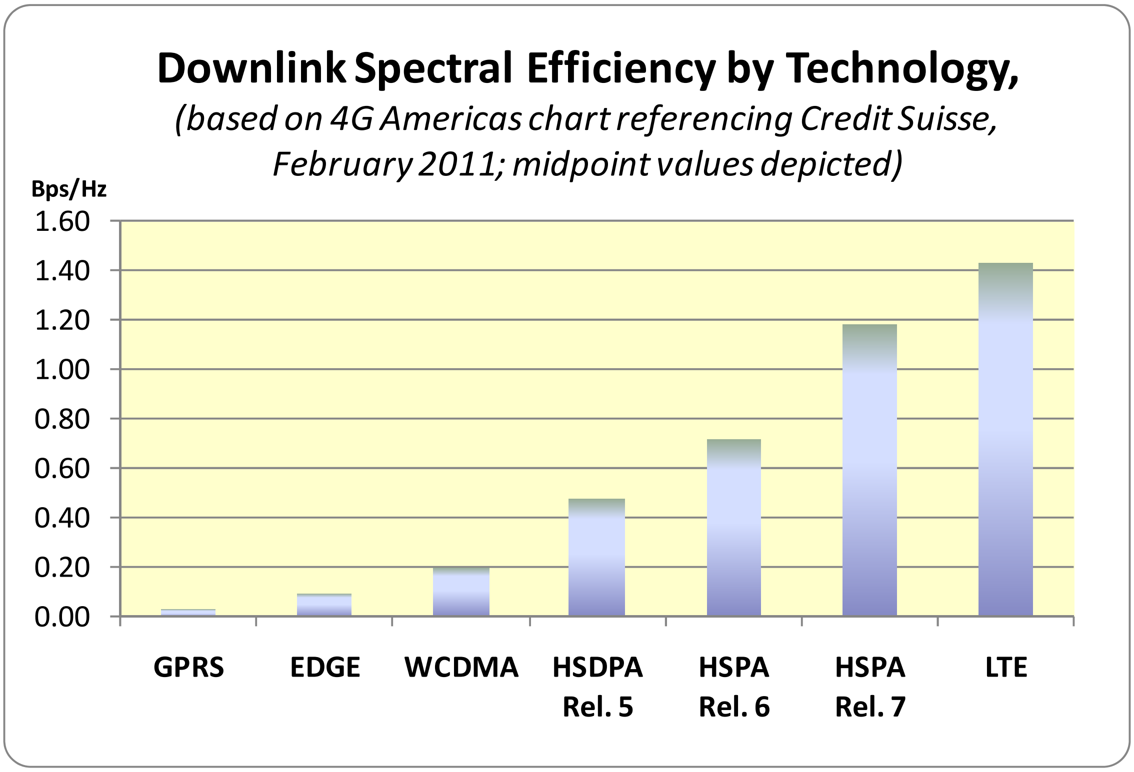
65 Ricknäs, Mikael. *PC World*, "Ericsson Demonstrates HSPA at 168 Mbps" (January 30, 2011). Available at: http://www.pcworld.com/businesscenter/article/218257/ericsson_demonstrates_hspa_at_168m_bps.html

66 *Id.*

67 Videotron Comments, p. 11 and Shaw Comments, p. 8.

68 Nguyen, Hubert. "Dual-cell HSPA networks deployed in Canada: why are they cool?" (August 4, 2010). Available at: http://www.ubergizmo.com/2010/08/dual-cell-hspa-networks-deployed-in-canada-why-are-they-cool/ *See also,* Bell Canada, "Bell doubling data speeds on world-leading HSPA+ wireless network" (November 18, 2010). Available at : http://www.bce.ca/en/news/releases/bm/2010/11/18/76761.html?feedt=rss&feeds=News+Release&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+BCE-NewsRelease_rss+%28BCE.ca+-+Prod+-+EN+-+RSS+-+Ne T-Mobile announced deployment of dual-cell carriers in March 2011. *See,* "T-Mobile Makes America's Largest 4G Network Even Faster by Lighting Up 42 Mbps Speed in Las Vegas, New York and Orlando" (March 24, 2011). Available at: http://www.fierceiptv.com/press-releases/t-mobile-makes-americas-largest-4g-network-even-faster-lighting-42-mbps-spe

69 4G Americas, "Sustaining the Mobile Miracle. A 4G Americas Blueprint for Securing Mobile Broadband Spectrum in this Decade" (March 2011), ("4G Americas March 2011 Report") p. 23.



Another method of increasing capacity in mobile networks is cell densification – building additional (infill) cell sites within the existing network area. While traditionally this method of expanding network capacity is considered capital-intensive, recent developments in lightweight radios may reduce capital and operating cost requirements of cell densifications significantly. Earlier this year, Alcatel-Lucent, followed by Ericsson, introduced their versions of lightweight radios: lightRadio™ by Alcatel-Lucent[70] and AIR by Ericsson.[71] Alcatel-Lucent describes its lightRadio™ as "a groundbreaking antenna, capable of 2G, 3G, and 4G, small enough to fit in your hand, that promises to radically streamline and simplify mobile networks."[72]

70 Alcatel-Lucent, "LightRadio: Evolve your wireless broadband network for the new generation of application and users." ("Alcatel-Lucent lightRadio web site") Available at :http://www.alcatel-lucent.com/features/light_radio/index.html

71 Ricknäs, Mikael. *PC World*, "Ericsson Airs Smaller Mobile Base Stations" (February 8, 2011). Available at: http://www.pcworld.com/businesscenter/article/219053/ericsson_airs_smaller_mobile_base_stations.html

72 Comments of Alcatel-Lucent, Gazette Notice No. SMSE-018-10 (February 28, 2011), p. 2.

Picture. Alcatel-Lucent's lightRadio™ Cube[73]

Below are some excerpts from the description of lightRadio™ on Alcatel-Lucent's web site:[74]

> a new architecture where the base station, typically located at the base of each cell tower, is broken into its component elements and distributed through the network or 'carrier cloud.' Additionally the various cell tower antennas are combined and shrunk into a single powerful, Bell Labs-pioneered multi frequency, multi standard (2G, 3G, LTE) device that can be mounted on poles, sides of buildings or anywhere else there is power and a broadband connection.
>
> **Addresses digital divide:** By reducing the cell site to just the antenna and leveraging future advances in microwave backhaul and compression techniques, this technology will eventually enable the easy creation of broadband coverage virtually anywhere there is power (electricity, sun, wind) by using microwave to connect back to the network.

According to Alcatel-Lucent,[75] lightRadio™ can simultaneously support 2G, 3G and LTE networks and various spectrum bands (as opposed to present day mobile radio systems that require separate remote radio heads for each band). It reduces total cost of network ownership (capital and operating cost) up to 50% and can be used in various situations, including small cells and replacement for macrocells.

In March 2011, Nokia Siemens introduced Liquid Radio,[76] which it calls an "intelligent radio."[77] According to Nokia Siemens, Liquid Radio "adapts the capacity and coverage of networks to

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73 Alcatel-Lucent lightRadio web site.

74 *Id.*

75 *Id.*

76 Ramsay, Maisie. *Wireless Week*, "Nokia Siemens Counters ALU with Liquid Radio Tech" (March 21, 2011). Available at: http://www.wirelessweek.com/News/2011/03/Technologies-Nokia-Siemens-ALU-Liquid-Radio-Tech-Wireless-Networks/

77 Nokia Siemens Networks, "Nokia Siemens Networks Liquid Radio." Available at: http://www.nokiasiemensnetworks.com/sites/default/files/document/Nokia_Siemens_Networks_Liquid_Radio_Executive_Summary_lore_17-03-11.pdf

match this fluctuating user demand."[78] Below are additional excerpts from Nokia Siemens description of the Liquid Radio technology:

> Nokia Siemens Networks Liquid Radio architecture removes the highly structured constraints of traditional mobile broadband networks. This allows the 'ebb and flow' of network traffic to be addressed as users move across the network. The result is a network that operates fluidly to meet waves of demand that change constantly with location and time.
>
> Baseband pooling centralizes the digital signal processing typically done at base station sites and shares it with several sites to ensure that capacity is dynamically used where needed. This enables the network to always match the actual capacity needs of end users as they change during the day or over longer periods...
>
> The Nokia Siemens Networks Flexi Multiradio Antenna System introduces a new way of providing highly targeted additional capacity with beamforming. Beamforming allows coverage to be directed exactly where it is needed in concert with the other layers of coverage from macro, pico and micro site configurations. It is an effective tool for providing liquid capacity – capacity exactly where users need it. In addition, Flexi Multiradio Antenna System can be combined with baseband pooling, further increasing the efficiency of network and spectrum assets.[79]

Cell densification increases total capacity of the network, just like an addition of new bandwidth. According to Ericsson, both methods of increasing capacity have similar effects on downlink capacity, but cell densification is a better method of increasing uplink capacity.[80] For example, in HSPA networks, doubling the spectrum from 10 MHz to 20 MHz roughly doubles downlink capacity, but barely increases uplink capacity because of power limitation.[81] Increasing inter-site distance from 425 meters to 300 meters similarly doubles downlink capacity, but the uplink capacity is more than doubled.[82]

Cell densification comes in several forms. The example of cell densification discussed above is a situation where new "regular" sites (macrocells) are added. Recently, many operators have begun to deploy low power nodes, such as femtocells, picocells and microcells, to serve various hotspots and coverage holes (including indoor, home or enterprise coverage). Femtocells are very low power small cellular base stations that are typically deployed in residential or enterprise settings (typically covering less than 50 meters). Femtocells are typically sold to end-users and

78 Nokia Siemens Liquid Radio product description. Available at: http://www.nokiasiemensnetworks.com/pt/portfolio/products/mobile-broadband/liquid-radio

79 *Id.*

80 Landström, Sara and Anders Furuskär, Klas Johansson, Laetitia Falconetti and Fredric Kronestedt. Ericsson Review, "Heterogeneous networks – increasing cellular capacity" (2011), Issue 1 ("Landström *et al*."). Available at http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2011/heterogeneous_networks.pdf

81 *Id.*

82 *Id.*

utilize the end-user broadband connection to serve end user-specified mobile phone numbers.[83] Picocells are essentially higher power femtocells, typically deployed indoors for larger businesses or public access at shopping malls (typically covering less than 200 meters). Microcells typically have much lower power than macrocells but higher power than picocells (typically covering about 1 km), which can be used for providing either indoor coverage or for filling holes in macrocell coverage.[84]

Low-power cells are deployed to increase coverage and/or capacity. To continue Ericsson's example discussed above, [85] deploying 12 picocells has approximately the same doubling effect on downlink capacity as increasing spectrum from 10 MHz to 20 MHz or macro cell densification (an increase of inter-site distance from 425 meters to 300 meters). However, picocells have a significantly more profound effect on uplink capacity than the increase of spectrum or even macro cell densification. Another study by NEC Europe[86] found that LTE picocells are able to deliver 200 times the traffic density of LTE macrocells.

Complementing macro cells with low-power pico cells is a particularly attractive approach for areas where users are highly clustered.[87] This strategy of deploying two or more overlaying cell layers is referred to as heterogeneous deployment or heterogeneous networks ("hetnets") and depicted in the following chart by Ericsson:

83 Some QSI consultants have femtocells that significantly increase wireless capabilities in their offices.

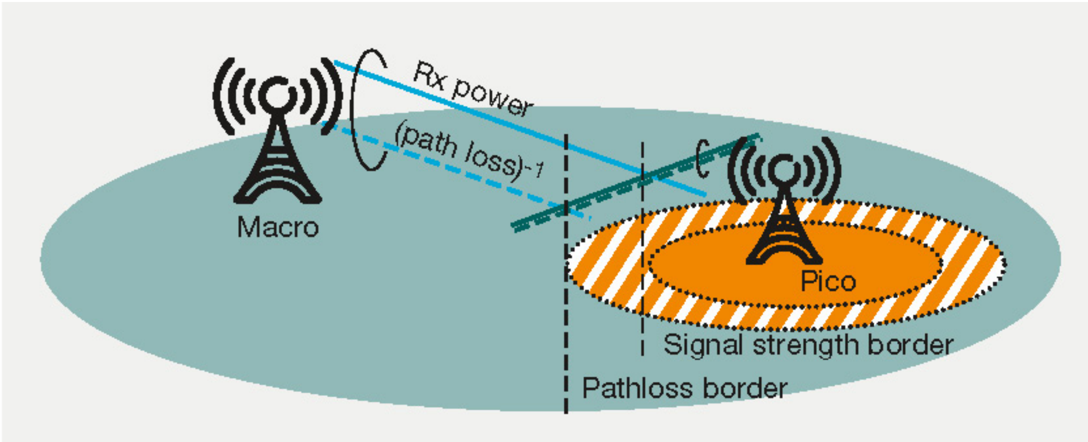
84 The descriptions of femto, pico and microcells are based on 4G Americas, "4G Mobile Broadband Evolution: 3GPP Release 10 and Beyond" (February 2011), p. 40. In the U.S., AT&T's brand 3G MicroCell™ meets the definition of a femtocell.

85 Landström *et al.*

86 Femtoforum, "Femtocells – A Natural Solution to Offload" (June 2010), p. 3. Available at: http://www.3gamericas.org/documents/016+Femtocells+Natural+Solution+for+Offload%5B1%5D.pdf . This report references a Simulation Study to Examine Various Deployment Scenarios for LTE by Dr. Hamid Falaki, Sr. Product Manager, LTE/SAE Strategy & Solution, NEC Europe.

87 Parkvall, Stefan and Anders Furuskär and Erik Dahlman. Ericsson Review, "Next Generation LTE, LTE-Advanced" (2010), Issue 2, p. 24. ("Parkvall *et al.*") Available at http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2010/Ericsson-Review-2010-2.pdf

Chart. Heterogeneous Deployment with a Macro Cell Overlaying Multiple Pico Cells:[88]



Heterogeneous deployments are possible with LTE Rel-8 and Rel-9, and LTE Rel-10 provides additional features that improve the support for this type of deployment.

Cell densification (whether it relates to building a new macro site or deploying femtocells, which require femtocell-related core network infrastructure such as femtocells gateways) requires capital investment. Accordingly, this method of expanding network capacity works better for large wireless companies that enjoy scale economies and can spread costs over a large number of subscribers.

The number of providers offering femtocells is growing fast. According to Informa Telecom & Media's "Femtocell Market Status" report,[89] as of February 2011, nineteen operators in 13 countries have commercially deployed femtocells (up from nine operators in 2009), including three U.S. operators (Sprint, Verizon and AT&T) and no Canadian operators.[90]

According to a recent 4G Americas report, "[t]he trend toward more and more cells with diminishing cell radii is forecast to continue in the near term."[91]

An operator may deploy femtocells to extremely heavy users in order to reduce the load on the macro-cellular network. In other cases, femtocells can be used in an area with poor cellular signal to improve coverage. The idea behind femtocells is that they increase coverage or/and performance by offloading mobile traffic to the end-user broadband wireline connection, which serves as wireless backhaul. More generally, traffic offload can happen not only via a femtocell,

88 Reproduced from Parkvall *et al*., p. 24, Figure 2.

89 Informa Telecom & Media's Femtocell Market Status Report, Issue 6 (February 2011), p. 8. Available at: http://www.femtoforum.org/femto/pdfs01.php

90 Rogers offers a somewhat related service called Talkspot, which works only on a limited number of mobile devices. Rogers markets Talkspot as a replacement for wireline service and a way to make and receive unlimited calls without using wireless minutes, rather than a method of increasing capacity and coverage. *See*, https://www.rogers.com/web/content/wireless-products/talkspot

91 4G Americas March 2011 Report, p. 25.

but also a Wi-Fi router, with the latter approach requiring a handset with Wi-Fi connectivity (often present in smartphones). In both cases, a device other than the macrocell site carries mobile traffic over an alternative network to the mobile operator or another Internet destination.

Traffic offloading is a natural strategy when dealing with mobile data traffic because a large portion of mobile data usage takes place indoors in areas where wireline broadband is often available. For example, as discussed above, a recent Cisco's survey found that out of total time spent on mobile usage, 40% of time is spent at home, 35% "on the move," and the remaining 25% of mobile Internet use occurs at work.[92] In addition, mobile broadband traffic "on the move" often takes place in areas such as airports and downtown locations that already have Wi-Fi hot spots. As noted by an AT&T executive, "Wi-Fi provides critical coverage and capacity where most needed."[93] According to industry analysts, AT&T is continually expanding its Wi-Fi network and building a dedicated Wi-Fi network as a capacity relief valve for its mobile broadband network.[94]

Another reason why traffic offloading is a "natural" strategy for mobile data usage is that indoor traffic demands greater radio resources from the macro-cellular network than outdoor traffic because the signal must penetrate walls to reach the indoor subscriber. Therefore, the benefit to the macro network goes beyond the sheer fact that traffic is offloaded because those subscribers whose data is offloaded are all sitting behind radio-wave absorbing walls.[95]

Cisco has estimated the amount of smartphone traffic that potentially can be offloaded through dual-mode devices or femtocells for different countries. Cisco's offload factor for each country is a combination of smartphone penetration, the share of smartphones of Wi-Fi mode, percentage of home-based mobile Internet use, and percentage of dual-mode smartphone owners with Wi-Fi fixed Internet access at home. Cisco's estimates for Canada are presented in the following chart.[96]

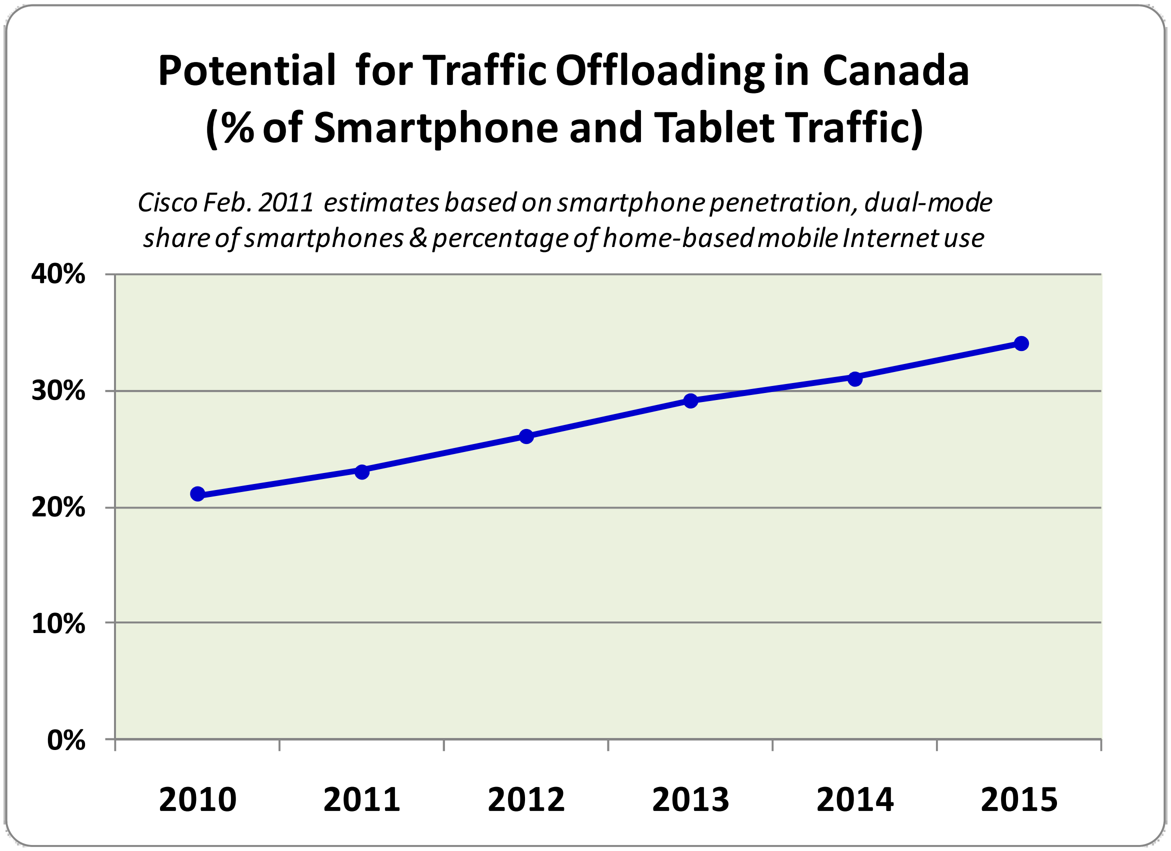
[92] Cisco White Paper, p. 10.

[93] PrepaidMVNO, "As Mobile Data Demand Spikes, Can Wi-Fi Come to 3G's Rescue?" (September 30, 2010). Available at: http://www.prepaidmvno.com/2010/09/30/as-mobile-data-demand-spikes-can-wi-fi-come-to-3g%E2%80%99s-rescue/ This report cites to Dennis Whiteside, assistant Vice President for AT&T Wi-Fi service.

[94] *Id.*

[95] Femtoforum, "Femtocells – A Natural Solution to Offload" (June 2010), p. 12. Available at: http://www.3gamericas.org/documents/016+Femtocells+Natural+Solution+for+Offload%5B1%5D.pdf

[96] Cisco White Paper, Table 7, p. 11.



As shown, Cisco estimates that the current potential for traffic offloading in Canada is 23% of smartphone and tablet traffic (for 2011), increasing to 34% by 2015. The latter figure is greater than the corresponding estimates for the U.S. (30%) and Japan (28%).[97] It appears that actual rates of traffic offloading are uneven among various operators. For example, in the U.S., AT&T, which owns thousands of Wi-Fi hot spots nationwide, has been aggressively pursuing a Wi-Fi offloading strategy. AT&T smartphones come with auto-authentication at AT&T Wi-Fi hot spots, and Wi-Fi usage is not counted towards total smartphone usage. In contrast, Verizon and Sprint do not have similar marketing and pricing plans that encourage Wi-Fi offloading.[98] In Canada, Rogers launched Canada's first special pricing plan designed to encourage Wi-Fi offloading for business customers in March 2011.[99] The plan is called "Wi-Fi Calling for

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97 *Id.*

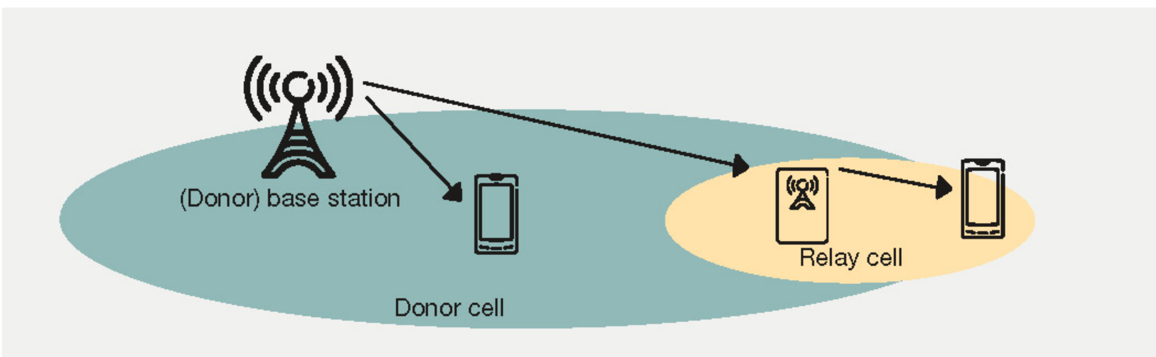
98 Luna, Lynnette. "Wi-Fi Offload for Mobile Networks: 20% of Traffic and Counting" (February 25, 2011). Available at: http://www.fiercebroadbandwireless.com/special-reports/wi-fi-offload-mobile-networks-20-traffic-and-counting

99 Rogers New Release, "Mar 11, 2011 - Rogers launches Canada's First Wi-Fi Smartphone Service for Business." Available at: http://www.rogers.com/web/Rogers.portal?_nfpb=true&_windowLabel=investor_1_1&investor_1_1_actionOverride=%2Fportlets%2Fconsumer%2Finvestor%2FshowNewsDetail&investor_1_1yearInSelection=2011&investor_1_1BusiUnit=RCI&investor_1_1NewsID=1903118235&investor_1_1selectedPageIndex=0&investor_1_1fromNewReleasePage=RCI&_pageLabel=IR_LANDING

Business" and allows business customers to place mobile calls from their smartphones over Wi-Fi networks registered on their devices. With the $10 per month add-on, customers can make calls over the Wi-Fi network that do not count towards monthly voice plan minutes. Rogers also currently offers Wi-Fi calling for residential customers for a fee.[100] Yet, in the U.S. T- Mobile has been offering a similar service without additional fees[101] since 2007, and currently its subscribers place around 40 million calls per month over Wi-Fi.[102]

Another enhancement related to the notion of heterogeneous networks is the use of relay nodes, which are supported in LTE.[103] Like femto and other low powered cells, relay nodes are placed at problematic locations (such as indoor environments) to improve coverage. The difference between relay nodes and femtocells is that relay nodes are connected to the network (the donor cell) wirelessly using the LTE radio interface technology, rather than via an Internet wireline connection. Relay nodes enable the deployment of small cells at locations where conventional wireline or microwave backhaul is not possible or commercially viable. Relaying is depicted in the following diagram by Ericsson:

<u>Chart. Relaying</u>:[104]



Yet another means of capacity enhancement involves increased cell-site sectorization. A typical cell site is composed of three sectors (directions). Increasing the number of sectors to six almost doubles the capacity: equipment manufacturer trials showed that this method increases capacity

[100] Rogers Calling Services description. Available at: http://www.rogers.com/web/content/add-ons/callingservices?tab1_content&submenu5

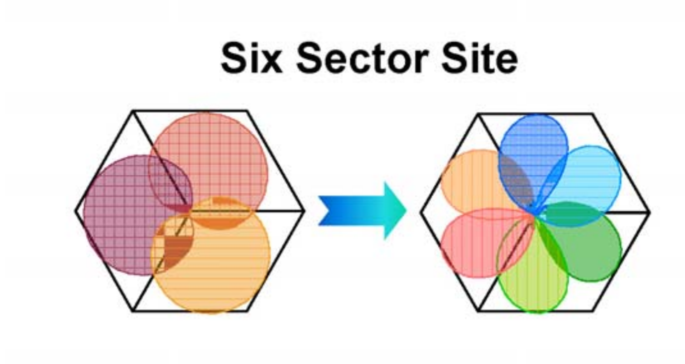
[101] T-Mobile Wi-Fi Calling FAQs. Available at: http://support.t-mobile.com/doc/tm24195.xml

[102] Dano, Mike. "T-Mobile USA offloads 5M Wi-Fi callers" (February 16, 2011). Available at: http://www.fiercewireless.com/story/t-mobile-usa-offloads-5m-wi-fi-callers/2011-02-16#ixzz1IIcUXk2T

[103] Parkvall *et al.*, pp. 25-26. *See also,* Nokia Siemens Networks Technical White Paper, "LTE-Advanced. The advanced LTE Toolbox for More Efficient Delivery of Better User Experience" (2011) ("Nokia Siemens LTE White Paper"), p. 10. Available at http://www.nokiasiemensnetworks.com/portfolio/products/mobile-broadband/long-term-evolution-lte

[104] Reproduced from Parkvall *et al.*, p. 26, Figure 3.

by 80% and also increases in-building penetration.[105] The following diagram[106] illustrates this technology:



This method of increasing capacity is commercially available and is being used in dense areas. For example, South Korea's biggest mobile operator, SK Telecom, announced last summer that in preparation for its unlimited data offering, the company is increasing its network capacity by using a combination of the six-sector approach, femtocells and Wi-Fi offloading.[107] As noted in the recent SeaBoard report,[108] Canadian incumbents use predominantly three-sector antennas.

Another recent enhancement that improves spectral efficiency and coverage is a set of optimizing technologies referred to as Self Organizing Networks (SON),[109] which were introduced as part of the 3GPP LTE standard. These technologies dynamically optimize radio network performance during operation, such as optimization of handovers and capacity-based optimization in situations of traffic congestion. For example, SON can change an antenna tilt to improve coverage or distribute bandwidth equitably among users and minimize overloads that deprive each user of bandwidth.[110] Similarly, when one cell is overloaded, SON can hand over users at the cell's edge to a neighboring cell.[111]

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[105] Linehan, Kevin. 4G Americas, "Smart Antennas and SON," presentation at 4GWorld, Chicago (October 18-21, 2010) ("Smart Antennas and SON"). Available at: http://www.3gamericas.org/UserFiles/file/4G%20Americas%20at%204G%20World/Kevin%20Linehan,%20Andrew,%20Smart%20Antennas%20and%20SON.pdf

[106] Reproduced from "Smart Antennas and SON," p. 5.

[107] Ji-hyun, Cho. *The Korean Herald*, "SKT Ups Ante in Network Competition" (August 19, 2010). Available at: http://www.koreaherald.com/national/Detail.jsp?newsMLId=20100819000804

[108] SeaBoard Report, p. 15.

[109] Nokia Siemens LTE White Paper, pp. 12 and 14.

[110] Nokia Siemens Networks White Paper, "Self-Organizing Network (SON) Introducing the Nokia Siemens Networks SON Suite – an efficient, future-proof platform for SON" (2009) ("Nokia Siemens SON White Paper"), p. 10. Available at http://www.nokiasiemensnetworks.com/portfolio/products/self-organizing-networks-suite/son-suite

[111] Nokia Siemens SON White Paper, p. 10.

E. LTE Deployment is not Limited to 700 MHz Spectrum

Long Term Evolution or "LTE" is the latest standard in mobile technology that provides downlink peak rates of at least 100 Mbps and uplink speeds of at least 50 Mbps. It is an all-IP technology that is characterized by better performance (higher radio network efficiency, lower latency) than current technologies.[112] Industry analysts estimate that the cost per megabyte for LTE services will be 83% lower than Wideband Code Division Multiple Access (W-CDMA) and 66% lower than High-Speed Downlink Packet Access (HSDPA).[113]

Because LTE is operationally more efficient than current technologies, industry experts view it as a technology to which all networks would migrate. For example, Ovum forecasts that "[b]y 2020, LTE is expected to be the dominant mobile technology…"[114] Rogers states that it, "is using all of its available mobile spectrum to implement Long Term Evolution (LTE) technology in Canada's top markets."[115] Alcatel-Lucent notes that "LTE [is] deployable in any of the "3GPP" [3rd Generation Mobile System] bands,…(and more)," including the 800 MHz (the cellular band), 1800 MHz, 1900 MHz (PCS), and 1700/2100 MHz (AWS) bands.[116] A recent 4G Americas Report notes that "over 30 frequency bands are supported in the standards for LTE[.]"[117] Industry analysts also predict that while initial deployments of LTE would happen in the more recently licensed (and therefore, often unused) bands such as the North American bands 700 MHz and AWS, eventually other bands will be re-farmed to LTE such as the cellular and PCS bands.[118]

A U.S. provider, MetroPCS, was the first North American operator to launch an LTE network in September 2010 (in Las Vegas, Nevada), and this launch was based on AWS spectrum.[119] According to Tom Keys, chief operating officer for MetroPCS, the provider will manage its spectrum on a market-by-market basis, deploying both in the PCS and AWS bands.[120] The only other U.S. provider that has launched LTE in the U.S., Verizon, deployed it in the 700 MHz band. The third U.S. operator expected to launch LTE in 2011, AT&T, is deploying LTE over

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112 Motorola Technical White Paper, "Long Term Evolution (LTE): A Technical Overview," p. 3. Available at http://www.motorola.com/web/Business/Solutions/Industry%20Solutions/Service%20Providers/Wireless%20Operators/LTE/_Document/Static%20Files/6834_MotDoc_New.pdf

113 UMTS Forum Report 42, Ovum, "LTE Mobile Broadband Ecosystem: the Global Opportunity" (May 2009), p. 2, referencing report published by the UMTS Forum "Global Mobile Broadband: Market potential for 3G LTE."

114 *Id.*, p. 5.

115 Rogers Comments, p. 3.

116 Palamara, Maria E. Alcatel-Lucent, "Realizing LTE: Understanding the Challenges and Planning for LTE Introduction" (January 2009), p. 11.

117 4G Americas March 2011 Report, p. 33.

118 Palamara, Maria E. Alcatel-Lucent, "Realizing LTE: Understanding the Challenges and Planning for LTE Introduction" (January 2009), p. 11. *See also,* Nokia Siemens LTE White Paper, p. 10.

119 Fitchard, Kevin. "LTE launches in the U.S. — MetroPCS Style" (September 21, 2010). Available at: http://connectedplanetonline.com/3g4g/news/metropcs-launches-lte-092110/index.html

120 *Id.*

700 MHz and the AWS bands.[121] One of the themes in AT&T's recent announcement about purchasing T-Mobile was the ability to free T-Mobile's AWS spectrum for LTE offerings.[122] In Canada, Rogers announced LTE trials in October 2010 based on the AWS band.[123] Notably, Canadian incumbents currently hold 95% of the 800 MHz spectrum as well as unused AWS spectrum, and have the option of deploying LTE over these spectrum bands.

Further, as discussed above, one of the newest advancements in mobile broadband technologies (HSPA and LTE) is the capability to aggregate carriers (spectrum) from different spectrum bands, including non-contiguous bands. Aggregation from non-contiguous "pipes" results in the creation of a "virtual pipe" that allows speeds not achievable with smaller bandwidths. For example, in February 2011, Nokia Siemens Networks conducted the world's first successful demonstration of LTE-Advanced carrier aggregation on commercial equipment – the company's Flexi Multiradio Base Station – using a combination of 800 MHz and 2.6 GHz bands.[124] The capability of aggregating various bands to produce bigger (and faster) broadband pipes favors the dominant wireless providers, which hold large amounts of spectrum in cellular, PCS, AWS and BRS bands. As a hypothetical example, under the auction cap proposal, Rogers (a 800 MHz license holder in each service area) may obtain in a given service area up to 10MHz of spectrum in the 700 MHz band. However, Rogers owns at least 125 MHz of spectrum in each market, including 20 MHz of unused AWS spectrum. Therefore, by utilizing the multi-carrier aggregation technology, Rogers can aggregate its 700 MHz and other spectrum holdings to offer very high speed LTE over a bandwidth of 20, 30 or 40 MHz, and still have 75 to 95 MHz bandwidth to offer non-LTE services. Because under the multi-carrier technology more spectrum translates into higher speeds, a large player like Rogers can always match or exceed mobile broadband speeds that a smaller player can achieve.

The incumbents have expressed skepticism that a Canadian provider can offer LTE over spectrum bands other than those used by the big U.S. providers out of fear that vendors would

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121 Fitchard, Kevin. "MWC: NSN mixing and maxing LTE frequencies" (February 9, 2011). Available at: http://connectedplanetonline.com/3g4g/news/MWC-NSN-mixing-and-maxing-LTE-frequencies-0209/index.html *See also*, Lawson, Stephen. "AT&T's T-Mobile Deal Shows Importance of Spectrum" (March 21, 2011). Available at: http://www.cio.com/article/677703/AT_T_s_T_Mobile_Deal_Shows_Importance_of_Spectrum?page=2&taxonomyId=3061

122 Lawson, Stephen. "AT&T's T-Mobile Deal Shows Importance of Spectrum" (March 21, 2011). Available at: http://www.cio.com/article/677703/AT_T_s_T_Mobile_Deal_Shows_Importance_of_Spectrum?page=2&taxonomyId=3061 *See also*, AT&T Presentation, dated March 21, 2011. Available at: http://www.att.com/Common/about_us/pdf/INV_PRES_3-21-11_FINAL.pdf

123 Rogers News Release, dated, October 6, 2010, "Rogers Announces First LTE Technical Trial In Canada." Available at: http://www.rogers.com/web/Rogers.portal?_nfpb=true&_windowLabel=investor_1_1&investor_1_1_actionOverride=%2Fportlets%2Fconsumer%2Finvestor%2FshowNewsDetail&investor_1_1yearInSelection=2010&investor_1_1BusiUnit=Wireless&investor_1_1NewsID=1810068753&investor_1_1selectedPageIndex=0&investor_1_1fromNewReleasePage=Wireless&_pageLabel=IR_LANDING

124 Nokia Siemens Networks Press Release, "LTE-Advanced 'carrier aggregation' on commercial equipment a world first #MWC11" (February 9, 2011). Available at: http://www.nokiasiemensnetworks.com/news-events/press-room/press-releases/lte-advanced-carrier-aggregation-on-commercial-equipment-a-wor

decline to provide an adequate ecosystem for the dominant wireless providers in Canada.[125] The example of the U.S. provider MetroPCS suggests that these fears are exaggerated. MetroPCS, a provider of approximately the same size as TELUS,[126] managed to secure equipment vendors and device manufacturers for its LTE network. Similarly, in the recent past, MetroPCS and another U.S. operator, Leap Wireless, persuaded major vendors to build them CDMA equipment in the AWS spectrum that these two providers acquired in 2006.[127] At the time, MetroPCS had less than 3 million subscribers, and Leap Wireless had slightly over 2 million subscribers, meaning that both operators were smaller than the Canadian incumbents today.[128] Besides company size, another factor that makes the task of securing vendors easier for the Canadian incumbents compared to the case of MetroPCS and Leap Wireless is the expected revenue: LTE deployment is associated with much higher average revenue per unit than the case of voice-centric business plans of the U.S. providers in 2006.

More generally, because there is an agreement in the industry that LTE is the next generation mobile network technology, it is inevitable that a robust ecosystem will develop for this technology.[129] Given that LTE is being deployed in different spectrum bands, it is reasonable to expect that LTE handsets will be multi-band handsets, just like the present day GSM/HSPA handsets offered by the incumbents which simultaneously support four GSM bands (800/900/1800/1900 MHz) and three HSPA bands (800/1900/2100 MHz) to permit global roaming.[130] The 800 MHz LTE band is very likely to be accommodated in future LTE handsets for global roaming because this band is being used to deploy LTE in a number of countries.

Specifically, in Europe, the 800 MHz spectrum is being freed-up by the digital television switch-over and has been reserved by the European Commission for LTE and WiMAX.[131] In Germany, Vodafone has launched LTE over the 800 MHz spectrum, and two other German operators, T-

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[125] Rogers Comments, p. 16, ¶36.

[126] According to the FCC 14th Report on Wireless Competition, released on May 20, 2010 (at p. 10), MetroPCS had 6.6 million subscribers at the end of 2009 (a year before LTE was deployed). TELUS had slightly over 6.9 million subscribers at the end of 2010 (*see* TELUS Corporation, Management's Review of Operation 4Q 2010, p. 18).

[127] Fitchard, Kevin. "Alltel looks to LTE, but over which spectrum?" (May 15, 2008). Available at: http://connectedplanetonline.com/wireless/news/alltel-lte-spectrum-0515/

[128] FCC, 13th Report on Wireless Competition, p. 138, Table A-4 (data for the end of 2006).

[129] Alcatel-Lucent Strategic White Paper, "CDMA and LTE: Making the most of wireless broadband, An overview of strategies, issues and opportunities" (May 2009), p. 2. Available at http://webform.alcatel-lucent.com/res/alu/survey/alu2CustomForm.jsp?cw=alu2CorpDocDownload&LMSG_CABINET=Docs_and_Resource_Ctr&LMSG_CONTENT_FILE=White_Papers/cdma_lte_SWP.pdf&lu_lang_code=en_WW

[130] See, e.g., specifications for the following sample smartphones: Samsung Focus by Rogers (http://www.rogers.com/web/link/wirelessBuyFlow?forwardTo=PhoneThenPlan&productType=normal&productId_Detailed=I917BLKR&N=52+11), Motorola Atrix by Bell Canada (http://www.bell.ca/shopping/en_CA_ON.MOTOROLA-ATRIX/71866.details?contractId=term36m#tabCont1-tabs) and HTC 7 Surround by TELUS (http://www.telusmobility.com/en/ON/htc_7_surround/index.shtml).

[131] Davies, Simon. "Europe to Reserve 800Mhz Bands for LTE and WiMAX Networks" (May 6, 2010). Available at: http://www.cellular-news.com/story/43196.php The European "digital dividend" spectrum is the 790-862 MHz band.

Mobile (Deutsche Telekom) and O2 also plan to deploy LTE over the 800 MHz spectrum.[132] An auction of the 800 MHz band was completed in Sweden in early March of this year, and winners in that auction already indicated that they plan to deploy LTE over that band.[133] British operators have been conducting LTE trials over the 800 MHz band in rural areas of the U.K,[134] and the 800 MHz spectrum will be auctioned in the U.K. in 2012.[135] According to 4G Americas, France's largest mobile operator, Orange, plans to deploy LTE in 800 MHz and 2.6 MHz bands.[136] Croatian operator, Vip, has trialed LTE in the 800 MHz spectrum and plans to launch LTE commercially later in 2011.[137] Nokia Siemens will be upgrading Telecom Italia's network with LTE base stations that will allow implementation of LTE in 800 MHz and 2.6 GHz bands.[138] In South Korea, the largest wireless provider, SK Telecom, indicated that it also plans on using 800 MHz spectrum for the LTE services (to be launched later in 2011), for which it is currently awaiting governmental approval.[139] In Japan, the second largest provider, KDDI (au),

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132 Donegan, Michelle. "Vodafone Beats Deutsche Telekom to LTE Launch" (November 29, 2010). Available at: http://www.lightreading.com/document.asp?doc_id=201103 *See also*, "Deutsche Telekom launches LTE via 800 MHz with Nokia Siemens" (October 22, 2010). Available at: http://www.telecompaper.com/news/deutsche-telekom-launches-lte-via-800-mhz-with-nokia-siemens *See also* 4G Americas, "Global 3G Status HSPA / HSPA+ / LTE" (March 24, 2011). Available at: http://www.4gamericas.org/UserFiles/file/Global%20Status%20Updates/Global%20Status%20Update%20March%2024%202011.pdf

133 Ricknäs, Mikael. *IDG News*, "Spectrum for Rural 4G Auctioned off in Sweden" (March 4, 2011). Available at: http://www.pcworld.com/businesscenter/article/221386/spectrum_for_rural_4g_auctioned_off_in_sweden.html

134 "O2 UK to trial LTE at 800 MHz" (May 22, 2010). Available at: http://www.intomobile.com/2010/05/22/o2-uk-to-trial-lte-at-800mhz/ *See also*, "Clear Mobitel announces UK LTE trial in 800MHz 'Digital Dividend' Spectrum in Cornwall" (July 17, 2010). Available at: http://blog.epn-online.com/rfwirelessblog/2010/07/clear-mobitel-announces-uk-lte-trial-in-800mhz-digital-dividend-spectrum-in-cornwall.html *See also*, "Nokia Siemens Looking for Rural 800MHz LTE Trial Location in UK" (March 11, 2011) (discussing Nokia Siemens LTE trials in partnership with operator Cambridge Wireless). Available at: http://www.mobileeurope.co.uk/news/blog/8645-nokia-siemens-looking-for-rural-800mhz-lte-trial-location-in-uk

135 Parker, Andrew. *Financial Times*, "Ofcom Outlines Auction Rules for 4G Spectrum" (March 22, 2011). Available at: http://www.ft.com/cms/s/0/48117eb0-545a-11e0-979a-00144feab49a.html#axzz1IVmHJopV

136 4G Americas, "Global 3G Status HSPA / HSPA+ / LTE" (March 24, 2011) ("4G Americas Global Status HSPA / HSPA+ / LTE"). Available at: http://www.4gamericas.org/UserFiles/file/Global%20Status%20Updates/Global%20Status%20Update%20March%2024%202011.pdf

137 Mansfield, Ian. "LTE Trials at 800 MHz in Croatia" (March 24, 2011). Available at: http://www.cellular-news.com/story/48462.php

138 "NSN Upgrades Telecom Italia" (March 28, 2011). Available at: http://www.lightreading.com/document.asp?doc_id=206116

139 Meyer, Dan. *RCR Wireless News*, "SK Telecom Sets Partners for LTE Launch" (January 27, 2011). Available at: http://www.rcrwireless.com/article/20110127/CARRIERS/110129958/-1/sk-telecom-sets-partners-for-lte-launch SK Telecom is awaiting approval from the Korea Communications Commission to utilize the 800 MHz bandwidth for LTE service.

plans to deploy LTE initially in the 800MHz band and later using 1.5GHz spectrum.[140] The company says that the 800MHz band will be used for nationwide coverage, while 1.5GHz will be used only in densely populated areas. According to 4G Americas,[141] Vodafone Qatar is conducting LTE trials in the 800 MHz band. Given the number of planned LTE deployments in the 800 MHz spectrum across the globe, as well as the general trend towards LTE technology, it is likely that the 800 MHz band will be supported in handsets designed for global roaming.

An example showing that LTE ecosystems are moving towards multi-band equipment is the recent announcement that equipment manufacturer ZTE has developed for Swedish operator TeliaSonera an LTE modem that supports multiple bands.[142] This modem can access LTE networks in the 800MHz, 1.8GHz and 2.6GHz bands, or use HSPA+. Industry analysts observe that "[t]he arrival of modems that can access LTE networks on multiple spectrum bands is also a sign that the technology is maturing." [143]

IV. THE AUCTION CAP PROMOTES COMPETITION FOR MOBILE WIRELESS SERVICES IN LOW DENSITY AND RURAL AREAS

The superior propagation characteristics of low-frequency spectrum make it ideal for deploying mobile wireless services to rural areas.[144] The low-frequency spectrum allows providers to extend coverage to a larger geographic region at lower cost compared to higher frequency spectrums. Accordingly, low-frequency spectrum "haves" enjoy a significant competitive cost advantage over low-frequency spectrum "have nots," particularly in rural areas.[145]

The Consultation notes that Canada's geography and widely-dispersed population can render it difficult to make a business case for the deployment of advanced, innovative services in some parts of the country.[146] This must be considered when encouraging the deployment of alternative networks and services. Most countries, including Canada, have a governmental mandate to

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140 Zander, Jens. "Neither LTE nor 800 MHz is enough" (November 24, 2010). Available at: http://theunwiredpeople.org/neither-lte-nor-800-mhz-is-enough/. *See also*, "KDDI Confirms LTE Migration Plan; But Will Use WiMAX/Wi-Fi Too" (November 17, 2010). Available at http://www.telegeography.com/cu/article.php?article_id=35225.

141 4G Americas Global 3G Status HSPA / HSPA+ / LTE.

142 Rícknäs, Mikael. *IDG News*, "TeliaSonera, ZTE Readies First Multimode LTE Modem" (March 7, 2011). Available at: http://www.pcworld.com/businesscenter/article/221498/teliasonera_zte_readies_first_multimode_lte_modem.html#tk.mod_rel

143 *Id.*

144 The Consultation outlines the superior characteristics and benefits of the 700 MHz spectrum at pages 2 and 42.

145 It is obvious that not having low-frequency spectrum will either prevent competitive entry in rural areas or severely limit the new entrants' ability to compete because their cost structure will be less efficient than the incumbent. In the U.S., the Government Accountability Office (GAO) has observed that new entrants are limited in their ability to compete in rural areas because of insufficient amounts of spectrum. (GAO-10-779; dated July 2010).

146 Consultation, p. 40.

provide advanced services to all consumers in all regions of the country. Communities in rural and low-density areas should not be left behind and indeed a case could be made that they require advanced services, including wireless services, to a greater degree than urban communities. The fact remains, however, that certain factors – population density, terrain, backhaul requirements, lack of existing infrastructure (power sources and wireline infrastructure) – have limited the deployment of wireless to these areas.[147] While it is widely recognized that competition will develop in urban areas and then, as economics permit, expand to more rural areas, the availability of low-frequency spectrum will impact that process directly and dramatically.

The incumbents hold 95% of the existing low-frequency spectrum in the 800 MHz band today.[148] Allowing them to acquire all or a vast majority of 700 MHz spectrum at an unrestricted auction will create a wide chasm between the incumbents (as low-frequency spectrum "haves") and other wireless providers (as "have nots.") This would raise serious concerns for consumers in rural areas that would be forced to rely solely on the incumbents, acting as an effective duopoly, to roll out services to underserved areas. This lack of competition would negatively impact the rate of deployment, the quality of services deployed and the prices in rural and low-density areas where the incumbents have "significant market power."[149] In short, all Canadians, including those in rural, remote and low-density areas should be able to participate in the global information society, and an in-band auction cap will assist in that important goal.

In the AWS Consultation it was noted that "[n]ew facilities-based wireless operators have several barriers to market entry. Spectrum is a finite resource that can only be accessed periodically subject to changes in international and national allocation plans and technical standards." And "…the economies of scale that a wireless incumbent enjoys, may prevent a competitive entrant from being able to match the incumbent's incremental costs of serving each additional subscriber."[150] These economies of scale combined with sole access to low-frequency spectrum would create an insurmountable barrier to entry for any wireless provider attempting to compete with the incumbents in rural or low-density areas. In the alternative, the proposed in-band auction cap would allow providers other than the incumbents to offer services with spectrum that is equally efficient. It would also be consistent with the Canadian Telecommunications Act requirement "…to render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada."

The importance of mobile broadband services and access to low-frequency spectrum to rural areas is well-recognized. In the U.S., the FCC's National Broadband Plan specifically recognizes the importance of wireless and low-frequency spectrum for rural areas, noting that "especially for highly propagating lower bands, increased availability of spectrum provides

[147] GAO-06-426; "Broadband Deployment is Extensive Throughout the United States, But it is Difficult to Assess the Extent of Deployment Gaps in Rural Areas" (May 5, 2006), pp. 19-20. *See also*, GAO-10-779, p. 39.

[148] Consultation, Figure 4.1.

[149] Telecommunications Policy Review Panel (TPRP) Final Report 2006, Executive Summary, p. 5.

[150] AWS Consultation at 2.5.

sufficient capacity to serve very large rural areas with a single cell, thereby further reducing the cost of rural deployments."[151]

Mobile broadband providers in the U.S. have also argued for more loans and spending on mobile broadband in rural areas because of the importance of mobile broadband to all consumers. For instance, Crossroads Wireless Holdings LLC made the following comments to the Rural Utilities Service of the U.S. Department of Agriculture on rural broadband loans and guarantees:

> Mobile broadband could transform rural development throughout the country. In America, business is becoming increasingly dependent on mobile technology; and rural areas should not be left behind. Rural health care and education will benefit from the range, low cost, and mobility that typify today's mobile networks. Rural mobile broadband means that individuals in rural areas who need to consult with medical specialists in the larger cities do not necessarily need to travel long distances but can connect with the medical specialists wherever they are on their family farms or ranches via mobile broadband service. New mobile broadband connections will benefit rural Americans who otherwise might have to travel hundreds of miles to gain access to the information, expertise, and markets they need. Finally, rural communities require mobile broadband to meet their essential homeland security needs. Mobile networks will allow rural first responders to communicate with law enforcement – and enable people to get help when and where they need it.[152]

These same arguments are just as pertinent to the rural areas of Canada. Indeed, the TPRP Report identified many of the same kinds of benefits associated with broadband to rural parts of Canada, noting "[a]s well as offering improved education, health care and economic opportunities, access to broadband in unserved areas of the country will help ensure all Canadians have the opportunity to participate in the 'global information society.'"[153] The need for mobile broadband access is universal and allocating the 700 MHz spectrum in an equitable manner that promotes competition will be key to meeting this need. Allowing the incumbents to acquire all, or virtually all, of the spectrum through an unrestricted auction runs counter to this objective.

All parties recognize the need for 700MHz spectrum and all parties should have the opportunity to acquire low-frequency spectrum. Since low-frequency spectrum is needed to efficiently deploy mobile broadband to rural areas, a company without low-frequency spectrum cannot cost-effectively enter rural markets to provide mobile broadband. Therefore, in order to create competition for mobile broadband in rural areas, it is particularly important for the auction to provide equitable access to 700 MHz spectrum to operators that currently do not hold any low-frequency spectrum. That is the goal and effect of the in-band spectrum auction cap.

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[151] "Connecting America: The National Broadband Plan" (rel. March 17, 2010), p. 85.

[152] Comments of Crossroads Wireless Holdings LLC in Docket No. RUS-06-Agency-0052 (July 10, 2007).

[153] TPRP Final Report 2006, pp. 8-3 through 8-5.

By preventing the incumbents from acquiring all low-frequency spectrum, the auction cap ensures that a rival to the incumbent has the opportunity to serve rural consumers in remote and low-density areas thereby providing a market disciplining check on the incumbents. To provide additional assurances that the presence of a rival will, in fact, spur service deployment using low-frequency spectrum in the 700 MHz band, the auction cap proposals are accompanied by deployment obligations for 700 MHz spectrum holders. The in-band auction cap promotes competition, the sustainability of competition, and provides opportunities for competition in rural areas that would not exist otherwise.

V. CONCLUSION

An in-band auction cap should be employed when auctioning spectrum in the 700 MHz band in Canada. This framework abounds with benefits. It will distribute 700 MHz spectrum on an equitable basis, allowing each wireless provider the opportunity to bid on 700 MHz spectrum. It will promote sustainable competition by allowing at least one competitor to acquire 700 MHz spectrum, rather than allowing further concentration in low-frequency spectrum holdings and a resulting increase in incumbent market power. It will provide incentives for spectrum holders to use their spectrum as efficiently as possible by making it less likely that incumbents will acquire 700 MHz spectrum for the purposes of thwarting competition and more likely that spectrum holders employ spectral efficiency strategies. And it will produce benefits for consumers in rural areas by spurring competitive roll-out and investment in these areas, rather than relying solely on incumbent companies which have already shown a reluctance to use existing low-frequency spectrum to serve these areas. As an added benefit, the auction cap avoids most of the criticisms incumbents have ascribed to other auction frameworks, thus making the auction cap a reasonable "middle ground" position between parties advocating for an unrestricted auction and parties advocating for a set-aside.

While the auction of 700 MHz spectrum will make much-needed additional capacity available, it will not solve the "spectrum crunch" according to current traffic forecasts regardless of which auction framework is adopted. As a result, it will be critical for all spectrum holders to use spectrum as efficiently as possible. Fortunately, there are numerous existing and emerging methods and technologies that can be used to increase spectral efficiency. The potential for these strategies – most of which have yet to be deployed in Canada – to alleviate spectrum shortage is promising. Notably, the incumbents have the most to gain from these strategies because of their significant economies of scale and vast holdings of existing spectrum. The auction cap will promote the use of these spectral efficiency strategies as a means of spectrum management, without placing undue restrictions on any provider's ability to provide quality mobile wireless services.

Because no auction framework will completely solve the spectrum scarcity issue that faces the global wireless industry, the framework that best promotes competition and the most efficient use of spectrum should be utilized. That framework is the in-band auction cap.

Toronto Hydro-Electric System Limited
EB-2011-0120
Interrogatory Responses
Tab 5.2
Schedule 46
Attachment 2
(129 pages)

QSI TECHNICAL DOCUMENTATION

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THE STATE OF WIRELESS TECHNOLOGIES IN CANADA

A Comparison of Wireless Technologies in Canada and the United States of America

Contributors:
August Ankum, Ph.D.
Olesya Denney, Ph.D.
Warren Fischer, C.P.A.
Stephanie Goldman, C.F.A.
Timothy Gates
Dima Leshchinskii, Ph.D.
Sidney Morrison
Patrick Phipps

QSI consulting, inc.

Contact Information
2977 Highway K
Box #304
O'Fallon, MO 63366-7862
www.qsiconsulting.com

NOTE

This report was prepared on behalf of Bell Canada Enterprises. Nevertheless, the views expressed in this report are those of QSI Consulting, Inc. and, as such, they are not intended to and nor do they necessarily reflect the view of Bell Canada Enterprises.

QSI Consulting, Inc. is a consulting firm specializing in traditional and non-traditional utility industries, econometric analysis, convergence of network technologies and computer-aided modeling. QSI's experienced consultants provide services to a wide array of clients, including multi-billion dollar telecommunications firms, small start-up companies, state legislatures and regulatory agencies.

QSI Consulting, Inc.
O'Fallon, Missouri USA

Contacts:

Tim Gates	Phone: 303.424.4433	E-mail: tgates@qsiconsulting.com
Warren Fischer	Phone: 303.722.2684	E-mail: wfischer@qsiconsulting.com

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Attachment 1: Acronyms Used in the Report

Attachment 2: Archive of Press Releases Regarding Technology and Services Deployment and Innovation for the Major Canadian and US Mobile Wireless Carriers

CONCLUSIONS

The Canadian mobile wireless industry is keeping pace with the United States (hereafter "US") mobile wireless industry in terms of deployment of next generation mobile wireless technology and services, and leads the US in certain respects. The major mobile wireless carriers in both Canada and the US have deployed 2.5G and 3G mobile wireless technologies and have introduced services and handsets that take advantage of the higher speeds and capabilities that 3G technologies provide.

Canada is on par with the US in adoption of new handsets, and in some cases, such as the adoption of BlackBerry® platform products, Canada leads the US. For instance, for handsets, Canadian GSM carriers introduce handsets at approximately the same time as US GSM carriers and Canadian CDMA carriers introduce handsets at approximately the same time as CDMA carriers in the US.

Entertainment and multimedia services delivered via mobile wireless handsets is an area where Canada appears to be leading the US. For instance, video calling is available in Canada but not in the US, as is the commercial availability of full-length movies.

Canada has also led the US in introducing inter-carrier agreements that increase convenience and ubiquity of wireless service, such as the SMS agreement (later adopted by the US) and Wi-Fi roaming agreement.

In terms of wireless coverage as a percent of population, Canada compares favorably to the US, and both countries have access to CDMA- and GSM-based technologies, with CDMA being the more prevalent technology in both Canada and the US.

In relative terms, Canadian penetration is approximately 71% of the US penetration (calculated as Canadian penetration of 56% divided by the US penetration of 78%). The difference in penetration rates is due in large part to the differences in disposable income between Canada and the US, the US' 18-month head start in the industry and the relative size and economies of scale of the two countries. Given these key differences in the markets and the risk associated with being first to market, Canada is exceeding expectations in terms of deployment of mobile wireless technology and services.

EXECUTIVE SUMMARY

In February of 2007, Bell Canada Enterprises contracted with QSI Consulting to conduct a study to compare the wireless technology in Canada with that in the US. A number of studies assessing Canada's wireless industry have been published over the years. A report issued in March of 2006 by the Federal Telecommunications Policy Review Panel ("TPR Report") recommended a variety of changes to wireless policy, and painted the sector as uncompetitive, lagging in technology deployment and high priced. The purpose of this study is to determine whether there is any basis for the recent concerns raised about the deployment of technology in the Canadian wireless industry.

The study focused on wireless technology and services in the two countries. The key issues addressed include:

- A review of the technologies and services deployed by major providers in both Canada and the US, focusing on technology and innovation
- Case studies on wireless devices and next generation services
- Merits of quick adopter approach to innovation
- The structure and current status of the wireless industries in Canada and the US
- Penetration and coverage of wireless services

The findings on each of these key points are summarized below.

Technology Deployment:

Technology, from a consumer perspective, is reflected in the services available for purchase from the major wireless providers. This study addresses the mobile wireless technologies deployed by each provider and the services associated with each technology. In terms of innovation, which for the consumer is represented by services and handset features, the study provides evidence showing that Canadian consumers enjoy features and capabilities not available in the US, and have not been denied any benefits of new mobile wireless technologies or features.

In terms of technology, as of the third quarter of 2006, about 6.5 million Canadian subscribers were served by GSM/UMTS/WCDMA (35% of total), about 11 million subscribers were served by CDMA (59% of total), about 0.3 million subscribers were served by TDMA (2% of total), and about 0.7 million were served by other technology (4% of total).

In the US as of the third quarter of 2006, about 80.3 million subscribers were served by GSM/UMTS/WCDMA (36% of total), about 109.1 million subscribers were served by CDMA (49% of total), about 5.6 million subscribers were served by TDMA (3% of total), and about 29.2 million were served by other technology (12% of total). The Canadian and US technology percentages compare to the international average of 80% on GSM/UMTS/WCDMA, 14% on CDMA, and 2% on TDMA.

The table below summarizes the technologies and the percentage of subscribers on each for Canada, the US and the rest of the world:

Table. Subscribers by Technology in Canada, US and World*

Country	Metrics	GSM/ UMTS/ WCDMA	CDMA	TDMA	OTHER	TOTAL
Canada	Total Subscribers (M)	6.5	11.0	0.3	0.7**	**18.4**
	% Subscribers	35%	59%	2%	4%	**100%**
	Major Carriers	*Rogers*	*Bell Canada, TELUS*	*Rogers*	*TELUS*	
US	Total Subscribers (M)	80.3	109.1	5.6	29.2	**224.2**
	% Subscribers	36%	49%	3%	12%	**100%**
	Major Carriers	*AT&T, T-Mobile*	*Verizon, Sprint*	*AT&T*	*Sprint*	
All Countries	Total Subscribers (M)	1,851.2	320.4	47.4	85.5	**2,304.6**
	% Subscribers	80%	14%	2%	4%	**100%**

** -- Canada data based on CWTA company-level 4Q2006 subcribers. TDMA (Rogers) subscribers estimated from www.angustel.ca/update/up578.html. US and All Countries data based on Merrill Lynch Telecom Services Research Interactive Global Wireless Matrix, January 2007 (data for 3Q 2006). Note that the Merrill Lynch estimate for Canadian TDMA (2 million in 3Q2006, which is also in the 2004 edition of Merrill Lynch Matrix) appears to be too high.*

*** -- An estimate for TELUS "Other" (Mike) subscribers based on EOY 2000 share of Clearnet (Mike) subscribers in total TELUS subscribers. Note that for category "Other" Merril Lynch reports an estimate of 3.7 million subscribers in Canada, which appears to be too high.*

The following table summarizes the technology and innovations deployed over time by the various major carriers in Canada and the US:

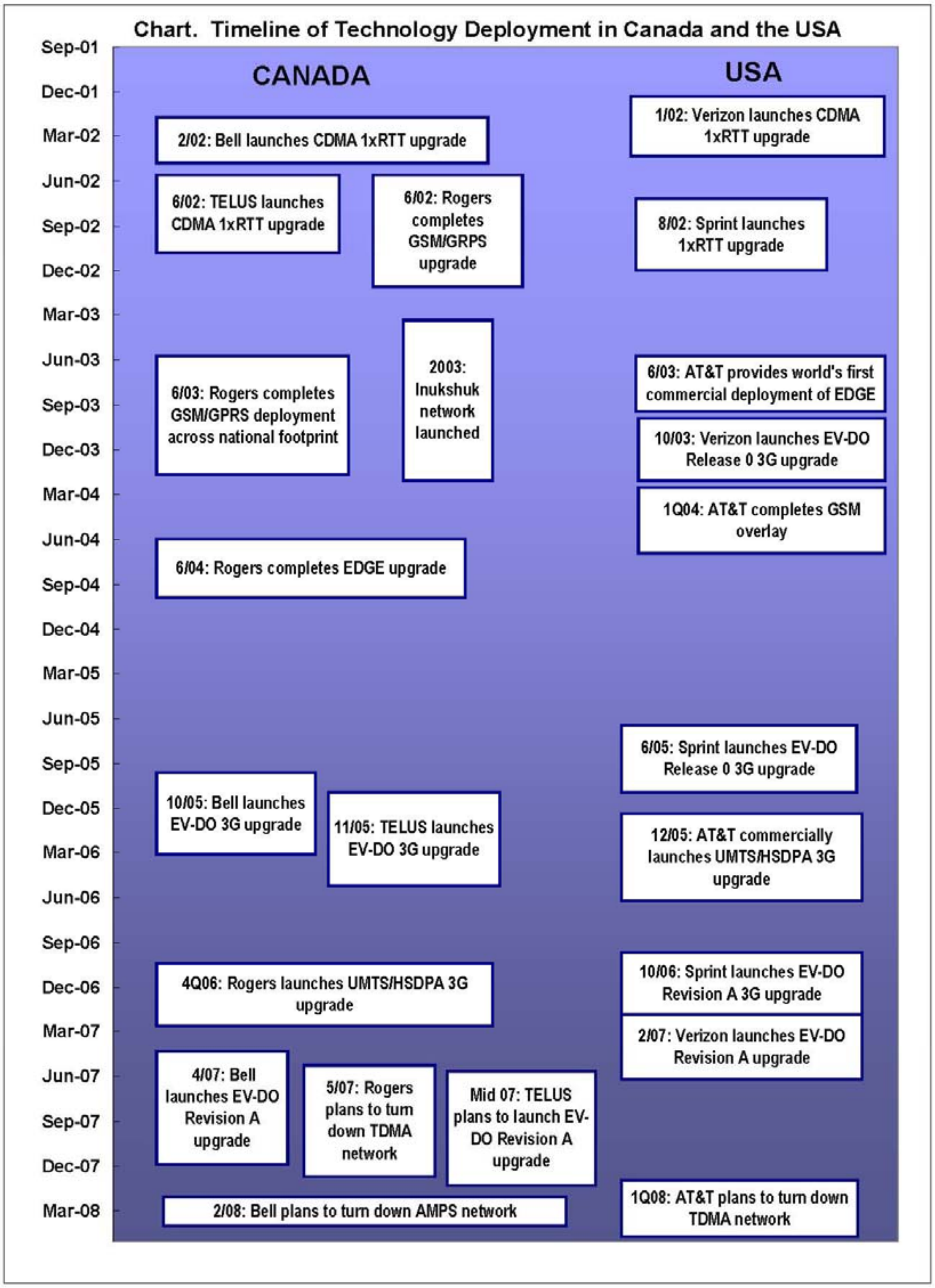


Chart. Timeline of Technology Deployment in Canada and the USA
CANADA
USA
Sep-01
Dec-01
Mar-02
Jun-02
Sep-02
Dec-02
Mar-03
Jun-03
Sep-03
Dec-03
Mar-04
Jun-04
Sep-04
Dec-04
Mar-05
Jun-05
Sep-05
Dec-05
Mar-06
Jun-06
Sep-06
Dec-06
Mar-07
Jun-07
Sep-07
Dec-07
Mar-08
2/02: Bell launches CDMA 1xRTT upgrade
6/02: TELUS launches CDMA 1xRTT upgrade
6/02: Rogers completes GSM/GRPS upgrade
6/03: Rogers completes GSM/GPRS deployment across national footprint
2003: Inukshuk network launched
6/04: Rogers completes EDGE upgrade
10/05: Bell launches EV-DO 3G upgrade
11/05: TELUS launches EV-DO 3G upgrade
4Q06: Rogers launches UMTS/HSDPA 3G upgrade
4/07: Bell launches EV-DO Revision A upgrade
5/07: Rogers plans to turn down TDMA network
Mid 07: TELUS plans to launch EV-DO Revision A upgrade
2/08: Bell plans to turn down AMPS network
1/02: Verizon launches CDMA 1xRTT upgrade
8/02: Sprint launches 1xRTT upgrade
6/03: AT&T provides world's first commercial deployment of EDGE
10/03: Verizon launches EV-DO Release 0 3G upgrade
1Q04: AT&T completes GSM overlay
6/05: Sprint launches EV-DO Release 0 3G upgrade
12/05: AT&T commercially launches UMTS/HSDPA 3G upgrade
10/06: Sprint launches EV-DO Revision A 3G upgrade
2/07: Verizon launches EV-DO Revision A upgrade
1Q08: AT&T plans to turn down TDMA network

As the data in the study show and as the table above portrays visually, Canada has not lagged behind the US in any significant manner regarding the deployment of available technology. While there are instances where providers in the US were first to market with some technologies, Canada has always been quick to adopt that technology – frequently deploying the technologies within days or months of deployment in the US. As this study discusses, such a "quick adopter" approach is what one would expect given that the US mobile wireless market is 9 times larger than the Canadian market in terms of population (potential market). Despite the smaller size of the Canada mobile wireless market as compared to the US, the Canadian wireless industry has led the US in technology, innovation or service deployment in some areas.

The following is a sample of "firsts" in North America or Canada, which show that Canada either leads or is generally on par with the US in terms of general wireless technology/service innovation:

- 05/1998: Bell Mobility first in world to provide Tri-mode phones (AMPS/CDMA 850/1900).
- 07/1998: Bell Mobility is first North American wireless company to introduce switchless, trunkless pre-paid service.
- 05/24/00: Bell Mobility provides North America's first Instant Message service on Digital PCS phones.
- 12/20/00: Bell Mobility announces first color display mobile phone in Canada. The first color display was introduced in the US by Verizon on 11/29/00, less than one month earlier.
- 05/03: Bell Mobility provides world's first location based service "Mr. Rescue".
- 11/30/04: TELUS introduces Fastap™, the world's first wireless phone that integrates text keys around a standard numeric phone keypad – making it easier to send text messages and enter contacts in contact list.
- 10/14/04: TELUS introduces first 1.3MP wireless phone camera in Canada. By comparison, Sprint announced the introduction of its first 1.3MP camera on July 8, 2004 – three months earlier than TELUS' introduction.
- 05/09/05: Rogers provides North America's first full music download to a wireless device.
- 02/01/06: Rogers launches North America's first Podcast Service over mobile phones. By comparison, AT&T announced mobile podcast capability in October 2006, eight months after Rogers' launch.
- 06/06/06: Rogers provides first Name Display service – allowing a customer to see the name and number of the party calling even if not in contacts list – in North America.
- 02/15/07: Bell Mobility provides first Canadian full length pay per view movie service. By comparison, Sprint announced on 12/12/05 the availability of the first mobile entertainment with full length films in the US (MSpot), but the services is not commercially available from Sprint at this time.

- 04/02/07: Rogers announces North America's first video calling service. By comparison, AT&T made the first US video share call on 1/5/07 at a trade show in demo mode, but has not yet made it commercially available.

Wireless Devices:

From the standpoint of consumers, phones, smartphones and other mobile handheld devices such as Personal Digital Assistants ("PDAs") constitute the "face" of technological developments. Therefore, the availability and the speed of adoption of these devices by mobile carriers present useful measures of technological deployment and innovations. What follows are two summary tables from case studies on wireless devices deployed by Canadian and US providers:

Table. Adoption Dates of Currently Offered BlackBerry ® Devices*

Introduced by	 8800 Series	 Pearl	 8700 Series	 7200 Series	 7130 Series
AT&T	2/12/2007	11/30/2006	11/1/2005	9/28/2004	6/8/2006
Rogers	2/12/2007	9/7/2006	11/9/2005	10/22/2004	
T-Mobile	4/20/2007	9/7/2006	4/18/2006	3/11/2005	
Bell Canada	4/25/2007	*not available*	9/2006**	2/16/2005	11/2005**
Sprint	*not available*	*not available*	9/20/2006	6/22/2005***	5/31/2006****
TELUS	*not available*	*not available*	11/29/2006	3/2/2005	12/15/2005
Verizon	4/25/2007	*not available*	9/12/2006	2/7/2005	11/21/2005

** -- Press Release dates. Source: RIM Press Release Archives (http://www.rim.net/news/press/index.shtml).*
Device images taken from RIM Image Gallery at http://www.rim.com/newsroom/media/gallery/index.shtml
Availability based on company web sites as of May 5, 2007.
T-Mobile also offers 7105t; Sprint offers 7100i (introduced on 10/14/05) for Nextel customers and 7520.

*** -- Dates provided by company to QSI.*

**** -- Not listed as current offer on Sprint web site.*

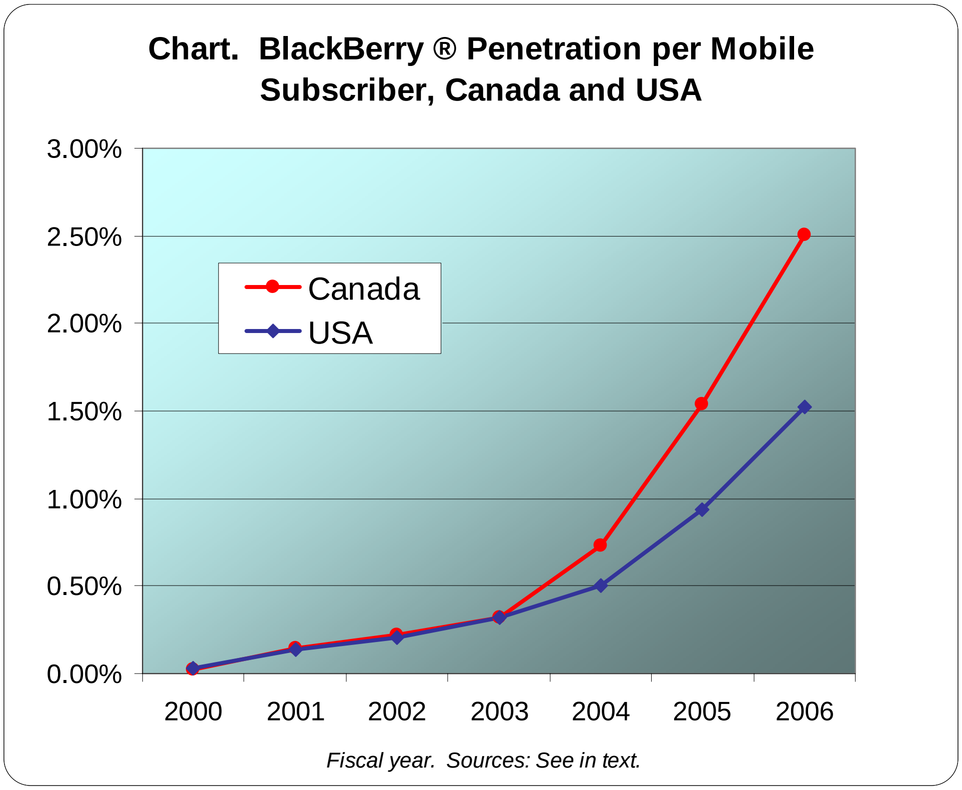
***** -- Based on Sprint Press Release.*

Table. Adoption Dates of Motorola RAZR™ Handset*

Availability	Carrier Network Standard	Date
AT&T (Cingular)	GSM	Nov-04
Rogers	GSM	Feb-05
T-Mobile	GSM	Jun-05
Verizon	CDMA	Dec-05
Bell Canada	CDMA	Feb-06
TELUS	CDMA/iDEN	Feb-06
Sprint	CDMA/iDEN	Oct-06

** -- Announcement dates. Based on Motorola News Releases available at http://www.motorola.com/mediacenter/news/archive.jsp.*
Source for Bell Canada: http://www.bce.ca/en/news/releases/bm/2006/01/24/73285.html.
Source for TELUS: http://en.wikipedia.org/wiki/Razr#_note-2#_note-2.

In addition to availability of BlackBerry® handheld devices, it is useful to look at the "penetration" (or, equivalently, subscribership) of BlackBerry® products in both countries. Using information in RIM annual reports, we estimated subscribership to the BlackBerry® wireless platform by country. Next, we calculated penetration of BlackBerry® platform in both countries on a per wireless subscriber basis. The Chart below depicts BlackBerry® penetration as a share of total mobile wireless subscribers.



As seen in the chart above, although, early on, the Canadian and US BlackBerry® penetration rates were very close, Canada has exceeded the US penetration rates for the BlackBerry® wireless platform in recent years, and Canada's lead over the US is increasing. In terms of BlackBerry® penetration per mobile wireless subscriber, Canada (with 2.5% rate) exceeds the US (with 1.5%) by one percentage point.

To summarize, the analysis shows that Canada leads the US in terms of BlackBerry® wireless platform penetration despite lagging the US in terms of "mass market" mobile voice penetration. This finding corroborates the analysis showing that Canada leads the US in terms of high-end/value added services.

Entertainment and Multi-Media Services:

The following table summarizes the entertainment and multi-media services provided by the major wireless carriers in Canada and the US. Note that areas shaded in green indicate that a service is being offered by a carrier:

Table. Entertainment and Multimedia Product Offerings by Carrier*

Services & Features	Canada			USA			
	Bell Mobility	Rogers Wireless	TELUS Mobility	AT&T	Verizon Wireless	Sprint	T-Mobile
Full-Length Movies	■						
Real-Time TV	■	■	■		■	■	
Download Full-Length Songs	■	■	■	■	■	■	
Streaming Radio		■	■	■		■	
Video Calling		■					
Text Messenging	■	■	■	■	■	■	■
Picture Messenging	■	■	■	■	■	■	■
Video Messaging	■	■	■	■	■	■	■
International Messenging	■	■	■	■	■	■	■
Instant Messenging	■	■	■	■	■	■	■
Download & Play Games**	■	■	■	■	■	■	■
Interactive Games/Multiplayer	■	■	■	■		■	
Download video clips	■	■	■	■	■	■	
Download Ring Tones	■	■	■	■	■	■	■
Download Wallpaper/Screensavers	■	■	■	■	■	■	■
Caller Ring Tunes***	■	■		■	■	■	■
Mobile Web Access	■	■	■	■	■	■	■
Voice SMS						■	

** -- Color shading indicates service availability. Does not include offerings offered by MVNOs and regional wireless providers.*
*** -- Both Bell Mobility and Verizon offer 3D games, according to their websites.*
**** -- Caller Ring Tunes allows the caller to hear a song instead of the traditional ring. Each carrier has a unique name for this service.*

The table above shows that currently Canada leads the US in terms of next-generation services/features roll-out, and at worst, is on par with the US in this regard. According to the companies' websites, Rogers Wireless (Canada) is the only mobile wireless carrier studied that provides video calling – the ability to hear *and see* the person on the other end of a phone call. One of the most advanced entertainment capabilities – the ability to watch full-length movies on a mobile phone – is exclusively available in Canada through Bell Mobility. Sprint announced the availability of a service providing full-length movie streaming to mobile phones in the US called Mspot Movies,[1] but Sprint is not advertising this offering on its website and it does not appear to be commercially available at this time. Therefore, the table above does not show Sprint offering full-length movies.

Quick Adopter Behavior:

Based on a review of the operation of the Canadian and US wireless markets over the last five years, the Canadian wireless industry is not lagging behind the US. While the US wireless providers introduce certain technologies before their Canadian counterparts, this trend is reflective of the relative size differences of the two countries. And though handset manufacturers may cater to the larger US market, it appears that the Canadian

[1] "Sprint and MSpot Roll Out Red Carpet with Streaming Movie Service for Mobile Phones." Sprint Press Release. 12/12/05. Sprint announced that MSpot Movies marks the first time full-length feature films are streamed to mobile phones in the United States.

wireless industry has been able to introduce next-generation handsets and services at approximately the same time as the US despite a modest lag in deployment of the technology that makes next-generation handsets and services a reality.

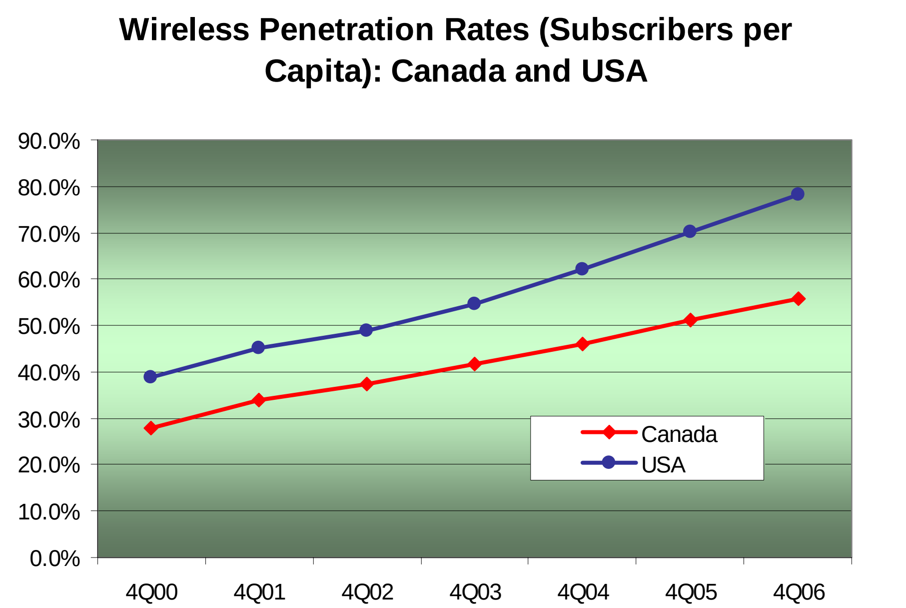
Structure of Wireless Industries:

The wireless industries in Canada and the US reflect the differences in the size and economic profiles of the two countries. As compared to the US, Canada has 11 percent of the population and the wireless industry metrics reflect similar differences in magnitude. Both countries have three to four major providers. As the wireless industry begins to mature, we see consolidation in both countries and an increase in market concentration. This is to be expected and reflects the rational move to increase efficiencies. The size of the overall market generally dictates the number of major providers that can efficiently provide service. It is not surprising that the US would have more large providers given the size of that market in terms of geography and potential revenues.

Penetration and Coverage:

At the end of 2006, which is the most recent data available, Canadian penetration of mobile wireless service (measured as subscribers per capita) was estimated at 56%. By comparison, in the US, per capita mobile wireless penetration was 78% for the same time period. Based on the data reviewed, disposable net income differences between the two countries may account for a significant portion of the differences in penetration and coverage.

The following chart compares mobile wireless penetration in both countries over time:



Sources: CWTA (Canada Subscribers); FCC 11th Report of Wireless Competition, Table 1 (US Subscribers 2000-2005), CTIA Semi-Annual Survey December 2006 (US Subscribers 2006); US Census Bureau, International Database (Population)

The gap between the US and Canadian wireless penetration rates is typically attributed to the fact that the US wireless industry had an 18-month head start based on the first wave of wireless spectrum auctions in both countries. The proportionate difference in penetration rates between the two countries over time indicates that Canada remained on par with the US in terms of penetration given the head start enjoyed by the US.

Geographically disaggregated country-level data suggest that income is an important driver of wireless penetration rates. Therefore, it is reasonable to expect that differences in income levels between the two countries may explain some of the differences in penetration rates. A comparison of different income measures in both countries shows that Canada has lower per capita income than the US. Canada lags the US in various measures of income, including personal disposable income – an income measure that is particularly relevant to consumption decisions such as whether or not to purchase mobile wireless services and devices.

In relative terms, Canadian personal disposable income is approximately 70% of the US personal disposable income. On the nationwide level, Canadian mobile wireless penetration rates constitute approximately 70-75% of the US penetration. Although it would be too simplistic to suggest a proportional relationship between penetration and income, the fact that the difference in magnitudes between these two measures is approximately the same for Canada and the US is telling. Other demographic metrics such as age and education of consumers in Canada and the US show only minor differences between the two and do not appear to explain the differences in penetration and coverage.

Wall Communications, Inc., compiled national and provincial-level mobile wireless coverage estimates by aggregating company-level coverage data. According to the *Wall Report*, digital mobile wireless services cover 97% of population in Canada. For comparison, the most recent US digital wireless coverage is estimated by the FCC as approaching 100% of population.[2] QSI investigated the premise that urban areas would have better coverage than rural areas, but based on the available data, we cannot conclude that urbanization is a factor in the difference between the two countries in wireless penetration and coverage.

[2] As discussed in its report, the FCC notes that this number is likely overstated due to the FCC's coverage calculation methodology. The FCC aggregates coverage data on a county-basis, and counts as covered by wireless any county that has a wireless offering in it, though not all of the population in that county would be covered by that wireless offering.

I. INTRODUCTION AND BACKGROUND

Recent reports have made statements claiming that the Canadian wireless industry is not sufficiently competitive, and that high prices for wireless service and a lack of innovation has resulted. Certain parties have suggested that additional providers might stimulate the Canadian wireless industry. For instance, in the Telecom Policy Review ("TPR") report it states:

> The smaller number of mobile providers in Canada – and the fact that all three national wireless service providers are also owned by large telecommunications service providers that also provide wireline services – may mean that there is less competition in the Canadian wireless market than in the US market, which consequently has resulted in higher prices, less innovation, lower uptake and lower rates of usage". (TPR, p. 1-21)

The March 2006 report by the Federal Telecommunications Policy Review Panel recommended a variety of changes to wireless policy, and painted the Canadian wireless industry as uncompetitive, lagging in technology deployment and relatively high priced as compared to the US. Other reports include the July 2005 report by the SeaBoard Group on wireless pricing, and the report published by Wall Communications Inc., commissioned by the Canadian Wireless Telecommunications Association ("CWTA"), which assessed various dimensions of the industry, including coverage and penetration, the financial state of the industry, the status of competition, pricing and other market performance parameters.

Bell Canada has asked QSI Consulting, Inc. ("QSI") to conduct a study on wireless technology, focusing on a comparison of the innovations, technologies and services of the major wireless providers in Canada, with those in the US. Unlike the abovementioned studies, many of which make international comparisons, this report selects the US as the sole source for comparison. This provides a controlled comparison due to the similarity between the two countries in such areas as wireless network standards, data collection, demographics, regulation, and availability of landline services permit meaningful comparisons. In contrast, the differences between Canada and other countries often undermine the value of international comparisons. For example, the *SeaBoard Report* compares Canadian wireless penetration and pricing to those in Russia, noting that Russia has higher wireless penetration rates than Canada.[3] The *SeaBoard Report* does mention a number of country-specific factors that may affect relatively high wireless penetration rates in Russia, namely the inadequacy of landline service (a substitute of wireless service), which has extremely high installation intervals (up to six months) and very high long-distance tariffs. At the same time, the *SeaBoard Report* fails to mention that the inadequacy of Russian landline service translates into very low penetration rates of

[3] SeaBoard Report, Wireless Pricing: A Cross-National Survey: Canada, US. and Europe, July 2005, p. 23.

Russian landline service, estimated at approximately 28% per capita, which is in stark contrast with Canada's 65% per capita landline penetration rate.[4] Clearly, because of the significant differences in the quality of landline services between Canada and Russia, comparing their wireless penetration rates, as the *SeaBoard Report* does, is suspect.

II. OVERVIEW OF WIRELESS TECHNOLOGY

A. NETWORK STANDARDS

An important factor affecting the development of the mobile wireless industry throughout its history is the existence of multiple standards, which are not compatible with each other. Currently there are four major network standards in North America, which are Code Division Multiple Access ("CDMA"), Global System for Mobile communications ("GSM"), Time Division Multiple Access ("TDMA"), and Integrated Digital Enhanced Network ("iDEN").

CDMA is a technology that divides up a radio channel not by time (as TDMA), but instead, by using different pseudo-random code sequences for each user. CDMA subscribers represent approximately 14% of the world's wireless market. CDMA technology is used by Bell Mobility in Canada, and by Verizon Wireless and Sprint Nextel (Sprint customers) in the US.

TDMA is a technology that multiplexes (divides) the signal into different timeslots. TDMA is currently being phased out in North America by the major wireless providers. Rogers in Canada and AT&T in the US have either completely phased out TDMA or are scheduled to phase out TDMA in the near future.

GSM is a digital wireless technology originally developed by the European operator community and later adopted by operators around the world to become the world's most dominant wireless technology. GSM is used to serve more than 1.8 billion users and accounts for 80% of the world's wireless market. GSM technology is used by Rogers in Canada and by AT&T and T-Mobile in the US.

iDEN is a mobile telecommunications technology, developed by Motorola, which provides its users the benefits of a walkie-talkie functionality (trunked radio) as well as a cellular phone. In Canada, iDEN is used by TELUS' Mike network, and in the US, it serves Sprint Nextel (Nextel) customers.

TDMA, GSM and iDEN technologies work by dividing a single radio frequency into multiple time slots so they can support multiple calls. TDMA allows for up to three calls

[4] Russian and Canadian landline penetration rates are based on Merrill Lynch Global Wireless Matrix, 4Q2006, Table 1.

per frequency (30 kilohertz (kHz) of spectrum), iDEN allows up to six, and GSM allows for up to eight (200 kHz of spectrum).

B. TECHNOLOGY GENERATIONS

1G

This is a first-generation wireless technology based on an analog cellular standard introduced in the 1980s that was replaced by the 2G standard.

2G

This is a second-generation wireless technology introduced in 1990s. The main difference between two succeeding 1G and 2G mobile telephone systems is that the radio signals in a 1G network are analog, while the radio signal in a 2G network is digital.

2G technologies can be divided into TDMA- and CDMA-based standards depending on the type of multiplexing (signal compression) used. Specifically, GSM is a 2G TDMA-based standard, as is iDEN, while IS-95 is the CDMA 2G standard used in North America.

2.5G

This is a "second and a half generation" – a term used to describe 2G-systems that have implemented a packet switched domain in addition to the circuit switched domain. 2.5G provides some of the benefits of 3G (e.g., it is packet-switched) and can use some of the existing 2G infrastructure in CDMA and GSM networks. For GSM operators, a 2.5 technology example includes the hardware and software enhancements utilizing General Packet Radio Service ("GPRS") or Enhanced Data Rates for Global Evolution ("EDGE") technology, which allows higher speed packet data communications. Some protocols, such as EDGE for GSM and CDMA2000 1x-RTT for CDMA, can qualify as "3G" services because they have a data rate of above 144 kbps, but are typically considered 2.5G.

3G

This is a third-generation technology with speeds that provide the ability to transfer simultaneously both voice data (a telephone call) and non-voice data. It is based on the International Telecommunication Union ("ITU") family of standards under the International Mobile Telecommunications program ("IMT-2000"). For GSM operators in Canada and the US (Rogers, AT&T and T-Mobile), the names for the 3G technology interface are Universal Mobile Telecommunications System ("UMTS"), High-Speed Downlink Packet Access ("HSDPA") and Wideband Code Division Multiple Access

("WCDMA"). Though WCDMA is the fundamental 3G technology, it is more commonly referred to in public press releases and in this report as HSDPA. The two terms are used interchangeably to refer to the 3G technology for GSM-based carriers. For CDMA-based operators (Bell Mobility, TELUS Mobility, Verizon Wireless, and Sprint Nextel), the name of the 3G technology is Evolution-Data Optimized ("EV-DO") technology, specifically its original Release 0 and a more recent successor Revision A.

III. ANALYSIS OF THE CANADIAN AND US WIRELESS INDUSTRIES

A. COMPANY-LEVEL OVERVIEW

In this section, we compare the Canadian and US wireless industries in terms of technology and innovation. The mobile wireless network technologies are compared by country and by company, including a description of the network technology deployed in each country by the major wireless companies, the date of the introduction of these technologies, the data speeds made available by these technologies and the innovations and services made available over the technology. The coverage of these networks and technology are also analyzed in terms of population counts for both Canada and the US.

1. Canada Mobile Wireless Industry

Overall, the Canadian wireless market comprises less than one percent (0.8%) of the total global wireless market in terms of subscribers.[5] As of fourth quarter of 2006, the current wireless penetration rate per capita in Canada was 57.5% (or over 18.5 million subscribers), 23% of which are prepaid subscribers.[6] Bell Mobility, Rogers Wireless and TELUS Mobility represent 96% of the Canadian wireless market in terms of subscribers and 96% of the Canadian wireless market in terms of wireless services revenue.[7] In terms of technology, at the end of 2006, about 6.5 million Canadian subscribers were served by GSM/UMTS/WCDMA[8] (35% of total), about 11 million subscribers were served by CDMA[9] (59% of total), about 0.3 million subscribers were served by TDMA[10]

5 Merrill Lynch Global Wireless Matrix, 4Q06 ("ML GWM 4Q06"), Table 20, March 28, 2007.

6 ML GWM 4Q06, Tables 1 & 51.

7 ML GMW 4Q06, Tables 51 and 52, Subscriber Market Share (Canada): Rogers (37.2%), Bell Mobility (31.6%), TELUS (27.2%); Wireless Services Market Share (Canada): Rogers (36.7%), Bell Mobility (29.3%), TELUS (30.1%).

8 GSM (Global System for Mobile Communications), UMTS (Universal Mobile Telecommunications System), WCDMA (Wideband Code Division Multiple Access).

9 CDMA or Code Division Multiple Access.

10 TDMA (Time Division Multiple Access).

(2% of total), and about 0.7 million were served by other technology (4% of total). [11] This compares to the international average of 80% on GSM/UMTS/WCDMA, 14% on CDMA, and 2% on TDMA.[12]

a. Bell Mobility

Network Technology & Migration[13]

Bell Mobility (or its predecessors – the Bell Mobility companies) has operated in the Canadian mobile wireless market since its inception in 1985, and was licensed, along with three other wireless companies, to provide 2G[14] digital PCS service in 1995.[15] Bell Mobility's "core" technology standard is CDMA. Bell Mobility launched its (2.5G) 1xRTT[16] network upgrade in February of 2002, providing typical data speeds of 120 Kbps up to 144 Kbps. Regarding 3G[17] technology, on October 31, 2005, Bell Mobility launched Canada's first 3G Evolution Data Optimized ("EV-DO") wireless data network in Toronto and Montréal,[18] which delivers average data download speeds of 400-700 kbps with peaks of up to 2.4 Mbps. On April 30, 2007, Bell Mobility announced the launch of EV-DO Revision A technology for laptop users, providing peak download speeds of 3.1 Mbps and peak upload speeds of 1.8Mbps. This offering is initially available in selected areas of Ontario, with plans for further deployment and speed enhancements throughout 2007.[19]

Bell Mobility reportedly plans to terminate its analog first generation (1G) AMPS[20] network services in February of 2008.[21]

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[11] Merrill Lynch Global Interactive Global Wireless Matrix 3Q06 ("ML Interactive GWM 3Q06"). Merrill Lynch groups technology into four categories – (i) GSM/UMTS/WCDMA, (ii) CDMA, (iii) TDMA and (iv) "other."

[12] ML Interactive GWM 3Q06.

[13] Bell Canada and Rogers have an equal partnership in Inukshuk Wireless, a Canada-wide fixed wireless network. Bell Mobility's mobile wireless technology is discussed here. Inukshuk is discussed in more detail below.

[14] "2G" refers to second generation mobile wireless technology.

[15] A Study on the Wireless Environment in Canada, Wall Communications, 9/29/06, p. 3.

[16] 1xRTT (1 channel Radio Transmission Technology) is the first step in the evolution of CDMA 2000 to 3G which provides high data-rate services.

[17] 3G refers to third generation mobile wireless technology.

[18] Bell Canada 2006 Annual Report, p. 25.

[19] "Bell Canada Enhances Mobile Data Network Access Speeds." Bell Mobility 4/30/07 Press Release.

[20] AMPS = Advanced Mobile Phone Service, and refers to an analog system.

[21] Lojack Corp., 10-K Exhibit-10 (JJ) "Amendment to the Bell Mobility Contract," as of 3/15/05, for the period 12/31/04.

Network Coverage

Bell Mobility's CDMA mobile wireless network covers more than 97% of the total population of Canada.[22] In 1Q 2007, the footprint of Bell Mobility's high-speed 3G EV-DO wireless data network covered 60% of the population of Canada,[23] and will cover 67% of the Canadian population by the end of 2Q07.

Innovative Services

Bell Mobility has a history of innovations in the mobile wireless industry. Attachment 2 to this report contains an archive of innovations and technology/services deployment for Bell Mobility over time. These include innovations in mobile phone design, features/services, and content. For example, Attachment 2 shows that Bell Mobility recently announced the exclusive availability of the thinnest phone in North America.[24] In addition, Bell Mobility recently announced "Mobile Movies," the first service in Canada providing full-length pay-per-view movies.[25] Other Bell Mobility innovations include: North America's first interoperable picture messaging service (with Sprint),[26] North America's first inter-carrier mobile text messaging (with Microcell and Rogers),[27] North America's first instant messaging service available on a digital PCS phone,[28] Canada's first phone to phone video messaging,[29] Canada's first music video ringtones,[30]Canada's first streaming video clip service,[31] Canada's first mobile phone with built in FM transmitter,[32] and Canada's first color display mobile phone.[33]

[22] Bell Response to QSI Consulting, Inc. Information Request. This is the coverage of the total Canadian population as of 1Q07.

[23] Bell Response to QSI Consulting, Inc. Information Request. See also Bell Canada 2007 Information Form (Dec 2006), p. 23 citing end of year 2006 coverage as 55%: "We continued to invest in our high-speed EV-DO wireless data network by expanding the footprint to a number of cities and towns in Ontario, Quebec, British Columbia and Alberta, bringing coverage to 55% of the Canadian population."

[24] Appendix 1, Bell Mobility 3/19/07 entry.

[25] Appendix 1, Bell Mobility 2/15/07 entry.

[26] Appendix 1, Bell Mobility 2/24/04 entry.

[27] Appendix 1, Bell Mobility 4/2/02 entry.

[28] Appendix 1, Bell Mobility 5/24/00 entry.

[29] Appendix 1, Bell Mobility 10/14/04 entry.

[30] Appendix 1, Bell Mobility 8/14/06 entry.

[31] Appendix 1, Bell Mobility 11/14/05 entry.

[32] Appendix 1, Bell Mobility 12/7/06 entry.

[33] Appendix 1, Bell Mobility 12/20/00 entry.

b. Rogers Wireless

Network Technology & Migration[34]

Rogers Wireless (or its predecessor – Rogers Cantel) has operated in the Canadian mobile wireless market since its inception in 1985. In the early 1990's, Rogers deployed TDMA IS-136 technology to cover 83% of the Canadian population including all major urban areas.[35] Rogers was licensed to provide 2G digital PCS service in 1995.[36] Rogers is the only GSM[37]/GPRS[38] provider in Canada, adding GSM/GPRS voice/data technology – allowing speeds up to 30kbps on the downlink – beginning in 2001.[39] Rogers began deployment of GSM/GPRS in 2001,[40] and in June 2002, Rogers completed the deployment of its digital wireless GSM/GPRS network overlay in the 1900 megahertz frequency,[41] and in 2003, Rogers completed the deployment of GSM/GPRS operating in the 850Mhz spectrum across its national footprint.[42] Rogers completed deployment of EDGE technology[43] across its national GSM/GPRS network in June 2004, which more than tripled the data transmission speeds available to Rogers customers[44] to average speeds of around 120 kbps[45] and bursts of up to 200 kbps.[46] Rogers substantially completed the integration of Microcell (which changed its name to Fido) networks in

[34] Rogers and Bell Canada have an equal partnership in Inukshuk Wireless, a Canada-wide fixed wireless network. Rogers' mobile wireless technology is discussed here. Inukshuk is discussed in more detail below.

[35] Rogers Wireless Responses to Wall Communications Information Requests, p. 2. Used with permission.

[36] A Study on the Wireless Environment in Canada, Wall Communications, 9/29/06, p. 3.

[37] GSM = Global System for Mobile Communications – standard wireless digital phone service (GSM is actually ETSI standard).

[38] GPRS = General Packet Radio Service – always on packet data service for GSM (115 Kbps) – primary feature of what is known as 2.5G.

[39] Rogers Wireless Responses to Wall Communications Information Requests, p. 3. Used with permission.

[40] Rogers Wireless Responses to QSI Consulting, p. 2.

[41] Rogers 2004 Annual Report, p. 24.

[42] Rogers 2004 Annual Report, p. 24.

[43] Rogers 2004 Annual Report, p. 10.

[44] Rogers 2004 Annual Report, p. 24.

[45] "Rogers Unveils New Wireless Network – High Speed Downlink Packet Access." Asterisk VoIP News. Available at: www.asteriskvoipnews.com/wifi_wireless/rogers_unveils_new_wireless_network_high_speed_downlink_ppacket_access.html

[46] Rogers Wireless Responses to Wall Communications Information Requests, p. 3. Used with permission.

2005 that it acquired in late 2004,[47] and integrated Call-Net Enterprises in 2005 which it acquired on July 1, 2005.[48]

Regarding 3G technology, in December 2005, Rogers began testing UMTS/HSDPA 3G technology in the downtown core of Toronto,[49] and in November 2006, Rogers launched its UMTS/HSDPA[50] network with speeds of between 800 Kbps and 1.1 Mbps.[51] This technology supports 14.4 Mbps downlink speeds and Rogers plans to support devices capable of 1.8Mbps and 3.6Mbps in the near term.[52]

Rogers plans to turn down its TDMA[53] and analog (AMPS) networks (that were substituted by its GSM overbuild) effective May 31, 2007.[54]

Network Coverage

Rogers' GSM/GPRS/EDGE network provides coverage to approximately 94% of Canada's population[55] and is located in all 10 provinces.[56] Rogers reports that by year end 2007, Rogers' HSDPA 3G technology will cover 60% of the Canadian population.

Innovative Services

Rogers Wireless has a history of innovations in the mobile wireless industry. Attachment 2 to this report contains an archive of innovations and technology/services deployment for Rogers over time. These include innovations in mobile phone technology, features/services, and content. For instance, Rogers recently announced that it was the first and only carrier in North America to offer video calling (i.e., face to face video calling in real-time),[57] and also recently announced the availability of a "talking cellphone," with screen reading software for customers with vision loss.[58] Rogers was

47 Rogers 2005 Annual Report, p. 10. Fido network acquired by Rogers is GSM as well.

48 Rogers 2005 Annual Report, p. 10.

49 Rogers 2005 Annual Report, p. 23.

50 High-Speed Downlink Packet Access (sometimes known as High-Speed Downlink Protocol Access) is a 3G mobile telephony protocol in the High-Speed Packet Access (HSPA) family, which provides a roadmap for UMTS-based networks to increase their data transfer speeds and capacity. Universal Mobile Telecommunications System (UMTS) is one of the third-generation (3G) mobile phone technologies

51 Rogers 4Q06 Earnings Press Release, pp. 1-2, 14.

52 Rogers Wireless Responses to Wall Communications Information Requests, p. 3. Used with permission.

53 TDMA = Time Division Multiple Access – allocates discrete amounts of bandwidth to each user in order to permit many simultaneous conversations. Packetizes data and uses spectrum more efficiently.

54 Rogers 4Q06 Earnings Press Release, pp. 1-2, 14.

55 Rogers 2005 Annual Report.

56 Rogers 2005 Form 20-F, p. 10.

57 Appendix 1, Rogers 4/2/07 entry.

58 Appendix 1 Rogers 5/8/07 entry.

also the first carrier in North America to debut HSDPA high speed data mobile wireless technology.[59] Other Rogers-related innovations include: first carrier in North America to implement downloadable music to a cellphone,[60] first carrier in North America to offer Name Display feature,[61] first in North America to provide a mobile podcast service,[62] first carrier in North America to implement a commercial digital wireless service,[63] and first Canadian provider to provide access to BlackBerry® Connect ™ (allowing access to BlackBerry wireless services through Nokia phones).[64]

c. TELUS Mobility

Network Technology & Migration

Up until 2000, TELUS and its predecessors – AGT and B.C. Tel – were partners with seven other Canadian telephone companies in the Stentor Alliance (f/k/a Telecom Canada and Trans-Canada Telephone System). In 2000, TELUS began to compete with Bell Canada and the Stentor Alliance dissolved, and later in 2000, TELUS acquired Clearnet Communications – another mobile wireless provider in Canada – to create a wireless provider with a national scope. TELUS' core network standard is CDMA, and it also operates the "Mike" network - the only iDEN network in Canada featuring push to talk ("PTT") Direct Connect capability.[65] TELUS also uses legacy AMPS (analog) wireless technology. TELUS launched its 1x wireless network in June of 2002, providing network speeds of 40-60 kilobits per second.[66] In November 2005, TELUS launched its EV-DO 3G wireless high speed network in 19 centres,[67] with typical download speeds of between 400-700 kbps. This EV-DO launch covered 5 cities, including Vancouver, Calgary, Edmonton, Toronto and Montreal, enabling data speeds 6 times faster than previous TELUS service.[68]

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59 Appendix 1, Rogers 11/2/06 entry.

60 Appendix 1, Rogers 2005 and 5/9/05 entries.

61 Appendix 1, Rogers 6/6/06 entry. Name Display allows viewing the calling party's name even if the person is not in the contact list.

62 Appendix 1, Rogers 2/1/06 entry.

63 Appendix 1, Rogers 1992 entry.

64 Appendix 1, Rogers 12/13/06 entry.

65 TELUS 2002 Annual Report, p. 6.

66 TELUS 2002 Annual Report, p. 20. TELUS' 1X network provides the always-on Internet access at speeds of 40-60 kilobits per second, which are comparable to wireline dial-up technology. (See http://www.telusmobility.com/bc/1X/index.shtml).

67 2Q06 TELUS release.

68 TELUS 2005 Annual Report business review, p. 5.

Network Coverage

As of second quarter of 2006, TELUS' CDMA network reached approximately 95% of the Canadian population.[69] In December 2006, TELUS also extended service to more than 230 US cities. TELUS launched its EV-DO 3G technology in November 2005,[70] and as of 2Q07, TELUS' EV-DO 3G network covered about 65% of the Canadian population.

Regarding TELUS' iDEN ("Mike") network, in 2003, the Mike network covered 5,000 kilometers from Vancouver Island to Eastern Quebec, and was expanded to rural and remote regions of Alberta and B.C., Manitoba Ontario and Quebec, with service to the US through roaming agreements,[71] and in 2004 the Mike network was expanded to Nova Scotia, allowing PTT from sea to sea.[72]

Innovative Services

TELUS Mobility has a history of innovations in the mobile wireless industry. Attachment 2 to this report contains an archive of innovations and technology/services deployment for TELUS Mobility over time. These include innovations in mobile phone design, features/services, and content. For instance, TELUS introduced Fastap technology, the world's first wireless phone that integrates text keys around a standard phone keypad.[73]

Other innovations for TELUS Mobility include: first in Canada to offer real time streaming satellite radio,[74] first in Canada to offer a 1.3 MP camera phone,[75] first in Canada to provide the world's slimmest QWERTY device and smallest "Mike" phone,[76] and first in Canada to offer a Windows® based PDA camera phone.[77]

[69] TELUS 2Q06 release.

[70] "TELUS Mobility Introduces National Wireless High Speed Network." TELUS Press Release. 11/14/05.

[71] TELUS 2003 Annual Report, p. 21.

[72] TELUS 2004 Annual Report, p. 19.

[73] Appendix 1, TELUS 11/30/04 entry.

[74] Appendix 1, TELUS 7/6/06 entry.

[75] Appendix 1, TELUS 10/14/04 entry.

[76] Appendix 1, TELUS 6/15/06, 6/13/06, and 6/10/04 entries.

[77] Appendix 1, TELUS 12/23/03 entry.

2. US Mobile Wireless Industry

Overall, the US wireless market comprises 9.5% of the total global wireless market in terms of subscribers.[78] As of the fourth quarter of 2006, the wireless penetration rate per capita in the US was 76.87% (or about 231.4 million subscribers), 14% of which are prepaid subscribers.[79] Verizon Wireless, AT&T, Sprint, and T-Mobile comprise 80.7% of the US mobile wireless market in terms of subscribers,[80] and over 99% combined market share in terms of services revenue.[81] In terms of technology, as of the third quarter of 2006, 80.3 million subscribers were served by GSM/UMTS/WCDMA[82] (36% of total), 109.1 million subscribers were served by CDMA (49% of total), 5.6 million subscribers were served by TDMA (3% of total), and 29.2 million are served by other technology (12% of total).[83] This compares to the international average of 80% on GSM/UMTS/WCDMA, 14% on CDMA, and 2% on TDMA.[84]

a. AT&T

Network Technology & Migration

AT&T's "core" wireless technology is GSM/GPRS/EDGE.[85] Prior to 2002, AT&T's network consisted of both TDMA (approximately 70%) and GSM (approximately 30%) technologies. In late 2001, AT&T began to overlay GSM/ GPRS throughout its TDMA network and upgrade its data network to EDGE (which delivers 2 to 3 times higher data rates than GPRS technology).[86] AT&T's GSM overlay was completed in early 2004, and as of December 31, 2005, more than 86% of AT&T's subscriber base was GSM−equipped and 95% of its minutes were being carried by the GSM network.[87] AT&T was using TDMA in 2005 in some markets pending subscriber migration to GSM-

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78 ML GWM 4Q06, Table 1.

79 ML GWM 4Q06, Table 1.

80 AT&T (26.3%), Verizon Wireless (25.5%), Sprint (18.1%), and T Mobile (10.8%). ML GWM 4Q06.

81 ML GWM 4Q06, Table 140.

82 Merrill Lynch Global Wireless Matrix groups technology into four categories -- GSM/UMTS/WCDMA, CDMA, TDMA and "other."

83 ML Interactive GWM 3Q06.

84 ML Interactive GWM 3Q06.

85 AT&T 2006 Annual Report, p. 2. 99% of AT&T's total usage, based on MOUs, is on the GSM network, p. 31. See, also, AT&T Annual Report, p. 31.

86 AT&T 2005 10-k, pp. 8-9.

87 AT&T 2005 10-k, pp. 8-9.

based technologies, and at last report, AT&T had migrated virtually all of its wireless traffic away from TDMA and onto GSM/GPRS/EDGE. AT&T's EDGE technology provides average data speeds of between 100 kbps and 130 kbps.[88]

Regarding 3G technology, as of October 2004, AT&T had deployed UMTS systems in six markets which allowed user average data download speeds between 220−320 Kbps, and in January 2005, Cingular field tested an improved version of UMTS with HSDPA, which has average mobile data throughput speed in the 400−700 Kbps range.[89] Development and deployment of UMTS with HSDPA by AT&T continued throughout 2005, and in December 2005 Cingular commercially launched these 3G networks in Austin, Baltimore, Boston, Chicago, Dallas, Houston, Las Vegas, Phoenix, Portland, Salt Lake City, San Diego, San Francisco, San Jose, Seattle, Tacoma and Washington DC, which included replacement of the six UMTS systems which had been previously deployed by AT&T Wireless.[90] These UMTS/HSDPA services were branded as "BroadbandConnect," providing average mobile data connection speeds from 400 to 700 kilobits per second (Kbps) on the downlink and bursts to more than three megabit per second.[91]

AT&T plans to cease operating its analog and TDMA networks in early 2008.[92]

Network coverage

As of December 31, 2006, AT&T served approximately 61 million customers and had access to licenses to provide wireless communications services covering an aggregate population of 296 million, or approximately 99% of the US population, including most of the 100 largest US metropolitan areas.[93] In terms of the population coverage of its mobile wireless network, as of December 31, 2006, AT&T Wireless' GSM/GPRS network covered about 282 million Americans or about 94% of the US population.[94] As of December 2006, AT&T's EDGE network covered more than 270 million people, or 90% of the US population.[95] Coverage numbers for AT&T's HSDPA 3G network were not publicly available.

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88 "AT&T Wireless Lives on the EDGE." PC World. November 18, 2003.

89 AT&T 2005 10-K, pp. 8-9.

90 AT&T 2005 10-K, pp. 8-9.

91 AT&T 2005 10-K, p. 5.

92 AT&T 2006 Annual Report, p. 26.

93 AT&T 2006 Annual Report, p. 31.

94 http://www.att.com/Investor/ATT_Annual/downloads/ATT_2006_Annual_Report.pdf US. population is assumed to be 300.9 million as of 12/31/06. See, US. Census Bureau press release, 12/28/06.

95 "Cingular 3G Coverage in More Than 160 Markets." AT&T Press Release. 12/20/06. US. population assumed to be 300.9 million.

Innovative Services

A history of AT&T's (or its predecessors') innovations in the mobile wireless industry is summarized in Attachment 2. For instance, AT&T was the first carrier in the world to announce a commercial deployment of EDGE technology.[96] Other AT&T mobile wireless innovations include: first carrier in North America to offer a UMTS/HSDPA enabled PDA,[97] first carrier in North America to launch the BlackBerry® 8800 (the slimmest BlackBerry handset available),[98] first carrier in North America to provide commercially available HSDPA 3.6 Mbps network card,[99] first carrier in world to offer EDGE enabled BlackBerry® device,[100] first carrier in US to make wireless video share call (in demo mode),[101] exclusive US carrier of the Apple iPhone,[102] and first in US to offer smartphone with Microsoft Mobile 5.0 operating system.[103]

b. VERIZON

Network Technology & Migration

Verizon Wireless's primary wireless technology platform is CDMA based on spread spectrum digital radio technology, 1xRTT (CMDA2000) that was launched in January 2002 and is now deployed in all cell sites,[104] and provides data speeds of between 120-144 kbps.

Regarding 3G technology, in October 2003, Verizon began deploying Evolution-Data Optimized (EV-DO) Release 0[105]branded as BroadbandAccess, giving customers wireless access to the Internet, intranets, e-mail and other applications at speeds of 300-500 kilobits per second.[106] In 2006, Verizon began deploying CDMA 1x EV-DO

[96] Appendix 1, AT&T 6/30/03 entry.

[97] Appendix 1, AT&T 11/6/06 entry.

[98] Appendix 1 AT&T 2/12/07 entry.

[99] Appendix 1 AT&T 9/12/06 entry.

[100] Appendix 1 AT&T 11/1/05 entry.

[101] Appendix 1, AT&T 1/5/07 entry.

[102] Appendix 1 AT&T 1/9/07 entry.

[103] Appendix 1 AT&T 1/18/06 entry.

[104] Verizon 2006 Annual Report, p. 19.

[105] EV-DO Release 0 is the first generation of mobile broadband technology for CDMA carriers providing speeds of up to 2.4 Mbps. EV-DO Revision A is the second generation upgrade to EV-DO technology providing peak data speeds of 3.1 Mbps upstream and 1.8 Mbps downstream. *See* www.cdg.org/technology/3g_1xEV-DO.asp#rev A

[106] Verizon 2003 Annual Report, pp. 4-9.

Revision A technology and in February 2007, launched its EV-DO (Rev. A) high-speed wireless broadband network with average download speeds of 450-800 kbps (peaks of 3.1Mbps)[107] and average upload speeds of 300-400 kbps (peaks of 1.8 Mbps).[108]

Network Coverage

Verizon's CDMA based network covers approximately 85% of the US population.[109] As of the fourth quarter of 2006, Verizon's 3G EV-DO high speed data network reached more than 200 million Americans (about 67% of the US population) in 30 states.[110] At the end of the fourth quarter of 2006, one-third of Verizon's retail customers – 18.8 million subscribers – had broadband-capable devices, including phones, PDAs, BlackBerrys and laptop PC cards.

Innovative Services

A summary of Verizon's innovations in the mobile wireless industry over time is provided in Attachment 2. Verizon's innovations are focused on deploying next generation technology and services for its CDMA/EV-DO mobile wireless network. For instance, Verizon was the first US carrier to launch a 3G multimedia service for mobile phones (V CAST).[111] Other Verizon innovations include being the first US carrier to offer Ringback tones,[112] and the first-ever carrier to offer color screen mobile phone.[113] Verizon also provides unique content over mobile phones including TiVo® Mobile and YouTube.[114]

c SPRINT NEXTEL

Network Technology & Migration

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[107] "Verizon Wireless Selects Lucent Technologies for CDMA2000 1xEV-DO Revision A Technology." Verizon Press Release. 6/27/06.

[108] "Verizon Wireless Rolls Out Faster EV-DO Revision A Wireless Broadband Network in Greater Chicago Area." Verizon Press Release. 2/2/07.

[109] Verizon's network reaches about 255 million Americans. Assumes 300.9 million US. population. http://aboutus.vzw.com/bestnetwork/network_facts.html

[110] Verizon 10-K 2006, p. 14. Assumes 300 million US. population.

[111] Appendix 1 Verizon 1/7/05 entry.

[112] Appendix 1 Verizon 11/16/04 entry.

[113] Appendix 1 Verizon 11/29/00.

[114] Appendix 1, Verizon 3/14/07 and 11/28/06 entries.

SprintNextel uses CDMA and iDEN[115] "core" technologies.[116] Sprint launched in 3Q02 nationwide "PCS Vision," with typical speeds of 50 to 70 Kbps with maximum speeds of 144 Kbps.[117] SprintNextel first introduced 3G EV-DO commercially in the 2Q05 and has plans to continue to expand EV-DO – a technology providing average download speeds of 400-700 kbps and average upload speeds of 50-70 kbps.[118] Sprint launched its EV-DO Revision A network in October 2006, providing average download speeds of 600 kbps – 1.4Mpbs and average upload speeds of 350-500 kbps.[119] SprintNextel plans to announce 4G technology soon.[120]

Sprint will in the future use QUALCOMM Qchat technology to provide walkie talkie over CDMA and will increase the interoperability between CDMA and iDEN.[121]

Network Coverage

Sprint's CDMA network covers over 300 metro markets, including 297 of the 300 largest US metro areas, with a footprint covering 262 million people (or about 87% of the US population).[122] SprintNextel's iDEN network covers 300 metro areas, including 293 of the 300 top US markets and 274 million people (representing about 91% of the US population).[123]

Regarding 3G technology, as of December 31, 2006, Sprint's EV-DO covered 209 million people (or about 70% of the US population) and serves over 219 communities with populations of at least 100,000.[124] Sprint has also begun the next generation EV-DO technology (EV-DO Rev A) that, which as of December 2006, covered 60 million Americans (or about 20% of the US population)[125] – and by the third quarter of 2007,

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[115] Motorola is Sprint's sole source provider of iDEN technology, except Black Berries with are manufactured by RIM. Sprint 2005, 10-K.

[116] Sprint 10-K 3-31-06.

[117] Sprint 200310-KA.

[118] "Sprint 'Powers Up' Largest Mobile Broadband Network with More Upgraded Markets, Faster Speeds, New Device and Integrated GPS Capabilities." Sprint Press Release. 1/30/07.

[119] "Sprint 'Powers Up' Largest Mobile Broadband Network with More Upgraded Markets, Faster Speeds, New Device and Integrated GPS Capabilities." Sprint Press Release. 1/30/07.

[120] Sprint 2006 Q2P.

[121] Sprint Nextel Form 10-K, filed March 1, 2007 (period: December 31, 2006), p. 4.

[122] Sprint Nextel Form 10-K, filed March 1, 2007 (period: December 31, 2006), p. 7.

[123] Sprint Nextel Form 10-K, filed March 1, 2007 (period: December 31, 2006), p. 7.

[124] Sprint Nextel Form 10-K, filed March 1, 2007 (period: December 31, 2006), pp. 4, 7, 37. See also, Sprint 10/24/06 Press Release.

[125] Sprint Power Up Faster Mobile Broadband Network in 10 More markets, Upgraded Coverage Reaches 60 million People." Sprint Press Release. 12/12/06.

Sprint's wireless broadband network is expected to be completely upgraded with the faster EV-DO (Rev A) technology.[126]

Innovative Services

A history of Sprint's innovations in the mobile wireless industry is provided in Attachment 2. One such example is that Sprint was the first company in the US to launch EV-DO Revision A technology.[127] Other Sprint innovations include: first carrier in US to offer a EV-DO Rev. A capable device,[128] first carrier in US to stream full-length films to mobile phones,[129] first in US to offer 2 megapixel camera phone,[130] first in US to offer music video ringers,[131] first in US to launch instant over the air music download service,[132] first in US to launch streaming music clip subscription service,[133] and first in US to offer a phone with a built in camera.[134]

d. T-MOBILE (USA)

Network Technology & Migration

T-Mobile's "core" wireless technology is GSM/GPRS/EDGE technologies.[135] T-Mobile USA plans to offer its first commercial services based on UMTS-HSDPA technology in the second half of 2007,[136] and commenced 3G deployment in November 2006.[137] T-

[126] "Sprint Launches Nation's First EV-DO Revision A Mobile Broadband Network." Sprint Press Release. 10/24/06. See also, Sprint 2006 10-K, p. 4.

[127] Appendix 1 Sprint 10/24/05 entry.

[128] Appendix 1 Sprint 8/29/06 entry.

[129] Appendix 1 Sprint 12/12/05 entry.

[130] Appendix 1 Sprint 5/12/05 entry. Sprint was also first in US. to offer 1.3 MP camera phone. See Appendix 1 Sprint 7/8/04 entry.

[131] Appendix 1 Sprint 3/14/05 entry.

[132] Appendix 1 Sprint 10/31/05 entry.

[133] Appendix 1 Sprint 1/8/03 entry.

[134] Appendix 1 Sprint 10/15/02 entry.

[135] T-Mobile 2006 Form 20-F, p. 18.

[136] T-Mobile 2006 Form 20-F, p. 18.

[137] T-Mobile 20F, p. 79.

Mobile's roll-out of 3G in the US has been limited by a lack of suitable spectrum,[138] until recently, when it acquired the necessary spectrum.[139]

Network Coverage

T-Mobile's GSM/GPRS 1900 voice and data network reaches about 277 million people in the US, representing about 92% of the US population, when roaming agreements are included.[140] T-Mobile's 3G network is currently being deployed and is not commercially available. As of 12/31/06, T Mobile had about 37,000 base station cells in the US.[141] T-Mobile also has the largest Wi-Fi WLAN in the US with 8200 public access locations across country.

Innovative Services

A history of T-Mobile's mobile wireless innovations is provided in Attachment 2. As this attachment shows, T-Mobile was the first in the US to offer ringback tone service.[142] Other innovations for T-Mobile include offering the slimmest bar phone available in the US[143] and first in US to offer video messaging service.[144]

B. TECHNOLOGY COMPARISON OF CANADIAN AND US MOBILE WIRELESS COMPANIES

1. Technology Standards

[138] The UMTS requirement for 5 MHz frequency slots, much larger than that required for existing networks, can create difficulty for US operators as many are only licensed for 5MHz in each direction in certain areas, and as such cannot run both their existing system and UMTS in the areas affected. (Source: http://www.mobilecomms-technology.com/projects/tmobileusa/).

[139] Until October 2006 the company was constrained by a severe shortage of wireless spectrum in the US, which meant inferior reception in many areas and many more network busy signals than its bigger rivals. In the latest Federal Communications Commission (FCC) spectrum auction (auction 66) T-Mobile USA bid $4.2bn to ensure that it was the high bidder for 120 licenses in markets across the US and so would gain use of a usable range of AWS (advanced wireless services) spectrum in the 1.7GHz and 2.1GHz bands for data and voice services. T-Mobile USA has more than doubled its average frequency coverage in the top 100 US markets, from 25.9MHz to 52.2MHz. (Source: http://www.mobilecomms-technology.com/projects/tmobileusa/)

[140] "T-Mobile USA Exceeds 25 Million Customer Milestone and Reports Fourth Quarter and 2006 Results." T-Mobile 4th Quarter Press Release, 3/1/07.

[141] T-Mobile 2006 Form 20-F, p. 77.

[142] Appendix 1 T-Mobile 12/8/04 entry.

[143] Appendix 1 T-Mobile 9/12/06 entry. See also Sprint 5/2/06 entry.

[144] Appendix 1 T-Mobile 3/27/03 entry.

Table III.1 provides a summary of "core" (most prevalent standard) mobile technology adopted by Canadian and US national mobile carriers.

Table III.1. Subscribers by Technology in Canada, US and World*

Country	Metrics	GSM/ UMTS/ WCDMA	CDMA	TDMA	OTHER	TOTAL
Canada	Total Subscribers (M)	6.5	11.0	0.3	0.7**	**18.4**
	% Subscribers	35%	59%	2%	4%	**100%**
	Major Carriers	*Rogers*	*Bell Canada, TELUS*	*Rogers*	*TELUS*	
US	Total Subscribers (M)	80.3	109.1	5.6	29.2	**224.2**
	% Subscribers	36%	49%	3%	12%	**100%**
	Major Carriers	*AT&T, T-Mobile*	*Verizon, Sprint*	*AT&T*	*Sprint*	
All Countries	Total Subscribers (M)	1,851.2	320.4	47.4	85.5	**2,304.6**
	% Subscribers	80%	14%	2%	4%	**100%**

** -- Canada data based on CWTA company-level 4Q2006 subcribers. TDMA (Rogers) subscribers estimated from www.angustel.ca/update/up578.html. US and All Countries data based on Merrill Lynch Telecom Services Research Interactive Global Wireless Matrix, January 2007 (data for 3Q 2006). Note that the Merrill Lynch estimate for Canadian TDMA (2 million in 3Q2006, which is also in the 2004 edition of Merrill Lynch Matrix) appears to be too high.*

*** -- An estimate for TELUS "Other" (Mike) subscribers based on EOY 2000 share of Clearnet (Mike) subscribers in total TELUS subscribers. Note that for category "Other" Merril Lynch reports an estimate of 3.7 million subscribers in Canada, which appears to be too high.*

As seen from table III.1, the prevalent wireless standard in both Canada and the US is the digital CDMA standard (59% and 49% of total subscribers respectively) – the standard used by Bell Mobility and TELUS in Canada, and by Verizon and Sprint (non-Nextel customers) in the US. The second most prevalent standard in Canada and the US is GSM, comprising 35% of the total subscribers in Canada and 36% of the total subscribers in the US, which is used by Rogers in Canada and AT&T and T-Mobile in the US. Canada and US have a similar amount of TDMA in their networks (2% for Canada and 3% for the US), both of which are phasing out this technology. Rogers is turning down its TDMA networks at the end of May 2007, while AT&T is scheduled to turn down its TDMA network in early 2008.

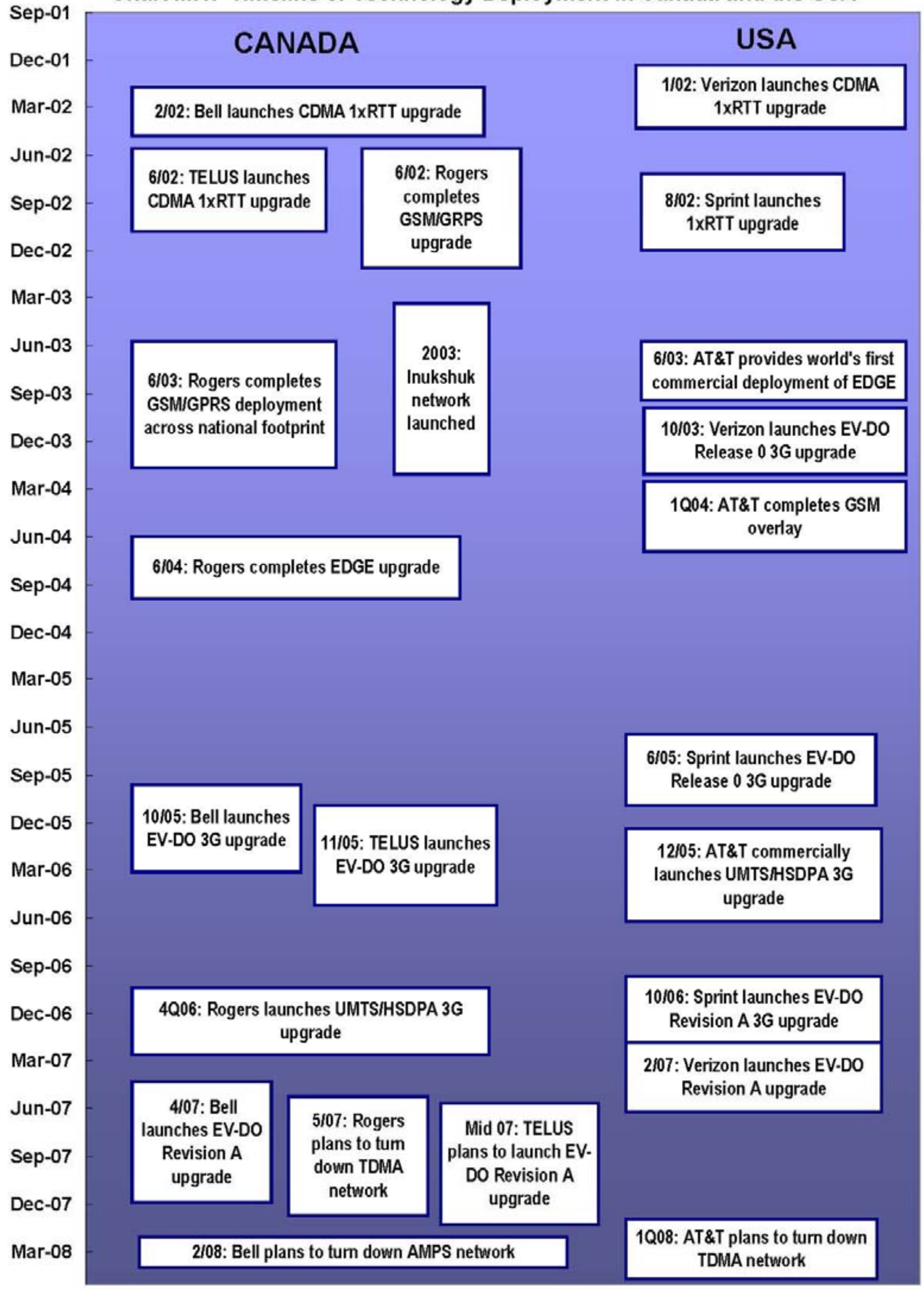
The primary difference between the Canadian and US markets in terms of technology used by subscribers is the higher percentage of "other" wireless technologies – e.g., iDEN – used by subscribers in Canada (4% in Canada and 12% in US). Table III.1 above also shows that the makeup of the global wireless technology used is different than that found in Canada and the US, with a higher percentage (80%) of global wireless subscribers using the GSM standard and a lower 14% using CDMA technology. The amount of TDMA in the global wireless customers (2%) is similar to that in Canada and the US.

Also evident in the table above is the sheer difference in size of the mobile wireless markets in Canada versus the US. The US mobile wireless market (224.18 million subscribers) is more than 12 times the size of the Canadian market (18.43 million subscribers) in terms of subscribers, and the US mobile wireless market comprises 9.7% of the total global market (in subscribers) compared to Canada's 0.8% of the total.

2. Timing of Technology Innovations

The following Chart III.1 shows how the various carriers deployed technology over time in Canada and the US:

Chart III.1. Timeline of Technology Deployment in Canada and the USA



As seen on chart III.1, regarding 2.5 G technology for CDMA based carriers, Verizon and Bell Mobility launched their 1xRTT upgrades in the US and Canada, respectively, at approximately the same time in early 2002. TELUS launched its 1xRTT upgrade in Canada in June 2002 – five months after Verizon's launch in the US and four months after Bell Mobility's launch in Canada; and Sprint launched its 1xRTT upgrade in August 2002 – six months after Bell Canada's launch, seven months after the US launch and two months after TELUS launches in Canada. Therefore, while a US carrier was first to launch 1xRTT, the first Canadian launch followed within 1 month of the US launch, and both of Canada's CDMA based providers launched 1xRTT before Sprint – a major US carrier – launched. For GSM-based carriers, the first 2.5G upgrade – defined as upgrade from TDMA to GSM/GPRS and or EDGE – occurred in June 2002 when Rogers completed its GSM/GPRS overlay in the 1900 megahertz frequency[145] (Rogers completed the deployment of GSM/GPRS operating in the 850Mhz spectrum across its national footprint in 2003),[146] which predates AT&T's completion of its GSM overlay which was completed in 1Q04. Though AT&T was the first to commercially *launch* EDGE technology in June 2003, Rogers *completed* its EDGE deployment within one year of AT&T's launch (in June 2004).

Regarding 3G technology for CDMA based carriers, Verizon was the first to launch with its EV-DO Release 0 upgrade launched in October 2003 and significantly expanded in January 2004. Sprint was second to deploy its EV-DO technology Release 0 in July 2005, about 20 months after Verizon first launched EV-DO Release 0. Bell Mobility launched EV-DO Release 0 in Canada in October 2005 - 3 months after Sprint's launch in the US, and TELUS launched EV-DO Release 0 in November 2005 – 4 months after Sprint's launch. Besides Verizon, which deployed 3G EV-DO Release 0 twenty months before the second carrier deployed it, the remaining CDMA based carriers (Sprint, Bell Mobility and TELUS Mobility) all launched 3G Release 0 in a 4 – 5 month time period. Regarding EV-DO Revision A technology, Sprint was the first to launch in October 2006, followed by Verizon in February 2007, and most recently, by Bell Mobility on April 30, 2007. TELUS Mobility has plans to launch EV-DO Revision A later in 2007.

Regarding 3G deployment for GSM-based carriers, AT&T launched UMTS/HSDPA in December 2005 in the US, and Rogers launched UMTS/HSPDA in Canada in the 4Q06 – within one year of AT&T's launch. T-Mobile began deploying 3G UMTS technology in November 2006, with most work to be done in 2007, and plans to start offering 3G services in several markets by mid-2007.

[145] Rogers 2004 Annual Report, p. 24.

[146] Rogers 2004 Annual Report, p. 24.

3. Carrier-Specific Coverage

The network coverage data discussed above for each wireless carrier was taken from company reports, as well as information provided by the companies themselves (in the case of the Canadian companies). For companies reporting network coverage in terms of people covered, assumptions were made regarding the population of the country to calculate coverage as a percent of total population. Best efforts have been made to ensure that this coverage data excludes coverage associated with resale and roaming agreements. In addition, mobile wireless network coverage is constantly evolving due to additional deployment and investment, so the date on which the coverage is measured provides only a snapshot in time of that coverage.

The data on coverage shows that as a percentage of total Canadian population, the digital networks of Bell Mobility, Rogers Wireless and TELUS Mobility cover 97%, 94% and 95%, respectively. In the US, the digital networks of AT&T, Sprint, and Verizon Wireless cover 94% (90% for EDGE), 87%, and 85% of the total US population, respectively. The GSM providers in the two countries compare very favorably, with Rogers' network covering 94% of the Canadian population and AT&T's network covering 94% of the US population. Bell Canada leads the CDMA providers with 97% coverage of the Canadian population, followed by TELUS (95% of the Canadian population), Sprint (87% of the US population), and Verizon (85% of US population).[147]

Regarding coverage of 3G technology (EV-DO for CDMA carriers and HSDPA for GSM carriers) for Canada, Bell Mobility's EV-DO network will cover 67% of the Canadian population at the end of 2Q07,[148] Rogers HSPDA network will cover 60% of the Canadian population at year end 2007,[149] and TELUS' EV-DO network covers 65% of the Canadian population as of 2Q07. By comparison, in the US, Verizon's and Sprint's EV-DO networks covered 67% and 70% of the US population as of 4Q06. Coverage data for AT&T's HSDPA network are not publicly available. A comparison of the CDMA carriers shows that 3G coverage in Canada (around 65% coverage of the Canadian population for both Bell Mobility and TELUS) compares favorably to that in the US (around 70% of the US population for both Verizon and Sprint). A comparison of GSM 3G coverage between the two companies due to a lack of data for AT&T's 3G coverage in the US.

Also, as mentioned above, both Verizon and Sprint have deployed EV-DO Revision A technology. Sprint's EV-DO Revision A technology covers about 20% of the US

[147] Note: according to another source – www.cdg.org/worldwide/index.asp - Verizon has deployed EV-DO in all markets.

[148] This number is estimated. Bell Mobility's 3G network covered about 60% of the Canadian population in 1Q07.

[149] This is Rogers Wireless' estimated coverage for year end 2007.

population and there is not available data regarding Verizon's EV-DO Revision A coverage. Bell Mobility's EV-DO Revision A technology was just recently launched on April 30, 2007 and is, at this time, available in areas of Ontario, with plans for deployment to additional areas in 2007.

4. Canadian Innovations

Canada is responsible for many mobile wireless "firsts" in North America, demonstrating a commitment to innovation. One such example is inter-carrier messaging. On April 2, 2002, Canada announced North America's first inter-carrier text messaging network, allowing for the first time in North America real-time, two-way text messaging between 4 different companies.[150] Canada also led the US, in announcing the first inter-carrier multimedia messaging among carriers on June 29, 2005[151] - the US made this announcement about a week after Canada. [152] Canadian companies have also been active in cross-border text[153] and picture[154] and multimedia[155] messaging with US carriers. Other "firsts" in North America or Canada show that Canada either leads or is generally on par with the US in terms of general innovation.

- 05/1998: Bell Mobility first in world to provide Tri-mode phones (AMPS/CDMA 850/1900).
- 07/1998: Bell Mobility is first North American wireless company to introduce switchless trunkless Pre-paid.[156]
- 05/24/00: Bell Mobility provides North America's first Instant Message service on Digital PCS phones.[157]
- 12/20/00: Bell Mobility announces first color display mobile phone in Canada.[158] The first color display was introduced in the US by Verizon on 11/29/00,[159] less than one month earlier.
- 05/03: Bell Mobility provides world's first location based service Mr. Rescue.

[150] Bell Mobility 4/2/02 Press Release.

[151] TELUS 6/29/05 Press Release.

[152] AT&T, T-Mobile, and Sprint 7/7/05 Press Releases. T-Mobile 7/7/05 Press Release.

[153] Bell Mobility 1/23/03 Press Release.

[154] Bell Mobility 2/24/04 Press Release.

[155] TELUS 6/21/06 Press Release.

[156] Bell Mobility responses to QSI information requests, p. 2.

[157] Bell Mobility 5/24/00.

[158] Bell Mobility 12/20/00 Press Release.

[159] Verizon 11/29/00 Press Release.

- 11/30/04: TELUS introduces Fastap™, the world's first wireless phone that integrates text keys around a standard numeric phone keypad – making it easier to send text messages and enter contacts in contact list.
- 10/14/04: TELUS introduces first 1.3MP in Canada.[160] By comparison, Sprint announced the introduction of its first 1.3MP camera on July 8, 2004 – three months earlier than TELUS' introduction.
- 05/09/05: Rogers provides North America's first full music download.[161]
- 02/01/06: Rogers launches North America' first Podcast Service over mobile phones.[162] By comparison, AT&T announced mobile podcast in October 2006,[163] eight months after Rogers' launch.
- 06/06/06: Rogers provides first Name Display service – allowing a customer to see the name and number of the party calling even if not in contacts list - in North America.[164]
- 02/15/07: Bell Mobility provides first Canadian full length pay per view movie service.[165] By comparison, Sprint announced on 12/12/05 the availability of the first mobile entertainment with full length films (Mspot)[166] – about two months earlier.
- 04/02/07: Rogers announces North America's first video calling service.[167] AT&T demonstrated the first US video share call on 1/5/07 at a trade show.[168]

C. CASE STUDIES

1. Phones and PDA Devices

a. Blackberry® Devices

From the standpoint of consumers, phones, smartphones and other mobile handheld devices such as Personal Digital Assistants ("PDAs") constitute the "face" of technological developments. Therefore, the availability and the speed of adoption of

[160] TELUS 10/14/04 Press Release.

[161] Rogers 5/9/05 Press Release.

[162] Rogers 2/1/06 Press Release.

[163] AT&T 10/2/06 Press Release.

[164] Rogers 6/6/06 Press Release.

[165] Bell Mobility 2/15/07 Press Release.

[166] Sprint 12/12/05 Press Release.

[167] Rogers 4/2/07 Press Release.

[168] AT&T 1/5/07 Press Release.

these devices by mobile carriers provide useful measures of technological deployment and innovations. For mobile data services, one of the popular series of handheld mobile devices for business use is the BlackBerry® device that combines the usual PDA applications such as an address book and a calendar with telephone and e-mail capabilities. It typically features a full ("QWERTY") keyboard and a scrolling wheel to facilitate data entry and navigation. BlackBerry® utilizes wireless data networks of mobile phone service companies to support e-mail, mobile telephone, text messaging, web browsing and other wireless information services.

Developed by the Canadian company Research In Motion (RIM),[169] BlackBerry® was first introduced in 1999 and first made headway in the marketplace by concentrating on e-mail for corporate employees on the move. Cingular was the first US mobile carrier to establish a wholesale relationship with RIM for the BlackBerry® platform (1999).[170] Rogers first signed a supply agreement for BlackBerry® handhelds in March 2000.[171] Also dating back to 2000 are the wholesale relationships of *RIM* with Bell Canada[172] and Microcell (later merged with Rogers).[173] The US member of T-Mobile group (now T-Mobile USA), VoiceStream, signed a supply agreements for BlackBerry® at the end of 2001,[174] followed by the joint announcement of Nextel (later merged with Sprint) and RIM to develop BlackBerry® for Nextel's iDEN network.[175] AT&T Wireless (later merged with Cingular; now AT&T) signed an agreement for BlackBerry® at the beginning of 2002.[176]

Currently BlackBerry® devices are offered to consumer and business markets by all major mobile carriers in Canada and the US. As explained above, three of the seven major Canadian and US mobile carriers operate on GSM network (Rogers, AT&T and T-Mobile), four carriers operate a CDMA network (Bell Mobility, TELUS Mobility, Verizon and Sprint (non-Nextel customers)), and two other carries operate the iDEN

[169] See http://www.rim.net/index.shtml.

[170] See http://www.rim.net/news/press/2004/pr-25_02_2004-01.shtml. Note that BlackBerry® products include not only the BlackBerry® handheld devices, but also special software, including the software necessary to integrate BlackBerry® devices into corporate e-mail systems and e-mail software that runs on non-BlackBerry® devices.

[171] See http://www.rim.net/news/press/2000/pr-15_03_2000.shtml.

[172] See http://www.rim.net/news/press/2000/pr-19_09_2000.shtml.

[173] In 2000 Microcell signed a supply agreement with RIM (see http://www.rim.net/news/press/2000/pr-14_12_2000.shtml), which was preceded by joint testing of high-speed mobile data services based on Microcell's GSM General Packet Radio Services (GPRS) wireless technology. (See http://www.rim.net/news/press/2000/pr-04_05_2000.shtml).

[174] See http://www.rim.net/news/press/2001/pr-30_10_2001.shtml. Note that for its European operations, T-Mobile signed an agreement for BlackBerry® in early 2002 (see http://www.rim.net/news/press/2002/pr-19_02_2002.shtml).

[175] See http://www.rim.net/news/press/2001/pr-20_12_2001-02.shtml.

[176] See http://www.rim.net/news/press/2002/pr-29_01_2002-02.shtml.

network – Nextel (Sprint) in the US, and TELUS Mobility (“Mike’s” customers) in Canada. Because BlackBerry® devices rely on the networks of mobile carriers, adoption rates of specific BlackBerry® models by mobile carriers are influenced by the date when a particular device became available for a particular network standard. Two most recent BlackBerry® products, which are also RIM’s first two consumer-oriented devices, are the smallest and lightest full QWERTY BlackBerry® Curve™ and the compact BlackBerry® Pearl (featuring a reduced key keyboard). Specifically, the most recent BlackBerry® product, the Curve, though not yet currently[177] offered by any provider, is being announced as coming soon to AT&T and Rogers.[178] The other model, BlackBerry® Pearl, is currently available only from the GSM-based mobile carriers.

Table III.2 below provides a comprehensive listing and adoption dates of all BlackBerry® devices currently offered by the seven major Canadian and US mobile wireless carriers. (As noted above, BlackBerry® Curve, though introduced by RIM, is not yet available in retail stores).

Table III.2. Adoption Dates of Currently Offered BlackBerry ® Devices*

Introduced by	 8800 Series	 Pearl	 8700 Series	 7200 Series	 7130 Series
AT&T	2/12/2007	11/30/2006	11/1/2005	9/28/2004	6/8/2006
Rogers	2/12/2007	9/7/2006	11/9/2005	10/22/2004	
T-Mobile	4/20/2007	9/7/2006	4/18/2006	3/11/2005	
Bell Canada	4/25/2007	*not available*	9/2006**	2/16/2005	11/2005**
Sprint	*not available*	*not available*	9/20/2006	6/22/2005***	5/31/2006****
TELUS	*not available*	*not available*	11/29/2006	3/2/2005	12/15/2005
Verizon	4/25/2007	*not available*	9/12/2006	2/7/2005	11/21/2005

* -- *Press Release dates. Source: RIM Press Release Archives (http://www.rim.net/news/press/index.shtml).*
Device images taken from RIM Image Gallery at http://www.rim.com/newsroom/media/gallery/index.shtml
Availability based on company web sites as of May 5, 2007.
T-Mobile also offers 7105t; Sprint offers 7100i (introduced on 10/14/05) for Nextel customers and 7520.

** -- *Dates provided by company to QSI.*

*** -- *Not listed as current offer on Sprint web site.*

**** -- *Based on Sprint Press Release.*

[177] As of May 5, 2007.

[178] See http://www.rim.net/news/press/2007/pr-04_05_2007-01.shtml and http://www.rim.net/news/press/2007/pr-03_05_2007-05.shtml.

As table III.2 shows, each carrier offers three to five BlackBerry® devices. GSM-based carriers are adopting the recent models of BlackBerry® devices soon after they become available from the developer, RIM, and close to each other. For example, BlackBerry® Pearl, which was introduced by RIM in September 2006, is currently offered by Rogers in Canada, and AT&T (Cingular) and T-Mobile in the US. Rogers and T-Mobile announced its availability to their customers on the same day – September 7, 2006 (available in stores on September 12, 2006 for T-Mobile, and October 2006, for Rogers).[179] AT&T (Cingular) followed two months later with a November 30, 2006 announcement.[180] These models are not yet available[181] from carriers utilizing CDMA and iDEN-based networks. The BlackBerry® 7130, a non-QWERTY keyboard smartphone was first introduced for CDMA-based carriers. Verizon and Bell Canada introduced the BlackBerry® 7130e in the same month (November 2005), followed by TELUS' introduction the next month on December 15, 2005.[182] Sprint launched the BlackBerry® 7130e in the US about six months after TELUS launched it in Canada.

Table III. 2 also refutes the notion that Canada lags the US in adopting new handsets and devices. Or, in other words, Canadian wireless companies introduce wireless handsets and devices at approximately the same time as the US companies. Take the BlackBerry® 7200 series, for example. The first GSM carrier to launch this device was AT&T in the US in September 2004, followed closely by Rogers in Canada the next month, followed, in turn, by T-Mobile in March 2005 (after some of the CDMA-based carriers). The first CDMA carrier to launch the BlackBerry® 7200 series was Verizon on February 7, 2005, followed closely by Bell Mobility on February 16, 2005 (9 days later) and TELUS Mobility on March 2, 2005 (less than a month after Verizon). Sprint launched this model in June 2005, more than 3 months after the last carrier launched it in Canada. The results of the BlackBerry® 8700 series is similar, with GSM-based AT&T launching this model on November 1, 2005, followed by Rogers about a week later (11/9/05), and T-Mobile about five months later in April 2006. CDMA-based carriers Bell Mobility (in Canada) and Verizon and Sprint (in the US) introduced the 8700 series in the same month (September 2006), followed by TELUS.

In addition to availability of BlackBerry® handheld devices, it is useful to look at the "penetration" (or, equivalently, subscribership) of BlackBerry® products in both countries. RIM annual reports contain information on total worldwide subscribership of BlackBerry® wireless platform, as well as the distribution of total revenues between countries.[183] Using these two data sets, we estimated subscribership to the BlackBerry®

[179] See http://www.rim.net/news/press/2006/pr-07_09_2006-02.shtml and http://www.rim.net/news/press/2006/pr-07_09_2006-01.shtml.

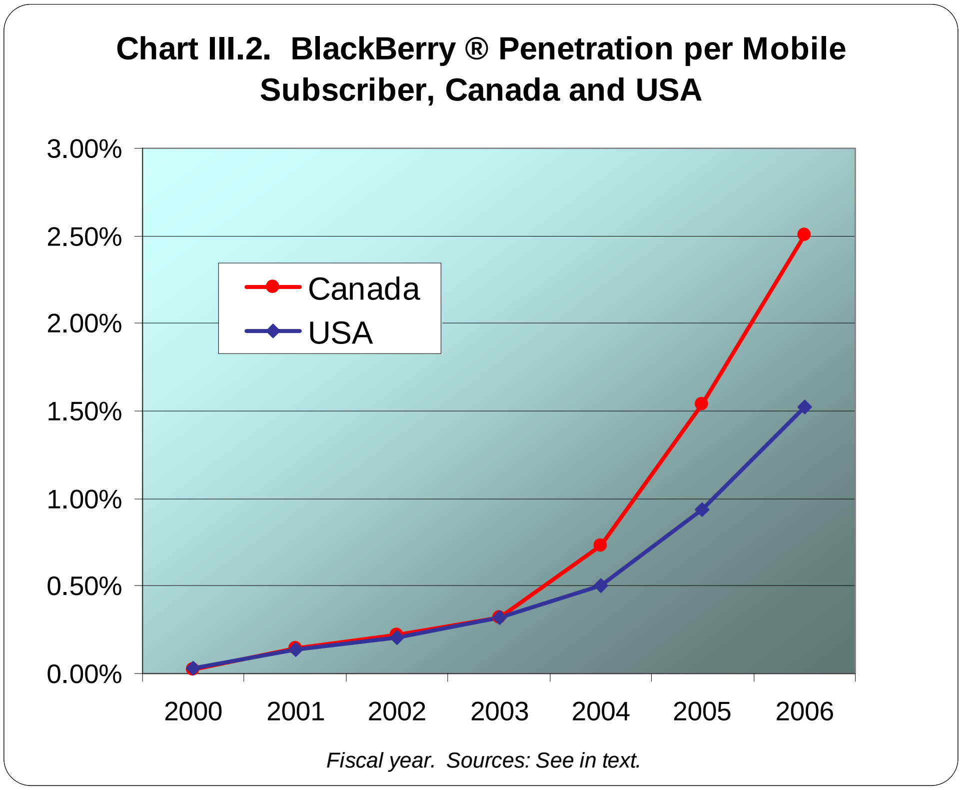
[180] See http://www.rim.net/news/press/2006/pr-30_11_2006-01.shtml.

[181] As of April 4, 2007.

[182] See, TELUS 12/8/05 press release.

[183] See, for example, RIM 2006 Annual Report, p. 4 (subscribership) and p. 74 (revenue by region/country).

wireless platform by country.[184] Next, we calculated penetration of BlackBerry® platform in both countries on a per wireless subscriber basis.[185] Chart III.2 below depicts BlackBerry® penetration as a share of total mobile wireless subscribers.



As seen in the chart above, although, early on, the Canadian and US BlackBerry® penetration rates were very close, in recent years Canada has exceeded the US penetration rates for the BlackBerry® wireless platform, and this lead over the US has increased over time. In terms of BlackBerry® penetration per mobile wireless subscriber, Canada (with 2.5% rate) currently exceeds the US (with 1.5%) by one percentage point.

[184] For example, Canadian subscribers are estimated as worldwide subscribers times the percent of Canada in total revenue. Note that this analysis assumes that revenues per subscriber are equal in both countries.

[185] Sources for mobile wireless subscribership: CWTA (Canada mobile wireless subscribers) and FCC 11th Report of Wireless Competition, Table 1 (US mobile wireless subscribers 2000-2005). Note that because RIM reports data for fiscal year (ending in Spring of each year with the specific ending date varying by year), and mobile wireless subscriber data are for end of calendar year, BlackBerry® penetration per mobile wireless subscriber was calculated for each year using mobile wireless subscribers for the preceding year.

To summarize, our analysis suggests that Canada is slightly ahead of the US in terms of BlackBerry® wireless platform penetration despite being behind the US in terms of "mass market" mobile voice penetration. This finding corroborates our analysis that Canada leads the US in terms of high-end/value added services.

b. Other Devices

Motorola RAZR™ is a camera phone best known for its distinctive fashionable look.[186] At the time of its introduction, it was the slimmest phone available, and its cumulative sales world wide made it the most popular phone in history.[187] Table III. 3 below provides the timeline of the mobile carriers' offerings of this phone to their subscribers.

Table III.3. Adoption Dates of Motorola RAZR™ Handset*

Availability	Carrier Network Standard	Date
AT&T (Cingular)	GSM	Nov-04
Rogers	GSM	Feb-05
T-Mobile	GSM	Jun-05
Verizon	CDMA	Dec-05
Bell Canada	CDMA	Feb-06
TELUS	CDMA/iDEN	Feb-06
Sprint	CDMA/iDEN	Oct-06

** -- Announcement dates. Based on Motorola News Releases available at http://www.motorola.com/mediacenter/news/archive.jsp.*
Source for Bell Canada: http://www.bce.ca/en/news/releases/bm/2006/01/24/73285.html.
Source for TELUS: http://en.wikipedia.org/wiki/Razr#_note-2#_note-2.

As seen from table III.3, Motorola RAZR™ was first adopted by GSM-based carriers. The US carrier Cingular (now AT&T) was the first to introduce this model in North America (in November 2004), followed by Rogers (February 2005) – the Canadian GSM-based carrier – and T-Mobile (March 2005) - the third GSM-based carrier.

[186] See, for example, a review of its appearances on popular US TV shows at http://en.wikipedia.org/wiki/Razr#_note-2#_note-2 and an introduction of special edition RAZR™ by high-end fashion designer Dolce and Gabbana in 2005 (http://www.motorola.com/mediacenter/news/archive.jsp?globalObjectId=Q4-2005).

[187] See for example, Motorola reporting the shipment of 50 millionth RAZR phone in July 2006 (http://www.motorola.com/mediacenter/news/detail.jsp?globalObjectId=7031_6980_23).

Canadian CDMA-based carriers, Bell Canada and TELUS, adopted Motorola RAZR™ in February 2006, 2 months from the date on which Verizon introduced this device on the CDMA network in the US. Sprint was a distant last, offering this phone seven months after it became available to Canadian CDMA-based subscribers.[188] Currently, this phone is offered by all seven major Canadian and US mobile carriers.

As with Blackberry® devices, Motorola RAZR™ was first developed for GSM networks. This is expected given the global nature of Motorola Corporation and the fact that the majority of world mobile phone subscribers are GSM-based. Recall, that 80% of world-wide mobile subscribers are served by GSM networks, compared to 36% of US and 35% of Canadian subscribers being served by GSM.[189]

The information above shows two primary points. First, mobile wireless handset technology gets focused first by GSM technology, and second, there is not a significant lag in the introduction of wireless handsets and devices in Canada relative to the US. To the latter point, there are additional examples that show that adoption of wireless handsets in Canada does not lag to a significant degree the US, and in some instances, Canada leads the US in handset/device introduction. The following is a sample listing of some of these devices and introduction dates in Canada and the US:

- Motorola MOTO Q[190]: TELUS launched this device in Canada on June 15, 2006[191] and Verizon launched this device in the US on May 31, 2006[192] - about two weeks before TELUS's launch.
- Treo 650[193]: this device is one that was first introduced by a CDMA carrier. Sprint introduced this device in the US in October 2004.[194] The GSM carriers followed a few months later, with AT&T introducing this device in February 2005[195] and Rogers introducing it about one and a half months after AT&T, in

[188] As is evident from Sprint's press release (http://www2.sprint.com/mr/news_dtl.do?page=show&id=13840), Sprint Motorola RAZR™ came with distinctive features, including its association with the (PRODUCT) RED™ campaign, which is a global partnership aimed at raising money and awareness of AIDS in Africa.

[189] Merrill Lynch Telecom Services Research *Interactive Global Wireless Matrix, January 2007* (data for 3Q 2006).

[190] The MOTOQ by Motorola includes a QWERTY keyboard, 1.3MP camera, miniSD memory card, full-duplex speakerphone, powered by Microsoft Windows Mobile 5.0.

[191] TELUS Press Release 6/15/06.

[192] Verizon Press Release 5/22/06.

[193] The Treo™ 650 smartphone by palmOne includes 23MB storage, VGA 2x digital zoom camera, MP3 player, and QWERTY keyboard.

[194] Sprint Press Release 10/25/04.

[195] AT&T Press Release 2/2/05. First device to use AT&T's EDGE network.

March 2005.[196] TELUS launched this device in November 2005, about nine months after the GSM carriers.[197]

- Treo 680[198]: this device is currently offered by GSM carriers AT&T and Rogers. AT&T launched this device on November 22, 2006,[199] while Rogers launched it about two weeks later on December 5, 2006.[200]
- Nokia E62[201]: this phone is provided by the GSM carriers AT&T and Rogers, both of which announced the availability of the device in September of 2006.[202] Rogers was the first carrier in North America to introduce this device.
- HP iPAQ 6300 series[203]: this device, too, is provided by the GSM carriers AT&T and Rogers, both of which announced its availability in June 2005 (Rogers announced four days before AT&T).[204]
- UTStarcom Pocket PC 6700 series[205]: this device is provided by CDMA carriers Verizon and TELUS Mobility (the first device in Canada with Windows Mobile 5.0). TELUS announced availability on November 18, 2005,[206] while Verizon announced availability on January 4, 2006.[207]
- Sierra Wireless AirCard 580: this network card was developed for the EV-DO 3G network. Sprint announced on March 3, 2005[208] that this card would be available later in 2005 for its EV-DO network, while TELUS announced the availability of this card on May 4, 2005, two months after Sprint's announcement.[209]

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196 Rogers 3/14/05 Press Release.

197 TELUS 11/11/05 Press Release.

198 The Treo™ 680 smartphone includes internal antenna, QWERTY keyboard, MP3 player, integrated camera, video camera and video player.

199 AT&T 11/22/06 Press Release.

200 Rogers 12/5/06 Press Release.

201 The Nokia E62 includes push email capabilities, enhanced web browser capabilities, 2.8" display, and more.

202 See, AT&T 9/12/06 Press Release, and Rogers 9/6/06 Press Release and 12/21/06 Press Release. Rogers made this device available to customers in December 2006.

203 The HP iPAQ h6320 (non-camera) and h6325 (built-in camera) offer global roaming capabilities, and the industry's first devices to provide 3-way integrated wireless voice and data capabilities over GSM/GPRS, WiFi, and Bluetooth™ technology.

204 See, Rogers 6/2/05 Press Release and AT&T 6/6/05 Press Release.

205 UTStarcom 6700 Pocket PC includes Windows Mobile® 5.0, Microsoft Office, QWERTY keyboard, 1.3MP camera and video camera with 8x digital zoom, built-in WiFi capability, Bluetooth for hands free capability, miniSD memory card, 2-way speakerphone.

206 TELUS 11/18/05 Press Release.

207 Verizon 1/4/06 Press Release.

208 Sprint 3/3/05 Press Release.

209 TELUS 5/4/05 Press Release.

- Motorola i580[210] and i880[211] phones: these models are iDEN phones provided by the two iDEN carriers – TELUS Mobility and Sprint (Nextel). The i580 is a "rugged" iDEN phone and the i880 is the first iDEN phone with a 2.0 megapixel camera. Sprint (Nextel) and TELUS both announced the availability of the Motorola i580 in July 2006 (Sprint on July 6, 2006[212] and TELUS on July 17, 2006)[213] and both announced the availability of the i880 iDEN picture phone in November 2006.[214]

2. Next-Generation Mobile Wireless Services

The services available to any mobile wireless customer is a function of the network technology deployed and devices/handsets available. A comparison of the carriers' network technology and available mobile wireless devices is provided above – this section compares the services that are available to customers. Multimedia and entertainment applications are the special focus of this analysis because these services reflect the "latest and greatest" services available over mobile wireless devices, and often are available from more recent handsets/devices. The services listed below are based on research of the companies' websites and press releases, and availability varies by handset and geographic area.

- **Bell Mobility**: Bell Mobility's entertainment packages include the following:
    - Movies[215]: allows customers to watch full-length feature films on the mobile phone.
    - TV:[216] real-time TV on a mobile phone, currently about 30 channels, including the Shopping Network, TLC and the Weather Network. Also allows viewing of videos (1-4 minute clips) either by download or streaming.[217]

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[210] The Motorola i580 includes a 1.3MP camera phone, Bluetooth wireless technology for wireless data transfer of non-copyrighted material, optional microSD memory card, Push to Talk, Push To View, voice playback, MP3 player, and GPS capability.

[211] The Motorola i880 includes a 2.0MP camera, walkie-talkie service, Java applications, GPS capabilities, picture caller ID, voice dialing, speakerphone, voice recorder.

[212] Sprint 7/6/06 Press Release.

[213] TELUS 7/17/06 Press Release.

[214] Sprint 11/9/06 Press Release.

[215] Available on 6 different handsets available from Bell Mobility.

[216] Available on 7 different handsets available from Bell Mobility.

[217] Streaming video is available on 7 handsets available from Bell Mobility. Download clips on 3 handsets available from Bell Mobility.

- Music (Full Track Music): allows download of over 1 million tracks to the mobile phone from the online music store and to transfer songs from a PC to a phone.
- Games: download and play games, including 3D games.
- Applications: allows downloading screensavers (from catalog or personalized), ringtones (TrueTones, VoiceTones, and video ringtones available), and caller ring tunes (which allows callers to hear tunes instead of ringing when calling a Rung Tunes customer).
- Messaging: allows text messaging, picture messaging, video messaging, international messaging, Text for fun, and picture postcards. Also provides access to IM with Windows Live MSN Messenger.

- **Rogers Wireless**: Rogers offers Rogers VISION, which provides customers access to a number of entertainment and multimedia applications focused on use of Rogers' 3G HSDPA network.
  - Video Calling (VISION): the only wireless carrier in North America to offer Video calling, which allows callers to hear and see the person they are talking to.
  - Video on Demand (VISION): allows streaming 2-6 minute clips, including YouTube, Tonight Show, ET Canada and more.
  - Radio on Demand (VISION): allows customers to listen to XM Satellite radio, including about 25 channels and 5 exclusive channels.
  - Mobile TV (VISION): allows customers to watch real-time TV with more than 25 channels, including exclusive Toronto Blue Jays games, The Weather Network, CBC Newsworld.
  - Mobile Music (VISION): allows download of hundreds of full length music videos and thousands of music tracks from Rogers MusicStore.
  - Mobile Internet (VISION): high speed access to wireless Internet, email including Yahoo!® and Windows Live™ Mail.
  - Applications: download games, ring tunes, caller ring tones (Caller Ring Trax™) videos and more.
  - Games: download games and play online with multiple players.
  - Messaging: allows instant messaging (Yahoo!, AOL, MSN), Fun with TXT, international texting, picture messaging, and video messaging.

- **TELUS Mobility**: TELUS Mobility offers SPARK™, a package of entertainment and multimedia services. SPARK provides the following:
  - Mobile TV:[218] real-time TV on a mobile phone, including YTV, CBC Newsworld, Bloomberg Television, and FOX.

[218] Available on 6 different handsets available from TELUS.

- Mobile Music:[219] allows download of thousands of tracks to the mobile phone from the online music store and to download songs from a PC to a phone.
- Mobile Radio:[220] allows mobile customers to listen to XM Satellite Radio, commercial free music and other programming (20 channels to choose from at this time).
- Games: allows web games (games that are accessed by the phone's browser), downloadable games (interactive, multi-media, arcade-style games with full sound and enhanced graphics) and multiplayer games.
- Videos: allows downloads of latest movie trailers, music videos and TV clips to mobile phone.
- Applications; download screensavers, images, and ringtones.
- Messaging: allows text messaging, international text messaging, picture messaging, video messaging, and instant messaging (MSN Messenger).

- **Verizon Wireless:** Verizon Wireless offers V CAST which is a suite of entertainment and multimedia applications for Verizon's 3G EV-DO network.
  - Mobile TV (V CAST): watch streaming real-time TV.
  - Mobile Music (V CAST): download music to mobile phone and import from PC.
  - Games: download and play games, including 3D games, on mobile phone.
  - Mobile Web 2.0: provides access to MSN® Hotmail® and AOL®.
  - Video clips: watch on-demand clips of sports, comedy, news, weather from major networks.
  - Messaging: text messaging, picture messaging, video messaging, Mobile IM for AOL®, MSN®, and Yahoo!®, text alerts,
  - Applications: allows download wallpaper, ringback tones (callers hear a song instead of a ring), and ringtones.

- **AT&T**: AT&T provides entertainment/multimedia packages that include the following:
  - Mobile Music (Cingular Music): listen to streaming music stations (XM Radio Mobile), download music, download music videos.
  - Mobile On-demand video (Cingular Video): Cingular Video allows viewing of clips from news (CNN, NBC), sports, HBOMobile(SM), music videos, etc.
  - Mobile Email: access to AOL®, AIM, Yahoo!®, MSN® Hotmail, BellSouth and AT&T Yahoo! Mail.
  - Games: download and play games from AT&T's Media™ Net, and some games available in a multi-player environment.

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[219] Available on 5 different handsets available from TELUS.

[220] Available on 5 different handsets available from TELUS.

- Messaging: text messaging, international messaging, picture messaging, video messaging, and IM via AOL®, Yahoo!®, and Windows Live™ messenger services.
- Applications: download ringtones, graphics, Answer Tones (same as ringback tunes).

- **Sprint:** Sprint offers Power Vision(SM), which is a suite of entertainment and multimedia applications.
    - Mspot: full-length streaming movies via Mspot.[221] Sprint has announced this offering (see Sprint 9/5/06 and 12/12/05 press releases), but Sprint does not currently make it available on its website.
    - SprintTV(SM): watch TV channels including NFL Network, Fox Sports, E!, CNN and more on the mobile phone.
    - Mobile Music: download full-length songs from Sprint's Music Store, listen to streaming music from SIRIUS music, and music videos.
    - Games: download and play games on mobile phones or play real-time with others in remote locations.
    - Mobile Web access: allows browsing and downloading of online content from MobiTV, CNNtoGO, Reuters, SI.com, The Weather Channel®, E!Online, CNN Money, Rand McNally, and more. Mobile email also available through Yahoo®!, MSN®, and AOL®.
    - Messaging: text messaging, international messaging, voice SMS, picture messaging, video messaging, fun messaging, and IM (i.e., AOL™, MSN® and Yahoo®!).
    - Applications: download screen savers, ring tones, call tones (same as ring back tunes), on-demand information updates, and graphics.

- **T-Mobile:** T-Mobile offers a suite of entertainment and multimedia services called t-zones.
    - Mobile Web: wireless access to web content and email. Some of T-Mobile's devices/handsets are capable of downloading and playing full-length songs or video, but T-Mobile does not feature these services under the mobile wireless entertainment/multimedia services on its website.
    - Messaging: text messaging, international text messaging, IM (via AOL®, icq, MSN®, and Yahoo!®), picture messaging, video messaging, and email.
    - Games: download and play games on mobile phone.
    - Applications: download wallpaper, on-demand information including movie listings, weather, sports scores, etc. download ringtones, caller ringtunes, voice tones.

[221] See, Sprint 12/12/05 press release.

Table III.4 summarizes the entertainment and multi-media services provided by the major wireless carriers in Canada and the US. Note that shading indicates that a service is being offered by a carrier:

Table III.4. Entertainment and Multimedia Product Offerings by Carrier*

Services & Features	Canada			USA			
	Bell Mobility	Rogers Wireless	TELUS Mobility	AT&T	Verizon Wireless	Sprint	T-Mobile
Full-Length Movies							
Real-Time TV							
Download Full-Length Songs							
Streaming Radio							
Video Calling							
Text Messenging							
Picture Messenging							
Video Messaging							
International Messenging							
Instant Messenging							
Download & Play Games**							
Interactive Games/Multiplayer							
Download video clips							
Download Ring Tones							
Download Wallpaper/Screensavers							
Caller Ring Tunes***							
Mobile Web Access							
Voice SMS							

** -- Color shading indicates service availability. Does not include offerings offered by MVNOs and regional wireless providers.*
*** -- Both Bell Mobility and Verizon offer 3D games, according to their websites.*
**** -- Caller Ring Tunes allows the caller to hear a song instead of the traditional ring. Each carrier has a unique name for this service.*

Overall, table III.4 shows that currently Canada leads the US in terms of next-generation services/features roll-out, and at worst, is on par with the US in this regard. According to the companies' websites, Rogers Wireless (Canada) is the only mobile wireless carrier studied that provides video calling – the ability to hear *and see* the person on the other end of a phone call. Another advanced entertainment/multimedia capability – the ability to watch full-length movies on a mobile phone – is exclusively available in Canada through Bell Mobility.[222] Sprint announced the availability of a service providing full-length movie streaming to mobile phones in the US called Mspot Movies,[223] but Sprint is not advertising this offering on its website and it does not appear to be commercially available at this time. Therefore, the table above does not show Sprint offering full-

[222] As of the writing of this report, Bell Canada offered movies, including *Spiderman 2, Men in Black 2* and *The Cable Guy*, for viewing over no fewer than 7 different handsets. *See* www.bell.ca/shopping/VasWlsMovie.details

[223] "Sprint and MSpot Roll Out Red Carpet with Streaming Movie Service for Mobile Phones." Sprint Press Release. 12/12/05. Sprint announced that MSpot Movies marks the first time full-length feature films are streamed to mobile phones in the United States.

length movies.. Sprint (US) it the only carrier studied that advertises voice SMS[224] on its website.

In terms of real-time television on a mobile phone, all three carriers in Canada provide this capability while Verizon and Sprint provide it in the US (AT&T and T-Mobile do not). Reports indicate that AT&T plans to roll-out mobile TV service in later in 2007.[225] All carriers studied except T-Mobile (US) provide the capability to download full-length songs to a mobile phone, and customers in both Canada and US can transfer songs from a personal computer to a cellphone. More than one provider in each country – Rogers and TELUS in Canada and AT&T and Sprint in US – provides the capability to listen to streaming radio over a mobile phone from satellite radio providers for example.

Messaging capabilities are ubiquitous throughout all carriers in both countries. Every carrier provides the ability to send text messages, international text messages, picture messages, video messages, and instant messages. Regarding gaming, all carriers provide the ability to download and play games on a mobile phone, and 3-dimensional games are available in both Canada and the US (e.g., Bell Mobility and Verizon), as is the ability to play interactive games with multiple players in remote locations (Bell Mobility, Rogers and TELUS in Canada and AT&T and Sprint in the US). Mobile web access as well as personalization downloads (e.g., ringtones, caller ring tones, wallpaper) are ubiquitously available among carriers in both countries.

The availability of full-length movie viewing and video calling in Canada suggests that Canada is currently ahead of the US in terms of making available the newest entertainment/multimedia offerings and capabilities to customers. All other offerings (except voice SMS) can be obtained in both Canada and the US.

3. Wi-Fi Services

a. Hot Spots

Wi-Fi is a popular technology standard for Wireless Local Area Networks ("WLAN") that provides users with laptops short-range wireless[226] high-speed Internet connection at "hot-spots." Wi-Fi operates in an unlicensed spectrum, has limited coverage and is often

[224] According to Sprint's website, voice SMS allows users to send voice messages to any phone or email address in seconds without dialing.

[225] "Cingular Signs on for Qualcomm mobile TV." InfoWorld. February 13, 2007 ["Starting in the fourth quarter, Cingular will offer multiple channels of live TV with the [Qualcomm MediaFLO] technology…"].

[226] Several hundred feet from a wireless access point, which connects to the networks via landline facilities such as a T1.

provided by entities other than mobile carriers.[227] However, mobile carriers have been active in this segment of the market, providing Internet connectivity as a supplement to voice services either via their own deployments or partnerships.

Public hot spots are typically located at airports, coffee shops, hotels and other public places, and are often provided for free. This service is particularly useful at airports (where it is more likely to be offered for a fee) because it provides e-mail and Internet access to travelers. To achieve ubiquity, which is important to a business traveler, companies enter into roaming agreements with Wi-Fi providers (which can be mobile carriers or other companies) in specific airports.

The Canadian approach to Wi-Fi Hot Spots is somewhat unique because instead of bilateral agreements, national mobile providers, in conjunction with the Canadian Wireless Telecommunications Association ("CWTA"), reached an agreement to provide inter-carrier Wi-Fi service.[228] This agreement was made in May 2005 and is the broadest inter-carrier undertaking of its kind in North America, and allows for cross-Canada roaming between carrier-run hot spots. All public commercial hotspots operated by the participating carriers (which included Bell Canada, Rogers, TELUS and FIDO (now merged with Rogers)) are branded consistently with the common hotspot identifier. Similarly consistent is the browser-based login area of all branded hot spots. If user support is required, clients will continue to access their own carrier's customer service. This initiative also simplifies payment options for customers, allowing them to charge Wi-Fi usage at any of the branded hotspots to their existing wireless carrier bills.

By contrast, in the US, for example, Sprint established a bilateral roaming agreement with Wayport when launching Wi-Fi in 2003, which at the time operated hot spots in 13 airports, as well as hotels and restaurants.[229] In 2004 the US carrier AT&T Wireless (now AT&T) established a hot spot roaming agreement with T-Mobile allowing T-Mobile subscribers to use AT&T Wireless facilities in the Denver and Philadelphia airports, and utilizing T-Mobile Wi-Fi facilities in San Francisco airport to serve its own customers.[230] Similarly, the same year AT&T Wireless and Sprint established a roaming agreement at Denver, Kansas City, Philadelphia, Raleigh-Durham and Salt Lake City Airports.[231]

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[227] See the FCC *11th Report* on Wireless Competition released on September 29, 2006, p. 91 footnote 574 explaining that services provided via WLAN are not commercial mobile radio services under the US federal rules.

[228] See http://www.canadianhotspot.ca/#.

[229] See http://www.wi-fiplanet.com/news/article.php/3080181.

[230] See http://news.com.com/T-Mobile%2C+AT38T+Wireless+form+roaming+pact/2110-7351_3-5154711.html.

[231] See http://news.com.com/2100-7351-5194443.html.

Estimates on the number of public hot spots vary.[232] Critics of Wi-Fi also suggest that the initial expectations of demand for this service may have been overstated,[233] and that mobile data (3G) services provide a better, more secure Internet connection that also allows true roaming. However, they acknowledge that Wi-Fi hot spots have their "place" at certain locations, such as airports.[234] Therefore, airports present a good location type for international comparisons of hot spot proliferation not only because of their proven demand and viability of service, but also because data on airport hot spot locations is more manageable because of its limited scope.

Table III.5 compares hot spot counts in Canada and the US at commercial airports. As with any comparison between these two countries, the differences in population and geography affect interpretation of the data: Because Canada's population is roughly 11% of the US population, it is expected that, other things being equal, all absolute metrics such as the airport counts and hot spot counts would be of similar proportions. The last column of the table provides similarly calculated percentages (percent of Canada count in the US count) for each absolute metric.

Table III.5. Comparison of Airport Wi-Fi Hot Spot Counts in the US and Canada*

Metrics	US	Canada	Canada as % US
Number of Airports with Hot Spots	166	24	14%
Total Airport Hot Spots	581	49	8%
including Airport Hot Spots by Wireless Companies:			
Absolute Count	157	20	13%
Percent	27%	41%	
Large and Medium Airports**	68	6	9%

** -- Based on MSN Wi Fi Hot Spot Locator (http://hotspot.live.com/web/SearchView.aspx)*

*** -- US classification as reported by the FAA (http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/index.cfm?year=2005) Canada: Airports with passenger enplanements exceeding US "Small" Airports. Canada 2004 enplanements based on Transport Canada (http://www.tc.gc.ca/pol/en/Report/anre2005/add/taba917.htm). US 2005 enplanements are estimated as total "deplanements and enplanements" divided by 2.*

As seen from the last column of table III.5, the differences between Canadian and US airport hot spot counts, which range from 8 to 14% depending on the metrics, are roughly proportional to the differences in population. The most significant difference between the two countries is that a larger proportion of airport hot spots are operated by mobile

232 See for example, the FCC *11th Report* on Wireless Competition released on September 29, 2006, p. 92 citing various estimates of hot spot counts for the US.

233 See for example, a story of Verizon decommissioning its free Wi-Fi spots at payphones in New York City in 2005 (http://www.pcworld.com/article/id,120753-page,1/article.html).

234 See http://www.pcworld.com/article/id,120753-page,1/article.html.

carriers in Canada (41%) than in the US (27%).[235] On a more granular level, Canada has slightly better representation than the US in terms of the number of airports with Wi-Fi access (at 14% of the US). In terms of total hot spot count, Canada has relatively less hot spots than the US (at 8% of the US) , which is driven by the fact that Canada has less (relatively speaking, 9% of the US count) large airports, which tend to have multiple hot spots. For example, the largest US airport in terms of passenger counts,[236] Atlanta, has 30 hot spots, while the largest Canadian airport, Toronto (which is much smaller than Atlanta in terms of passenger counts[237]), has 5 hot spots.[238] In other words, while the US has relatively more airport hot spots, it has relatively less distinctive airports with hot spots than Canada. It should be noted that these relative differences are not large differences.

b. Inukshuk Network

Canada has also deployed (and is in the process of expanding) a Canada-wide fixed wireless network called Inukshuk (or Inukshuk Wireless). Inukshuk is a joint venture between Bell Canada and Rogers, designed to build and manage a Canada-wide wireless broadband network licensed by Industry Canada.[239] This next-generation Internet protocol ("IP") wireless network, based on pre-WiMax standards, is a fixed wireless (as opposed to mobile wireless technology discussed above) non-line-of-sight technology[240] that allows subscribers, including subscribers in rural and under-served areas, to access the Internet and other applications such as VoIP and video streaming.[241] Inukshuk was launched in 2003 to provide wireless high-speed Internet access across Canada using spectrum in the 2.5 GHz range,[242] and provides data speeds of between 512 kbps and 3Mbps.[243] In 2006, the initial phase of Inukshuk was completed, bringing Inukshuk to five million households representing 40% of the population in 20 urban centres across

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[235] As shown in row 5 of the table, 40% of Canadian airport hot spots are operated by mobile carriers, compared to 27% in the US. Note that for Canada this percentage includes one Toronto airport hot spot served by a non-Canadian (T-Mobile) carrier. Exclusion of this hot spot brings the percentage to 39%.

[236] According to the US FAA, it had 42,402,653 revenue passenger enplanements in 2005 (see http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/index.cfm?year=2005).

[237] According to *Transport Canada*, Toronto had 26,830,507 passenger enplanements and deplanements in 2004 (see http://www.tc.gc.ca/pol/en/Report/anre2005/add/taba917.htm).

[238] Hot spot counts as listed by MSN Wi Fi Hot Spot Locator: http://hotspot.live.com/web/SearchView.aspx.

[239] www.inukshuk.ca/anglais/nous.html

[240] www.inukshuk.ca/anglais/offre.html

[241] www.inukshuk.ca/anglais/offre.html

[242] Bell Canada 2007 Information Form (Dec 2006), p. 25.

[243] Montreal Tech Watch, 3/30/07, available at: www.montrealtechwatch.com/2007/03/inukshuk-extends-its-wireless-coverage.html See also, Bell Mobility's responses to QSI information requests, p. 6.

Canada.[244] In the first quarter of 2007, Inukshuk was expanded to cover about 100 urban and rural areas in Canada, bringing Inukshuk to over 6.5 Canadian households.[245] By the end of 2008, Inukshuk's wireless footprint is expected to cover 45 cities and approximately 100 un-served rural and underserved communities across Canada, for a total of 145 urban and rural areas, covering almost 7 million Canadian households.[246] Inukshuk is licensed to provide service in 10 service areas covering approximately 30 million Canadians (or about 91% of Canada's population).[247] According to Bell Canada, Inukshuk is the largest deployment of pre-WiMAX technology, as a function of population served, of any country in the developed and the developing world.[248]

In addition to the objective of serving rural un-served and underserved communities, Inukshuk has committed to fulfill a Learning Plan, in which Inukshuk Wireless works with regional advisory committees to evaluate and fund projects to advance the needs of Canada's learning community.[249] These projects are based on three C's: "Connectedness" (accelerate deployment and coverage of the network), Content (multi-media-rich content to foster on-line learning) and Continuity (establishment and continuation of a relationship between Inukshuk Wireless and Canada's learning community).[250] One example of a Inukshuk project is "PocketSnips"[251] – a project done with the Northern Ontario School of Medicine in which a library of micro-videos will be created to provide open access multimedia medical education materials to a variety of learning communities including medical students, health professionals and patients.[252]

IV. PENETRATION AND COVERAGE: CANADA VERSUS THE US

A. NATIONWIDE PENETRATION RATES

244 Bell Canada 2007 Information Form (Dec 2006), p. 23.

245 Inukshuk Wireless deployment schedule, 2006-2008 (4/26/07). Inukshuk Wireless Coverage Area Expanded, Digital Home, 4/2/07, www.digitalhome.ca/content/view/1778/206/

246 Inukshuk Wireless deployment schedule, 2006-2008 (4/26/07).

247 Canada's population is assumed to be 30.8 million. See, http://www.statcan.ca/english/edu/clock/population.htm

248 Bell Mobility responses to QSI information requests, p. 4.

249 www.inukshuk.ca/anglais/education.html

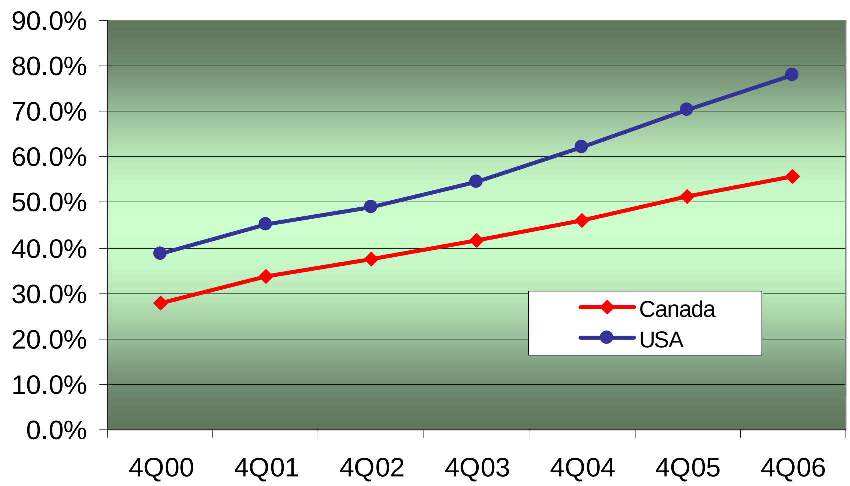
250 www.inukshuk.ca/anglais/education.html

251 www.normed.ca/pocketsnips/

252 www.inukshuk.ca/anglais/funded_on.html

At the end of 2006, which is the most recent data available, Canadian penetration of mobile wireless service (measured as subscribers per capita)[253] was estimated at 55.7%.[254] By comparison, the US per capita mobile wireless penetration was 78.1% for the same time period.[255] Chart IV.1 below compares mobile wireless penetration in both countries over time:

Chart IV. 1. Wireless Penetration Rates (Subscribers per Capita): Canada and USA



Sources: CWTA (Canada Subscribers); FCC 11th Report of Wireless Competition, Table 1 (US Subscribers 2000-2005), CTIA Semi-Annual Survey December 2006 (US Subscribers 2006); US Census Bureau, International Database (Population)

As shown in chart IV.1, Canadian wireless penetration, though lower than penetration in the US, is growing along a similarly sloped – almost linear – curve, and follows the general dynamics of the US penetration. In general, Canadian penetration constitutes approximately 70-75% of penetration in the US (measured as the ratio of penetration

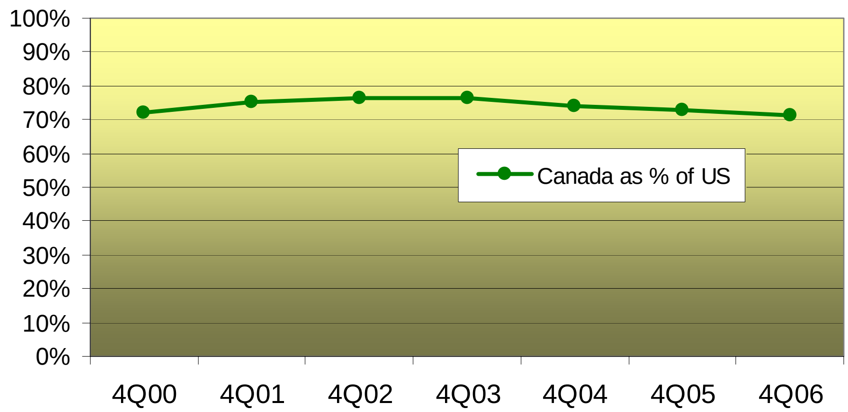
253 Note that sometimes penetration is measured in terms of 100 households. See, for example, CRTC 2006 Monitoring Report, Table 2.3.1 and the *Decima Study* discussed below.

254 Derived from subscribership and population counts (sources: CWTA (Subscribers) available at http://www.cwta.ca/CWTASite/english/industryfacts.html; US Census Bureau, International Database available at http://www.census.gov/cgi-bin/ipc/idbagg (Population)).

255 Derived from subscribership and population counts (sources: CTIA Semi-Annual Survey December 2006 available at http://www.ctia.org/advocacy/research/index.cfm/AID/10316; US Census Bureau, International Database available at http://www.census.gov/cgi-bin/ipc/idbagg (Population)).

rates in Canada and the US).[256] The following chart IV.2 provides additional details on the dynamics of relative penetration rates in the two countries:

Chart IV.2.
Per Capita Wireless Penetration Rates:
Canada as % of the United States



Sources: CWTA (Canada Subscribers); FCC 11th Report of Wireless Competition, Table 1 (US Subscribers 2000-2005), CTIA Semi-Annual Survey December 2006 (US Subscribers 2006); US Census Bureau, International Database (Population)

As seen from chart IV.2, Canadian wireless penetration relative to the US is somewhat stable, approaching 80% in 2002 and 2003, and being approximately 75% in 2006.

Conclusion: The difference between the US and Canadian wireless penetration rates can be attributed to the fact that the US wireless industry had an 18-month head start based on the first wave of wireless spectrum auctions in both countries. The difference in penetration rates – which has remained relatively stable over time – indicates that Canada's penetration growth is roughly equal to that of the US.

[256] Note that the above comparison of the US and Canada wireless penetration is based on the data from industry associations in both countries (CWTA in Canada, and CTIA in the US). Other sources report somewhat different estimates of subscribership. For example, in addition to the CTIA data, the US FCC lists its own estimate of subscribership, which is lower that the CTIA estimates. (The FCC-own and CTIA estimates are contained in Tables 2 and 1 (respectively) of the FCC 11th Report on Wireless Competition.)

B. REGIONAL DIFFERENCES IN PENETRATION

Wireless penetration varies by region. Specifically, table IV.1 presents mobile wireless per capita penetration by province based on the data from Statistics Canada.[257] Provinces are listed in this table in descending order in terms of mobile wireless penetration:

Table IV.1. Canadian Mobile Wireless Per Capita Penetration by Province (2004)*

Geographic Area	Penetration	Population
Alberta	58.3%	3,215,869
Ontario	51.8%	12,454,171
British Columbia	48.0%	4,215,695
Saskatchewan	42.9%	995,351
Manitoba	41.2%	1,173,358
Québec	36.0%	7,566,136
Atlantic Provinces	35.4%	2,346,008
Territories	NA	103,411
Canada Total	**46.4%**	**32,069,999**

** -- Calculated from source: Statistics Canada, Catalogue 56-001, Table 7 (Mobile Telephony subscribers only; excluded "Paging" and "Other" subscribers).*

As seen from table IV.1, Alberta has the highest mobile penetration at 58.3% of population, and the Atlantic Provinces have the lowest penetration at 35.4%. Within the Atlantic provinces, Newfoundland and Labrador (not separately listed in the table) had the lowest penetration at 30%.[258] The data presented in table IV.1 are consistent with a more recent study by *Decima Research*,[259] whose survey-based method estimated that in 2006 Alberta had the highest provincial wireless penetration rate (which the study measures as penetration per household rather than population), followed by Ontario.

257 Statistics Canada Catalogue 56-001, Vol. 36 No. 1 (released in July 25, 2006) available at http://www.statcan.ca/bsolc/english/bsolc?catno=56-001-X&CHROPG=1.

258 Calculated from data in Table 7 of Statistics Canada Catalogue 56-001, Vol. 36 No. 1 (released in July 25, 2006) available at http://www.statcan.ca/bsolc/english/bsolc?catno=56-001-X&CHROPG=1.

259 See p. 9, Decima Research, Usage of Wireless Communications in Canada, Final Report, April 2006 available at http://www.cwta.ca/CWTASite/english/industryfacts.html ("*Decima Study*").

Similarly, *Decima Study* found that Quebec and Atlantic provinces are the bottom two areas in terms of mobile wireless penetration.[260]

US wireless penetration similarly varies by region. The FCC reports penetration by economic area. The most recent data show that per capita penetration was as high as 95% in *Fort Myers-Cape Coral, Florida* economic area, and as low as 41% in *Northern Michigan,* economic area.[261] Note that an economic area is a smaller geographical unit than a province or state, and is more comparable to a metropolitan area.[262] Because of its smaller size, the variation of observed penetration rates in economic areas is expected to be larger than in broader geographical units such as a province. In other words, the highs and lows in the US economic area-level data are expected to be more extreme than the province-level Canadian penetration data presented in table above.

Income Effect

The above mentioned *Decima Study* estimated wireless penetration in different population groups. According to the results, income was the most significant factor that affects penetration.[263] This result is consistent with QSI's cross-regional comparisons of penetration and income based on publicly available data from Statistics Canada. Specifically, table IV.2 lists provincial penetration estimates and median family income data:[264]

[260] According to Decima study, Quebec was below the Atlantic province in terms of household wireless penetration.

[261] The FCC *11th Report* on Wireless Competition, released on September 29, 2006, Table 3.

[262] For example, the *Northern Michigan* economic area had population of 269,986 (2000 census; see the FCC *11th Report* on Wireless Competition, released on September 29, 2006, Table 3) .

[263] For example, at p. 9 of the *Decima Study* reports that in the income group $60K+ penetration was 82% of households, while in the income group, $30K penetration was only 36%. (Decima Research, Usage of Wireless Communications in Canada, Final Report, April 2006 available at http://www.cwta.ca/CWTASite/english/industryfacts.html.)

[264] Income data are from Statistics Canada CANSIM Table 111-0009 available at http://www40.statcan.ca/l01/cst01/famil108a.htm.

Table IV.2. Canadian Mobile Wireless Per Capita Penetration and Median Family Income by Province (2004)*

Geographic Area	Penetration	Median Family Income
Alberta	58.3%	$ 66,400
Ontario	51.8%	$ 62,500
British Columbia	48.0%	$ 55,900
Saskatchewan	42.9%	$ 53,500
Manitoba	41.2%	$ 54,100
Québec	36.0%	$ 54,400
Atlantic Provinces	35.4%	$ 49,729
Correlation Coefficient	**0.93**	

** -- Source: Statistics Canada, Catalogue 56-001, Table 7 (basis for penetration) and CANSIM Table 111-0009 (income).*

Table IV.2 shows that provinces with relatively high family incomes tend to have high mobile penetration rates, and provinces with relatively low family incomes tend to have low mobile penetration rates. For example, the first three provinces in terms of penetration are also the first three provinces in terms of median family income. These three provinces are provinces with above average penetration rate (which is 46.4% as listed in the previous table). For these three provinces the average median family income is $61,600,[265] while the average median family income for provinces with below average penetration (the remaining provinces) is $52,932. In relative terms, income in provinces with below-average wireless penetration rates is 16%[266] less than income in provinces with above average penetration. Incidentally, the province with the lowest median family income is Newfoundland and Labrador at $46,100 annually (this province is not separately listed in the above table, but aggregated within the "Atlantic provinces"). As discussed above, Newfoundland and Labrador have the lowest mobile penetration out of all provinces[267] at 30%. Finally, table IV.2 contains the correlation coefficient between income and penetration, which is a statistical measure of the degree of relationship between the two variables (income and penetration). The value of the correlation

[265] Simple average of the median family incomes of the top three provinces as listed in the table.

[266] Calculated as [($61,600 / $52,932) – 1].

[267] Excluding territories for which data are not available.

coefficient is 0.93, indicating a very strong positive relationship between income and penetration.[268]

The US penetration data for economic areas exhibit a similar positive relationship between income and penetration. For example, average[269] personal income in economic areas with above average penetration rates is CAD$37,189, while average personal income in economic areas with below average penetration rates is CAD$32,610.[270] In relative terms, the average personal income in economic areas with above-average penetration exceeds average personal income in economic areas with below-average penetration by 14%.[271]

Conclusion: geographically disaggregated country-level data suggest that income is an important driver of wireless penetration rates. Therefore, it is reasonable to expect that differences in income levels between the two countries may explain, at least in part, the differences in penetration rates between the two countries. A comparison of different income measures in both countries shows that Canada has lower per capita income than the US. Table IV.3 below, compiled from a larger dataset of the Canadian Centre for the Study of Living Standards, contains different measures of relative income.

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[268] Correlation coefficient is a statistical measure of linear relationship between two data sets. It is bounded between -1 and +1. Values close to zero indicate weak relationship; values close to 1 indicate strong positive relationship, and values close to -1 indicate strong negative relationship.

[269] Un-weighted average of income in economic areas.

[270] In US dollars, these numbers are $31,498 and $27,620 correspondingly. These numbers are calculated by using the *2005 penetration* data from the FCC *11th Report* on Wireless Competition, released on September 29, 2006 (Table 3 and Table 5), as well as the *2004 personal per capita income* data by economic area reported by the US Bureau of Economic Analysis (available at http://www.bea.gov/regional/reis/scb.cfm?areatype=econ). For currency conversion, a rate of 0.85 was used. This is the 2004 *Individual Consumption PPP exchange rate, US$/CAD$* used by Statistics Canada in income comparisons between the US and Canada (See *Centre for the Study of Living Standards, Aggregate Income and Productivity Trends, Canada vs US*, Table 3 available at http://www.csls.ca/data/ipt1.asp).

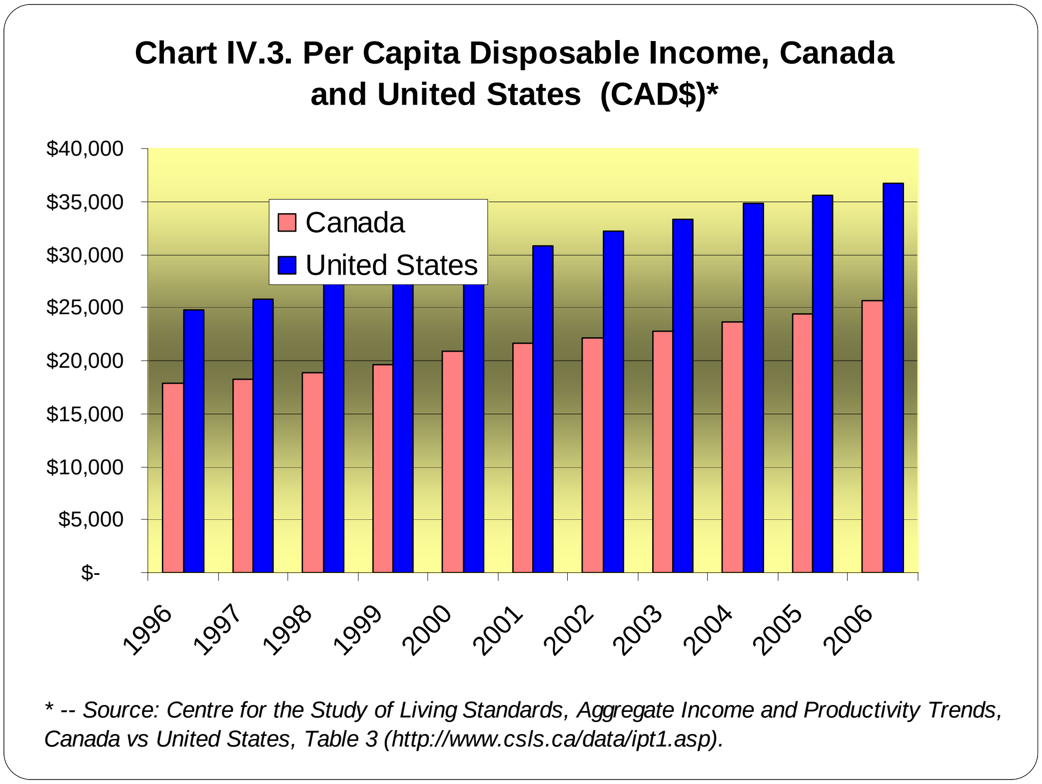
[271] Calculated as [(CAD$ 37,189 / CAD$ 32,610) -1].

Table IV.3. Comparison of Per Capita GDP, Personal Income and Personal Disposable Income (Canada and United States, CAD$)*

Year	Canada			United States			Canada as % of United States		
	GDP	Personal Income	Personal Disposable Income	GDP	Personal Income	Personal Disposable Income	GDP	Personal Income	Personal Disposable Income
1996	$ 28,301	$ 23,239	$ 17,848	$ 34,503	$ 28,442	$ 24,813	82%	82%	72%
1997	$ 29,554	$ 23,955	$ 18,286	$ 36,218	$ 29,805	$ 25,812	82%	80%	71%
1998	$ 30,372	$ 24,840	$ 18,880	$ 36,831	$ 31,623	$ 27,248	82%	79%	69%
1999	$ 32,350	$ 25,784	$ 19,632	$ 39,037	$ 32,862	$ 28,198	83%	78%	70%
2000	$ 35,124	$ 27,418	$ 20,866	$ 41,400	$ 35,132	$ 29,982	85%	78%	70%
2001	$ 35,773	$ 28,297	$ 21,605	$ 41,772	$ 35,981	$ 30,878	86%	79%	70%
2002	$ 36,807	$ 28,696	$ 22,157	$ 42,463	$ 36,496	$ 32,175	87%	79%	69%
2003	$ 38,359	$ 29,478	$ 22,821	$ 44,574	$ 37,484	$ 33,389	86%	79%	68%
2004	$ 40,404	$ 30,645	$ 23,662	$ 47,238	$ 39,124	$ 34,903	86%	78%	68%
2005	$ 42,514	$ 31,860	$ 24,413	$ 49,846	$ 40,288	$ 35,554	85%	79%	69%
2006	$ 44,175	$ 33,388	$ 25,657	$ 52,086	$ 41,924	$ 36,682	85%	80%	70%

** -- Source: Centre for the Study of Living Standards, Aggregate Income and Productivity Trends, Canada vs United States, Table 3 (http://www.csls.ca/data/ipt1.asp).*

As seen from table IV.3, Canada lags the US in terms of various measures of income, and most of all in terms of personal disposable income – an income measure that is particularly relevant to consumption decisions such as a purchase of mobile wireless service and devices. Chart IV.3, which is based on the data from table IV.3, further shows the persistence and magnitude of this gap:



Conclusion: in relative terms, Canadian personal disposable income is approximately 70% of the US personal disposable income.[272] Recall from our earlier discussion that on the nationwide level, Canadian mobile wireless penetration rates constitute approximately 70-75% of the US penetration. Although it would be too simplistic to suggest a proportional relationship between penetration and income, the fact that the magnitude of the differences in both measures is approximately the same is telling.

Other Population Characteristics

The *Decima Study* reported two other population characteristics (in addition to income) for which wireless penetration rates were noticeably different, age and education.[273] Specifically, the *Decima Study* found that younger people (people in age groups 18-34 and 34-55) were 1.5 times more likely to use a wireless phone than older people (over 55 years).[274] Similarly, the study found that people with university degrees were approximately 1.7 times more likely to use a wireless phone than people with some high school education but without a high school degree.

272 Last column in Table above, or, equivalently, the ratio of Canada and US personal disposable income amounts in chart above.

273 See p. 9, Decima Research, Usage of Wireless Communications in Canada, Final Report, April 2006.

274 *Id*.

A comparison of age and education characteristics of the Canadian and US population shows only minor differences between the two. Specifically, Canadian population may be somewhat older than the US population as measured by median population age: According to the US Census Bureau International Database,[275] in 2006 median age was 38.9 years in Canada, and 36.5 in the US. The fact that Canadian population appears to be somewhat older than the US population may be contributing to the gap between wireless penetration in the two countries. Educational comparison is not as straightforward because of the differences in the "definitions" of the statistical data in the two countries, but it appears that both countries have similar percentages of people with college and university degrees.[276]

Coverage

Wall Communications, Inc. compiled national and provincial-level mobile wireless coverage estimates by aggregating company-level coverage data.[277] According to the *Wall Report*, digital mobile wireless services in Canada cover 97% of population, and 14% of land mass.[278] For comparison, the most recent US digital wireless coverage is estimated by the FCC as approaching 100% of population, and 100% of land, though the FCC points out to the fact that its county-level method of estimating coverage (under which a county with partial coverage is classified as covered) tends to overstate coverage.[279]

Coverage, being a measure of availability and quality of mobile wireless services, is expected to affect penetration. This expectation is supported by Canadian provincial data. Table IV.4 lists penetration and coverage data by province:

[275] Available at http://www.census.gov/cgi-bin/ipc/idbagg.

[276] According to the US Census Bureau, Current Population Survey, 2006 Annual Social and Economic Supplement (available at http://www.census.gov/population/socdemo/education/cps2006/tab01-01.xls) 32% of people 15 years of age and older had some college degree (including associate, professional, Bachelors' and advanced degrees). According to Statistics Canada 2001 Census data, 33% of labor force had some college or university degree (available at http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=55498&APATH=3&GID=431515&METH=1&PTYPE=55496&THEME=51&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=0&GK=0&VID=0&VNAMEE=&VNAMEF=&FL=0&RL=0&FREE=0).

[277] Wall Communications, "A Study on the Wireless Environment in Canada," September 2006 ("*Wall Report*").

[278] *Id.*, tables 3.4 and 3.5.

[279] FCC 11th Report on Wireless Competition, released on September 28, 2006 (Table 7). Footnote 80 of the Report says "we found that less than one-tenth of one percent of the US population lacked cellular coverage." The FCC also notes that these data may overstate the true coverage because "to be considered as "covering" a county, an operator need only be offering any service in a portion of that county." (See p. 10).

Table IV.4. Canadian Per Capita Mobile Wireless Penetration and Coverage by Province*

Geographic Area	Penetration	Digital Coverage	
		% Population	% Land
Alberta	58%	100%	63%
Ontario	52%	98%	14%
British Columbia	48%	98%	11%
Saskatchewan	43%	95%	34%
Manitoba	41%	97%	20%
Québec	36%	94%	7%
Atlantic Provinces	35%	96%	23%
Territories	NA	57%	0%
Canada	**46%**	**97%**	**14%**

** -- Sources: Penetration: Statistics Canada, Catalogue 56-001, Table 7 (2004 data). Coverage: Wall Communications Report, September 2006 (tables 3.4 and 3.5).*

As seen from table IV.4, Alberta, which is the province with the highest wireless per capita penetration (58%), is also a province with the highest coverage, both in terms of population (100%) and land (63%). Ontario and British Columbia – second and third in terms of penetration, are also second and third in terms of population coverage (but not in terms of land). In general, the relationship between penetration and land coverage is not as pronounced as the relationship between population coverage and penetration: For example, Atlantic Provinces, which are last[280] in terms of penetration, are third best in terms of land coverage after Alberta and Saskatchewan. The weak relationship between land coverage and penetration is expected because the land area does not capture uneven distribution of population across geographical areas.

Provincial-level coverage and penetration data also provide an insight into urban/rural differences in mobile wireless services. The following table IV.5 supplements the penetration and coverage data with the data on the degree of urbanization (measured as the percent of urban[281] population). Provinces in this table are listed in descending order in terms of urbanization.

[280] Last if excluding the Territories, for which Statistics Canada does not report subscribership (from which our estimated of penetration are derived).

[281] The distinction between urban and rural population is by Statistics Canada, which defines rural population as "persons living outside centres with a population of 1,000 AND outside areas with 400 persons per square kilometer" (see http://www40.statcan.ca/l01/cst01/demo62a.htm).

Table IV.5. Canadian Per Capita Mobile Wireless Penetration, Coverage and Urban Population by Province*

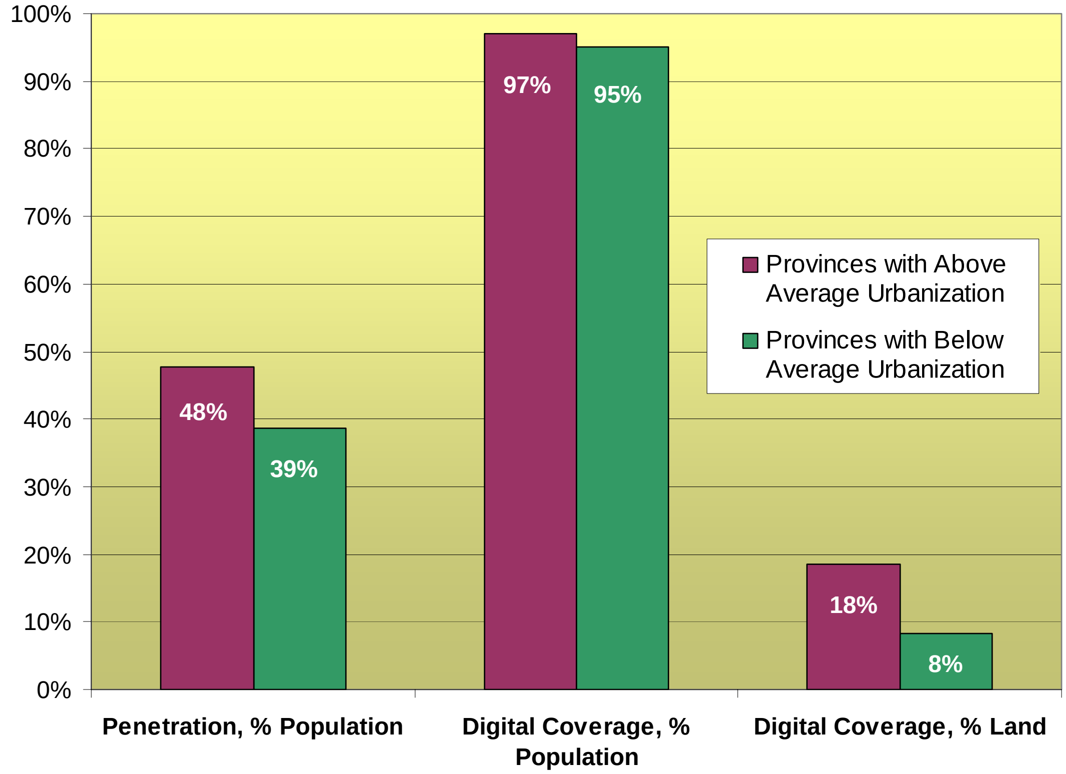
Geographic Area	Penetration	Digital Coverage		% Urban Population
		% Population	% Land	
Ontario	52%	98%	14%	85%
British Columbia	48%	98%	11%	85%
Alberta	58%	100%	63%	81%
Québec	36%	94%	7%	80%
Manitoba	41%	97%	20%	72%
Saskatchewan	43%	95%	34%	64%
Atlantic Provinces	35%	96%	23%	54%
Territories	NA	57%	0%	51%
Canada	**46%**	**97%**	**14%**	**80%**

** -- Sources: Penetration: Statistics Canada, Catalogue 56-001, Table 7 (2004 data). Coverage: Wall Report, September 2006 (tables 3.4 and 3.5). Urban Population: Statistics Canada, Census of Population (2001 data).*

As shown in table IV.5, the top three provinces in terms of the share of urban population (Ontario, British Columbia and Alberta) are also the top three provinces in terms of wireless per capita penetration and population coverage (though not in the same order). Note that the double-border in the table subdivides provinces into two groups – areas with above average urbanization in relation to the national average of 80% (the first four provinces) and areas with below average urbanization (the remaining four areas). The table suggests that more urbanized areas tend to have higher mobile wireless penetration and coverage, while less urbanized areas tend to have lower mobile wireless penetration and coverage. The following chart III.4 summarizes urban/rural differences captured in the above table IV.5 by aggregating the data in the table into two groups – "provinces with above average" and "provinces with below average urbanization:"[282]

[282] Note that penetration and coverage percentages for these two groups in the chart are calculated as weighted averages of the provincial-level data. Specifically, per capita penetration and population coverage are weighted by total population, while land coverage is weighted by land area.

Chart IV.4.
Urban/Rural Differences in Canadian Provincial Mobile Wireless Per Capita Penetration and Coverage



Based on sources: Penetration: Statistics Canada, Catalogue 56-001, Table 7 (2004 data). Coverage: Wall Report, September 2006 (tables 3.4 and 3.5). Urban Population: Statistics Canada, Census of Population (2001 data).

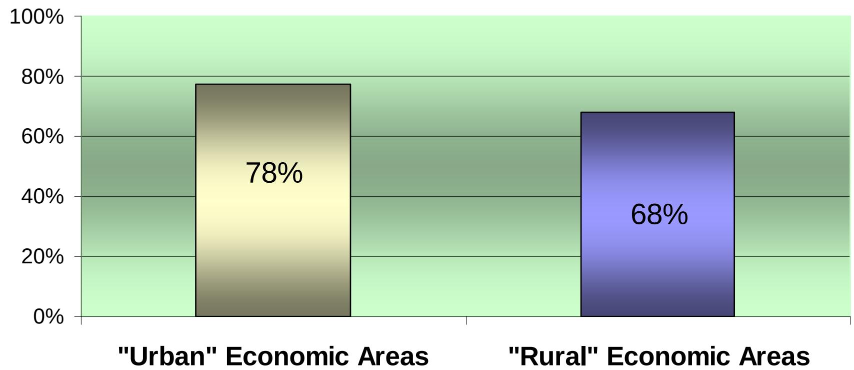
As seen from chart IV.4, the difference between mobile wireless per capita penetration in more and less urbanized provinces is significant – 48% and 39% correspondingly. This result may be driven by the differences in urban and rural lifestyles and availability of wireless services, but it may also be a result of income effects: As discussed above, provinces with relatively high median family incomes tend to have high penetration rates, and more urbanized provinces tend to have relatively high income.

At the same time the difference in population coverage is relatively small at 97% for "more urban" and 95% for "less urban" areas. This result is a reflection of the fact that all provinces with exception of the Territories have very high 2G digital coverage rates. Note that this conclusion of only minor differences in population coverage between urban and rural areas would likely not stand if the analysis is applied to 3G coverage. As discussed in detail in Section III of this report, 3G services are being rolled out in urban areas first. This observation applied equally to Canada and the US.

Finally, chart IV.4 shows that the relative difference between more and less urbanized areas in terms of land coverage is most significant – 18% and 8% correspondingly, or, equivalently, land coverage is more than 2 times higher in more urbanized areas compared to less urbanized areas.

The lag in rural wireless penetration in comparison to urban areas is also seen in the US: For example, the following chart IV.5 compares penetration in "rural" and "urban" economic areas using the FCC definition of rural areas as counties with population density of 100 persons per mile[283] or less.[284]

Chart IV.5. Urban/Rural Differences in Economic Area Per Capita Wireless Penetration, United States, 2004



Source: Derived from FCC 11th Report on Wireless Competition, Table 3. Rural area is defined as having density 100 or less persons per square mile.

As seen in chart IV.5, urban areas (areas with density of 100 persons or more per square mile) have an average[285] penetration rate of 78%, while rural areas have an average penetration rate of 68%. The observation that penetration decreases with population density is also present at a more granular level (not depicted on the chart): for example, average penetration for economic areas with population density below 50 persons per square mile is 65%.

The analyses above suggest that urbanization may be a factor that drives differences in mobile wireless penetration between Canada and the US. On the nationwide level 80%

[283] This translates into 39 persons per square kilometer.

[284] See, for example, the FCC 11th report of Wireless Competition, released on September 28, 2006, p. 39.

[285] Calculated as weighted average over population.

of the Canadian population lives in urban areas. The US Census estimates that 79% of the US population lives in urban areas.[286] In other words, on the surface it appears that despite differences in geography, both countries are approximately equally urbanized. When interpreting these data, however, it is important to keep in mind that the two countries use different definitions of "urban" and "rural" areas. Specifically, as quoted above, Statistics Canada defines rural areas as "persons living outside centres with a population of 1,000 AND outside areas with 400 persons per square kilometer."[287] In contrast, the US Census Bureau defines urban areas as all urbanized areas (over 50,000 population) and urban clusters (2,500 to 49,999 population), which include "core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile."[288] The definitions of urban and rural areas are different in the two countries. On the one hand, the Canadian definition includes in the urban count smaller population clusters than the US definition (such as centers with population over 1,000 people – centers that would not meet the US criterion for urban clusters as having 2,500 people or more). On the other hand, the US definition includes in urban count less dense areas than the Canadian definition (specifically, areas with density over 500 people per square mile (or equivalently 193 people per square kilometer), which is a lower density than the Canadian criterion of 400 persons per square kilometer)). These differences do not necessarily mean that one definition is broader than the other, meaning that we cannot conclude from the data that one country is more urbanized than another.
Conclusion: *We cannot conclude from the data that urbanization is a factor in the differences in wireless penetration between Canada and the US.*

V. OVERVIEW OF MOBILE WIRELESS COMMUNICATIONS INDUSTRY: CANADA AND THE US.

A. INDUSTRY AT A GLANCE

The following table provides the basic statistics of Canadian and US wireless industries. The first two "data" columns of this table contain absolute measures, while the last column contain relative measures, calculated as a ratio of the respective Canadian and US absolute statistics.

[286] 2000 Census. See http://www.fhwa.dot.gov/planning/census/cps2k.htm.

[287] See http://www40.statcan.ca/l01/cst01/demo62a.htm.

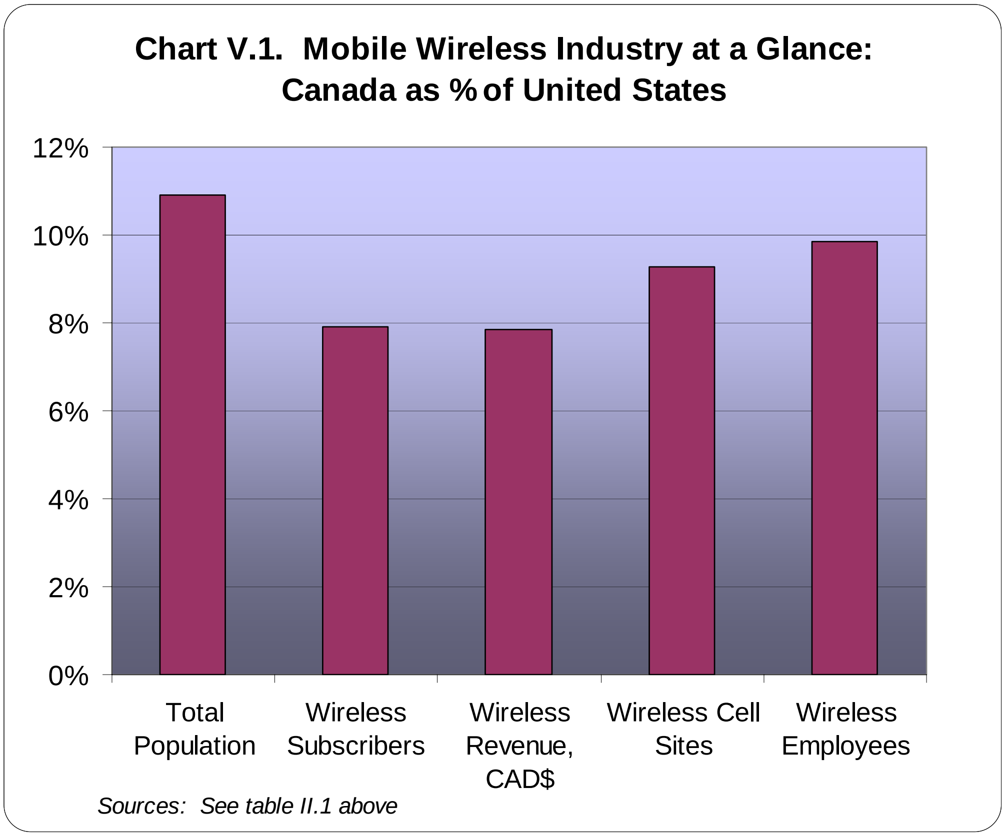
[288] See http://www.census.gov/geo/www/ua/ua_2k.html. Note that density of 500 persons per square mile translates into density of 193 persons per square kilometer.

Table V. 1. Mobile Wireless Industry at a Glance -- Canada and United States*

Measure	Canada	United States	Canada as % of the US
Total Population	32,898,551	301,756,938	11%
Wireless Subscribers	18,425,194	233,040,781	8%
Wireless Revenue, CAD$	$9,478,099	$120,955,369	8%
Wireless Cell Sites	16,305	175,725	9%
Wireless Employees	25,000	253,793	10%

** -- Sources and vintage dates: Statistics Canada (Canada Population Clock (May 2007), Revenue (2004), Cell Sites (2004)); US Census Bureau (US Population Clock (May 2007)); CWTA (EOY 2006 Canada Subscribers and current Employees), CTIA (EOY 2006 US Subscribers, Revenue and Employees). Currency converion based on GDP PPP exchange rate for 2004 (0.85CAD/US).*

As seen from table V.1, the Canadian wireless market is by a magnitude smaller than the US wireless market. Specifically, the Canadian market, measured as total country population, is approximately 11% of the US market. It terms of the realized market size, measured by subscriber counts and total revenue, Canada constitutes 8% of the US market. The differences in mobile wireless penetration rates in the two countries are discussed in detail later in this report. The Canadian wireless industry employs approximately 25,000 people which represent about 9% of the US wireless labor force. The Canadian cells sites represent about 10% of the US count of cell sites. Chart V.1 provides a graphical representation of these relationships:



These metrics on the relative size of the industries in the two countries are helpful in understanding the various incentives of the companies with respect to the deployment of technology.

B. COMPANY MARKET SHARES

Canada

Canada has three major mobile wireless providers – Bell Canada (Bell Mobility), Rogers (Rogers Wireless) and TELUS (TELUS Mobility), whose combined market share is currently estimated as 96% of subscribers.[289] The following chart (Chart V.2) depicts the relative shares of Canadian wireless companies, where category "other" includes MTS Mobility and SaskTel.

[289] CWTA EOY 2006 data available at http://www.cwta.ca/CWTASite/english/industryfacts.html. Note that Bell Canada subscriber counts include Aliant.

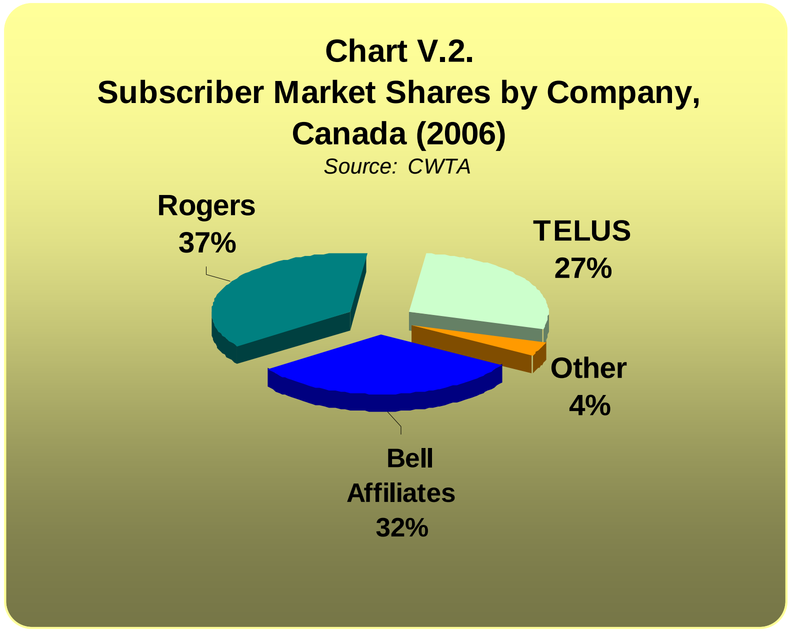
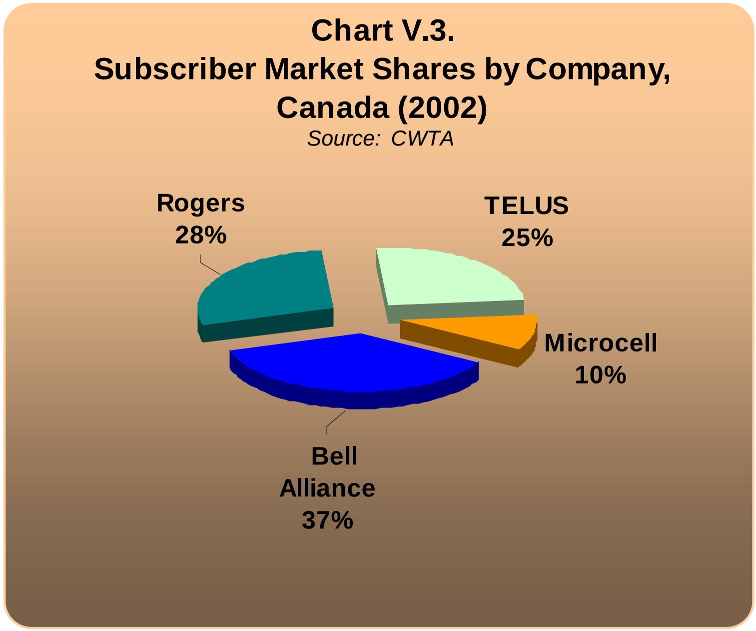


Chart V.3 (below) depicts historical relative shares of Canadian wireless companies. The biggest difference compared to the current market shares is the presence of Microcell (10% market share in 2002), which is now part of Rogers. In addition, Bell's market share in 2002 includes all Bell Wireless Alliance companies, including SaskTel and MTS,[290] which are included in category "other" in 2006.

[290] Bell Wireless Alliance in 2002 also included Bell Mobility, Aliant Telecom, Northwestel Mobility Inc., Télébec Mobilité and NorTel (Northern) Mobility.

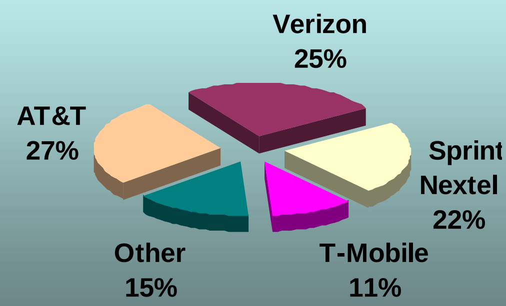


A comparison of charts V.2 and V.3 shows that apart from the above described structural changes, companies market shares did not change significantly.

United States

The US currently has four national companies – AT&T (formerly Cingular), Verizon Wireless, Sprint Nextel and T-Mobile. Chart V.4 depicts relative market shares of the US wireless providers derived from the subscribership data reported by the FCC. Note that category "other" includes 21 carriers, with the largest being Alltel -- a carrier that is considered to be a regional carrier because of its geographically limited coverage -- with 5% of subscribers.

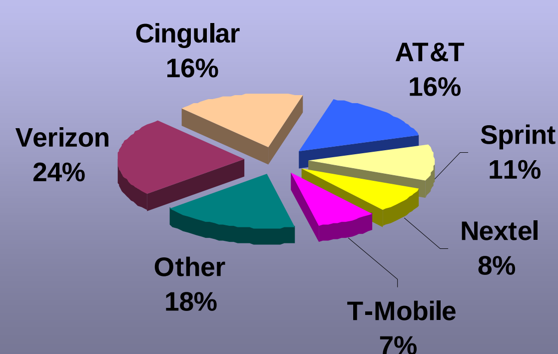
Chart V.4.
Subscriber Market Shares by Company, United States (2005)
Source: FCC 11th Report on Wireless Competition



As seen from chart V.4, the four national US mobile carriers serve 85% of the US subscribers.

The US wireless industry experienced some consolidation in recent years, specifically, a merger of Sprint and Nextel (now Sprint Nextel), as well as the merger of AT&T Wireless and Cingular (now AT&T). The following chart V.5 depicts the US wireless companies' market shares in 2002 (before the above described mergers):

Chart V.5.
Subscriber Market Shares by Company, United States (2002)
Source: FCC 8th Report on Wireless Competition



The comparison of the US current (2005) and historical (2002) market share charts (charts V.4 and V.5) shows an increase in market concentration. This is evident not only in the fact that the number of national wireless carriers decreased from six in 2002 to four in 2005, but also in the fact that the market share of "other" carriers went down by three percentage points (from 18% in 2002 to 15% in 2005).

Conclusion: Three to four major wireless facilities-based carriers in both countries serve the majority of subscribers. As the wireless industry begins to mature, we see consolidation in both countries and an increase in market concentration. This is to be expected and reflects the rational move to increase efficiencies and utilize scale economies. The size of the overall market generally dictates the number of major providers that can efficiently provide service. It is not surprising that the US would have more large providers given the size of that market in terms of geography and potential revenues.

VI. QUICK ADOPTER APPROACH TO INNOVATIONS

Business success is attributed to pioneers of technological innovation. However, despite this stereotype, empirical evidence augmented by theoretical models shows that being a technological pioneer is neither necessary, nor sufficient for achievement of business success, customer satisfaction and public policy goals of affordable telephone and development of advanced telecommunications service.

A. TYPES OF INNOVATIONS

When discussing innovations, it is useful to distinguish two types of innovations – technological innovations and commercial (business) innovations. This distinction becomes particularly important for network industries such as mobile telecommunications because fundamental technological innovations such as network upgrades require exerting of a lot of effort and capital expenses, while its outcome is very uncertain. Even if technology works, it does not guarantee business success, because real costs can exceed expected demand, thus making the business model unprofitable. A classical example is the story of *Iridium* consortium, a satellite telephony provider, when disappointingly low demand forced it into bankruptcy.[291]

> In mid-1998, Iridium was one of the darlings of Wall Street having more than tripled in stock price in less than a year. Armed with expertise and over 1,000 patents, the company seemed poised to capture first-mover advantage in providing global telephony via a network of low-Earth-

[291] Iridium LLC Chapter 11 Filing , Case No. 99-45005-CB, US Bankruptcy Court, Southern District of New York.

> orbiting satellites. Additionally, Iridium appeared to have identified an attractive target segment after having screened over 200,000 people, interviewed 23,000 people from 42 countries, and surveyed over 3,000 corporations.[292] To provide high-quality global communication the company successfully deployed 66 satellites in low-earth orbit with a total system cost of $5.7 billion.[293] In order to break-even, the company needed 500,000 to 600,000 subscribers **worldwide**. In March 2000, with only **50,000** subscribers 15 months after the beginning of operations, the company had decided to terminate the service. In December 2000 the assets of the bankrupt company were acquired by Iridium Satellite LLC at a price of $25 million (approximately $6.5 million in cash and an unsecured note in the approximate amount of $18.5 million). As of December 31, 2006 the system has 175,000 subscribers.[294]

The example of *Iridium* teaches us that technological success does not guarantee financial success. While the company successfully overcame formidable *technological* challenges – it deployed in low-Earth orbit 66 satellites using launchers from three different countries without exceeding original budget and practically on schedule – the project became operational with only a two months delay, it failed to achieve its *financial* goals, because the actual demand did not meet initial forecasts. One of the reasons of miscalculating demand was that the business concept developed in late 1980s-early 1990s failed to predict that competing technology (wireless innovations, networks and handsets) would develop and improve so fast that it would erode much of the demand for *Iridium's* satellite service.

Another reason why an innovation that is sound in terms of technology may fail financially (or, at least, not realize its potential in full) is the "standards wars" and the presence of multiple technology standards. For example, as discussed in this report, both Canada and US have multiple wireless standards, with the CDMA standard serving over 45% of subscribers in each country (59% in Canada and 49% in US). At the same time the standard that dominates the world market (and particularly, Europe) is the GSM standard. Also discussed in this report (see section on handheld devices) is the fact that equipment manufacturers often develop a new device for GMS networks.

A subclass of technology innovations relevant to mobile wireless industry is technology-based product innovations (as opposed to innovations in the underlying networks), such as introductions of new products or applications to be used with an existing technology. Quite often these applications emerge as byproducts of new capabilities fortuitously

[292] This description of Iridium is taken from Finkelstein, Sydney, and Shade H. Sanford. 2000. "Learning From Corporate Mistakes: The Rise and Fall of Iridium." *Organizational Dynamics* 29:138-148.

[293] All numbers quoted are from Lutz, E., M. Werner, and A. Jahn. 2000. *Satellite Systems for Personal and Broadband Communications*. Berlin: Springer-Verlag. Currency is US dollars.

[294] Lutz, E., M. Werner, and A. Jahn. 2000. *Satellite Systems for Personal and Broadband Communications*. Berlin: Springer-Verlag. Currency is US dollars.

made available by a new technology. For example, digital cell phone systems (2G) were developed to use digital signals primarily in voice communications, as a means of achieving higher capacity and lower noise level. Secondary to these improvements was the fact that digital signal allowed transferring other types of data (non-voice signals), thus creating market for such applications as SMS,[295] ringtones, music downloading etc., which now have become significant source of revenues for wireless companies, especially in Europe and Asia. According to Portio Research estimates, by 2012 the worldwide revenues from SMS will reach US$67 billion.[296] Standard & Poor's forecast predicts that mobile music downloads will generate more than US$14 billion in global revenues by 2011.[297] Another example of product innovation that utilizes digital networks is Canada's own BlackBerry® handset and service discussed as a case study of handheld devices in this report.

The investment and R&D costs of product innovation are usually lower than in the case of technology innovation, because the underlying technology already exists. Innovators still face uncertainty of demand for new products and services, and some risk of technological fit. For example, while WAP[298] browser intended to enable 2G phones to surf the Internet starting in 1997, Internet surfing using WAP has not become a major revenue generator, because its consumer performance (in terms of speed, ease of use, appearance, and interoperability), as well as availability of content were inadequate until recently. Internet browsing over mobile handheld devices is becoming more popular in recent years as mobile carriers offer supplemental innovations, such as downloadable content (for example, ringtones) and applications designed to ease use of WAP browsing, such as TELUS' FastTap keypad – a keypad that makes text entry on a mobile phone faster by adding a key for each letter around the traditional numeric keyboard.

Another caveat is the difference in technology adoption rate in different parts of the world. A product's success in one geographic region does not guarantee its replication in other countries. For example, in Canada and the US the usage of SMS service is well behind Europe and Asia, which industry analysts attribute to a number of factors. Among these factors are the popularity of substitutes such as BlackBerry® e-mail service, availability of push-to-talk service, generous calling plans such as free mobile-to-mobile calls, practice of charging for both sent and received SMS, and the presence of multiple wireless standards that slowed down original availability of SMS messaging between different providers.

[295] *Aldiscon – an Irish company* -- introduced SMS in June 1991. See Hidding, Gezinus J., and Jeffrey R. Williams. 2003. "Are there First-Mover Advantages in B2B eCommerce Technologies?" in *36th Hawaii International Conference on System Sciences*. Hawaii.

[296] *Total Telecom Online*, Feb 20, 2007. http://www.totaltele.com/.

[297] Standard & Poor's. 2006. "Industry Surveys. Telecommunications: Wireless." p. 3.

[298] Wireless Application Protocol. It is an open international standard for applications that use wireless communication. Its principal application is to enable access to the Internet from a mobile phone or PDA.

Commercial (business) innovations is another class of innovations (as opposed to technological innovations) -- a process in which an innovative pricing scheme or service plan attracts new customers ideally without negatively affecting revenues from incumbent customers, thus making profits' to increase. For example, by offering prepaid (rather than postpaid) service plans -- plans under which customers buy minutes that they can use over a limited time in advance) – wireless companies can attract low-usage and/or low-income customers who do not want to subscribe to plans with monthly payments and mandatory contract terms of service. Carefully designed variety of service plans allow companies to increase their customer base and maximize companies' profits.[299] Referring to this particular example of commercial innovation, Canada leads the US in terms of the relative portion of pre-paid subscribers in the total number of subscribers. As of 3Q 2006 the share of prepaid subscribers was 22% in Canada, and 13% in the US.[300] In the US, the number of prepaid subscribers has more than doubled to 28.9 million between 2002 and 2005.[301] The Telecommunication Industry Association (TIA) predicts that prepaid revenues will grow from US$13.8 billion in 2006 to US$22.2 billion in 2009.[302] In Canada, Virgin Mobile (a joint venture between Virgin and Bell Canada) expected to have 400,000 prepaid subscribers by the end of 2007. While prepaid customers have much lower ARPU (in case of Bell Mobility – CAD$14 per month[303]), these are the customers, who might not use wireless service otherwise, thus, offering prepaid plans allows carriers to capture this segment of the market.

Another way to innovate commercially is to offer a menu of options – whether to buy services separately, or as a bundle in which different services (voice communications, internet access and SMS) are offered as a package.

If designed and implemented properly, commercial innovation increases welfare by increasing adoption (penetration) rate of an offered product without commanding huge capital expenditures.

B. ECONOMICS OF TECHNOLOGICAL INNOVATION IN THE WIRELESS PHONE INDUSTRY

The distinction between technological, product and commercial innovation in the wireless phone industry is important when analyzing the economics of innovations.

299 Economists refer to this method as "price discrimination," when customers pay for the service a price which is close to their reservation price (or maximum willingness to pay).

300 Merrill Lynch Global Wireless Matrix, January 2007 (data for 3Q 2006).

301 This number was expected to be 34.7 million by the end of 2006. Standard&Poor's. 2006. "Industry Surveys. Telecommunications: Wireless." p. 10.

302 Standard & Poor's. 2006. "Industry Surveys. Telecommunications: Wireless." p. 10.

303 Bell Canada Enterprises 2006 Annual Report, p. 29.

Technological innovation is the most *risky* innovation, especially when considering the underlying networks because of high capital expenditures and the sunk nature of investments in fixed assets in a networking industry. An additional challenge faced by the mobile wireless industry is the "war of standards," or the absence of one single standard. As discussed above, this is a specific problem of both the Canadian and US wireless industry. The GSM standard dominates the world markets with 80% of world subscribers, and CDMA being the most common standard in both Canada and the US. Because many popular handheld devices such as Motorola RAZR™ or RIM's BlackBerry® were first developed for GSM-based carriers, CDMA carriers face a certain disadvantage. At the same time there is high uncertainty about the true costs to develop the innovation and usually quite a high probability that technology will not work as expected, at least initially (WAP and early attempts of using videos in wireless phones discussed below are examples of such initial false starts), then there is high uncertainty regarding the implementation costs (capital expenditures) and future demand.

A good illustration of the uncertainty regarding future demand is the history of mobile TV. Early product offerings in this field, such as Sony's *Watchman* (a portable handheld TV, designed to be analogous to Sony's success with *Walkman*), offered as early as the 1980s, did not gain much popularity, suggesting that there was not much demand for mobile TV services. However, more recently some mobile telecommunications companies started offering mobile TV over TV-capable cellular phones. In the US, Sprint was first to offer this service in late 2003. According to industry analysts, "That service is powered by MobiTV Inc., whose live simulcast of cable TV channels has improved markedly over the years, but remains more akin to live radio played against a jittery slideshow rather than normal full-motion video."[304] In Canada, mobile TV is offered by all major mobile carriers. As put by AT&T's chief operating office Randall Stephenson, "I don't know if people will want to watch it, but every time I say one of these 'I don't knows,' [referring to the growth in text messaging despite the inconvenience of numerical keypad and a surprising demand for ringtones] it goes beyond my wildest imagination."[305]

In fact, future *demand is a double-edged sword*. If demand for the new technology is low, then the innovator will end up losing money (see the *Iridium* example above); but even high demand does not guarantee high profits, because without high barriers to entry, it will attract competitors and competition can erode the first mover's profit margins. Commercial innovations, which often do not require significant additional cost or license (such as on offering of prepaid plan) can typically be easily copied, thus quickly erasing the first mover's advantage.

The story of mobile TV provides another twist on the point that demand is a double-edged sword: Originally, mobile carriers offered this service over their 3G networks.

[304] Minneapolis Star Tribune, April 1, 2007. "Squint TV" by Bruce Meyerson, Associated Press.

[305] Quoted from Minneapolis Star Tribune, April 1, 2007. "Squint TV by Bruce Meyerson, Associated Press.

Because these networks are not engineered to handle a stream of live TV, growing demand for this service means that networks may eventually become bogged down, deteriorating the quality of TV signal. This is exactly what happened in South Korea when the network became congested with video traffic within eight to nine months after this service was launched. A South Korean company, SK Telecom quickly realized that a new approach was necessary, and it built a separate satellite network to broadcast its mobile TV service.[306] In other words, the experience of early providers of mobile TV service exposed the deficiency inherent in standard cellular technology. Its *unicast* principle (signal is transmitted to each phone individually) means that if there is more than one user tuning to a specific live TV broadcast in the same cell, the same signal is transmitted many times. Early leaders such as SK Telecom found that building a separate TV broadcasting network where the signal broadcasts at once to all mobile TV users in the area (like traditional broadcast TV) preserves the quality of signal as the demand for mobile TV grows.[307] Learning from these experiences, two US mobile carriers – Verizon and AT&T – are launching in 2007 a new version of mobile TV over cellular phones, the version that uses Qualcomm's *MediaFlo* network, which is a dedicated network that broadcasts video to all viewers at once, just as a traditional broadcast television network operates.[308]

Threat of further competition such as *government intentions to ease spectrum regulation* may slow down innovations. For example, an academic paper by Hazlett[309] showed that removing license restrictions on usage of spectrum in Australia and Latin American countries decreased spectrum license bids (indicating lower expected profits) in anticipation of higher competition. In these countries these licenses had so-called "expansive spectrum property rights", which allowed license buyers to resell unused parts of the spectrum to others. Although the most immediate effect of such ease in regulations would be increased revenues to license holders, expansive spectrum property rights essentially lower entry barriers for competition in these countries, thus reducing anticipated profits (the source and driving force of innovations) of the bidders. Indeed, the study showed that participants in auctions for expansive spectrum property rights bid on average 38% less than bidders in other countries, with more restrictive licenses.

Another important economic phenomenon that affects innovations in the wireless communication industry is the fact that it is experiencing *positive network externalities* – the more people are connected, the more valuable the network is for users. A classical academic paper studying technological adoption in the network with positive externalities

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306 See http://news.com.com/Tight+squeeze+for+mobile+TV/2100-1039_3-5886537.html.

307 See http://news.com.com/Tight+squeeze+for+mobile+TV/2100-1039_3-5886537.html and http://news.com.com/ATT+taps+MediaFlo+for+mobile+TV/2100-1039_3-6158544.html.

308 Verizon launched this service in January 2007, and AT&T plans to launch it later in 2007. See Minneapolis Star Tribune, April 1, 2007. "Squint TV" by Bruce Meyerson, Associated Press.

309 Hazlett, Thomas W. 2004. "Property Rights and Wireless License Values." AEI-Brookings Joint Center Working Paper No. 04-08. Also in *SSRN eLibrary*: SSRN 10.2139/ssrn.519602.

is by Katz and Shapiro[310]. They show two important results: 1) In the absence of barriers to entry competitive equilibrium will lead to an inefficient result, specifically, an *underinvestment* in technology and products; and, 2) With two or more promoters of incompatible technologies (standards), the advantage will go to the latest mover.

The intuition behind the first result is derived as follows. A company has to invest a significant amount of money in the network deployment. Without barriers to entry, later entrants will drive the price down to marginal cost, without allowing the incumbent to recuperate this initial investment, which has become a sunk cost. Therefore, the companies will be reluctant to invest in the network in the first place, because they rationally anticipate that they will not be able to recover this investment later. It means that barriers to entry (for example, in the form of restricted use licenses) are necessary. Analysis shows that "a cartel of producers may be socially desirable to the extent that it allows them to set later prices above marginal costs and thus generate incentives to invest in a new technology in the presence of network externalities. Pricing at the marginal cost of production in each period may not be socially optimal."[311]

In the case of two competing technologies a second-mover advantage arises, because the second mover can implement a more recent technology, and technology that will be superior tomorrow has a strategic advantage. In other words, a late comer can see which standard (technology) is winning and choose the winning (more widely adopted) technology, because he is not locked-in with another technology. One illustration of this theoretical result is the world history of wireless communications, where late comers such as the countries of the former Soviet block were able to *leapfrog* ahead by starting with "next generation" networks and typically networks of the now-prevalent GSM standard.

In other words, a company does not have to be a pioneer and innovation leader in order to reach financial success. Similarly, Hidding and Williams[312] in their empirical study of financial success in 27 eCommerce sectors found that current leaders typically arrive 2-4 years later than innovators, with half of the current leaders being the fast followers. In at least 22 (out of 27) eCommerce technology product categories there was no sustained first-mover advantage. Often, current leaders are large companies who acquired pioneers (typically smaller companies) after witnessing their financial success. In essence, these companies utilized the smart follower strategy by waiting and allowing the market to reveal (select) winning technological or business innovations. Examples of such acquisitions include AT&T's purchase of the US cellular pioneer McCaw Cellular, Rogers' purchase of Microcell (FIDO), the first Canadian GSM network provider, and

[310] Katz, Michael L., and Carl Shapiro. 1986. "Technology Adoption in the Presence of Network Externalities." *The Journal of Political Economy* 94:822-841.

[311] Katz, Michael L., and Carl Shapiro. 1986. "Technology Adoption in the Presence of Network Externalities." *The Journal of Political Economy* 94:822-841, p. 840.

[312] Hidding, Gezinus J., and Jeffrey R. Williams. 2003. "Are there First-Mover Advantages in B2B eCommerce Technologies?" in *36th Hawaii International Conference on System Sciences*. Hawaii.

UK's *Logica*'s (current leader in provisioning SMS centers) purchase of the above mentioned Irish Aldiscon, a pioneer of SMS services.

In summary, there exist a number of first mover disadvantages and smart follower advantages:[313]

- Resolution of technological uncertainty by the time the fast followers move in, i.e., emergence of a "dominant design." For example, in the case of a standards war, followers enter by the time a dominant standard emerges. Delayed entry allows followers to reap the benefits of picking up the winner.
- Smart follower leapfrogs over older technologies or rejected standards. For example, transitional economies (Eastern Europe) and Asia developed their wireless networks by starting from 2G networks, thus avoiding investment in 1G. Delayed entry allows followers to avoid investment in outdated networks, while the leaders may have to continue using the outdated network because it represents sunk cost and continues generating revenues.
- Market uncertainty that innovator faces – whether there will be enough demand for a new service or product such as mobile TV or the high-priced Apple iPhone. As discussed above, sometimes a new service fails to succeed, as illustrated by the *Iridium* fiasco and Sony's Watchman. The story now repeats itself with mobile TV via cellular phones. Even a few years after introduction of the first video-capable phones, the business model and future demand for this product remains unclear.
- Free-rider effects – when later entrants can imitate the innovator's success at lower cost/higher quality and avoid his mistakes.
- Learning-based productivity improvement. For example, as discussed above, carriers that were first to offer mobile TV over the phone, such as South Korean SK Telecom, learned that cellular 3G networks were inadequate for supporting increasing demand for live TV broadcasts, and that alternative broadcasting principles (as opposed to cellular unicast) must be utilized.
- Attracting skilled labor. Such free-rider effects may be enhanced by complementary assets of an imitator.
- Followers use the experience of leaders as a low-cost method of revealing consumer preferences. By the time the followers enter they have a better understanding regarding consumer demand and they can offer more fine-tuned deals than the pioneers were offering initially.
- Technology or customer needs shift, which is difficult for incumbents to discern and/or react to, because they are already locked-in with a technology or product

[313] Based on Hidding, Gezinus J., and Jeffrey R. Williams. 2003. "Are there First-Mover Advantages in B2B eCommerce Technologies?" in *36th Hawaii International Conference on System Sciences*. Hawaii.

they have chosen. For example, in 1980s, French communications company Poste, Téléphone et Télécommunications (now France Telecom) launched an online service called *Minitel* - a simple-to-use, low cost and low speed digital network designed for text-based information exchanges implemented on the telephone network.[314] This service is considered the world's most successful pre-World Wide Web online service.[315] While it "conditioned" (psychologically prepared) French consumers for adoption of the Internet and Internet-based e-commerce, it hindered the actual adoption of the Internet in France because French consumers were locked-in with Minitel. Consequently, this delayed the adoption of a better and more advanced technology.[316]

- Organizational inertia, due to:
  - Dedicated fixed assets (particularly if they have not been fully depreciated such as older-generation wireless networks).
  - Long-term contracts with equipment manufacturers.
  - End-user term contracts. For example, in the US and Canada handsets are typically tied to carrier plans. High-end handsets are typically subsidies through a term contract. In order to subscribe to a new service such as Mobile TV, a customer may have to buy a new handset.
  - Reluctance to cannibalize existing popular products (mobile companies typically offer a limited number of handsets simultaneously), reluctance to antagonize existing sales channels.
  - Extra cost of adding new products. For example, an introduction of a new handset or value-added service requires training sales representatives and technical support.

What determines who will become an innovator or who will be the follower? A concept of <u>lead-lag countries</u> is described in a paper by Beise.[317] This article suggests that specialization of countries in international trade is determined by the lead-lag market pattern of national markets. Many internationally successful innovations have been adopted first in one country while other countries initially either preferred other designs or an established product. Home market, rather than technological knowledge, determines lead countries.

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[314] Brosseau, Eric, 2003, "E-Commerce in France: Did Early Adoption Prevent the Development? *The Information Society* 19(1).

[315] In North America, Bell Canada and US West were offering this service for a brief time in 1990s.

[316] See for example, http://wired-vig.wired.com/science/discoveries/news/2001/04/42943 and See http://www.forbes.com/2003/07/14/cx_al_0714tentech.html?partner=newscom.

[317] Beise, Marian. 2005. "Lead Markets, Innovation Differentials and Growth." *International Economics and Economic Policy* 1:305-28.

Size of the market makes research and development more profitable in larger countries. For example, it can make more sense for Canadian (smaller) wireless providers to follow US network innovations than trying to develop their own and face the risk of bearing high conversion costs (to the US standard) in case of failure.

Academic research attempted to quantify the advantage of the smart-follower's strategy in deployment of 3G wireless networks through a real options analysis.[318] The real options approach calculates the value of flexibility in making managerial decisions. One such decision is delay in investment. Due to the high volatility of estimates of future revenues, such *delay can bring value* to the company in the form of avoided risk, because it *preserves the option* of canceling the project, if revised demand forecasts will not be high enough. The cost of delay is equal to foregone revenues from the years when the system is not deployed due to the delay. The authors show that the value of this option depends on a number of factors, with *market size* being the most important one. They also show that while it may be optimal to invest in 3G for larger markets, it may be more efficient for small markets to wait. Because the Canadian market is much smaller than the US market, this qualitative conclusion should be kept in mind when comparing the scale and timeline of actual deployments of "next generation' wireless technologies in both countries.

[318] Harmantzis, Fotios C., and Venkata Praveen Tanguturi. 2007. "Investment decisions in the wireless industry applying real options." *Telecommunications Policy* 31:107-123.

ATTACHMENT 1

Acronym List

1G	First Generation Mobile Network
1x-RTT	First Phase of CDMA-Radio Transmission Technology
2G	Second Generation Mobile Network
2.5G	Second and a half Generation Mobile Network
3G	Third Generation Mobile System
4G	Fourth Generation Mobile Network
AMPS	Advanced Mobile Phone Service
AOL	America On Line
CAD	Canadian Dollars
CDMA	Code Division Multiple Access
CDMA2000	Code Division Multiple Access 2000
CRTC	Canadian Radio-television and Telecommunications Commission
CTIA	Cellular Telecommunications & Internet Association
CWTA	Canadian Wireless Telecommunications Association
EDGE	Enhanced Data Rates for Global Evolution
ETSI	European Telecommunications Standards Institute
EV-DO	Evolution-Data Optimized
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
GB	Giga Bit
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GWM	Global Wireless Matrix
HSDPA	High-Speed Downlink Packet Access
HSPA	High-Speed Packet Access
HTML	Hyper-Text Markup Language
iDEN	Integrated Digital Enhanced Network
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IM	Instant Messenger
IMS	IP Multimedia Subsystem
IMT-2000	International Mobile Telecommunications-for the year 2000
IP	Internet Protocol
ITU	International Telecommunication Union
kHz	kiloHertz
Mbps	Mega bits per second
ML	Merrill Lynch
MP3	MPEG Layer-3
MP	Multi-Pulse or Multi-Protocol
MPEG	Moving Picture Expert Group
MSA	Metropolitan Statistical Areas
NG	Next Generation
NHL	National Hockey League

MSN	MicroSoft Network
PC	Personal Computer
PDA	Personal Data Assistant
PTT	Push To Talk
QWERTY	The name for a computer or typewriter keyboard, named after the left side, upper row of letters.
SMS	Short Message Service
TDMA	Time Division Multiple Access
TIA	Telecommunication Industry Association
TPR	Federal Telecommunications Policy Review Panel
TV	TeleVision
UMTS	Universal Mobile Telecommunications System
US	United States
VGA	Video Graphics Array
WCDMA	Wideband Code Division Multiple Access
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Access Network
WLNP	Wireless Local Number Portability

ATTACHMENT 2

Archive of Press Releases Regarding Technology and Services Deployment and Innovation for the Major Canadian and US Mobile

I. CANADIAN MOBILE WIRELESS CARRIERS

A) BELL MOBILITY

- 4/25/07: Bell Mobility announces that it will make available in the summer of 2007 the BlackBerry® 8830 World Edition smartphone – the first CDMA BlackBerry smartphone that is compatible international roaming on GSM/GPRS networks outside of North America.[1]
- 3/19/07: Bell Mobility announces the exclusive availability of Samsung SPH-m610 multimedia mobile phone – the thinnest phone in North America.[2]
- 2/28/07: Bell Mobility announces "Bell to Bell Calling" – a set of rate plans providing unlimited calling from Bell mobile, residential and business phones.[3]
- 2/22/07: Bell Mobility announces exclusive content from GOLTV, Canada's only 24 hour soccer network for Bell Mobility customers with video-capable mobile phones.[4]
- 2/15/07: Bell Canada launches "Mobile Movies," the first service in Canada providing full-length pay-per-view movies to video-capable phones. Mobile Movies streams movies over Bell Mobility's wireless high speed network over at least 5 different handsets available from Bell Mobility, with more to be launched in 2007.[5]
- 12/7/06: Bell Canada announces nationwide availability of LG FUSIC™, the first phone in Canada with a built in FM transmitter, along with MP3 player and access to largest music download catalog in Canada.[6]
- 10/31/06: Bell Canada launches Nokia 6275i handset – Bell's first 2 MP mobile phone, along with other multimedia functionality.[7]
- 8/14/06: Bell Canada announces Canada's first music video ringtones.[8]

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1 "First CDMA BlackBerry Smartphone to Support International Roaming on GSM/GPRS Networks." Bell Mobility Press Release. 4/25/07.

2 "Bell Introduces the Slimmest Phone in Canada – Ultra-Thin Samsung SPH-m610 Features Stereo Sound, Big Colour Screen." Bell Mobility Press Release. 3/19/07.

3 "Bell to Bell Calling Offers Unlimited Local Calling to and From Bell Mobile, Residential and Business Phones." Bell Mobility Press Release. 2/28/07.

4 "Bell Launches Exclusive GOLTV Soccer Content on Mobile Phones and sympatico.msn.ca." Bell Mobility Press Release. 2/22/07.

5 "Full Length Pay-Per-View Movies Can Be Watched Directly on Bell Mobility Phones." Bell Mobility Press Release. 2/15/07.

6 "Bell Tunes in the LG Fusic™ Mobile Music Phone." Bell Mobility Press Release. 12/7/06.

7 "Silver Phone Combines Sleek and Stylish Looks with Hot Features That Include Videoplayer and MP3 phone Expandable Memory." Bell Mobility Press Release. 10/31/06.

8 "Listen and Watch the Latest Music Videos on Your Phone When it Rings!" Bell Mobility Press Release. 8/14/06.

- 7/13/06: Bell Canada and Good Technology, Inc. announce Good™ Mobile Messaging and Good Mobile Defense – enterprise push email with advanced mobile security features.[9]
- 1/24/06: Bell Canada announces availability of Motorola RAZR V3c handset – the next generation RAZR and first CDMA dual mode 1x digital handset on the market.[10]
- 1/19/06: Bell Canada announces nation-wide availability of exclusive NHL video clip service – first in Canada.[11]
- 12/19/05: Bell Canada and Groove Mobile announce launch of nationwide full track mobile music download service – allowing browsing, reviewing, downloading and sharing music.[12]
- 12/12/05: Bell Canada announces flat-rate, per minute billing for global roaming on GSM networks – a Canadian wireless industry first.[13]
- 11/14/05: Bell Canada launches streaming video clip service – the first in Canada – allowing viewing of, for example, movie trailers and music videos.[14]
- 10/31/05: Bell Canada launches 3G EVDO network – along with the first 3 EVDO-based handsets.[15]
- 10/17/05: Bell Canada launches Motorola e815 mobile flip phone – first MP3 capable phone available on Bell 1x network.[16]
- 8/31/05: Bell Canada announces availability of MSN Messenger over its mobile devices.[17]
- 8/18/05: Bell Canada announces trial of next generation 911 service for wireless customers – first in Canada.[18]

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9 "Bell Canada Offers Greater Choice for Corporate Email and Data Solutions for Wireless Customers." Bell Mobility Press Release. 7/13/06.

10 "Bell Canada Announces Availability of Next-Generation Motorola RAZR phone." Bell Mobility Press Release. 1/24/06.

11 "Bell Canada Offers Mobile Customers Exclusive NHL Game Content." Bell Mobility Press Release. 1/19/06.

12 "Bell Canada Launches Nationwide Mobile Music Download Service With Groove Mobile." Bell Mobility Press Release. 12/19/05.

13 "Bell Canada Launches Canada's First Flat-Rate Billing Service for Global Roaming on GSM Networks." Bell Mobility Press Release. 12/12/05.

14 "Bell Canada Launches First Mobile Streaming Video Clip Service in Canada with Sanyo 8300 Handset." Bell Mobility Press Release. 11/14/05.

15 "Bell Canada Launches Fastest Mobile Data Network." Bell Mobility Press Release. 10/31/05.

16 "Bell Canada and Motorola Launch e815 for the Ultimate Mobile Multimedia Experience." Bell Mobility Press Release. 10/17/05.

17 "Bell Canada First in Country to Offer Rich MSN Messenger on Mobile Phone." Bell Mobility Press Release. 8/31/05.

18 "Bell Canada First to Trial Next-Generation 9-1-1 for Wireless." Bell Mobility Press Release. 8/18/05.

- 8/9/05: Bell Canada launches Seek & Find, Canada's first wireless location based service for families.[19]
- 3/16/05: Bell Canada launches "10-4" – walkie talkie service.[20]
- 3/9/05: Bell Canada announces first in the world partnership with Sproqit Technologies to deliver remote access from PDA to all desktop applications.[21]
- 2/28/05: Bell Canada announces partnership with Universal Music Canada to deliver music ringtones (True Tones) and a Canada first "Caller Ring Tune" service.[22]
- 2/16/05: Bell Canada announces availability of BlackBerry 7250 – first in Canada.[23]
- 12/13/04: Bell Canada announces plans to roll out EVDO 3G technology.[24]
- 10/14/04: Bell Mobility launches phone to phone video messaging service on Samsung SPH-a680 phone – first in Canada.[25]
- 8/31/04: Bell Mobility and palmOne Canada announce availability of Treo™ 600 smartphone – first time palmOne device is available on CDMA 1x network in Canada.[26]
- 8/12/04: Bell Canada announces opening of Wireless Innovation Centre at Bell Mobility's Creekbank campus to focus on development of innovative wireless applications, devices and services.[27]
- 2/24/04: Bell Mobility and Sprint launch North America's first interoperable picture messaging service for camera phone users.[28]

[19] "Bell Launches Canada's First Location-Based Service for Families." Bell Canada Press Release. 8/9/05.

[20] "Bell Canada Pushes Button on its Wireless Walkie Talkie Service and Says "10-4, Good Buddy." Bell Mobility Press Release. 3/16/05.

[21] "Bell Canada First To Partner with Sproqit to Deliver Laptop Functionality to Handheld Devices." Bell Mobility Press Release. 3/9/05.

[22] "Bell Canada's Partnership with Universal Music Offers Canadians first "Caller Ring Tunes" Service." Bell Mobility Press Release. 2/28/05. Caller Ring Tunes allows callers to hear music instead of traditional ring when calling a Ring Tunes customer.

[23] "Bell Canada First in Country to Launch BlackBerry 7250." Bell Mobility Press Release. 2/16/05.

[24] "Bell Canada Announces Roll Out of Canada's Fastest Wireless Network." Bell Mobility Press Release. 12/13/04.

[25] "Bell Mobility Launches a Canadian First with Phone to Phone Video Messaging." Bell Mobility Press Release. 10/14/04.

[26] "palmOne's Treo 600 Smartphone Now Available to Bell Mobility Customers Over Leading 1x Digital Network." Bell Mobility Press Release. 8/31/04.

[27] "Bell Canada Opens Wireless Innovation Centre." Bell Mobility Press Release. 8/12/04.

[28] "Camera Phone Users Have One More Reason to Smile as Bell Mobility and Sprint Launch Cross-Border Picture Messaging Service." Bell Mobility Press Release. 2/24/04.

- 2/16/04: Bell Mobility announces suite of ruggedized data products and services on its 1x wireless network.[29]
- 11/14/03: Bell Mobility launches Samsung SPH-600 camera phone for first time in Canada, allowing picture messaging.[30]
- 6/18/03: Bell Mobility announces enhanced wireless games for Samsung n400, with broadest suite of games in Canada.[31]
- 5/15/03: Bell Mobility launches image download service to allow personalizing mobile phones.[32]
- 2/27/03: Bell Mobility and VoiceGenie Technologies, Inc. announce a $800,000 R&D initiative to extend speech recognition platform into a multimodal platform allowing access to information, graphics and streaming video on wireless devices using voice commands.[33]
- 2/19/03: Bell Mobility launches BlackBerry 6750 – first on CDMA technology in Canada.[34]
- 1/28/03: Bell Mobility launches availability of MSN messenger service.[35]
- 1/23/03: Canadian and US wireless industries introduce cross-border inter-carrier text messaging services.[36]
- 12/17/02: Bell Mobility launches MyFinder, the first offering in Bell's Location Based Services.[37]
- 11/6/02: Bell Mobility and Sprint announce collaboration to further advance CDMA2000 capabilities.[38]

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[29] "Bell Mobility Business Customers Get 'Ruggedized' With Durable Wireless Data Devices." Bell Mobility Press Release. 2/16/04.

[30] "Bell Mobility Launches Picture Perfect Camera Phone." Bell Mobility Press Release. 11/14/03.

[31] "Swing, Jump, Jam, Race and Wrestle Like Never Before with Enhanced Wireless Games from Bell Mobility." Bell Mobility Press Release. 6/18/03.

[32] "Put Your Face on Your Bell Mobility Phone." Bell Mobility Press Release. 5/15/03.

[33] "Bell Mobility and VoiceGenie Developing Simple Voice Command Technology." Bell Mobility Press Release. 2/27/03.

[34] "Bell Mobility Launches RIM's BlackBerry 6750™ with Built-in Cellphone." Bell Mobility Press Release. 2/19/03.

[35] "MSN.CA and Bell Mobility bring MSN Messenger and More to Canadian Cell Phone Users." Bell Mobility Press Release. 1/28/03.

[36] "Canadian and U.S. Wireless Service Providers Unify North American Text Message Markets." Bell Mobility Press Release. 1/23/03.

[37] 'Bell Mobility Introduces MyFinder – Canada's First Wireless Location Based Service." Bell Mobility Press Release. 12/17/02.

[38] "Sprint and Bell Mobility Collaborate on CDMA Technology Advancement." Bell Mobility Press Release. 11/6/02.

- 11/8/02: Bell Mobility and MOTIVUS Software Ltd. Launch MOTIVUS mobile desktop for real-time access to their desktop/files/emails through a wireless PDA or laptop.[39]
- 9/16/02: Bell Mobility launches Audiovox Thera™, Canada's first 1X Handheld PocketPC with Built in cellphone,[40] providing internet access, email, text messaging, speakerphone, voice recorder, MP3 player and phone.
- 4/23/02: Bell Mobility selects Sun Microsystems' JAVA™ technology to deliver wireless Java services to Bell Mobility handsets using 1x technology.[41]
- 4/2/02: Bell Mobility, Microcell, Rogers and TELUS launch North America's first inter-carrier mobile text messaging (SMS) network.[42]
- 2/12/02: Bell Mobility launches 1x wireless network, devices and services.[43]
- 1/22/02: Bell Mobility announces availability of VoiceNet (a product developed through BCE's $70 million Convergence Fund) which is a voice recognition application that enables Bell Mobility customers to have their email and web content read to them.[44]
- 11/6/01: North American First announced – a Canadian wireless initiative to enable inter-carrier, mobile text messaging.[45]
- 4/27/01: Bell Mobility and Speedware Corp. announce partnership to foster innovation of wireless Internet applications and services by creating the first Canadian website for wireless developers – providing all information needed to build innovative applications for Bell Mobility.[46]
- 4/25/01: Bell Mobility and Compaq Canada Corp. announce alliance to develop and deliver new wireless solutions.[47]

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[39] "MOTIVUS Software and Bell Mobility Bring the Windows Desktop to Canadian Wireless Customers." Bell Mobility Press Release. 5/8/02.

[40] Bell Mobility Launches Audiovox Thera – Canada's First 1X Handheld PocketPC with a Built-In Cellphone. 9/16/02. Available at: www.mobilemag.com/content/100/333/C1289/

[41] "Bell Mobility Selects Sun Microsystems' Java ™ Technology to Deliver Java Applications to Canadian Wireless Customers." Bell Mobility Press Release. 4/23/02.

[42] "Canadian Wireless Carriers Announce Availability of North America's First Inter-Carrier Mobile Text Messaging Network." Bell Mobility Press Release. 4/2/02.

[43] "Bell Mobility Launches Next Generation Wireless Network, Devices and Services." Bell Mobility Press Release. 2/12/02.

[44] "Heard the Latest? Bell Canada Delivers First Wireless Voice Recognition Portal to Canadians." Bell Mobility Press Release. 1/22/02.

[45] "Canadian Wireless Carriers Break Through North American Text Messaging Barriers."

[46] "Bell Mobility Launches First Canadian Website for Wireless Application and Service Developers." Bell Mobility Press Release. 4/27/01.

[47] "Compaq Canada Corp. and Bell Mobility Form Alliance to Develop and Deliver new Wireless Solutions." Bell Mobility Press Release. 4/25/01.

- 2/27/01: Bell Mobility and Siebel Systems, Inc. announce partnership to provide Siebel eBusiness Applications over Bell Mobility's Mobile Browser.[48]
- 2/15/01: Bell Mobility announces expanded wireless email applications suite from Nortel and Novell.[49]
- 1/11/01: Bell Mobility announces agreement with Sierra Wireless to deliver the AirCard 510, available through Bell Mobility in March 2001, making available Canada's first wireless CDMA PC Card technology in Canada.[50]
- 1/11/01: Bell Mobility announces first consumer field trial of wireless multimedia services in Canada.[51]
- 12/20/00: Bell Mobility launches Canada's first colour display wireless phone (Motorola Timeport™ P8767).[52]
- 11/30/00: Bell Mobility and Yahoo! Canada launch North America's first French-language wireless IM service on web-enabled phones.[53]
- 9/21/00: Bell Mobility launches wireless access to MSN Hotmail through Mobile Browser™ - first time in Canada.[54]
- 9/19/00: Bell Mobility announces that it will offer BlackBerry email solutions for use on ARDIS network.[55]
- 5/24/00: Bell Mobility and Yahoo! Canada announce North America's first instant messaging service available on a Digital PCS phone.[56]
- 4/12/00: Bell Mobility announces North America's first trial of myAladdin.com, a wireless location based information service.[57]

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48 "Bell Mobility First in Canada to Offer Siebel eBusiness Applications on Internet-ready Wireless Devices." Bell Mobility Press Release. 2/27/01.

49 "Bell Mobility Launches New Wireless Business Applications." Bell Mobility Press Release. 2/15/01.

50 Sierra Wireless Signs Supply Agreement with Bell Mobility, AirCard 510 Becomes First CDMA wireless data PC Card Solution in Canada. 1/11/01. Available at: www.sierrawireless.com/news_events/news.aspx?year=1&contentid=F12DE869-39FF-42C8-BC4A-53D62DA3DFD9

51 "PacketVideo Teams with Bell Mobility to Launch Canada's First Market Trial of Wireless Multimedia Customers." Bell Mobility Press Release. 1/11/01.

52 "Bell Mobility Launches Canada's First Colour Display Wireless Phone." Bell Mobility Press Release. 12/20/00.

53 "Yahoo!Canada and Bell Mobility Launch North America's First French-Language Wireless Instant Messaging Service on Web-Enabled Digital PCS phones.": Bell Mobility Press Release. 11/30/00.

54 "Bell Mobility First Cellular Service in Canada to Offer Wireless Access to MSN Hotmail." Bell Mobility Press Release. 9/21/00.

55 "Bell Mobility to Offer BlackBerry Wireless Email Solution." Bell Mobility Press Release. 9/19/00.

56 "Bell Mobility and Yahoo! Canada Launch North America's First Wireless Instant Messaging Service on ',com-ready' Digital PCS phones." Bell Mobility Press Release. 5/24/00.

57 "Bell Mobility and NeoPoint, Inc. Launch First Trial in Canada of Wireless Location-based Services." Bell Mobility Press Release. 4/12/00.

- 2/16/00: Bell Mobility and Amazon.com announce Canada's first on line shopping services through mobile phones.[58]
- 2/9/00: Bell Mobility and Yahoo! Canada announce availability of Yahoo over Bell Mobility phones.[59]
- 2/7/00: Bell Mobility announces availability of QUALCOMM pdQ™ smartphone – the only smartphone to offer Palm Computing® platform and support full-time access to the Internet using standard Internet protocols.[60]
- 10/25/99: Bell Mobility announces the completion of North America's first two "wireless campuses" – a new system that combines access to 3 communications networks via a single telephone.[61]
- 6/15/99: Bell Mobility offers the world's first tri-mode dual band CDMA handset (Nokia 6185).[62]
- 5/13/99: Bell Mobility, in a series of Canada's and world firsts, announces initiatives to provide email, internet, ecommerce applications to mobile wireless handsets: Digital DATA to Go™, PCS Mobile Browser, etc.[63]
- 11/23/98: Bell Mobility announces availability of Sony CM-Z100 Zuma handset – smallest phone on the market.[64]

B) ROGERS WIRELESS

- 5/8/07: Rogers launches the "talking cellphone" for customers with vision loss.[65]
- 4/12/07: Rogers launches mFleet™, a GPS based wireless fleet management solution.[66]
- 4/2/07: Rogers announces wireless video calling (part of Rogers VISION suite), turning the mobile phone into a webcam for face to face calling in real time – the first and only wireless carrier in North America to offer video calling.[67]

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[58] "Bell Mobility and Amazon.com Launch First Wireless On-Line Shopping Service in Canada." Bell Mobility Press Release. 2/16/00.

[59] "Yahoo! Canada and Bell Mobility Provide Wireless Access to Yahoo! Canada Internet Services on Your Digital PCS phone." Bell Mobility Press Release. 2/9/00.

[60] "QUALCOMM'S pdQ Smartphones Enters Commercial Service with Bell Mobility of Canada." Bell Mobility Press Release. 2/7/00.

[61] "New Breakthrough in Mobile Communications." Bell Mobility Press Release. 10/25/99.

[62] "Bell Mobility Offers the World's First Tri-mode, CDMA phone." Bell Mobility Press Release. 6/15/99.

[63] "Bell Mobility Offers Customers Wireless Access to E-Mail, Internet, and E-Commerce." Bell Mobility Press Releases. 5/13/99.

[64] "Bell Mobility Offers Smallest Digital Phone." Bell Mobility Press Release. 11/23/98.

[65] "Rogers Wireless launches 'Talking Cellphone' for Customers with Vision Loss." Rogers Press Release. 5/8/07.

[66] "Rogers introduces mFLEET™ - An advanced Wireless Fleet Management Solution for the Canadian Market." Rogers Press Release. 4/12/07.

- 3/23/07: Rogers launches HTC s621 smartphone – first in Canada – providing Microsoft® Windows Mobile 5.0®.[68]
- 1/10/07: Rogers announces turn-down of TDMA and analog networks effective 5/31/07.[69]
- 12/19/06: Rogers announces availability of Call Manager – allowing the managing of use of phones on one account.[70]
- 12/18/06: Rogers announces availability of MOTOKRZR K1.[71]
- 12/13/06: Rogers announce Canadian launch of BlackBerry® Connect™ for Nokia E62 (available 12/21/06) – allowing access to BlackBerry wireless services through Nokia phones.[72]
- 12/5/06: Rogers announces exclusive availability of Palm® Treo™ 680 smartphone.
- 11/2/06: Rogers debuts HSDPA – first in North America.[73]
- 10/3/06: Rogers announces availability of BlackBerry Pearl for the first time in Canada.[74]
- 9/6/06: Rogers announces availability of Nokia E62 for the first time anywhere in North America – providing push e-mail and enhanced web browsing.[75]
- 8/9/06: Rogers announces exclusive availability of Sony Ericsson W810i Walkman™ phone, and first in Canada to provide 1GB memory card.[76]
- 6/6/06: Rogers Wireless and Fido launch Name Display, the first offering in North America to show the name of the person calling even if not in personal contacts.[77]
- 5/25/06: Rogers announces availability of Sony Ericsson W810 Walkman® phone with 2MP camera and auto-focus – first in North America.[78]

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[67] "Rogers Introduces Next Generation of Wireless Technology." Rogers Press Release 4/2/07.

[68] "Rogers Wireless and HTC Launch HTC S621 Smartphone in Canada." Rogers Press Release. 3/23/07.

[69] "Rogers Wireless to Upgrade Remaining TDMA and Analog Wireless Customers." Rogers Press Release. 1/10/07.

[70] "Rogers Wireless Introduces the Ultimate in Cell Phone Control: Call Manager." Rogers Press Release. 12/19/06.

[71] "MOTOKRZR™ K1 Now Available from Rogers Wireless." Rogers Press Release. 12/18/06.

[72] "Nokia and Rogers Wireless Introduce BlackBerry Connect on the Nokia E62 Device." Rogers Press Release. 12/13/06.

[73] "Rogers Debuts HSDPA in Golden Horseshoe." Rogers Press Release. 11/2/06.

[74] "Rogers Wireless brings the BlackBerry Pearl to Canada." Rogers Press Release. 10/3/06.

[75] "Nokia E62 Push E-Mail Device from Rogers Wireless Brings Freedom of Mobility to Professionals." Rogers Press Release. 9/6/06.

[76] "New 1GB MP3 Phone from Rogers Wireless Holds up to 280 Songs." Rogers Press Release. 8/9/06.

[77] "Rogers Wireless and Fido Introduce Name Display for Mobile Phones." Rogers Press Release. 6/6/06.

- 5/24/06: Fido announces exclusive Canadian launch of the LG 9200 wireless handset providing access to Yahoo! And MSN instant messaging – with QWERTY keyboard.[79]
- 3/31/06: Inukshuk Completes first phase deployment covering 5 million households and 40% of the population of Canada.[80]
- 3/31/06: Rogers announces Portable Internet from Rogers Yahoo! Hi Speed Internet providing access to internet speeds of up to 1.5 Mbps download and 256 Kbps upload.[81]
- 2/1/06: Rogers announces launch of Rogers Podcast Service – North America's first mobile podcast service.[82]
- 12/14/05: Rogers announces availability of Canada's first Walkman™ phone, the Sony Ericsson W600i – providing music phone, 3D gaming, 1.3MP camera phone.[83]
- 11/22/05: Rogers announce availability of MyMail push email service on Motorola RAZR V3, providing Java-based push email available for GSM handset.[84]
- 11/9/05: Rogers announces availability of BlackBerry® 8700r Wireless Handheld™ (available 11/29) – first in Canada to support EDGE technology.[85]
- 11/3/05: Fido announces exclusive Canadian launch of Nokia 8801 handset – stainless steel slidephone.[86]
- 10/13/05: Rogers announces trial of UMTS/HSDPA network technology and Converged IP Multimedia Subsytem (IMS) Platform.[87]

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78 "Stylish Sony Ericsson W810 Walkman® Phone with 2Mega Pixel Camera Makes its North American Debut on Rogers Wireless." Rogers Press Release. 5/25/06.

79 "Instant Messaging Goes Mobile with Launch of LG9200 Wireless Handset with Yahoo! And MSN messenger on Fido." Rogers Press Release. 5/24/06.

80 "Inukshuk Announces Availability of National Wireless Broadband Network." Rogers Wireless Press Release. 3/31/06.

81 "Rogers Offers Canadians Access to Its Portable Internet Service Across Canada." Rogers Press Release. 3/31/06.

82 `"Rogers Wireless and Melodeo Introduce North America's First Mobile Podcast Service." Rogers Press Release. 2/1/06.

83 "Take a Walk on the 'Dial' Side." Rogers Press Release. 12/14/05.

84 "Rogers Wireless and Motorola Drive 'Push Email' to Business and Consumer Markets with MyMail on the Motorola RAZR V3." Rogers Press Release. 11/22/06.

85 "Rogers Wireless and Research In Motion Introduce the BlackBerry 8700r." Rogers Press Release. 11/9/06.

86 "Fido announces Exclusive Canadian Launch of the Much-anticipated Nokia 8801 Handset." Rogers Press Release. 11/3/05.

87 "Rogers Communications Inc. To Begin a Trial of 3rd Generation UMTS-HSDPA Wireless Network Technology and Converged IP Multimedia Subsystem (IMS) Platform with Ericsson." Rogers Press Release. 10/13/05.

- 10/4/05: Rogers announces availability of BlackBerry® 7100g™.[88]
- 9/16/05: Rogers launches channel line up on Rogers Mobile TV platform, providing real time access to live TV programming, news, music videos, etc.[89]
- 8/23/05: Rogers launches MusiquePlus Edition Pay as You Go™ phone, allowing music downloads.[90]
- 8/8/05: Rogers launches Firefly phone for pre-teens, providing call control capabilities.[91]
- 8/3/05: Rogers launches Samsung p207 the first phone with speech to text capabilities.[92]
- 6/2/05: Rogers announces availability of HP iPAQ Pocket PCs.[93]
- 5/9/05: Rogers announces Canada's first mobile music experience, with MP3 capability, mobile downloads of full songs, ring tunes, etc.[94]
- 4/14/05: Rogers and MobiTV announce Rogers Mobile Television, real-time access to live TV programming (available in 2Q05).[95]
- 3/24/05: Rogers announces exclusive availability of UTStarcom SMT5600 Smartphone, providing functionalities seen in larger devices in a smaller device.[96]
- 3/14/05: Rogers announces new Treo™ 650 Smartphone in Canada, the first all in one, quad-band smartphone on EDGE.[97]
- 2/22/05: Rogers launches Motorola Razr V3.[98]
- 2/1/05: Rogers announces availability of Sony Ericsson Z500a wireless phone, providing VGA digital camera, video camera, 3d gaming, etc.[99]

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[88] 10/4/05: "Rogers Wireless Expands BlackBerry Portfolio." Rogers Press Release. 10/4/05.

[89] "Rogers Launches Exclusive Channel Line Up for Rogers Mobile Television." Rogers Press Release. 9/16/05.

[90] "Rogers Launches the MusiquePlus Edition Pay As You Go Phone." Rogers Press Release. 8/23/05.

[91] "Rogers Wireless Lightens Up Life with Firefly – The Mobile Phone for Mobile Kids™." Rogers Press Release. 8/8/05.

[92] "Samsung Electronics Launches p207 Phone Featuring Canada's First Speech To Text Capabilities." Rogers Press Release. 8/3/05.

[93] "HP Canada and Rogers Wireless Announce Availability of HP iPAQ Pocket PCs in Canada." Rogers Press Release. 6/2/05.

[94] "Rogers Wireless Puts Your Life to Music." Rogers Press Release. 5/9/05.

[95] "Rogers First In Canada to Announce the Arrival of Live TV on Your Wireless Phone." Rogers Press Release. 4/14/05.

[96] "Audiovox SMT 5600, World's Smallest Windows Mobile-Based Smartphone, Comes to Canada Exclusively With Rogers Wireless." Rogers Press Release. 3/24/05.

[97] "palmOne Canada Launches Treo 650 Smartphone on Rogers Wireless High-Speed EDGE Network." Rogers Press Release. 3/14/05.

[98] "The Ultra-Thin, Revolutionary Motorola Razr V3 Makes its Canadian Entrance Exclusively With Rogers Wireless." Rogers Press Release. 2/22/05.

- 2005: Rogers Wireless is first carrier in North America to implement downloadable music to a cellphone.[100]
- 11/23/04: Rogers announces first national implementation of wireless priority service in Canada, providing government authorized wireless phone users priority on the network during emergencies.[101]
- 11/16/04: Rogers announces availability of BlackBerry 7100r™, providing always-on connectivity to email, voice, text messaging, HTML web browsing, etc.[102]
- 11/9/04: Rogers launches Video messaging service, allowing capture, share and save moments up to 20 seconds.[103]
- 11/2/04: Rogers launches “MuchPhone” with MuchMusic.[104]
- 10/22/04: Rogers announces availability of BlackBerry 7290 Handheld™ in Canada.[105]
- 1998: Rogers Wireless first carrier in the world to deploy a commercial integrated dual-band (1900 and 850 Mhz) dual-mode (TDMA and AMPS) network within the same service areas.[106]
- 1992: Rogers Wireless if first carrier in North America to implement commercial digital wireless cellular service.[107]
- 1989: Rogers Wireless is first carrier in North America to commercially deploy a public access digital wireless packet switching network; with Mobitex as Canada’s largest such network.[108]
- 1987: Rogers Wireless is first carrier in Canada to offer fully automatic roaming.[109]

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[99] “Sony Ericsson and Rogers Wireless Introduce Z500a Wireless Video Phone.” Rogers Press Release. 2/1/05.

[100] Rogers Response to QSI Questions, p. 1 of 8.

[101] “Rogers Wireless Announces Deployment of Wireless Priority Service in Canada.” Rogers Press Release. 11/23/04.

[102] “BlackBerry 7100r Now Available for Rogers Wireless Customers in Canada.” Rogers Press Release. 11/16/04.

[103] “Vide Messaging Allows Rogers Wireless Customers to Shoot, Share & Save Special Moments – Instantly.” Rogers Press Release. 11/9/04.

[104] “MuchMusic and Rogers Wireless Deliver “MuchPhone.”” Rogers Press Release. 11/2/04

[105] “Rogers Wireless and RIM Introduce the New BlackBerry 7290 in Canada.” Rogers Press Release. 10/22/04.

[106] Rogers Responses to QSI’s Questions, p. 1 of 8.

[107] Rogers Responses to QSI’s Questions, p. 1 of 8.

[108] Rogers Responses to QSI’s Questions, p. 1 of 8.

[109] Rogers Responses to QSI’s Questions, p. 1 of 8.

C) TELUS MOBILITY

- 02/07: TELUS introduces Pantech PN-8200 from UTStarcom, a smart phone exclusive to TELUS customers, with 1.3Megapixel digital camera, memory card slot up to 4GB, entertainment capabilities including Internet Explorer Mobile, Windows Media Player Mobile 10.[110]
- 11/06: TELUS expands TELUS GPS for small and mid sized business market, proving real time tracking over wireless handsets and in vehicle modems, running over 1X and Mike networks.[111]
- 11/06: TELUS introduces Motorola i880.
- 3Q06: TELUS expanded its SPARK with five new offerings: TELUS Kid Find, TELUS Navigator – GPS based services, Apna Des – a S. Asia based service, My Email; Mobile Search.[112]
- 8/4/06: TELUS and Amp'd Mobile announce exclusive relationship for the sale and distribution of Amp'd branded entertainment services, and Amp'd will use TELUS' EVDO network.[113]
- 7/17/06: TELUS announces exclusive availability of Motorola i580, the first Motorola to bring together stylish design and ultra-ruggedness, runs on Mike network.[114]
- 7/6/06: TELUS and XM Canada announce TELUS Mobile Radio, the first real time streaming satellite radio service from mobile phones in Canada.[115]
- 6/21/06: TELUS announces availability of multimedia messaging with US companies.[116]
- 6/16/06: TELUS announces Nokia 6265i – TELUS' first 2MP digital camera with video capability and customized video ringtones.[117]
- 6/15/06: TELUS announces availability of Motorola Q (MOTOQ), the world's slimmest QWERTY device – first in Canada.[118]

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[110] TELUS News Release 4Q06, p. 6.

[111] TELUS 4Q06 update.

[112] TELUS News Release 3Q06, p. 6.

[113] "TELUS and Amp'd Mobile Bringing Next Generation Mobile Entertainment Services to Canada." TELUS Press Release. 8/4/06.

[114] "TELUS Introduces the Motorola i580, the Ultimate in Sophistication and Ruggedness." TELUS Press Release. 7/17/06.

[115] "TELUS and XM Canada Launch Canada's First Streaming Mobile Radio Service." TELUS Press Release. 7/6/06.

[116] "TELUS Clients Can Now Instantly Share Video and Picture Messages with Friends, Family and Colleagues in U.S." TELUS Press Release. 6/21/06.

[117] "TELUS Introduces the Nokia 6265i Mobile Phone with 2 Megapixel Camera and Video Ringtone Capability." TELUS Press Release. 6/16/06.

[118] "TELUS First to Bring the Highly Anticipated MOTOQ to Canada." TELUS Press Release. 6/15/06.

- 6/13/06: TELUS announces Motorola i833, smallest Mike phone ever; has data capability.[119]
- 5/29/06: TELUS announces exclusive Canadian availability of Samsung A950, featuring mobile access to TELUS Mobile Music, TELUS Mobile TVTM, MP3, Bluetooth, 1.3MP Camera, video recorder.[120]
- 5/12/06: TELUS introduces Motorola i605, the first ruggedized Mike phone enabled with Bluetooth.[121]
- 5/5/06: TELUS introduces the Migo (LG phone) for pre-teens geared toward safety and security.[122]
- 4/11/06: TELUS introduces BlackBerry 7100i for Mike users, exclusive in Canada to TELUS.[123]
- 4/6/06: Panasonic announces that its ruggedized CF18 and CF29 notebooks will offer Canada's first Integrated Sierra Wireless EM5625 embedded modules, on TELUS' network.[124]
- 3/13/06: TELUS announces TELUS Mobile Music, access to Canada's largest mobile music catalog and the only offering from all of the world's biggest record labels; also announces exclusive availability of LG8100 – mobile entertainment device with MP3 player, stereo speakers, etc.[125]
- 2/2/06: TELUS introduces exclusive Canada availability of Samsung SPHA840, in different colors and personalized postcards – fashionable but affordable.[126]
- 2/2/06: TELUS announces Kyocera Passport KPC650 – a CDMA2000 1x EVDO PC Card, providing speeds at least 6 times faster than previous mobile data services.[127]
- 2/1/06: TELUS announces national availability of Canada's first EVDO capable Motorola RAZR V3c.[128]

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119 "TELUS Introduces a New Limited Edition Mike Phone Designed by Pininfarina." TELUS Press Release. 6/13/06.

120 "TELUS and Samsung Electronics Canada Introduce Advanced Multimedia Device for Wireless High Speed Network." TELUS Press Release. 5/29/06.

121 "TELUS Introduces Rugged, Bluetooth-enabled Mike Phone." TELUS Press Release. 5/12/06.

122 "TELUS and LG Introduce a Wireless Phone for Pre-Teens." TELUS Press Release. 5/5/06.

123 "TELUS and Research In Motion Introduce the BlackBerry 7100i for Mike Users." TELUS Press Release. 4/11/06.

124 "Panasonic Canada Announces Canada's First Certification of Toughbook Notebooks for High-Speed EVDO Network." TELUS Press Release. 4/6/06.

125 "SPARK a Rhythm with TELUS Mobile Music and the LG 8100 Mobile Entertainment Service." TELUS Press Release. 3/13/06.

126 2/2/06: "TELUS Introduces the Flashy and Fashionable Samsung SPHA840 Phone." TELUS Press Release. 2/2/06.

127 "Kyocera Wireless and TELUS Offer Wireless High Speed to Mobile Data Users." TELUS Press Release. 2/2/06.

- 12/8/05: TELUS announces availability of BlackBerry 7130e.[129]
- 11/18/05: TELUS announce availability of UTStarcom Pocket PC 6700, the first Pocket PC in Canada with Microsoft Windows Mobile 5.0.[130]
- 11/14/05: TELUS launches Wireless High Speed Network based on CDMA 1xEVDO technology with speeds of 400-700kbps, with maximum speeds of 2 Mbps.[131]
- 11/11/05: TELUS announces availability of Palm® Treo™ 650 Smartphone.[132]
- 8/26/05: TELUS launches TELUS mobile TV, offering real-time access to live TV programming including news, weather and shopping channels on wireless phones.[133]
- 8/25/05: TELUS announces availability of Motorola i860, the first of several Mike phones with multimedia messaging (Push to View Picture Messaging, Push to Send Contacts, Push to Send My Info).[134]
- 7/7/05: TELUS announces availability of Motorola V265 and V262, two new phones with advanced speech recognition and personalization options.[135]
- 6/29/05: Canada's wireless service providers to introduce inter-carrier multimedia message services (MMS) on 7/1/05.[136]
- 5/25/05: TELUS introduced Multi-Network Data Access Solution, for public safety and business clients to access critical data, including security.[137]
- 5/17/05: TELUS announces LG 4750, with instant PTT communication.[138]

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[128] "High-Speed Motorola RAZR V3c Now Available Across Canada from TELUS." TELUS Press Release. 2/1/06.

[129] "TELUS Wireless High Speed Brings Broadband Data Access to the BlackBerry 7130e." TELUS Press Release. 12/8/05.

[130] "TELUS Mobility Launches First Wireless High Speed Pocket PC in Canada." TELUS Press Release. 11/18/05.

[131] "TELUS Mobility Introduces National Wireless High Speed Network." TELUS Press Release. 11/14/05.

[132] "TELUS Mobility Extends Mobile Business Solutions Line with Palm Treo 650 Smartphone." TELUS Press Release. 11/11/05.

[133] "TELUS Mobility Launches TELUS Mobile TV on Its National 1x Network." TELUS Press Release. 8/26/05.

[134] "TELUS Mobility's Mike Extends the "Push To" Technology Into Instant Multimedia Communications." TELUS Press Release. 8/25/05.

[135] "TELUS Mobility Adds Stylish New Motorola Handsets To Its Exclusive Phone Line-Up." TELUS Press Release. 7/7/05.

[136] "Canadian Wireless Carriers Launch Inter-Carrier Multimedia Messaging on July 1." TELUS Press Release. 6/29/05.

[137] "TELUS Mobility Introduces Managed Wireless Data Communications for Critical Operations." TELUS Press Release. 5/25/05.

[138] "TELUS Mobility Introduces Its Newest Push to Talk Phone, The LG 4750." TELUS Press Release. 5/17/05.

- 5/16/04: TELUS introduces Motorola i355, a ruggedized PTT phone with walkie talkie feature and GPS.[139]
- 5/4/05: TELUS announces availability of Sierra Wireless AirCard® 580 network card, the first in Canada capable of operating on EVDO network.[140]
- 5/2/05: TELUS announces exclusive availability of Motorola M800, an in-vehicle CDMA phone allowing connections on the job site.[141]
- 4/1/05: TELUS announces exclusive availability of BlackBerry® 7520 – powered by Mike.[142]
- 3/14/05: TELUS announces that clients using Fastap phone send more than twice as many text messages those who use other PCS phones.[143]
- 3/4/05: TELUS announces exclusive availability of LG 535 phone, including high resolution digital camera, video recorder, MP3, stereo speakers.[144]
- 3/2/05: TELUS Mobility announces BlackBerry 7250.[145]
- 1/17/05: TELUS announces Instant Talk, a new PTT service.[146]
- 11/30/04: TELUS Mobility announces availability of Fastap™ LG 6190 the world's first wireless phone that integrates text keys around a standard numeric phone keypad.[147]
- 11/16/04: TELUS announces availability of Nokia 3205i a wireless phone focused on multimedia messaging and personalization.[148]
- 10/14/04: TELUS announces Audiovox 8920 King Kam, Canada's First 1.3MP Camera Phone.[149]

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[139] "TELUS Mobility Introduces New Ruggedized Mike Phone." TELUS Press Release. 5/16/04.

[140] "TELUS Mobility Delivers First EVDO Capable Wireless Network Card For Portable PCs." TELUS Press Release. 5/4/05.

[141] "TELUS Mobility Launches The Motorola M800 In-Vehicle Fixed CDMA Phone." TELUS Press Release. 5/2/05.

[142] "TELUS Mobility Launches Newest BlackBerry® Device for Mike Clients." TELUS Press Release. 4/1/05.

[143] "Digit Wireless Intuitive Fastap™ Technology Significantly Increases Data Usage For Canadian Wireless Carrier TELUS Mobility." TELUS Press Release. 3/14/05.

[144] "TELUS Mobility Introduces the LG 535, a Multimedia Slider Phone." TELUS Press Release. 3/4/05.

[145] "TELUS Mobility Launches Bluetooth®-enabled BlackBerry® Handheld." TELUS Press Release. 3/2/05.

[146] "TELUS Mobility Introduces Push To Talk Service on Its National PCS Network." TELUS Press Release. 1/1/705.

[147] "TELUS Mobility Launches World's First Fastap™ Wireless Phone For Fast Texting." TELUS Press Release. 11/30/04.

[148] "Nokia and TELUS Mobility Get Personal With The Nokia 3205i." TELUS Press Release. 11/16/04.

[149] "TELUS Mobility Expands Picture Messaging Lineup With Highest Resolution Camera Phone." TELUS Press Release. 10/14/04.

- 9/2/04: TELUS offers iR1200 Rugged and iR1200 GPS-enabled for use on Mike network.[150]
- 7/12/04: TELUS launches international text messaging to more than 25 countries.[151]
- 6/24/04: TELUS announces launch of 6 new wireless data modems equipped with GPS capability (ruggedized devices).[152]
- 6/10/04: TELUS introduces Motorola i830, the smallest Mike phone ever.[153]
- 5/4/04: TELUS announces cross-border walkie talkie service with Nextel.[154]
- 5/4/04: TELUS launches two new BlackBerry handhelds, BlackBerry 7510™ and BlackBerry 7750™.[155] BlackBerry 7510 is the BB first device in Canada to operate on the Mike iDEN network and the first BB with speakerphone.[156]
- 3/16/04: TELUS offers next generation arcade style multimedia mobile games.[157]
- 12/23/03: TELUS launches Canada's first integrated Windows® based PDA camera phone, the Samsung i700 Windows® Powered Pocket PC.[158]
- 10/23/03: TELUS Mobility announces exclusive new camera phone and unique picture messaging service.[159]
- 10/16/03: TELUS announces enhancements to all in one Mike wireless network and first wireless handsets with GPS capability.[160]
- 2/20/03: TELUS introduces the Windows-powered Thera™ Pocket PC from Audiovox, providing Microsoft applications.[161]

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[150] "TELUS Mobility Launches Rugged, GPS-Enabled Wireless Modem for Mike." TELUS Press Release. 9/2/04.

[151] "TELUS Mobility Launches International Text Messaging To More than 25 Countries." TELUS Press Release. 7/12/04.

[152] "TELUS Mobility Introduces Rugged Global Positioning System (GPS) Wireless Modems." TELUS Press Release. 6/24/04.

[153] "TELUS Mobility Introduces Smallest Mike® Phone Ever." TELUS Press Release. 6/10/04.

[154] "TELUS Mobility and Nextel® Extend Digital Walkie Talkie Service Across Canada and the Unites States." TELUS Press Release. 5/4/04.

[155] "TELUS Mobility Launches Two New BlackBerry® Handhelds." TELUS Press Release. 5/4/04.

[156] TELUS 2004 Annual Report, p. 19.

[157] "TELUS Mobility Scores Big With Multimedia, Arcade-Style Mobile Games Featuring Full Sound and Enhanced Colour Graphics." TELUS Press Release. 3/16/04.

[158] "TELUS Mobility Launches Canada's First Fully Integrated Wireless PDA Camera Phone." TELUS Press Release. 12/23/03.

[159] "TELUS Mobility Introduces Exclusive Camera Phone, Unique Picture Messaging Service." TELUS Press Release. 10/23/03.

[160] "TELUS Mobility's Mike Network Grows with National Direct Connect, Powerful New Phones." TELUS Press Release. 10/16/03.

[161] "Audiovox's Thera™ Pocket PC phone Enables Mobile Professionals to Maximize Benefits of TELUS Mobility's National 1x Network." TELUS Press Release. 2/20/03.

- 1/20/03: TELUS and RIM announces plans to offer RIM's BlackBerry™ wireless platform on TELUS 1x network.[162]

II. U.S. MOBILE WIRELESS CARRIERS

A) AT&T

- 2/28/07: AT&T announces availability of Motorola M900, in vehicle communications device for homeland security.[163][164]
- 2/12/07: AT&T first carrier in North America to launch the BlackBerry® 8800, the slimmest BlackBerry handset yet.[165]
- 1/9/07: AT&T/Cingular announces that it will be exclusive US carrier of Apple iPhone.[166]
- 1/5/07: AT&T/Cingular makes its first wireless video share call – in demo – which is first in US.[167]
- 12/18/06: AT&T/Cingular announces NetMotion Mobility XE, which allows wireless applications to be available for data input and activity even if the user travels outside of wireless coverage area and resumes the wireless session automatically once the mobile device regains contact with the network.
- 12/11/06: AT&T/Cingular announces availability of HP Compaq nc6400 Notebook PC, the first notebook PC in the US with global mobile broadband capability.[168]
- 12/5/06: AT&T/Cingular introduces the new CU400, the first 3G PTT phone.[169]
- 11/30/06: AT&T/Cingular announces availability of BlackBerry® Pearl.[170]

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[162] "TELUS Mobility and RIM To Provide the BlackBerry Platform to 1x Wireless Enterprise Client." TELUS Press Release. 1/20/03.

[163] "AT&T Launches Motorola M900 for Homeland Security, Emergency Management Community." AT&T Press Release. 2/28/07.

[164] ""Cingular Wireless Eliminates Data Loss Risk With NetMotion Mobility XE." AT&T Press Release. 12/18/06.

[165] "AT&T Customers Go Sleek & Stylish With the New BlackBerry 8800." AT&T Press Release. 2/12/07.

[166] "Apple Chooses Cingular as Exclusive U.S. Carrier for Its Revolutionary iPhone." AT&T Press Release. 1/9/07.

[167] "Cingular Makes First Wireless Video Share Call." AT&T Press Release. 1/5/07.

[168] "HP and Cingular Wireless Introduce First Global Mobile Broadband Notebook PC in U.S." AT&T Press Release. 12/11/06.

[169] "LG Electronics Mobilecomm and Cingular Wireless Offer the First 3G Phone with Push to Talk." AT&T Press Release. 12/5/06.

- 11/22/06: AT&T/Cingular announces availability of Palm® Treo™ 680.[171]
- 11/20/06: AT&T/Cingular launches enhanced version of TeleNav GPS Navigator on the Nokia E62, becoming the first carrier in US to introduce navigation system with 3D maps and "fuzzy search".[172]
- 11/13/06: AT&T/Cingular announces availability of the BlackJack, providing entertainment features, Windows Mobile® 5.0, on AT&T's 3G Broadband Connect Service.[173]
- 11/6/06: AT&T/Cingular announces the first UMTS/HSDPA-enabled PDA in North America – the Cingular 8525 Pocket PC.[174]
- 11/2/06: AT&T/Cingular announces Cingular Music, allowing content from Napster, Yahoo! Music, XM Satellite Radio and eMusic.[175]
- 10/3/06: AT&T/Cingular announces completion of National GSM Network Integration stemming from the merger of Cingular and AT&T Wireless.[176]
- 10/2/06: AT&T/Cingular announces Melodeo, Inc. mobile podcast.[177]
- 9/12/06: AT&T/Cingular announces availability of Sierra Wireless AirCard® 875, the first commercially available HSDPA 3.6 Mbps network card in the Americas.[178]
- 9/12/06: AT&T/Cingular announces availability of Nokia E62.[179]
- 9/12/06: AT&T/Cingular announces availability of MOTORAZR v3i mobile music device.[180]

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[170] "Cingular Rings in Holidays with BlackBerry Pearl." AT&T Press Release. 11/30/06.

[171] "Cingular Wireless Offers New-Look, $199 Palm Treo 680." AT&T Press Release. 11/22/06.

[172] "Cingular Unveils PDA-Based Wireless GPS Navigation System with 3D Moving Maps." AT&T Press Release. 11/22/06.

[173] "Cingular, Samsung Have Ace in Hand With Launch of New BlackJack, a Smart Device Vide Available." AT&T Press Release. 11/13/06.

[174] "Cingular 8525 Rides Wireless Speedway." AT&T Press Release. 11/6/06.

[175] "Cingular Wireless Customers Can Now Enjoy Music Content from Napster, Yahoo! Music, XM Satellite Radio and eMusic." AT&T Press Release. 11/2/06.

[176] "Cingular Completes National GSM Network Integration." AT&T Press Release. 10/3/06.

[177] "Listen Up. Cingular Teams With Melodeo to Offer Mobile Podcasting." AT&T Press Release. 10/2/06.

[178] "Cingular Adds Sierra Wireless AirCard® 875 Wireless WAN LaptopConnect Card to its 3G Device Portfolio." AT&T Press Release. 9/12/06.

[179] "Cingular, Nokia Introduce Nokia E62." AT&T Press Release. 9/12/06.

[180] "Cingular Wireless and Motorola Introduce Latest Music Enhanced Phone – the MOTORAZR v3i." AT&T Press Release. 9/12/06.

- 8/29/06: AT&T/Cingular launches Samsung SGH-zx20, Samsung's first commercially available HSDPA phone for the US market.[181]
- 6/8/06: AT&T/Cingular announces new BlackBerry® 7130c.[182]
- 5/31/06: AT&T/Cingular announces availability of Pantech C300 – the world's smallest camera flip phone.[183]
- 3/29/06: AT&T/Cingular announces that Cingular UMTS/HSDPA 3G technology built into Dell Latitude D620 and D820.[184]
- 3/7/06: AT&T/Cingular announced availability of Cingular Video On-Demand Streaming video service, with a large selection of content, including TV shows, sports, news, weather, entertainment on 3G capable phones.[185]
- 2/9/06: AT&T/Cingular announces Cingular Sounds Live, the first-ever concert series exclusively for mobile environment.[186]
- 2/9/06: AT&T/Cingular launches EDGE enabled Cingular 8100 series Pocket PC to expand its Windows Mobile 5.0 roster.[187]
- 1/31/06: AT&T/Cingular announces availability of Motorola SLVR L7, providing iTunes.[188]
- 1/18/06: AT&T/Cingular announces Cingular 2125, the first Smartphone in US to feature Microsoft Mobile 5.0 operating system.[189]
- 12/15/05: AT&T/Cingular announces upcoming availability of on-demand streaming video service over 3G phones.[190]

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[181] "Samsung and Cingular Wireless Unveil Award-Winning HSDPA Wireless Handset for North America." AT&T Press Release. 8/29/06.

[182] "Cingular Gets Personal with BlackBerry." AT&T Press Release. 6/8/06.

[183] "Cingular Offers GoPhone® Exclusive: World's Smallest Camera Flip Phone." AT&T Press Release. 5/31/06.

[184] "Cingular Built Into New Dell Notebooks." AT&T Press Release. 3/29/06.

[185] "Watch This! Cingular Video™ Now Available." AT&T Press Release. 3/7/06.

[186] "Cingular Launches First Ever Made-for-Mobile Concert Series, Cingular Sounds Live." AT&T Press Release. 2/9/06.

[187] "Cingular 8100 Series Pocket PCs Join Cingular's Windows Mobile 5.0 Roster." AT&T Press Release. 2/9/06.

[188] "Ultra-Thin Motorola SLVR L7 Debuts Exclusively at Cingular Wireless." AT&T Press Release. 1/31/06.

[189] "Cingular Debuts Cingular 2125 Smartphone." AT&T Press Release. 1/18/06.

[190] "Cingular Wireless Launches Cingular Video with Exclusive Content." AT&T Press Release. 12/15/05.

- 12/05: AT&T/Cingular introduces first 3G product called "LaptopConnect," which combines a laptop modem card, Cingular's Communication Manager software and a Data Connect plan for use on laptops so that customers can access the Internet or email, download large files and attachments and run corporate business applications. Where UMTS/ HSDPA is not available, the laptop modem card seamlessly falls back to the EDGE/GPRS networks but at lower speeds.[191]
- 12/6/05: AT&T/Cingular launches 3G UMTS/HSDPA network.[192]
- 11/14/05: AT&T/Cingular and MobiTV launch MobiRadio for Cingular customers – streaming digital music.[193]
- 11/1/05: AT&T/Cingular launch BlackBerry 8700c on 11/21/05, the world's first EDGE enabled BlackBerry device.[194]
- 10/24/05: AT&T/Cingular announce availability of Mobile Email and Mobile IM.[195]
- 10/18/05: AT&T/Cingular announce HP iPAQ hw6500 series Mobile Messenger, the first pocket PC in US to use Cingular's EDGE network.[196]
- 9/28/05: AT&T/Cingular announces the availability of EDGE powered Nokia 9300 – the first carrier to launch BlackBerry® services on third party handset through the BlackBerry Connect program.[197]
- 9/28/05: AT&T/Cingular announces that RealNetworks will launch Helix OnlineTV for Cingular mobile customers.[198]
- 9/7/05: AT&T/Cingular announces the first mobile phone with iTunes.[199]
- 7/25/05: AT&T/Cingular announce launch of RAZRWIRE™, Bluetooth® enabled eyewear available through Motorola and Cingular's network.[200]

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[191] AT&T 2005 10-K, p. 5.

[192] "Cingular Launches 3G Network." AT&T Press Release. 12/6/05.

[193] "Cingular and MobiTV Announce First Radio Service for the Nation's Largest Digital Voice and Data Network." AT&T Press Release. 11/14/05.

[194] "BlackBerry 8700c Accelerates in Cingular Fast Lane." AT&T Press Release. 11/1/05.

[195] "Cingular Responds to Consumer Demand by Bringing New Mobile Messaging Services to the Masses." AT&T Press Release. 10/24/05.

[196] "HP and Cingular Wireless Announce Complete Wireless Solution on HP iPAQ Mobile Messenger." AT&T Press Release. 10/18/05.

[197] "Cingular, Nokia 'Connect' with Nokia 9300." AT&T Press Release. 9/28/05.

[198] "RealNetworks to Launch Helix OnlineTV for Mobile Carriers with Cingular." AT&T Press Release. 9/28/05.

[199] "Apple, Motorola and Cingular Launch World's First Mobile Phone with iTunes." AT&T Press Release. 9/7/05.

- 7/7/05: AT&T/Cingular announces Multimedia Messaging Interoperability with the top wireless carriers in US.[201]
- 6/3/05: AT&T/Cingular launches Motorola RAZR Black, the sequel to the RAZR.[202]
- 6/6/05: AT&T/Cingular launches HP iPAQ Pocket PC.[203]
- 4/12/05: AT&T/Cingular launches Cingular Sounds™ - a music program providing new music singles, ringtones before they are debuted on the radio.[204]
- 3/15/05: AT&T/Cingular announces exclusive availability of Samsung p777, the first of Samsung's new line of highspeed, high-bandwidth, multimedia phones.[205]
- 2/10/05: AT&T/Cingular launches BlackBerry 7100g.[206]
- 2/2/05: AT&T/Cingular launches Treo™ 650 smartphone, the first device of its kind to use AT&T's EDGE technology.[207]
- 1/25/05: AT&T/Cingular launches MobiTV, offering live TV.[208]
- 11/30/04: AT&T/Cingular announces plans to begin deploying 3G UMTS/HSDPA.[209]
- 11/23/04: AT&T/Cingular announces exclusive availability of Motorola V551, using EDGE technology.[210]
- 11/16/04: AT&T/Cingular announces exclusive availability of Motorola RAZR V3.[211]

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[200] "Motorola and Oakley Announce Launch of RAZRWIRE™ With Cingular Wireless." AT&T Press Release. 7/25/05.

[201] "Cingular Wireless Announces Multimedia Messaging Interoperability With the Nation's Top Wireless Carriers." AT&T Press Release. 7/7/05.

[202] "Motorola RAZR Black Brings Hollywood Chic to the Handset Line-Up at Cingular Wireless." AT&T Press Release. 6/30/05.

[203] "Cingular and HP Launch HP iPAQ Pocket PC." AT&T Press Release. 6/6/05.

[204] "Cingular Announces Innovative Music Program That Debuts New Singles on Wireless Phones Before They are Heard Anywhere Else." AT&T Press Release. 4/12/05.

[205] "New Samsung p777 Slides Into Cingular Wireless Stores." AT&T Press Release. 3/15/05.

[206] "Cingular Introduces New Quad-Band BlackBerry 7100g." AT&T Press Release. 2/10/05.

[207] "Cingular and palmOne Deliver First Treo 650 Smartphone with High-Speed EDGE Wireless Data Capabilities." AT&T Press Release. 2/2/05.

[208] "Cingular Goes Live with MobiTV." AT&T Press Release. 1/25/05.

[209] "Cingular to Deliver 3G Wireless Broadband Services." AT&T Press Release. 11/30/04.

[210] "New Motorola V551 Clamshell Gives Cingular Wireless Users a High-Powered EDGE." AT&T Press Release. 11/23/04.

- 9/28/04: AT&T/Cingular announces availability of BlackBerry 7290 for international travelers.[212]
- 8/24/04: Cingular and AT&T announce inter-carrier multimedia messaging service.[213]
- 5/20/04: Cingular/AT&T announces availability of XpressMail(SM) with BlackBerry®.[214]
- 11/13/03: Cingular/AT&T announces availability of Treo 600 from palmOne with QWERTY keyboard.[215]
- 10/10/03: Cingular/AT&T announces next generation Multimedia Messaging Service (MMS).[216]
- 7/17/03: Cingular/AT&T announces Nokia 3300 Music Phone.[217]
- 6/30/03: Cingular/AT&T announces world's first commercial deployment of EDGE.[218]
- 5/6/03: Cingular/AT&T announces Nokia 3560 color display for TDMA customers.[219]
- 5/5/03: Cingular/AT&T announces Nokia 6800 messaging phone.[220]
- 3/17/03: Cingular/AT&T announces Nokia 3650, allowing picture messaging.[221]

[211] "New Motorola RAZR V3 Now Available Exclusively at Cingular Wireless." AT&T Press Release. 11/16/04.

[212] "Cingular Wireless and RIM Introduce the Blackberry 7290 for International Travelers." AT&T Press Release. 9/28/04.

[213] "Cingular Wireless and AT&T Wireless Customers Capture and Share Special Moments Quickly and Conveniently." AT&T Press Release. 8/24/04.

[214] "Cingular's xPressmail(SM) with BlackBerry® Goes Retail." AT&T Press Release. 5/20/04.

[215] "Treo 600 From palmOne Now Available for Cingular Wireless GSM/GPRS Customers." AT&T Press Release. 11/13/03.

[216] "Snap It, Say It, And Send It with Cingular's New Multimedia Messaging Service." AT&T Press Release. 10/10/03.

[217] "Cingular Wireless Introduces The Nokia 3300 Music Phone for Consumers Who Can't Leave Their Music Behind." AT&T Press Release. 7/17/03.

[218] "Cingular Wireless Is First to the Edge." AT&T Press Release. 6/30/03.

[219] "Cingular Wireless and Nokia Bring Color to TDMA Customers." AT&T Press Release. 5/6/03.

[220] "Cingular Wireless Introduces Nokia 6800 for On-the-Go Professionals." AT&T Press Release. 5/5/03.

[221] "Cingular Introduces Upscale Nokia 3650 Handset for Work and Play." AT&T Press Release. 3/17/03.

- 5/14/02: Cingular/AT&T demos Data Connect Service, a wireless internet package providing corporate web access, email and more from laptops and PDAs.[222]
- 3/18/02: Cingular/AT&T unveils new service offering providing picture messages, screen savers and downloadable graphics.[223]
- 1/28/02: Cingular announces palm™ i705 "always on" wireless device.[224]
- 12/5/01: Cingular/AT&T announces industry's first inter-carrier roaming for GPRS high speed data services.[225]
- 11/28/01: Cingular/AT&T announces availability of VoiceConnect, the carrier's first voice command product.[226]
- 10/30/01: Cingular/AT&T announces that it will begin deploying EDGE technology.[227]
- 3/20/01: Cingular/AT&T announces the first operational standards based GPRS in the US.[228]

B) VERIZON WIRELESS

- 4/25/07: Verizon announces availability of BlackBerry® 8830 World Edition Smartphone (available 5/14), the first global CDMA/GSM BlackBerry®.
- 3/28/07: Verizon announces April availability of MOTORAZR™ maxx Ve.[229]
- 3/28/07: Verizon announces Motorola Automotive Music & Hands Free System T605, providing digital music and hands free phone calls through auto sound system.[230]
- 3/28/07: Verizon announces 4GB microSD™ card for use in Verizon phones, largest capacity of world's smallest memory card.[231]

[222] "Cingular to Link Laptop and PDA Users to Web Via New Data Connect Service." AT&T Press Release. 5/14/02.

[223] "Cingular Powers Next Generation of Wireless Devices." AT&T Press Release. 3/18/02.

[224] "Cingular Powers the New Palm™ i705 Wireless Handheld." AT&T Press Release. 1/28/02.

[225] "Cingular Wireless First to Implement Inter-Carrier Roaming." AT&T Press Release. 12/5/01.

[226] "Don't Touch That Dial – Voice Connects Cingular Customers." AT&T Press Release. 11/28/01.

[227] "Cingular Moves to the EDGE." AT&T Press Release. 10/30/01.

[228] "Cingular Wireless First to Usher In Next Generation of Wireless Internet With Faster, Always-On Service." AT&T Press Release. 3/20/01.

[229] "Verizon Wireless and Motorola Take MOTORAZR To the Max." Verizon Press Release. 3/28/07.

[230] "Motorola's First In-Car Streaming Audio Solution Now Available At Verizon Wireless." Verizon Press Release." 3/28/07.

- 3/27/07: Verizon introduces Samsung SCH-u620, the first mobile phone to support Verizon's V-CAST Mobile TV service.[232]
- 3/15/07: Verizon announces commercial availability of the V740 ExpressCard™, the world's first ExpressCard to operate on Verizon's EVDO Rev A technology.[233]
- 3/14/07: Verizon announces availability of TiVo® Mobile, allowing TiVo functions exclusively over Verizon phones.[234]
- 2/20/07: Verizon announces Palm® Treo 700wx, providing Microsoft Window Mobile 5.0 and Direct Push Technology.[235]
- 2/14/07: Verizon announces availability of Samsung SCH-u740, messaging phone with dual hinge.[236]
- 2/1/07: Verizon announces launch of EV-DO Rev. A technology.[237]
- 1/7/07: Verizon announces availability of LG VX9400 that will support VCAST Mobile TV.[238]
- 1/7/07: Verizon announces availability of V CAST Mobile TV in 1Q07.[239]
- 12/18/06: Verizon announces commercial availability of Sierra Wireless AirCard® 595 PC Card for EV-DO Rev A.[240]
- 11/28/06: Verizon announces availability of YouTube on Verizon phones.[241]
- 11/24/06: Verizon announces MOTOKRZR K1m.[242]
- 9/12/06: Verizon launches BlackBerry 8703e.[243]

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231 "Verizon Wireless and SanDisk Introduce 4-Gigabyte MicroSDHC Mobile Phone Card for V-CAST Music Phones." Verizon Press Release. 3/28/07.

232 "Verizon Wireless Customers Can Now Watch TV on the SCH-u620 – The First V CAST Mobile TV Phone." Verizon Press Release. 3/27/07.

233 "Verizon Wireless Offers First ExpressCard by Novatel Wireless to take Advantage of New Faster Wireless Broadband Network." Verizon Press Release. 3/15/07.

234 "TiVo Launches Remote Scheduling With Verizon Wireless." Verizon Press Release. 3/14/07.

235 "Verizon Wireless and Palm Announce Treo 700wx Smartphone Now Available." Verizon Press Release. 2/20/07.

236 "Verizon Wireless and Samsung Introduce Slim, Dual-Hinge Phone." Verizon Wireless Press Release. 2/14/07.

237 "Verizon Wireless Launches Faster New Wireless Broadband Network." Verizon Press Release. 2/1/07.

238 "LG Mobile Phones and Verizon Wireless Announces the LG VX9400 to Support V CAST Mobile TV." Verizon Press Release. 1/7/07.

239 "Verizon Wireless Lifts the Curtain on V CAST Mobile TV." Verizon Press Release. 1/7/07.

240 "Verizon Wireless and Sierra Wireless Offers the AirCard® 595 PC Card For Use With Verizon Wireless' BroadbandAccess Service." Verizon Press Release. 12/18/06.

241 "YouTube Goes Mobile." Verizon Press Release. 11/28/06.

242 "Verizon Wireless Customers Can Work Off Their Turkey Dinners With MOTOKRZR K1m." Verizon Press Release. 11/24/06.

243 "Verizon Wireless Launches the New BlackBerry 8703e." Verizon Press Release. 9/12/06.

- 7/31/06: Verizon announces US debut of LG Chocolate.[244]
- 6/27/06: Verizon selects Lucent for CDMA2000 1xEV-DO Rev. A Technology.[245]
- 6/5/06: Verizon announces availability of Motorola RAZR V3m.[246]
- 6/5/06: Verizon launches Samsung SCH-a930 V CAST Music Phone.[247]
- 5/22/06: Verizon launches Motorola Q™ on 5/31/06.[248]
- 4/25/06: Verizon announces Wireless Priority Service during times of emergency.[249]
- 3/13/06: Verizon introduces Field Force Manager – fleet management tool with Location Based Services.[250]
- 3/7/06: Verizon announces TiVo functionalities on Verizon phone.[251]
- 1/30/06: Verizon announces availability of Motorola V325.[252]
- 1/30/06: Verizon introduces Verizon Navigator – location based services.[253]
- 1/6/06: Verizon introduces Samsung SCH-a950.[254]
- 1/5/06: Verizon introduces V CAST Music.[255]
- 1/4/06: Verizon introduces Palm Treo 700w Smartphone.[256]

[244] "Verizon Wireless Rocks Mobile Music as Chocolate by LG Makes Its American Debut." Verizon Press Release. 7/31/06.

[245] "Verizon Wireless Selects Lucent Technologies for CDMA2000 1xEV-DO Revision A Technology." Verizon Press Release. 6/27/06.

[246] "Motorola RAZR V3m Gives Verizon Wireless Customers The Skinny On Mobile Music." Verizon Press Release. 6/5/06.

[247] "Verizon Wireless and Samsung Announce the SCH-a930 V CAST Music Phone." Verizon Press Release. 6/5/06.

[248] "Verizon Wireless and Motorola Announce The Highly Anticipated Motorola Q." Verizon Press Release. 5/22/06.

[249] "Verizon Wireless Announces Wireless Priority Service to Be Available During Times of Emergency." Verizon Press Release. 4/25/06.

[250] "Verizon Wireless Introduces Field Force Manager – The Latest Must Have Tool for Small Businesses." Verizon Press Release. 3/13/06.

[251] "Verizon Wireless, TiVo Partner to Take TiVo To Mobile Phones." Verizon Press Release. 3/7/06.

[252] "Motorola and Verizon Wireless Deliver Style and Functionality with the V325." Verizon Press Release. 1/30/06.

[253] "Verizon Wireless Introduces VZ Navigator, Providing Location-Based Service for Consumers." Verizon Press Release. 1/30/06.

[254] "V CAST Music: Samsung and Verizon Wireless Announce the SCH-a950." Verizon Press Release. 1/6/06.

[255] "Verizon Wireless Introduces V CAST Music." Verizon Press Release. 1/5/06.

[256] "Palm Treo 700w Smartphone Available on the Verizon Wireless Network." Verizon Press Release. 1/4/06.

- 1/4/06: Verizon launches UTStarcom Pocket PC XV6700, first UTStarcom device for Verizon using Microsoft Windows Mobile™ 5.0.[257]
- 12/5/05: Verizon announces Motorola RAZR V3c.[258]
- 12/5/05: Verizon introduces RAZRWIRE™.[259]
- 11/21/05: Verizon introduces BlackBerry 7130e™, the first BlackBerry to use Verizon's EVDO network.[260]
- 9/6/05: Verizon announces availability of UTStarcom CDM-8940 and LG VX8100 MP3 player phones.[261]
- 6/2/05: Verizon announces new 3D games.[262]
- 2/7/05: Verizon announces BlackBerry 7250.[263]
- 1/26/05: Verizon first to offer CDM8940 handset, first EVDO phone with built in 1.3MP camera.[264]
- 1/20/05: Verizon announces Samsung SCH-a890, the first Samsung for Verizon's EVDO network.[265]
- 1/7/05: Verizon announces the 2/1/05 availability of LG VX8000 phone, the first handset in US for the Verizon EVDO network.[266]
- 1/7/05: Verizon launches V CAST the US' first and only consumer 3G Multimedia Service.[267]
- 11/16/04: Verizon becomes first national US Carrier to provide Ringback tones.[268]

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[257] "Verizon Wireless and UTStarcom Offer Award-Winning Pocket PC XV6700 With Windows Mobile 5.0" Verizon Press Release. 1/4/06.

[258] "This Year's Wireless Must-Have Debuts At Verizon Wireless: The V CAST-Enabled Motorola RAZR V3c." Verizon Press Release. 12/5/05.

[259] "Motorola, Oakley and Verizon Wireless Let RAZRWIRE Do the Talking." Verizon Press Release. 12/5/05.

[260] "Verizon Wireless Brings BroadbandAccess to New BlackBerry 7130e with Tethered Modem Capabilities." Verizon Press Release. 11/21/05.

[261] "Verizon Wireless Phones Groove All Day Long." Verizon Press Release. 9/6/05.

[262] "Verizon Wireless Builds On Commanding Lead in Multimedia Services With 3D Games on V CAST." Verizon Press Release. 6/2/05.

[263] "Verizon Wireless Launches New BlackBerry 7250 for Mobile Professionals." Verizon Press Release. 2/7/05.

[264] "Verizon Wireless Launches UTSTarcom CDM8940 3G EVDO Handset." Verizon Press Release. 1/26/05.

[265] "Verizon Wireless and Samsung Announce VCAST-Enabled SCH-a890 Wireless Phone." Verizon Press Release. 1/20/05.

[266] "Verizon Wireless and LG Mobile Phones Deliver The Future of Wireless Technology Today With The Launch of the VX8000." Verizon Press Release. 1/7/05.

[267] "On-Demand In the Palm of Your Hand: Verizon Wireless Launches 'VCAST' – Nation's First And Only Consumer 3G Multimedia Service." Verizon Press Release. 1/7/05.

- 10/26/04: Verizon announces Verizon Mobile Web 2.0(SM).[269]
- 9/29/04: Verizon announces the availability of AOL® Mail on Verizon phones.[270]
- 9/23/04: Verizon announces Motorola V710 with integrated 1.2MP phone (one of the first CDMA MP phones in US).[271]
- 8/5/04: Verizon announces availability of MSN Hotmail® and MSN Messenger in 1 application on Verizon phones.[272]
- 7/1/04: Verizon launches Mobile Web 2.0, providing web access and email.[273]
- 5/28/04: Verizon announces availability of Samsung SCH-a650 with enhanced text messaging capabilities.[274]
- 5/5/04: Verizon announces availability of dotPhoto, Inc.'s MyWallpaper™ for mobile phones.[275]
- 3/24/04: Verizon launches Sony Music Box Service for Get It Now customers, allowing download of music clips, Music Tones, ringtones, wallpaper, etc.[276]
- 2/10/04: Verizon announces Samsung SCH-a610 for Get It Now customers.[277]
- 1/28/04: Verizon announces availability of LG VX4500 with voice recognition and 2-way speakerphone.[278]
- 1/28/04: Verizon announces availability of Remo™ allowing remote access to email and calendar/contacts through mobile phone.[279]

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[268] "Verizon Wireless Becomes the First National Carrier to Begin Offering Ringback Tones." Verizon Press Release. 11/16/04.

[269] "Verizon Wireless and Yahoo! Team Up to Help Customers on the Go Get in the Know With Access to Yahoo! Mail and More." Verizon Press Release. 10/26/04.

[270] "Mobile AOL Mail Now Available to Verizon Wireless Get It Now Customers." Verizon Press Release 9/29/04.

[271] "Verizon Wireless Exclusive: New Motorola V710 Megapixel Camera Phone." Verizon Press Release. 8/12/04.

[272] "MSN Mobilizes Hotmail and Messenger for Verizon Wireless Customers." Verizon Press Release. 8/5/04.

[273] "Verizon Wireless Launches Mobile Web 2.0." Verizon Press Release. 7/1/04.

[274] "Verizon Wireless and Samsung Let Customers Do the Talking with the Introduction of the SCH-a650." Verizon Press Release. 5/28/04.

[275] "dotPhoto, Inc. Launches New Photo Wallpaper Application for Verizon Wireless Get it Now Customers." Verizon Press Release. 5/5/04.

[276] "Sony Music Entertainment and Verizon Wireless Launch the First 'Real Music' Ringtone Offering for Verizon Wireless Customers." Verizon Press Release. 3/24/04.

[277] "Verizon Wireless and Samsung Advance Wireless Camera Phone Industry with Introduction of SCH-a610." Verizon Press Release. 2/10/04.

[278] "LG Mobile Phones and Verizon Wireless Blend Must-Have Style and Advanced Features In Latest Handset." Verizon Press Release. 1/28/04.

[279] "Verizon Wireless Launches Complete Connectivity Solution for Mobile Subscribers – Remo by Xpherix Corp." Verizon Press Release. 1/28/04.

- 1/28/04: Verizon announces availability of new wallpaper applications for its Get It Now mobile customers.[280]
- 1/8/04: Verizon expands its EV-DO service beyond Washington D.C. and San Diego.[281]
- 12/11/03: Verizon announces availability of Audiovox CDM-8900 camera phone with 300-pixel phone and picture messaging.[282]
- 9/29/03: Verizon announces roll out of EV-DO service in Washington DC and San Diego on 10/1.[283]
- 8/27/03: Verizon announces LG VX6000 picture phone with iPhonebook allowing pictures to be sent to virtually anyone.[284]
- 8/14/03: Verizon announces availability of national PTT service (on 8/18).[285]
- 7/8/03: Verizon launches Easy To Use Picture Messaging Service.[286]
- 7/1/03: Verizon launches mobile AOL® Instant Messaging.[287]
- 4/30/03: Verizon announces availability of BlackBerry 6750™.[288]
- 4/28/03: Verizon announces MovieGoer, allowing Verizon customers to download movie guides on phones.[289]
- 3/9/01: Verizon announces availability of Kyocera 6035, the smartest smartphone that is web-ready, Palm-powered PDA.[290]
- 11/29/00: Verizon announces availability of first-ever color screen mobile phone.[291]

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280 "Vindigo Studios Launches Two New Wallpaper Applications for Verizon Wireless Get It Now Customers." Verizon Press Release. 1/28/04.

281 "Verizon Wireless Announces Roll Out of National 3G Network." Verizon Press Release. 1/8/04.

282 "Verizon Wireless and Audiovox Announce the New CDM-8900 Camera Phone." Verizon Press Release. 12/11/03.

283 "Wireless Broadband Data Service Introduced in Major Metro Areas." Verizon Press Release. 9/29/03.

284 "Verizon Wireless Customers Can Send Photos to Microsoft Outlook or Palm Contact Lists with iPhonebook." Verizon Press Release. 8/27/03.

285 "Verizon Wireless Launches National Push To Talk Service." Verizon Press Release. 8/14/03.

286 "Verizon Wireless Launches Easy-To-Use Picture Messaging Service." Verizon Press Release. 7/8/03.

287 "America Online and Verizon Wireless Launch Mobile IM Service to Verizon Wireless Customers." Verizon Press Release. 7/1/03.

288 "Multi-Tasking Just Got Easier With Verizon Wireless' Express Network and the BlackBerry 6750." Verizon Press Release. 4/30/03.

289 "Vindigo Brings Verizon Wireless Customers to the Movies." Verizon Press Release. 4/28/03.

290 "Verizon Wireless Jumpstarts Smartphone Market." Verizon Press Release. 3/9/01.

291 "Just In Time for the Holidays: Cell Phones that Let you See In Color." Verizon Press Release. 11/29/00.

C) SPRINT/NEXTEL

- 3/26/07: Sprint announces the upcoming availability of Samsung UpStage, a phone on 1 side and a MP3 player on the other.[292]
- 3/21/07: Sprint announces GPS bundled with data packages – an industry first.[293]
- 1/16/07: Sprint launches group of handsets that use the CDMA and iDEN networks.[294]
- 1/5/07: Sprint announces that it's the first US carrier to have more than 1 million customers with mobile video capability.[295]
- 1/3/07: Sprint announces M1 from Sanyo, the first Sprint wireless device with 1GB of internal memory.[296]
- 11/30/06: Sprint launches new mobile email and messaging service for customers.[297]
- 11/16/06: Sprint announces LG LX150 text messaging phone, one of the first consumer phones with dedicated text messaging key.[298]
- 11/14/06: Sprint announces Samsung M500 multimedia phone.[299]
- 11/9/06: Sprint announces Motorola i880, the first iDEN phone with a 2.0MP camera.[300]
- 11/6/06: Sprint announces the MOTOKRZR™ K1m by Motorola.[301]
- 11/6/06: Sprint announces the MOTOSLVR L7c, Motorola's first CDMA SLVR handset and Sprint's first candy bar style high speed EVDO consumer phone.[302]

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[292] "Get the Power To Redefine Mobile Music and Turn Up the Volume With UpStage™ by Samsung, exclusively for Sprint." Sprint Press Release. 3/26/07.

[293] "Sprint Customers Get Industry First: GPS Navigation Bundled in Data Packs." Sprint Press Release. 3/21/07.

[294] "Sprint Joins Strength of its two Networks to Offer Customers Industry-First Phones, Power To Do More." Sprint Press Release. 1/16/07.

[295] "Sprint's Leadership in Mobile Video More Powerful Than Ever." Sprint Press Release. 1/5/07.

[296] "Sprint Power Vision M1 by Sanyo Announces as First Sprint Wireless Device with 1 Gigabyte of Internal Memory." Sprint Press Release. 1/3/07.

[297] "Sprint Launches Combined Mobile Email Client." Sprint Press Release. 11/30/06.

[298] "Sprint PCS Vision Phone LX 150 by LG®." Sprint Press Release. 11/16/06.

[299] "Sprint Power Vision M500 by Samsung." Sprint Press Release. 11/14/06.

[300] "First 2.0 Megapixel Camera Phone Available on Nextel Network with i880 by Motorola." Sprint Press Release. 11/9/06.

[301] "MOTOKRZR™ K1m by Motorola." Sprint Press Release. 11/6/06.

- 10/24/06: Sprint launches US' first EV-DO Revision A mobile broadband network.[303]
- 9/20/06: Sprint introduces the BlackBerry® 8703e with GPS and EVDO.[304]
- 9/12/06: Sprint announces 2 network cards for EV-DO Rev. A network.[305]
- 8/29/06: Sprint launches commercial availability of Novatel Wireless Sprint Mobile Broadband Card – the first EV-DO Rev. A capable device in the US.[306]
- 8/8/06: Sprint announces plans for 4G wireless broadband using WiMAX IEEE 802.16e-2005 technology standard.[307]
- 7/6/06: Sprint announces Motorola i580, a rugged iDEN phone.[308]
- 6/29/06: Sprint announces SCP-2400 phone with parental controls.[309]
- 5/31/06: Sprint announces BlackBerry 7130e™.[310]
- 5/24/06: Sprint announces LG® FUSIC™ music phone.[311]
- 5/16/06: Sprint announces late May availability of Treo™ 700p by Palm – the first broadband capable Palm Treo running Palm OS.[312]
- 4/26/06: Sprint announces Samsung A580, one of the first mobile device to offer Sprint's storage backup.[313]

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302 "MOTOSLVR™ L7c by Motorola." Sprint Press Release. 11/6/06.

303 "Sprint Launches Nation's First EV-DO Revision A mobile broadband network." Sprint Press Release. 10/24/06.

304 "Sprint and RIM Introduce BlackBerry 8703e Featuring Sprint Mobile Broadband and GPS Capability." Sprint Press Release. 9/20/06.

305 "Sprint Announces Plans to Expand EV-DO Revision A-Capable Device Portfolio." Sprint Press Release. 9/12/06.

306 "Sprint Launches First EV-DO Revision A-Capable Mobile Broadband Card in the Nation." Sprint Press Release. 8/29/06.

307 "Sprint Nextel Announces 4G Wireless Broadband Initiative with Intel, Motorola, and Samsung." Sprint Press Release. 8/8/06.

308 "Sprint Nextel and Motorola Break new Ground in Rugged Phone Market with the i580 by Motorola." Spring Press Release. 7/6/06.

309 "Sprint and Sanyo Introduce Phone with Parental Control Feature to Help Parents Maintain Control of a Child's Wireless Phone Usage." Sprint Press Release. 6/29/06.

310 "Sprint Enhances BlackBerry Portfolio with Mobile Broadband-Powered Devices for the Sprint Power Vision(SM) Network." Sprint Press Release. 5/31/06.

311 "Hear the FUSIC™ by LG®." Sprint Press Release. 5/24/06.

312 "Sprint Announces Plans to Be First to Offer Mobile Broadband-Capable Palm Treo Running Palm OS." Sprint Press Release. 5/16/06.

- 12/12/05: Sprint announces MSpot Movies the first mobile entertainment service to stream full-length films to mobile phones.[314]
- 11/29/05: Sprint announces availability of Samsung MM-A920 and MM-A900, that provides access to Sprint Music Store and on demand video from Sprint TV(SM).[315]
- 11/7/05: Sprint announces Nextel Direct Send(SM) Picture, a first of its kind service allowing pictures to be sent on walkie talkie call.[316]
- 10/31/05: Sprint announces availability of Samsung MM-A940 and Sanyo MM-9000 bringing Sprint Music Store with music downloads and live broadcast TV from Sprint TV.[317]
- 10/31/05: Sprint launches first, instant over the air music download service in US.[318]
- 10/31/05: Sprint launches high speed entertainment and information services via Power Vision network, including Sprint Music Store(SM), On Demand, Sprint TV(SM), Sprint PCS Picture Mail(SM).[319]
- 10/14/05: Sprint launches BlackBerry 7100i™ for Nextel, with slimmer phone like design.[320]
- 9/27/05: Sprint launches Motorola i930, the industry's first wireless phone to combine Windows Mobile Smartphone platform with nationwide and international Nextel Walkie Talkie services and international voice and data capabilities.[321]

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313 "Sprint PCS® Vision Phone A580 by Samsung®." Sprint Press Release. 4/26/06.

314 "Sprint and MSpot Roll Out Red Carpet with Streaming Movie Service for Mobile Phones." Sprint Press Release. 12/12/05.

315 "Eye-Catching Handsets Bring Full-Track Music Download Power and Live Broadcast Television to the Palm of your Hand." Sprint Press Release. 11/29/05.

316 "Sprint Launches the Latest Innovation for Nextel Walkie-Talkie Services – Nextel Direct Send (SM) Picture." Sprint Press Release. 11/7/05.

317 "Sprint and Samsung Launch the Sprint Power Vision MM-A940…" and "Sprint and Sanyo…" Sprint Press Releases. 10/31/05.

318 "Sprint Launches the First, Instant, Over the Air Music Download Service in the U.S." Sprint Press Release. 10/31/05.

319 "Sprint Premieres High-Speed Entertainment and Information Services Via Sprint Power Vision(SM) Network." Sprint Press Release. 10/31/05.

320 "Spring and RIM Launch BlackBerry 7100 series for the Nextel National Network." Sprint Press Release. 10/14/05.

321 "Sprint and Motorola's Newest Windows Mobile-Based Smartphone Lets Business Professionals Get More Done in More Places." Sprint Press Release. 9/27/05.

- 9/26/05: Sprint announces TeleNav GPS service providing Java enabled GPS services.[322]
- 9/26/05: Sprint launches Sprint TV Live.[323]
- 9/16/05: Sprint launches PPC-6700 Smart device, the first PDA/phone combo to provide Windows Mobile 5.0 software.[324]
- 9/13/05: Sprint debuts SIRIUS Music on its phones.[325]
- 8/23/05: Sprint launches Precision Locator(SM), a fleet management product.[326]
- 7/7/05: Sprint announces multimedia messaging inter-operability with T-Mobile.[327]
- 7/7/05: Sprint announces it has begun rollout of EVDO network.[328]
- 6/22/05: Sprint announces availability of BlackBerry 7250™.[329]
- 6/16/05: Sprint announces availability of Novatel Connection Card for Sprint's EV-DO network when it is available.[330]
- 6/8/05: Sprint launches enhanced Yahoo! Mobile Email Service.[331]
- 5/16/05: Sprint introduces 3D games.[332]
- 5/12/05: Sprint launches Samsung MM-A800, the US' first 2MP camera phone.[333]

[322] "Sprint Extends Customer Choice and Flexibility with TeleNav GPS Navigator Offering." Sprint Press Release. 9/26/05.

[323] "Sprint TV Live Launches on Sprint Multimedia Handsets." Sprint Press Release. 9/26/05.

[324] "Sprint Launches First Pocket PC Phone in the Country to Feature Windows Mobile™ 5.0 Platform." Sprint Press Release. 9/16/05.

[325] "SIRIUS Music Channel Makes Its Mobile Debut on Sprint." Sprint Press Release. 9/13/05.

[326] "Sprint Precision Locator(SM) Helps Businesses Locate Fleets and Mobile Workers Through their Wireless Devices." Sprint Press Release. 8/23/05.

[327] "T-Mobile USA and Sprint Make it a Snap for Customers to Share Picture Messages." Sprint Press Release. 7/7/05.

[328] "Sprint Begins Launch of EV-DO Wireless High-Speed Data Service." Sprint Press Release. 7/7/05.

[329] "Sprint Expands Wireless Portfolio with Availability of New Sprint PCS Smart Device – BlackBerry 7250™ and Enhanced BlackBerry Enterprise Server Features." Sprint Press Release. 6/22/05.

[330] "Sprint Offers EV-DO-Ready Sprint PCS Connection Card™ from Novatel Wireless." Sprint Press Release. 6/16/05.

[331] "Yahoo! And Sprint Launch Enhanced Mobile E-Mail Service." Sprint Press Release. 6/8/05.

[332] "Sprint Gives Mobile Games an Extreme Makeover with New Categories and 3D Games." Sprint Press Release. 5/16/05.

[333] "Sprint and Samsung Launch First Two-Megapixel Camera Phone in the United States." Sprint Press Release. 5/12/05.

- 3/14/05: Sprint introduces music video ringers – the first in US.[334]
- 3/3/05: Sprint announces availability of Sierra Wireless AirCard 580 for EV-DO network later in 2005.[335]
- 11/16/04: Sprint announces availability of BlackBerry® 7750.[336]
- 10/25/04: Sprint announces that it's the first in US to offer Treo™ 650 by palmOne.[337]
- 9/22/04: Sprint announces Samsung SP-i600, the Sprint's first Windows Mobile™ based smart device on Smartphone platform.[338]
- 8/31/04: Sprint launches Sprint PCS Vision(SM) Multimedia services, offering streaming video and audio content.[339]
- 8/27/04: Sprint announces EarthCam Mobile, allowing customers to view Webcams on mobile phones.[340]
- 7/8/04: Sprint announces availability of Samsung PM-8920, the first 1.3MP camera in the US.[341]
- 2/24/04: Sprint announces North America's first inter-operable picture messaging service with Bell Mobility.[342]
- 12/11/03: Sprint announces Samsung VI660, a voice recognition phone.[343]

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[334] "A First in the United States: Music Videos Now Rock Sprint PCS Vision(SM) Calls." Sprint Press Release. 3/14/05.

[335] "Sprint Begins Offering EV-DO Ready Sprint PCS Connection Card™ by Sierra Wireless to Business Customers." Sprint Press Release. 3/3/05.

[336] "Sprint Launches BlackBerry® on the Enhanced Sprint Nationwide PCS Network." Sprint Press Release. 11/16/04.

[337] "Sprint Announces Plans to Be First Wireless Carrier in the Country to Offer Next-Generation Model Treo™ Smart Device." Sprint Press Release. 10/25/04.

[338] "Sprint and Samsung Help Mobile Professionals Get Organized with Smart Device Featuring Microsoft® Windows Mobile™ 2003 Software for Smartphone." Sprint Press Release. 9/22/04.

[339] "Sprint Launches Nationwide Streaming Video and Audio in United States on The First Built-In MediaPlayer Phone from Samsung." Sprint Press Release. 8/13/04.

[340] "Sprint Launches New Live Webcam Application for Mobile Handsets." Sprint Press Release. 8/27/04.

[341] "Taking Sharper Pictures is Now a Snap as Sprint Launches First 1.3-Megapixel Camera Phone in the United States." Sprint Press Release. 7/8/04.

[342] "Sprint Camera Phone Customers Can Now Share Smiles Across the U.S./Canadian Border with Picture Messaging Service Powered by LightSurf." Sprint Press Release. 2/24/04.

[343] "Sprint and Samsung Introduce VI660 Wireless Phone as First Phone in the U.S. Featuring Revolutionary Voice-Activated Status Updates." Sprint Press Release. 12/11/03.

- 12/3/03: Sprint becomes first carrier to truly deliver a Video Mail service to consumers – 15 second clip.[344]
- 8/23/03: Sprint launches Sprint Messenger(SM) service, allowing customers to receive email on any phone and mass distribute text and voice messages.[345]
- 7/24/04: Sprint announces Hitachi Model SH-G1000 the first pocket PC to integrate a rotating camera, built in keyboard and wireless phone in 1 device.[346]
- 3/17/03: Sprint announces Sanyo 8100, the first built in camera phone to add a 10 second voice message to any picture and then send.[347]
- 1/8/03: Sprint announces America's first Wireless streaming music clip subscription service, allowing ringtone downloads from Warner Music Group.[348]
- 12/23/02: Sprint announces that it's the first US Carrier to introduce next generation services via PCS Vision(SM) and introduced Samsung SPH-i330 device for the PCS Vision.[349]
- Sprint introduces Nokia 3585.[350]
- 11/11/02: Sprint rolls out streaming media application for corporate clients.[351]
- 11/6/02: Sprint and Bell Mobility announce collaboration on CDMA technology advancement.[352]
- 10/15/02: Sprint introduces Sanyo 5300, the first phone in US with built in camera.[353]

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[344] "Lights, Camera, Action! Sprint Introduces Video Mail." Sprint Press Release. 12/3/03.

[345] "Sprint Introduces Sprint Messenger(SM) Service." Sprint Press Release. 8/19/03.

[346] "Sprint Announces Nationwide Availability of the First Pocket PC with Integrated Camera, Built-In Keyboard and Wireless Phone." Sprint Press Release. 7/24/03.

[347] "Sprint and Sanyo Debut America's First Camera Phone to Add Voice Messages to Wireless Pictures." Sprint Press Release. 3/17/03.

[348] "Sprint and Warner Music Group Offer America's First Wireless Streaming Music Clip Subscription Service…" Sprint Press Release. 1/8/03.

[349] "Sprint and Samsung Telecommunications America Usher in Next Generation of Palm Powered™ Phones with PCS Phone SPH-i330." Sprint Press Release. 12/23/02.

[350] "Sprint Adds Nokia Handset to Line-Up of PCS phones." Sprint Press Release. 12/2/02.

[351] "Sprint Rolls Out Streaming Media Capabilities to its Hosted Solutions Portfolio." Sprint Press Release. 11/11/02.

[352] "Sprint and Bell Mobility Collaborate on CDMA Technology Advancement." Sprint Press Release. 11/6/02.

[353] "Sprint and Sanyo Introduce America's First Built-In Camera Phone." Sprint Press Release. 10/15/02.

- 9/30/02: Sprint announces new videoconferencing and audioconferencing solutions.[354]
- 9/16/02: Sprint announces availability of LG 5350, the first LG model with color LCD display.[355]
- 9/4/02: Sprint announces picture messaging service.[356]
- 8/22/02: Sprint announces Sanyo 4900 with color screen.[357]

D) T-MOBILE

- 4/13/07: T Mobile announces T Mobile® Sidekick® iD.[358]
- 3/21/07: T-Mobile exclusively launches MOTORIZR™ Z3.[359]
- 10/11/06: T-Mobile announces upcoming availability of T-Mobile Dash™ a Smartphone designed for customers with busy home and work lives.[360]
- 9/27/06: T-Mobile announce availability of Samsung SGH-t719 a flip phone with BlackBerry Connect service and QWERTY-like keyboard.[361]
- 9/12/06: T-Mobile announce Samsung Trace™, the slimmest bar phone available in US.[362]
- 9/7/06: T-Mobile introduces BlackBerry Pearl.[363]
- 6/20/06: T-Mobile announces availability of next generation T-Mobile® Sidekick® 3.[364]

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[354] "Sprint Announces Automated Videoconferencing and Web-Enabled Audio Conferencing." Sprint Press Release. 9/30/02.

[355] "Sprint Offers Full-Loaded PCS Phone by LG Model 5350…" Sprint Press Release. 9/16/02.

[356] "Sprint and LightSurf Enable Wireless Customers to Instantly Shoot, View and Share Clear Pictures Nationwide with PCS Vision Camera and LightSurf Technology." Sprint Press Release. 9/4/02.

[357] "Sprint Introduces Affordable, Vivid Color Screen PCS Phone by Sanyo Featuring Full Support for PCS Vision(SM) from Sprint." Sprint Press Release. 8/22/02.

[358] "T-Mobile Sidekick iD Makes a Statement." T-Mobile Press Release. 4/13/07.

[359] "Motorola and T-Mobile Launch the MOTORIZR™ Z3." T-Mobile Press Release. 3/21/07.

[360] "T-Mobile Unveils a new Full-Featured Smartphone, the T-Mobile Dash." T-Mobile Press Release. 10/11/06.

[361] "Samsung and T-Mobile Unveil Premium Slim Flip Phone with BlackBerry Connect and QWERTY-like keyboard." T-Mobile Press Release. 9/27/06.

[362] "Samsung and T-Mobile Set the Ultra-Slim Bar with the Samsung Trace™." T-Mobile Press Release. 9/12/06.

[363] "T-Mobile USA and RIM Introduce the Ultra-Sleek BlackBerry Pearl." T-Mobile Press Release. 9/7/06.

[364] "T-Mobile Sidekick 3 Available to 'Kick-Start' the Summer." T-Mobile Press Release. 6/20/06.

- 6/12/06: T-Mobile offering kidConnect, allowing parents to keep in contact with kids.[365]
- 5/2/06: T-Mobile announces Samsung t509, the thinnest bar phone in the US market.[366]
- 2/13/06: T-Mobile announces availability of two new smartphones – T-Mobile SDA and T-Mobile MDA – EDGE capable with integrated Wi-Fi and QWERTY keyboard.[367]
- 10/13/05: T-Mobile announces availability of BlackBerry® 7105t as well as BlackBerry Internet Email™ for Yahoo! Mail users.[368]
- 7/15/05: T-Mobile announces availability of Motorola RAZR.[369]
- 7/7/05: T-Mobile announces Multimedia Messaging Services interoperability with Sprint.[370]
- 7/7/05: T-Mobile announces Multimedia Messaging Services interoperability with Cingular.[371]
- 3/11/05: T-Mobile announces availability of BlackBerry 7290.[372]
- 12/8/04: T-Mobile launches CallerTunes, the US' first ringback tone service.[373]
- 9/22/04: T-Mobile launches T-Mobile Sidekick II.[374]
- 9/8/04: T-Mobile launches BlackBerry 7100t™ phone, packing BlackBerry functionalities into a phone.[375]

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[365] "T-Mobile Introduces kidConnect: A Worry-Free Wireless Plan for Parents to Stay Connected to Kids." T-Mobile Press Release. 6/12/06.

[366] "T-Mobile and Samsung Introduce the Thinnest Bar Phone for the U.S. Market." T-Mobile Press Release. 5/2/06.

[367] "T-Mobile USA Introduces Two New Smartphones to Keep you Effortlessly Connected." T-Mobile Press Release. 2/13/06.

[368] "T-Mobile USA and RIM Launch the New BlackBerry 7105t and new BlackBerry Internet E-Mail Service for Yahoo! Mail Users." T-Mobile Press Release. 10/13/05.

[369] "World Renowned Motorola RAZR Debuts at T-Mobile USA." T-Mobile Press Release. 7/15/05.

[370] "T-Mobile USA and Sprint Make it a Snap for Customers to Share Pictures and Text Messages." T-Mobile Press Release. 7/7/05.

[371] "T-Mobile Shows It's Better to Give and to Receive Picture and Video Messages." T-Mobile Press Release. 7/7/05.

[372] "T-Mobile USA Welcomes a New Member to the BlackBerry Family." T-Mobile Press Release. 3/11/05.

[373] "T-Mobile USA Launches CallerTunes; The First Nationwide Ringback Tone Service That Lets Users 'Represent Their Style." T-Mobile Press Release. 12/8/04.

[374] "America Flips its Lid for the T-Mobile Sidekick II." T-Mobile Press Release. 9/22/04.

- 8/31/04: T-Mobile announces availability of Nokia 6800 messaging phone, which makes choice of IM a non-issue.[376]
- 8/11/03: T-Mobile introduces exclusive availability of BlackBerry® 7230 with high-resolution color display.[377]
- 6/19/03: T-Mobile announces availability of BlackBerry® 6210™.[378]
- 3/27/03: T-Mobile introduces video messaging services with Nokia 3650 – first in US.[379]
- 3/4/03: T-Mobile announces availability of Treo 270.[380]
- 11/7/02: T-Mobile announces Camera Phones starting at under $100.[381]
- 8/1/02: T-Mobile launches Windows Powered Pocket PC.[382]

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375 "A New BlackBerry Phone that Fits In Your Shirt Pocket? Now You're Talking!" T-Mobile Press Release. 9/8/04.

376 "CUL8R: Triple Tap." T-Mobile Press Release. 8/31/04.

377 "World-Capable Color BlackBerry 7230 From RIM Arrives in United States, Available Exclusively from T-Mobile USA." T-Mobile Press Release. 8/11/03.

378 "T-Mobile USA Launches New BlackBerry 6210." T-Mobile Press Release. 6/19/03.

379 "T-Mobile, First Wireless Carrier to Introduce Video Messaging Services in the U.S." T-Mobile Press Release. 3/27/03.

380 "T-Mobile Launches Handspring Treo 270." T-Mobile Press Release. 3/4/03.

381 "T-Mobile Introduces Camera Phones Starting at Under $100." T-Mobile Press Release. 11/7/02.

382 "T-Mobile Launches Microsoft Windows Powered Pocket PC Phone Edition." T-Mobile Press Release. 8/1/02.

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QSI Contributors to the Report:

August Ankum, Ph.D. – Dr. Ankum is a founding partner of QSI and serves as Senior Vice President. He is a practicing economist and consultant specializing in both domestic and international telecommunications issues. Dr. Ankum received a PhD in Economics from the University of Texas at Austin, a MA in Economics from the University of Texas and a BA in Economics from Quincy College in Illinois.

Olesya Denney, Ph.D. – Dr. Denney serves as Senior Consultant in QSI's Telecommunications Division. Dr. Denney is an economist and statistician and has conducted research in both the telecommunications and energy industries. Dr. Denney holds a PhD and MS in Economics from Oregon State University as well as a BS in Economics from Novosibirsk State University in Russia.

Warren Fischer, C.P.A. – Mr. Fischer, a Certified Public Accountant, is a QSI Partner and Chief Financial Officer for the firm. Mr. Fischer has extensive experience in the telecommunications and accounting industries and is a sought after resource in the regulatory arena. Mr. Fischer, CPA, holds a BS in Business Administration with an emphasis in accounting from the University of Colorado.

Timothy Gates – Mr. Gates is a QSI Partner and serves as Senior Vice President. He has provided expert testimony in more than 200 proceedings in 44 states and Puerto Rico. Mr. Gates holds a BS in Forest Management from Oregon State University and a MM with an emphasis in Finance and Quantitative Methods from the Atkinson School at Willamette University.

Stephanie Goldman, C.F.A. – Ms. Goldman is a Special Consultant to QSI. She has extensive executive experience in both domestic and international utility (telecommunications and energy) regulation and the US financial industry. Ms. Goldman holds a MBA from the University of Texas and a BA in Economics from Wellesley College.

Dima Leshchinskii, Ph.D. – Dr. Leshchinskii is a visiting assistant professor at Lally School of Management Rensselaer Polytechnic Institute (Troy, NY, USA) teaching undergraduate and graduate courses in Corporate Finance, International Finance and Business Economics. His research focuses on corporate and entrepreneurship finance. Dr. Leshchinskii holds a Ph.D. and M.S. in Management (Finance) from INSEAD, Paris, France, MBA from David Eccles School of Business, University of Utah, USA and Honors Diploma in Applied Mathematics, Tomsk State University, Tomsk, Russia.

Sidney Morrison – Mr. Morrison is QSI's Chief Engineer and in charge of QSI's Technical Services Division. He brings over 30 years of experience to the firm, with 22 years at US WEST's Network Management Group. Mr. Morrison has also designed, built and managed networks in Malaysia and Switzerland.

Patrick Phipps – Mr. Phipps is a QSI Senior Consultant with a variety of regulatory experience. As an advisor to regulatory commissioners and as an economist Mr. Phipps has provided extensive expert advice and analysis on the regulation of telecommunications and transportation industries. Mr. Phipps holds an MA in Economics from the University of Illinois and a BS in Economics from Illinois College.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 1:

Reference(s): none provided

(a) On what date did THESL adopt the “no wireless” policy?

(b) Provide a copy of THESL’s “no wireless” policy, as adopted.

(c) Has THESL amended or revised the “no wireless” policy since its adoption? If yes, please provide a copy of the amended or revised policy.

(d) Provide copies of THESL’s written policy with respect to attachments to distribution poles as it existed prior to the submission date of the August 13, 2010 letter to the Board (“**THESL Letter**”).

(e) Did THESL’s Board of Directors approve or otherwise endorse the “no wireless” policy?

(f) If the response to (e) is “yes”, provide the date of the meeting at which this occurred and a list of those Board members who voted to adopt a “no wireless” policy.

(g) If the adoption of the “no wireless” policy was not endorsed by the THESL Board of Directors, by vote or otherwise, how was the Board of Directors advised of THESL’s adoption of the “no wireless” policy?

(h) Were any presentations (oral or in writing) made to the THESL Board of Directors in relation to any of the subjects discussed in the THESL Letter, prior to the letter being filed with the Ontario Energy Board (“**Board**”)? If yes, provide particulars of any oral presentations and copies of any written presentations, including, without limitation, power points, notes, memoranda, executive summaries and any similar writing.

(i) Provide copies of all drafts, including notes to draft, of the THESL Letter.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

RESPONSE:

(a) This in an inaccurate summary of THESL's position with regard to wireless attachments. THESL's policy, clearly stated in the August 13, 2010 letter, is that THESL does not believe that DAS or any other wireless attachers have a right to attach wireless equipment to THESL poles pursuant to the CCTA Decision. The Board's 2005 CCTA Decision did not mandate Ontario distributors to accommodate wireless attachments on their distribution poles. In particular, the issue and subject of wireless attachments was not raised, considered or addressed in the CCTA Decision or the CCTA proceeding. The CCTA Settlement Agreement explicitly excluded wireless as an unsettled issue and the Board accepted that Settlement Agreement as part of the CCTA proceeding, and as such, the CCTA Decision did not encompass wireless.

(b) Please see the response in (a) above. THESL has not developed any particular written policies with respect to wireless since that was unnecessary because the CCTA Decision did not mandate Ontario distributors to accommodate wireless attachments on their distribution poles.

(c) Please see the response in (a) and (b) above.

(d) THESL does not have written policies over and above those provided in Tab 5.1, Schedule 1, Attachment 1 (*Section - 23: Foreign Attachments*, *Index of Standards*.)

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(e) There was no need to take anything to THESL's Board because THESL had not adopted a "no wireless" policy at alleged by CANDAS. The Board's 2005 CCTA Decision did not mandate Ontario distributors to accommodate wireless attachments on their distribution poles. Please also see the response in (a) above.

(f) Not applicable.

(g) Not applicable.

(h) THESL declines to respond to this interrogatory on the basis that the information requested is privileged as being in contemplation of litigation.

(i) THESL declines to respond to this interrogatory on the basis that the information requested is privileged as being in contemplation of litigation.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 2:

Reference(s): none provided

Does the “no wireless” policy apply to the street lighting poles that are to be transferred to THESL from THESI?

RESPONSE:

Please refer to the responses in Tab 5.3, Schedule 1 and Tab 5.1, Schedule 2.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 3:

Reference(s): **none provided**

(a) Prior to adopting or implementing the "no wireless" policy, did THESL request any input from the Board or Board staff regarding this policy?

(b) Why did THESL not wait for the Board to reply to the THESL Letter, prior to adopting the "no wireless" policy?

(c) Is it THESL's practice to consult with the Board or Board staff prior to implementing new policies or changing existing policies?

(d) Prior to adopting the "no wireless" policy did THESL seek and obtain legal advice as to the application of the CCTA Order to wireless attachments?

(e) Did THESL receive any form of acknowledgement of receipt, by the Board, of the THESL Letter? If yes, provide copies of all correspondence received from the Board or its staff in this regard.

RESPONSE:

(a) Please refer to the response in Tab 5.3, Schedule 1. THESL formed its conclusion regarding the applicability of the CCTA Decision independently and wrote to the Board on August 13, 2010 to advise the Board of that fact and to invite the Board to contact THESL if the Board had any concerns.

(b) Please see the response in (a) above. At no time has the Board expressed concerns with respect to THESL's position as articulated over a year ago in its August 13, 2010 letter.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(c) THESL's approach to policy management is dependent on the specific issues and circumstances attending each policy question. Where THESL believes it is appropriate to consult the Board, it does so.

(d) THESL declines this interrogatory on the basis that the information sought is privileged as being in contemplation of litigation.

(e) No.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 8:

Reference(s): THESL's June, 2011 Letter, Section 3

"These companies seek to profit by attempting to pay an inappropriate rate of $22.35 per year to attach to LDC poles, which amount is significantly below market and cheaper than both the costs incurred by THESL to facilitate such attachments and the cost of other wireless attachment options already available in the market. As a regulated electricity distributor, THESL submits that is has no obligation to facilitate or accommodate the business models of private interests and it is not up to the LDC's and ultimately electricity ratepayers, to subsidize the CANDAS group's arbitrage opportunity/business model."

(a) At any point during any discussions or negotiations with any CANDAS member regarding wireless attachments did THESL offer, or otherwise make an attempt, to negotiate what THESL believed was a fair and just attachment rate? If yes, please provide copies of all emails, correspondence or other documentation to substantiate this claim.

(b) If THESL believes that the Board-approved attachment rate of $22.35 is "inappropriate" why did it not seek to vary this rate in its last cost-of-service rate application?

(c) To THESL's knowledge, are any of the other attachers to THESL poles established as not for profit organizations? If yes, please provide a list of such attachers.

(d) What criteria does THESL use to gauge which for-profit entities will be granted access and which should be denied access? Please provide a detailed description of this process and the decision metrics used to qualify or disqualify each for-profit entity based on this criterion.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

RESPONSE:

(a) Not to THESL's knowledge.

(b) THESL does not believe that the 'Board-approved rate' applies to wireless attachments on the basis that the CCTA Decision did not mandate Ontario distributors to accommodate wireless attachments on their distribution poles.

(c) Yes. THESL understands that the various Business Improvement Associations are not for profit organizations.

(d) THESL does not grant pole access on the basis (for profit versus not for profit) assumed in the question.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 9:

Reference(s): THESL's June 2011 Letter, Section 4

"LDC are not exercising any monopoly power in respect of wireless attachments. There are numerous alternatives which are available for wireless attachments, including but not limited to building-top and side-of-building attachments as well as stand-alone structures. There is, in fact, an active competitive market to site and place wireless equipment. The presence of such competitive alternatives undermines any suggestion that an LDC could exert monopoly power. A regulated attachment rate of $22.35 per year for wireless equipment may in fact seriously undermine the ability of this competitive market to further develop and efficiently operate in Ontario."

(a) Is it THESL's position that building top, side of building attachments and stand-alone structures represent an economically viable alternative to distribution poles for wireless attachment? If yes, please provide the financial analysis performed by THESL that supports this position. Include all costs including site acquisition costs, building and rooftop rental and network design assumptions.

(b) Is it THESL's position that building top side of building attachments and stand-alone structures represent a technically viable alternative to the use of evenly spaced distribution poles with relatively consistent heights? If yes, please provide the following

(i) THESLs analysis of the morphology, terrain, structure availability reports, tower and rooftop structure heights, RF coverage predictions, network link budget calculations, technical evaluations, as well as the credentials of any firms and individuals who conducted these analyses, which supports THESLs position regarding the technical viability of alternative support structures

(ii) The frequency bands, transport protocols, backhaul assumptions and transport

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

media used to provide backhaul transport from each alternative site to the specified switch center and all other material used in the analysis that led to this presumption

(c) What is THESL's definition of the word "monopoly" as used in THESL's June 2011 letter?

RESPONSE:

(a) The economic viability of such attachments would depend on the business acumen of, and business arrangements made by CANDAS members. THESL cannot comment on these issues.

(b) The technical viability of the suggested approach would depend on the technical and business choices made by CANDAS members, which THESL cannot comment on.

(c) THESL uses the word 'monopoly' in the ordinary sense to describe a situation where a single entity controls the supply of a good or service.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 26:

Reference(s): none provided

Does THESL's "no wireless" policy pertain to wireline attachments related to, or used in conjunction with, wireless attachments (e.g. the many fibre optic cable attachments connecting the various wireless "nodes" in a DAS network)?

(a) If yes, please explain the reasons why.

(b) If no, explain the reasons why.

RESPONSE:

a) THESL does not have a "no wireless" policy. THESL's policy with respect to wireline attachments is to treat them in accordance with the CCTA Decision. Please also refer to the responses in Tab 5.3, Schedule 1 and Tab 5.1, Schedule 27.

b) Not applicable.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 27:

Reference(s): **THESL Letter, "Pole Attachment Space is a Scarce Resource"**

THESL details many issues related to resource efficiency, cost, aesthetics and other public interests with installing and maintain utility poles. As a Canadian Telecommunications carrier, one of the alternatives for wireless attachments is to place poles in the Rights of Way (ROW).

Is it THESL's position that setting new poles in the ROW is a viable alternative to utility poles for wireless attachments.

RESPONSE:

It may be viable for wireless communications providers to place poles in the right of way to support their non-wireline equipment. Utility poles could then support fibre wireline equipment to transport signals to reception points.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 29:

Reference(s): none provided

Electric utilities in the United States are required to permit access on their electric distribution poles to wireless attachments.

What are the circumstances that exist in Ontario that are materially different from those in the United States that would make a requirement to permit wireless attachments unjustifiable or otherwise untenable?

RESPONSE:

It is not THESL's role or responsibility to demonstrate whether rulings in a foreign jurisdiction should apply in Ontario. CANDAS is the applicant in this proceeding and as such bears the burden of proof regarding the relief that it seeks.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 31:

Reference(s): none provided

Has THESL had any negotiations with any of its existing customers, including Rogers Communications Inc., regarding wireless attachment services? If "yes" what was the nature of those discussions?

RESPONSE:

THESL has had discussions with various parties regarding wireless attachments on THESL Poles. THESL's position taken in this regard is consistent with the position it takes in this proceeding. In particular, THESL has no obligation to accommodate wireless attachments on THESL Poles pursuant to the Board's 2005 CCTA Decision.

As noted in response to various other interrogatory responses, including that in Tab 3, Schedule 4, THESL's position is that the Board's 2005 CCTA Decision did not mandate Ontario distributors to accommodate wireless attachments on their distribution poles. In particular, the issue and subject of wireless attachments was not raised, considered or addressed in the CCTA Decision or the CCTA proceeding. The CCTA Settlement Agreement explicitly excluded wireless as an unsettled issue and the Board accepted that Settlement Agreement as part of the CCTA proceeding, and as such, the CCTA Decision did not encompass wireless attachments.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 5:

Reference(s): Yatchew, page 5, lines 9-10

Dr. Yatchew states:

"Markets for wireless services have evolved rapidly and successfully without mandatory pole access for wireless facilities."

(a) Dr. Yatchew refers to the rapid and successful evolution of markets for wireless services.

(i) Explain the relevant timeframe of the evolution of markets for wireless services.

(ii) Explain the basis for Dr. Yatchew's characterisation of this evolution as "successful." Provide full details and supporting references to published studies, reports or analyses of the Canadian wireless marketplace, if any.

RESPONSE:

i) Wireless mobile services have evolved over a period of more than 20 years.

ii) See, for example, "Communications Monitoring Report, July 2011", Canadian Radio-television and Communications Commission. The Canadian wireless industry compares favourably with those in the U.S. and other countries.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 8:

Reference(s): **Yatchew, page 7, lines 7-9**

Dr. Yatchew states:

"...wireless attachments do not typically fit within the 2 feet (or less) of communications space to which that Order applies....unlike wireline facilities, utility poles are not essential facilities for wireless services."

(a) Regarding the assertion that wireless attachments do not typically fit within the 2 feet (or less) of communications space,

(i) Define "communications space" as referred to in the above-noted citation.

(ii) Assuming that applicable ESA and safety clearances are maintained, confirm whether in Dr. Yatchew's experience, there are instances where equipment is placed in the unused space below the communications space. Describe these instances as well as Dr. Yatchew's prior experience with matters concerning the placement of equipment of utility poles.

(iii) Based on Dr. Yatchew's experience and knowledge, confirm that wireline carriers' attachments do not always fit within the so-called communications space.

(iv) Based on Dr. Yatchew's experience and knowledge, confirm that other municipally-owned or third-party equipment and facilities on poles do not always fit within the so-called communications pace.

(v) Describe Dr. Yatchew's prior experience with matters pertaining to the placement of equipment on utility poles.

(vi) Describe in detail Dr. Yatchew's personal knowledge regarding the standard equipment or attachment process for wireline carriers' equipment. For clarity,

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

"wireline carrier" includes both telecommunications carriers and cable (CATV) carriers:

I. Include all standards, calculations performed, and typical installations that apply to CATV and associated installations including cable facilities and related equipment (e.g. Cable TV boxes or batter units).

(1) Specify their size, weight, pole attachment method and location on the pole.

II. Include all standards, calculations performed and typical installations that apply to copper and fibre deployments.

III. Include all standards, calculations performed, and typical installations that apply to power supplies or similar functions.

(1) Specify their size, weight, attachment method and location on the pole.

IV. Include all standards, calculations performed and typical installations that apply to any other types of attachments.

(1) Specify their size, weight and attachment method and location on the pole.

(vii) Describe Dr. Yatchew's personal understanding of the type of attachments required for a DAS deployments and how they differ from typical wireline carriers' deployments (including associated equipment attached to poles).

I. Specifically, compare how a fibre attachment for DAS differs from a wireline carrier's attachment.

II. Specifically, compare how a "node" attachment for DAS differs from various wireline carriers' equipment attachments.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

RESPONSE:

a) The common definition of "communications space" is the space that is above the "clearance space" and below the "separation space" to which most wireline cable and telecom companies attach their cables. For a 40 foot pole, which was taken as the reference pole in the 2004-2005 OEB CCTA proceeding, the communications space is 2 feet in length and is situated 23.25 feet from the base of the pole.

It is my understanding that for most poles, wireline cable and telecom companies are able to place their equipment within this assigned space. It is my further understanding that the contemplated DAS deployment seeks to attach to such cables.

There are of course exceptions which occur on a relatively small proportion of poles. However, setting a new precedent which is based on exceptions would not be a prudent course of action for a regulator. Following the legal maxim, that "hard cases make bad law", in my opinion, exceptions make for poor regulation.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 10:

Reference(s): Yatchew, page 9, lines 20-22

Dr. Yatchew states:

"Current and future demand for pole space by distributing utilities is also growing as the industry rolls out smart metering; develops smart grid systems; and installs automatic switching devices."

(a) Regarding smart metering:

(i) Describe smart metering in the context of distributing utilities and explain the role of wireless transmission technologies in the deployment of smart metering.

(ii) Describe the elements and configuration of the elements of a smart metering network. Provide a network schematic diagram if possible.

(iii) Explain whether use of pole space is necessary or desirable for the implementation of a smart metering network and specifically identify the portions of a smart metering network for which pole space would be used.

(iv) To the extent that the use of pole space is necessary or desirable for the deployment of certain portions of a smart metering network, describe the advantages of use of pole space as opposed to macrocell sites, the sides of buildings or rooftops.

(v) Could smart metering be efficiently and practically deployed using only macrocell sites, the sides of buildings or rooftops? Fully describe the process and timeframes for such deployment, relative to deployment using pole space.

(b) Regarding a smart grid system:

(i) Describe smart grid systems in the context of distributing utilities and explain the role of wireless transmission technologies in the deployment of smart grid

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

systems.

(ii) Describe the elements and configuration of a smart grid system. Provide a network schematic diagram if possible.

(iii) Explain whether use of pole space is necessary or desirable for the implementation of a smart grid system and specifically identify the portions of a smart grid system for which pole space would be used.

(iv) To the extent that the use of pole space is necessary or desirable for the deployment of certain portions of a smart grid system, describe the advantages of use of pole space as opposed to macrocell sites, the sides of buildings or rooftops.

(v) Could a smart grid system be efficiently and practically deployed using only macrocell sites, the sides of buildings or rooftops? Fully describe the process and timeframes for such deployment, relative to deployment using pole space.

(c) Regarding the installation of automatic switching devices:

(i) Describe the installation of automatic switching devices in the context of distributing utilities and explain the role of wireless transmission technologies in the deployment of automatic switching devices.

(ii) Describe the elements and configuration of an automatic switching device network in relation to the distributing utility's distribution network. Provide a network schematic diagram if possible.

(iii) Explain whether use of pole space is necessary or desirable for the installation of automatic switching devices and specifically identify why pole space would be used for same.

(iv) To the extent that the use of pole space is necessary or desirable for the deployment of automatic switching devices, describe the advantages of use of pole space as opposed to macrocell sites, the sides of buildings or rooftops.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

(v) Could automatic switching devices be efficiently and practically deployed using only macrocell sites, the sides of buildings or rooftops? Fully describe the process and timeframes for such deployment, relative to deployment using pole space.

RESPONSE:

Please refer to the work of Ontario's Smart Grid Forum for a description of current and future smart grid systems, including smart metering and automatic switching devices (See: http://www.ieso.ca/imoweb/marketsandprograms/smart_grid.asp).

It is probably the case that certain information transmission components of utility smart metering and smart grid equipment could be placed elsewhere. However, it would be highly unusual for a regulator to instruct a wires utility to do so given that the utility owns the poles themselves.

Furthermore, safety and stability considerations would seem to be especially important when considering the placement of electricity utility devices which affect smart-grid response to variability in demand or supply, and automatic switching device response to system faults. In both cases, proximity and access to utility equipment would seem to dominate economic considerations. Maintenance and restoration of power is generally understood to be a very high priority from a public policy point of view.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 17:

Reference(s): **Yatchew, Page 16, line 16, and generally**

At page 16, line 16 of his Affidavit, Dr. Yatchew states:

"3. Utility poles are a limited and valuable resource."

At page 17, lines 12 to 14 of his Affidavit, Dr. Yatchew states:

"In addition to their critical importance as essential facilities, support structures such as poles constitute a valuable resource which, if appropriate conditions are met, may provide support services to nonessential facilities."

At page 30, line 2 of his Affidavit, Dr. Yatchew states:

Although THESL has a virtual monopoly on poles, it does not have a monopoly on support structures for wireless facilities ...

(a) Dr Yatchew states that "[u]tility poles are a limited and valuable resource", and that "THESL has a virtual monopoly on poles." Confirm that denial of access to such a limited and valuable resource would be an exercise of market power. If Dr. Yatchew does not agree, fully explain the basis of Dr. Yatchew's contrary conclusion.

RESPONSE:

Denial of access to wireline companies by THESL would constitute an exercise of market power. Denial of access to wireless components, such as antennas, would not constitute an exercise of market power because THESL has a small share of the siting market for antennas and wireless companies have a number of siting alternatives. THESL is not involved in the retail market for wireless services, and has no reason to exercise market power or to otherwise reduce competition.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 18:

Reference(s): **Yatchew, pages 18-19, lines 28-29**

Dr. Yatchew states:

"The existence of a very active, extensive and competitive siting market is well supported by the presence of companies whose primary business is the siting of wireless and other communications facilities."

(a) Provide evidence of conditions in the Canadian "competitive siting market" if any.

(b) Mr. Starkey states at page 23, lines 15 to 18 of his Affidavit filed with the Board in this matter that he relies on Dr. Yatchew's "determination" that for purposes of the CANDAS application, "the relevant product market is the market for siting wireless attachments." Confirm that Dr. Yatchew concurs with Mr. Starkey's interpretation of Dr. Yatchew's evidence.

(c) Assuming that Dr. Yatchew concurs with Mr. Starkey's interpretation, provide specific excerpts and references from Dr. Yatchew's Affidavit that relate to the determination that "the relevant product market is the market for siting wireless attachments" and in particular, analysis used by Dr. Yatchew to conclude that the relevant product market is the market for siting wireless attachments.

(d) In the above-noted citation, Dr. Yatchew refers to a single siting market. However, in other portions of his Affidavit, he refers to the existence of siting markets in the plural. Advise whether in Dr. Yatchew's view, there is a single siting market, or whether there are multiple siting markets.

(i) If in Dr. Yatchew's view, there are multiple siting markets, confirm whether these multiple siting markets are delineated

A. by geography and/or

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

B. by relevant product.

(ii) If in Dr. Yatchew's view, there a multiple siting markets defined by relevant product, identify the different relevant products.

RESPONSE:

a) The existence of a siting market in Canada is evidenced by the presence of numerous sites for antenna facilities belonging to various parties. As Mr. Starkey indicates in pages 26-27 of his affidavit and supporting documentation, there are over 1,300 physical locations in the Toronto area alone which support antennas.

b) Confirmed.

c) The designation of the relevant market is driven by the CANDAS application which seeks to attach "wireless equipment, including wireless components of distributed antenna systems" to THESL and other LDC poles. It is natural therefore to determine the market in terms of the alternatives that CANDAS has for siting wireless facilities.

d) For purposes of the present discussion, geography is the main determinant of the siting market. In order to serve customers in the Toronto area, CANDAS needs to place its antennas in or near Toronto.

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 21:

Reference(s): Yatchew, page 30, lines 27-29

Dr. Yatchew states:

"Q. CANDAS evidence refers extensively to DAS deployments in other jurisdictions. In particular, it suggests that in some cities, DAS networks have been deployed largely on poles."

(a) Does Dr. Yatchew agree that as a matter of fact, DAS networks have largely been deployed on poles? If not, why?

RESPONSE:

a) DAS networks come in various formats and serve various purposes. Some are installed indoors, others on buildings, still others on poles, lights, street furniture and specially designed support structures. I have not performed an independent assessment to determine whether the preponderance of antennas have been installed on poles.

I understand based on CANDAS' response to THESL IR#8(b)(ii) that just over 90% of ExteNet Systems' DAS networks are installed on utility poles. However, I am unable to make general industry observations based upon the data provided by a single market participant. This data reflects the particular strategy and preferences of ExteNet Systems to use utility poles when possible. However, this is not generalizable to the industry as a whole (notably, both American Tower and Crown Castle identify utility poles among their principle competition).

RESPONSES TO CANADIAN DISTRIBUTED ANTENNA SYSTEMS COALITION INTERROGATORIES

INTERROGATORY 24:

Reference(s): **Yatchew, page 31, lines 10-14**

Dr. Yatchew states

"The decision to strongly encourage or mandate attachment, in some instances, has been made by a telecom regulatory authority that has favoured its own industry, sometimes at the expense of other industries and ratepayers. While this decision may be reasonable for a telecom regulator, an energy regulator might be more likely to consider the needs of the energy industry and its ratepayers, and arrive at a different conclusion."

(a) Is the Federal Communications Commission decision of April 2011 an example that supports his assertion? Explain why.

RESPONSE:

Yes.

FCC rulings and U.S. telecommunications legislation have resulted in attachment rates to utility support structures that are favourable to the cable and communications industry.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 1:

Reference(s): **none provided**

The evidence of CANDAS, at paragraph 2.2, is that, until August, 2010, THESL permitted access to its poles for wireless attachments. In paragraph 2.3 of that evidence, CANDAS indicates that THESL sent a letter to the Ontario Energy Board (Board), on August 13, 2010 advising the Board of a new policy not to permit the attachment of wireless equipment to its power poles.

Please provide copies of all reports, analyses, written communications, including email, with respect to the policy referred to in the letter of August 13, 2010. Please include copies of all reports to THESL's management and board of directors with respect to that policy.

RESPONSE:

THESL disagrees with the premise of this question that "until August, 2010, THESL permitted access to its poles for wireless attachments." THESL currently has a valid contract with DAScom regarding wireless attachments.

It is not accurate to say that in its August 13, 2010 letter, THESL advised the Board of its "new policy not to permit the attachment wireless equipment to its power poles." Please see THESL responses to general CANDAS IR 1 and VECC IR 4.

With respect to the request to produce the above-noted information and documents, THESL declines this request on the basis that the materials and information sought are

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

privileged as communications between solicitor and client and/or being in contemplation of litigation.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 2:

Reference(s): **none provided**

Please provide copies of all communications, including correspondence and emails, between THESL and the Electricity Distributors Association or its members with respect to the following:

a) The interpretation of the Decision and Order of the Board in RP-2003-0249 (the CCTA Order);
b) The attachment of wireless communication equipment to electricity distribution poles;
c) THESL's policy reflected in its letter to the Board dated August 13, 2010.

RESPONSE:

a) THESL declines this interrogatory on the basis that it is extremely broad, and does not pertain to THESL's evidence. No reference to THESL's evidence is provided, the information sought is not relevant to this proceeding, and/or is unduly onerous to produce in relation to the probative value.
b) Please see the response in (a) above.
c) Please see the response in (a) above.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 3:

Reference(s): **none provided**

Please provide copies of all communications, including correspondence and emails, between THESL and the City of Toronto with respect to the following:

a) The interpretation of the CCTA Order;

b) The attachment of wireless communication equipment to THESL's electricity distribution poles;

c) The policy reflected in THESL's letter of August 13, 2010 to the Board;

RESPONSE:

a) THESL declines this interrogatory on the basis that it is extremely broad, and does not pertain to THESL's evidence. No reference to THESL's evidence is given, the information sought is not relevant to this proceeding, and/or is unduly onerous to produce in relation to the probative value.

b) Please see the response in (a) above.

c) Please see the response in (a) above.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 4:

Reference(s): **none provided**

Please provide copies of all studies, reports, and internal communications including correspondence and email, from the date of the CCTA Order to the present, with respect to the wireless communication plans of THESL, the City of Toronto and any related or affiliated entities, including business plans with respect to the development and implementation of wireless communications systems.

RESPONSE:

Apart from the operations of its own radio systems used for electricity distribution purposes (see affidavit of Ms. Byrne at paragraph 54 and Exhibit “K”), THESL does not plan to operate a ‘wireless communication’ system. THESL has no plans to operate a wireless communication system as a common carrier.

As THESI is not a party to this proceeding, THESI declines to produce any information related to this proceeding. Please also refer to the response in Tab 5.1, Schedule 2, (b).

Any plans of the City of Toronto are not within THESL’s knowledge.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 10:

Reference(s): **Affidavit of Mary Byrne**

Would THESL be willing to permit wireless attachments if the applicants provided THESL with full cost recovery, including installation and ongoing operating and maintenance costs? If not, why not?

RESPONSE:

Any commercial terms proposed by any existing or future customer would need to be fully reviewed, negotiated and approved by THESL in the ordinary commercial course. THESL believes that any attachment charges (and other terms and conditions) applicable to wireless attachments should only be determined by negotiation in the open market.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 13:

Reference(s): **Affidavit of Mary Byrne**

Were the Board to grant CANDAS's application, and require THESL to attach wireless communication equipment to its poles, what terms and conditions would THESL propose for the attachment of that equipment to those poles?

RESPONSE:

It is premature for THESL to comment on the terms and conditions of hypothetical access, as this is dependent on factors including the wording of the hypothetical decision that the CCC refers to in this interrogatory.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 14:

Reference(s): Affidavit of Mary Byrne

Were the Board to grant CANDAS's application, and require THESL to attach wireless communication equipment to its poles, what fee would THESL charge for each attachment of wireless communication equipment to one of its poles?

RESPONSE:

Were the Board to mandate access, but not set a rate, THESL would seek to set a rate that reflected market conditions and realized for the benefit of ratepayers the full value of distribution assets being used. Anything less than market rates would amount to a cross-subsidy by ratepayers to wireless telecommunications providers.