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Consultation on a Renewed Spectrum Policy Framework for Canada and Continued Advancements in Spectrum Management

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Key Recommendations

- **The Department needs to place a greater emphasis on informing the public. The Department should disseminate better information on spectrum management issues in order to provide citizens with the information resources required to meaningfully participate in the on-going policy discussions concerning this issue.**

- **The Department can better meet society's needs by strengthening its decision making processes. The Department can more effectively engage the public and invite feedback on its proposed initiatives.**

- **The use of market mechanisms alone is an inadequate substitute for regulation. There is a key role for the Department to play in providing leadership in this area by adopting a pro-active and flexible approach to spectrum management.**

Response to Notice No. DG-001-05
Consultation on a Renewed Spectrum Policy Framework for Canada and Continued Advancements in Spectrum Management

Rajen Akalu[*]

I. Introduction

The Consultation paper raises significant issues with respect to the modernization of Canada's telecommunications and radiocommunications policy and regulatory regimes.

It is to be observed the management of spectrum has followed a trend that began with highly specialized regulation based on the perceived technical limitations of the spectrum resource. The introduction of market forces signaled a sea change in conventional thinking, placing greater reliance on economic principles in the allocation of scarce resources.

As all forms of communication become increasingly mobile, the fundamental uses of spectrum is becoming a policy issue of the first order. The government will be called upon to re-examine position of vested interests as new applications for spectrum use are sought.

The effects and role of the spectrum manager and the process by which decisions formed is of prime importance in this context. The Consultation paper seeks comments aimed at strengthening these processes as well as a consideration of the technologies that are serving as a catalyst for change.

The following three recommendations emerge out the analysis of Part A and B. The first is that the Department can serve a key role in providing information on spectrum management issues by providing citizens with the information resources required to meaningfully participate in the on-going policy debate. Secondly, the Department needs to look for ways to strengthen the decision making process, by stimulating public interest and inviting feedback on proposed initiatives. Lastly, as the use of market mechanisms becomes more pervasive as a tool of spectrum management, there will be an increased requirement for forecasting demand with greater sophistication. This will involve a process of experimentation, mistake and error correction that will not be perfect, but will take into account social and political objectives and will result in the least likely adverse effects for society in the long-term.

These recommendations precipitate from the observation that the management of spectrum is no longer an esoteric technical matter but an area that raises considerable issues of public policy in the development of the communications network infrastructure. As such, the need for informing the public and raising awareness of these issues, strengthening the policy decision making process and developing a pro-active and flexible approach to spectrum management will be of prime importance in the years ahead.

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Part A

II. Proposed Changes to the Core objectives of Spectrum Policy Framework

The core objectives constitute the policy basis of the Spectrum Policy Framework (SPF) and must reflect the objectives of the Canadian telecommunications policy set out in s. 7 *Telecommunications Act* and s. 5 (1.1) *Radio Communications Act.*

The core objectives in the 2002 SPF is written in paragraph format, whereas the proposed core objectives are written in point form numbered 1-8. From the standpoint of clarity, this abbreviated form is welcomed. The numerical ordering of the various objectives implies a prioritization of objectives and thus the Department's emphasis on particular objectives that frame its mandate are therefore open to examination.

What is apparent from an initial reading of the core objectives is the increased focus on the market as the mechanism through which efficient resource allocation will be achieved. The objective of promoting economically efficient resource allocation and reliance of market forces is an objective derived from the *Telecommunications Act.* However the use of economic incentives to assign the spectrum is not specifically mentioned within s. 7 or the 2002 SPR and is proposed in the Consultation paper.

It should be appreciated that what constitutes an economic incentive will vary between market participants. In addition, given the plurality of uses and valuations of the spectrum resource, market mechanisms will always provide the best incentives. When using economic incentives then, the Department must be explicit about the precise operation of such inducements. Clarification of the exact meaning of the term 'economic incentives,' will be needed if it is to form part of the core objective.

Point four of the proposed changes to the core objectives reads "To regulate wisely and only when required." The Department proposes to omit the requirement to justify government intervention. This proposition is unsustainable as it would invite caprice rather than wisdom and confusion rather than clarity in an administrative process that demands transparency. It is assumed (or at least hoped) that the spectrum manager is acting wisely when he or she regulates. However as a statement of policy direction this objective is lacks meaning.

The proposed core objectives also omit the aim to "…support and promote innovation, research and development in new radiocommunications techniques and spectrum-based services and applications." This is a mistake. The promotion of research and development is crucial to innovation. The Department has an opportunity to play a key role in this area by stimulating not only products but ideas, which will form the very basis of future innovation.

If Canadian citizens are to be able to participate in the policy making process, they need to be informed. The Department needs to provide the basic information through which this can be accomplished. This can be achieved through the publication of reports on "Hot Topics" or key challenges facing the industry. This would provide citizens with the tools necessary to make informed decisions about the policy making process. This will be critical to the achievement of the wider social policy goals that the Department wishes to further. It is noted that the Department plans further revise its proposed changes to the

core objectives following a separate consultation, it is hoped that the issues raised above are re-visited at that time.

III. Proposed Changes to the Spectrum Policy Guidelines

Discussion of the four themes

The Department proposes a modification of the policy guidelines in the 2002 SPR organized around the four following themes: facilitating access to spectrum; making spectrum available to meet priority requirements and societal needs; improving the utilization of the spectrum resource; and the delivery of the Canadian Spectrum Management program.

The classification of the policy guidelines according to the above themes will contribute to the general understanding of how these guidelines will be applied. However, care must be taken to ensure that the categories are not regarded as distinct but rather inter-related since the Department will often be called upon to take a holistic approach in its treatment of an issue that cuts across more than one theme.

General issues concerning the proposed changes

Through its modification of the 2002 SPR policy guidelines the Department is changing its approach to spectrum management. However the format of the Consultation paper makes the proposed amendments difficult to discern. The Department has grouped new policy guidelines by theme and provided a brief rationale for the proposed change in italics with a referencing to the 2002 SPR. Close reading of the Consultation reveals the new approach that the Department is considering. But the changes that the Department seeks to make need to be explicit if they are to withstand public scrutiny in the long-term.

The Department could have created an integrated document of both new and old policy guidelines so that respondents can more easily view and comment on the proposed amendments. The rationale, provided by the Department in italics is terse and without more detailed explanation is likely to be inaccessible to a good number of respondents. Responses to the proposed policy changes follow the Department's thematic categorization and are outline below:

Theme – 1 Facilitating access to spectrum for all Canadians

The title of this theme should be reconsidered; it implies that access to spectrum by *all* Canadians should be a policy objective of the Department when this is not the case. While it can be said that all Canadians desire access to *services* that make use of the spectrum resource, not every Canadian requires access to the spectrum resource itself.

There are seven new guidelines organized under the theme the first of which deals with allocation of frequency bands to radio services. This guideline suffers from an internal contradiction. The new policy guideline 1 (PG1) discusses allocation in relation to interference while also stressing the importance of harmonizing spectrum allocations with other countries. These two ideals are difficult to reconcile; on the one hand Canada needs to benefit from the positive externality of network effects, which will be the consequence of harmonized policies. On the other hand conformity is an anathema to innovation.

First-mover advantages will be lost if Canada does not assume a leadership role in the international arena. It is important to be explicit about this inherent tension in policy making as this will be the basis of more nuanced decision making processes.

Approaches to spectrum management

The new policy reaffirms the Department's commitment to policing interference. However there are two possible approaches to policing of interference that the spectrum manager may adopt. The policy guidelines as outlined focuses on only one.

The allocation of bandwidth is an *ex ante* decision. Traditionally the spectrum manager, pursuant a 'command and control' regulatory model of spectrum management, promulgated rules regarding the issuance of spectrum and was responsible for the *ex post* enforcement of these rules.

In addition now, with the introduction of market forces, spectrum managers will need to take a more proactive role as 'market managers.' Regulatory agencies, notably the FCC for example, have become progressively more involved with the standards-setting process for technologies that make use of the spectrum. There are also proposals creating registration requirements in instances where licenced-exempt devices may impinge upon users of licenced spectrum. These enforcement solutions are is *ex ante* in orientation. It would appear new PG1 recognizes the traditional approach while failing to acknowledge the increased need for *ex ante* mechanisms and rules to resolve disputes concerning access to the spectrum resource.

It should be noted that in new PG13, under the theme of improving the spectrum resource, the Department states it will "…generally encourage the holders of area-licences and certain site specific licences to co-ordinate amongst themselves." This is not taken to apply to the relationship between licenced holders and licenced-except users of spectrum. This is an important issue and one that should be reflected in either PG1 or PG13.

Whether to designate spectrum based on use rather than user

The second proposed guideline PG2 reaffirms the Department's commitment to grouping together systems of similar characteristics and further assigning on the basis of use rather than user. The Department's stated rationale for this has been to enable access to spectrum by a greater number of potential users. This may be the case, but it may also result in economic inefficiency and sub-optimal spectrum utilization where society would be better served by limiting service providers and subjecting them to regulation. There is nothing preventing the Department regulating on the basis of use and/or users as the circumstances require. This will require the spectrum manager to take a proactive and flexible approach to management of the spectrum resource.

In the advent of technological convergence however, the distinction between use and user is becoming increasingly blurred in any event, as the uses to which spectrum may be put become more homogeneous. PG2 could does little to address the emerging phenomenon.

Economic issues

The Department has provided clarity with respect to its new policies on economic issues, licencing and secondary markets. New PG4 which deals with the economic principles of spectrum management and makes specific reference to the desire not to "…create artificial scarcity; to establish rules that ensure that competition for spectrum resources is fair and effective; and to create and maintain a stable environment for spectrum users." Presumably this policy was inspired by the mis-management of the European 3G mobile spectrum auctions in 2001. It is the function of government to ensure a fair economic return to the public where resource rents exist rather than engage in rent-seeking behaviour at the expense of market development.

Consequences of decision to omit forecasting from the policy guidelines

The stated rationale for the timely release of spectrum in new PG7 makes reference to the distinction between the release of spectrum on a licenced and licenced-exempt basis. This distinction recognizes the growing importance of technologies that make use of licenced-except spectrum. However, the Department has chosen to omit "[t]he Department will continue to forecast when, and in what situations, additional spectrum and satellite orbital positions will be released." With this omission the Department squanders a unique opportunity to engage in practices that are responsive to the needs of industry. By monitoring market conditions and providing forecasts of when spectrum will become available, the Department can provide the basic informational resources required for market participants to apply sound business acumen concerning an input factor that is limited in supply. It is hoped the Department revisits this propose policy guideline.

Theme – 2 Making Spectrum available to meet priority requirements and societal needs

This theme highlights the importance of spectrum to public safety bodies and the issues of interoperability between public safety agencies as well as the need to provide increased attention to underserved and remote areas of the country.

The new PG9 makes a provision for meeting societal needs that would not otherwise be achieved by market forces alone. There is recognition in theme 2 of potential for market failure and the need for public goods in this context. This would indicate that the market is imperfect and intervention is needed to correct this deficiency. But since regulatory decisions are also impaired because incomplete information concerning market conditions, the process by which decisions are made are of utmost importance in order to fashion public policy that is as informed as possible within a given context.

Theme 3 – Improving the Utilization of the Spectrum Resource

Relegating the requirement of research and development from the core objectives to the policy guidelines is problematic for the reasons expressed in section 2 above. However, that the Department should support the development of advanced technologies as expressed in new PG10 is a welcomed statement of policy.

Involvement in the standards setting process

The new PG11 deals with the issues of standards and does provide greater clarity to the corresponding guideline in the 2002 SPR. It also has a greater fidelity to the

Telecommunications Act objectives which also seeks the 'orderly development' of radio systems. It is likely as government will have a greater role in the standards setting process in the future and this is discussed in more detail in Part B below.

Frequency sharing technologies

Theme 3 is best served by new PG12. The new guideline greatly simplifies previous guidelines dealing with spectrum efficiency, sharing and the licensing process. As technologies become more adept at exploiting unused spectrum, the need for rules regarding how these devices interact with one another will become increasingly more significant. The Department has however chosen to omit its statement of giving increased attention to spectrum management practices "…particularly when market forces do not align with certain important public interests." This is problematic because the implicit assumption here is that market will be able to provide for the public interest when this is not the case.

Theme – 4 Delivery of the Canadian Spectrum Management Program

The Department should expand upon new PG14. The need for novel approaches to spectrum policy and practice is taking on a special significance as new technologies emerge. The government has an important role to inform the public as well as provide guidance to markets participants and intervene as required. These notions are not captured in the guidelines under theme 4.

Part B

Rather than addressing each of the Department's questions in turn. Constellations of questions are taken together and grouped by section heading. This has been done to give more detailed treatment to particular issues raised in Part B.

IV. Harmonized use of the Spectrum and Advancing Canadian Interests Internationally

Aligning policies, harmonizing use and global competition

Canada, like all countries, faces the difficulty of reconciling harmonizing its spectrum policy in the light of increased global market competition. The Department correctly identifies the positive externality of network effects that are facilitated by harmonized policies and the inflexibility that may result in the domestic context. These problems are not new. What may have changed as some commentators have noted is that standards are increasingly being embedded in software.[1] This will mean that Department will have to play a more proactive role in different types of institutions such as standards setting policies at the Institute for Electrical and Electronic Engineers (IEEE) for example. This will help mitigate the deleterious effects of path dependency.

The Consultation paper is correctly to identifies the need to 'harmonize spectrum allocations, policies, standards and regulations to the greatest extent possible' while recognizing the need to advancing Canadian interests in international fora.

[1] Philip Weiser and Dale Hatfield (2005) "Policing the spectrum commons," *Fordham Law Review* vol. 74.

However, it is not evident that Canada has much in this regard as compared to other countries. The preparations for the World Radio Conference 2007 are a case in point.

Established under the aegis of the United Nations, the World Radiocommunication Conference considers the regulatory framework to manage the international use of radio-frequency spectrum in a rational and equitable manner. The decisions taken at these conferences have a considerable impact in the domestic context. Therefore the importance of domestic preparations cannot be understated. However there seems to be little, if anything, on the Industry Canada website to stimulate public discussion on these issues. This is to be contrasted with Federal Communications Commission in the United States that has created a page providing details about the conference soliciting public comment.[2]

Clearly if Canadian interests are to be advanced they must first be understood. Individuals need be provided with the basic information required to meaningfully participate in a process that both directly and indirectly affects them. Informing people about the problem will focus attention and stimulate public interest in this topic.

While it may have been the case that previously these decisions could be taken by a small group of individuals with the requisite technical expertise, the need for larger sections of the population to become involved with the policies that will shape the development of the communications network is taking on a new significance as the technologies of communication become more pervasive.

This is totally lacking on the Industry Canada site. The information provided is woefully out-dated (the spectrum allocation chart has not been updated since 2000)

It is noted that Canada has produced a document titled "Proposed liaison statement to ITU-R Study Groups responsible for radio services - Improving the international spectrum regulatory framework."[3] But this document is only available though the ITU Telecom Information Exchange Services (TIES) service and is restricted to specified users. This is unsatisfactory. Canada's interests will be better advanced if the Department demonstrates a willingness to be transparent about its involvement with international telecommunications agencies. Public participation in this process can only serve to further Canada's interests internationally.[4]

V. Implementation of New Technologies and New Spectrum Management Concepts

Regulatory agencies are responding to advancements in spectrum utilization by developing new concepts that better characterize the emerging technologies in relation to the underlying resource. More sophisticated forms of measurement therefore will be needed in order to more appropriately calibrate the resource.

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[2] See Federal Communications Commission (2005) "World RadioCommunication Conference," <http://www.fcc.gov/ib/wrc-07/>.

[3] International Telecommunications Union (2004) "Proposed liaison statement to ITU-R Study Groups responsible for radio services - Improving the international spectrum regulatory framework" ITU-R WPIB-0043 <http://www.itu.int/md/meetingdoc.asp?type=sitems&lang=e&parent=R03-WP1B-C-0043>.

[4] International Telecommunictations Union (2005) "Who is eligible for TIES?" <http://www.itu.int/TIES/registration/index.html>.

As a general matter the spectrum has been segmented by frequency and has been transmitter-based, rather than receiver based. This approach was primarily premised on technical efficiency.

The measurement of spectrum serves two functions: First, it provides a basis for determining capacity. This is relevant to the number of users that can operate in the spectrum without causing in interference. Here, technical efficiency is based on maximizing utilization of the spectrum resource. Second, it can serve to describe the 'quality' of spectrum, that is the type of spectrum required for a given use. Here, economic efficiency is based on the maximizing value of the spectrum resource. Though it must be remembered that spectrum is subject to both public and private valuation and failure to recognize this will result in social inefficiency.[5]

The concepts used in spectrum management should not be thought of as static; they establish a framework for making use of a common resource. New technologies such as ultra-wide-band, software defined radio and cognitive radio challenge our conceptual understanding because their deployment would be favoured by alternate method of characterizing the resource.

The Department should not define concepts in such a way to favour one technology over another; indeed which, if any, of these technologies will become dominant in the future is an uncertainty that cannot (and should not) be the subject of a determination by the Department. The Department is however able to monitor developments in the area and seek to reduce entry barriers where possible. This can be done through the publication of its own research into the state-of-the art in relation to a given technology. This will help both the Department as well as industry better understand the market and make more informed policy and business decisions. This process will necessarily be heuristic but is likely to produce better outcomes in this dynamic context.

Other forms of measurement

Frequency is not the only to way measure spectrum. It may also be possible to provide measurements based on power or time. The measurement of power is of particular significance to underlay technologies such as UWB that operate below the noise floor. UWB has been the subject of an earlier Consultation by the Department.[6]

The Department is directed to the recent spectrum framework review completed by the UK regulator OFCOM.[7] The review considered the issue of entitlements based on power concluded that this has the potential for causing interference which is a particular concern for licenced users. As the Department will be aware the FCC has authorized operation of certain UWB devices on a licenced-exempt basis (pursuant to Part 15 of the FCC rules). It is generally understood that individuals wishing to make use of UWB technology will

[5] William Melody (1980) "Radio Spectrum Allocation: Role of the Market," *American Economic Review* Vol. 70 No. 2.
[6] Industry Canada (2005) "Consultation Paper on the Introduction of Wireless Systems using ultra-wideband technology," <http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/vwapj/spfconsultation2005-e.pdf/$FILE/spfconsultation2005-e.pdf>.
[7] OFCOM (2005) "Spectrum Framework Review," <http://www.ofcom.org.uk/consult/condocs/sfr/sfr/sfr_statement>.

likely find it impossible to negotiate with the various licenced holder spectrum over which their devices operate. But the more pressing concern is that failure to take regulatory action will result in a grey market for UWB technologies in Canada.

The Consultation document did not consider entitlements based on time. Such a measurement would allow third party unlicenced users to temporarily make use of spectrum. This would enable licenced holders to permit 'opportunistic access' but this may be unworkable in bands where multiple users share the same spectrum. It may be worthwhile for the Department to investigate this metric in relation to the spectrum resource.

Other technologies the Department should be investigating

The Consultation document does not discuss the issue of mesh (or collaborative gain) networks. A mesh network is a local area network where each device on the network simultaneously connects to and communicates with all devices in range. Other devices are then used as intermediaries for passing transmissions. This represents a cost-effective way to increase network access. Mesh networks can use higher-speed, shorter range frequencies than conventional radio communications devices. This may serve to facilitate the deployment of UWB and has even been suggested that is could supersede the need to allocate spectrum for mobile use. [8]

VI. Licence-exempt Spectrum

The Department is correct to point out that the success of licence-exempt devices has been stimulated in part through the proactive efforts of industry standards bodies such as the IEEE. However the initial allocation is a decision for which the Department is responsible. Determining how much spectrum should be allowed for licence-exempt use is a difficult one. There is no 'right answer' to this, rather it will be an ongoing process of industry monitoring and decision making.

Two conceptual notions may assist the Department in this regard. First, is the notion of inter-regulation. This would be taken to concern governing the relationship between licenced and licence-exempt spectrum. Second is the notion of intra-regulation. This would deal with need for regulation within licence-exempt 'commons' in order to prevent the 'tragedy of the commons' problem. Here, the distinctions between reactive *ex post* and proactive *ex ante* approaches to enforcement are of particular relevance.

The Department proposes oversight for certain licence-exempt devices through processes such as device registration and spectrum coexistence etiquettes. These approaches might be categorized as *ex ante* intra-regulation. As the devices that make use of licenced exempt spectrum increase, so too will the need to provide protocols that prevent interference. While the market is one of the tools that the Department can make use of in bringing about wealth effects for Canadians, it is not the only tool. The Department will also be called upon to facilitate the standards setting process. This will involve monitoring the development of new standards as well as shepherding market participants through impasses.

[8] ITU (2004) "Advanced wireless technologies and spectrum management," <http://www.itu.int/osg/spu/ni/spectrum/RSM-AWT.pdf>.

The efficacy of a registration process (*ex ante* inter-regulation) to facilitate band sharing between licenced and licence-exempt spectrum is unclear. The adoption a registration process does have the potential to lower transaction costs and barriers to market entry. They have been used with some success in the UK. Care must be taken in order to ensure that registration requirements do not create bottlenecks and are not an undue administrative burden on industry.

VII. Licenced Spectrum

The Consultation questions regarding licenced spectrum concern the flexibility of existing licences as well as the transfer and divisibility privileges that should be afforded to licencees.

The current treatment of issues concerning licenced spectrum have centred largely around secondary markets and trading. This has been typically treated as an economic issue which is better facilitated by well defined legal entitlements that will prescribe the transaction costs associated with the exchange.[9]

The economic theory of well-functioning market highlights a number of factors required for effective operation. These include: a) ease of market entry and exit by both buyers and sellers b) absence of a significant monopoly power c) all relevant demands are represented in the market place d) absence of public goods e) full information on prices and products available to all participants and f) mechanisms for facilitating market transactions at minimum cost and delay.

Users of licenced spectrum range from mobile operators, T.V. broadcasters, emergency services personnel as well as satellite operators. The range of users and uses of spectrum makes it clear that the market is highly imperfect and that the application of a fully fledged market system for spectrum management is therefore limited. Where policies result in an excessive number of participants, a reduction in technical performance may be experience. This will result in spectrum inefficiency.

This said a number of countries have implemented spectrum trading with varying degrees of success. A recent OECD report on this issue is instructive and highlights a number of the benefits and concerns associated with spectrum trading and secondary markets.[10] The report concludes that most countries that have adopted a phased approach to trading, affording regulators time to facilitate spectrum reorganizing markets as well as the opportunity to become more familiar with the new patterns of ownership.

Ownership reconfiguration and use variation are key themes of spectrum liberalization and trading. There are a wide range of possibilities in this to shape the middle ground between open markets and direct regulation in this context. It is submitted that the use of market forces also requires proactive management and public involvement in the decision-making process.

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[9] R. Coase (1959) "The Federal Communications Commission," *J. Law Econ.*, vol 2.
[10] OECD (2005) "Secondary Markets for Spectrum: Policy Issues," <http://www.oecd.org/dataoecd/59/2/34758854.pdf>.

Given the impossibility of predicting demand and dynamic nature of technical innovation a departure from the traditional command and control structure is warranted. However, in light of the fact this market is highly imperfect; mechanisms for error correction must be considered and taken into account. Our faith in market forces must be informed by experience. Otherwise we will be proceeding on the mere belief that the market will somehow work, as was the case with the 3G auctions in Europe.

Thus as the use of market mechanisms for spectrum management becomes more widespread the need for both monitoring of the market and the prediction of future demand will become greater.[11] It is submitted then that the market will not deliver on its promise of greater economic growth without balancing economic imperatives together with social and political values within prescribed technical parameters.

[11] In this regard the Department is directed to the recent publication of the UK Independent Audit of Spectrum Holdings (2005) "Spectrum Demand for non-government services 2005-2025," <http://www.spectrumaudit.org.uk/pdf/spectrum_demand.pdf>. This report by Analysys Consulting Limited and Mason communications is part of a comprehensive independent audit of spectrum holdings in the UK by Professor Martin Cave. The reprt forecasts spectrum demand for non-government services 2005-2025. It makes scenario-based demand projections focusing on the next 10 years but extending to 20 years, for cellular, fixed link, broadband wireless access, satellite and terrestrial TV broadcasting services, and concentrating on the major uses and users of the spectrum below 15GHz.