

Rules of (Dis)engagement: Regulating to Tackle Spectrum Demands in a Wire-Free World

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INTRODUCTION

In the past decade, there has been a significant increase in the deployment of wireless access services (WAS). This in turn has markedly increased the demand for radiofrequency spectrum.¹ At present, regulators are grappling with the problem of designing an effective regulatory framework to govern the deployment of WAS.² The *Radiocommunications Act 1992* (Cth) and the underlying *Broadcasting Services Act 1992* (Cth), and *Telecommunications Act 1997* (Cth) are hence being re-examined in the context of enhancing the efficacy of spectrum access and management.

This article outlines the legal reform discourse in Australia on the proper regulation of WAS. The paper begins by outlining the laws governing licensing arrangements in Australia, and considers the issues raised by the Australian Competition and Media Authority (ACMA) in its 2006 *Wireless Access Services Report*.³ Specifically the option of private park spectrum licensing put forward by ACMA is considered in the context of the industry response to date. In this context, attention is also given to ACMA's design of a new domestic *Radiofrequency Spectrum Plan* for release in 2009.⁴

1. THE NEED FOR ADEQUATE SPECTRUM TO SUPPORT EMERGING TECHNOLOGIES

Increased spectrum needs to be released in order to support

emerging technologies such as WiMAX and fourth generation mobile phone standards.⁵ Wireless ISPs play a key role in making broadband available in both metropolitan and regional areas, but unless they have the requisite spectrum available to them, they will be unable to support emerging nation-wide networks.⁶

High demand for spectrum to support WAS has become particularly evident over the last five years. ACMA noted in the *Wireless Access Services Report of 2006*:

From small local area networks (LANs) supporting internet access in the industrial, scientific and medical (ISM) bands (2.4 and 5.8GHz) about six years ago, there is now demand for regional area networks and networks providing Australia-wide coverage. A number of enterprises have already established city-wide networks, and the number of networks in regional towns continues to grow. The continuing increase in the use and capabilities of cellular mobile networks, and the increasing development and demand for converged devices using broadband, is increasing the pressure to provide spectrum to support these services.⁷ <http://www.youtube.com/watch?v=OuQRqGuYa80&feature=related>

In particular, the unmet demand for broadband wireless access

licences in the 1900-1960 MHz bands,⁸ has highlighted the need for a new strategy to provide sufficient spectrum to support future WAS. Demand is being driven by a number of factors including the requirement for greater bandwidth to cater for new services and applications and the expectation that these applications will be available anywhere and anytime. Demand for wireless access is also being created by the limited access to high rate data services in regional and remote areas. Finally, demand for spectrum is being strengthened by international trends that have resulted in the increased availability of low cost equipment and other benefits from international spectrum harmonisation.⁹

Issues that Need to be Addressed

Over the past three years, the ACMA strategy for WAS has been to attempt to develop a regime that ensures sufficient spectrum is available to meet current and future demand through the use of technology flexible arrangements.¹⁰ ACMA claims that these arrangements should have the dual goal of both stimulating competition and acknowledging the varying needs of consumers across rural and metropolitan centres. ACMA has identified a number of specific issues that must be given closer consideration in order to meet wireless needs. These include:

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- a) identifying the amount of spectrum needed to meet both current and future demand;
- b) identifying where spectrum is needed and when it should be released;
- c) determining the most suitable frequency bands taking into consideration factors such as economies of scale, global harmonisation of regimes, the current services available and the importance of providing spectrum within a reasonable timeframe;
- d) determining the most efficient and flexible way to make spectrum available – in particular, the most efficient licensing regime; and
- e) balancing the needs of existing and new users.¹¹

Prior to the consideration of how best to address these issues, it is useful to examine the present regulatory framework.

2. THE PRESENT REGULATORY FRAMEWORK

In most instances, in order to operate wireless technology users have to be able to utilise radiocommunications equipment and also supply a telecommunications service. There are two main types of licensing regimes relevant to WLAN technology:

- a) Radiocommunications licensing under the *Radiocommunications Act* which covers the use of radiocommunications equipment within the radio frequency spectrum.
- b) Telecommunications licensing under the *Telecommunications Act* which covers carrier licences that authorise the use of network units for the supply of telecommunications services to the public.

There are three types of radiocommunications licences: apparatus, class and spectrum. The apparatus licensing¹² format involves coordinating radiocommunications devices with existing licensed services. If coordination is successful, a licence is issued to authorise operation of that device at a specified site or within a specific area. The licence specifies conditions – such as frequency, transmit power and emission type – may be issued up to five years¹³ and renewed on expiry.

In comparison, class licensing¹⁴ allows licence holders to operate radiocommunications devices in designated segments of spectrum on an uncoordinated and shared basis. Under this approach users do not have to apply to the ACMA to operate a class licence spectrum and no other fees are payable. The downside of this "spectrum commons" regime is that devices do not receive interference protection and are not coordinated in terms of location and number of devices in operation, thus being difficult for providers to guarantee quality of service.

Finally, a spectrum licensing¹⁵ framework provides exclusive spectrum access to what is potentially a large geographical area (state or nation wide for example) where the holder of the licence is responsible for the deployment of the network and management of the quality of the service within the boundaries of the generic framework. Spectrum licences can be issued for up to 15 years and are usually issued via an auction.¹⁶

ACMA observes that traditionally, interference is managed under apparatus or spectrum licences by allowing each user an exclusive specified frequency band.¹⁷ The most notable inefficiency of this arrangement is that users may not use their exclusive spectrum space

to its maximum amount all the time.

ACMA acknowledges that there is a variety of specific challenges associated with licensing WAS.¹⁸ These involve getting the right pricing and delivery mechanisms across the country, and ensuring opportunities for smaller carriers to compete with established telecommunications carriers – especially in regional areas. ACMA also notes the need to make spectrum as widely available as possible while avoiding what ACMA terms the "tragedy of the commons": the unfettered use that can occur under class licences, which can make the band less than effective. Finally, ACMA acknowledges the need to reduce the dead zones (i.e. areas where service is unavailable) that sometimes occur at the boundaries of spectrum licence areas.

3. IMPROVING SPECTRUM MANAGEMENT

In order to gauge the demand for future WAS and the associated spectrum needed to support requirements, ACMA released a discussion paper, *Strategies for Wireless Access Services* in February 2006.¹⁹

ACMA sought input on a variety of critical issues including the amount of spectrum required to meet current and future demand, where spectrum is needed and when it should be released, how to best make spectrum available and how to best balance the needs of new and existing users.²⁰ The paper also sought industry views on the most suitable frequency bands, and identified a number of candidate frequency bands for WAS.

WAS Licensing and Allocation

The central issue that the respondents identified as critical was that of WAS licensing and allocation. Most WLANs presently operate radiocommunications

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equipment under class licences including citizen band radios, mobile phone handsets, cordless telephones and other low output devices - including radio microphones. Of the forty seven submissions received in response to the paper, twenty three indicated there was presently insufficient spectrum to support WAS. Three submitted there was already sufficient spectrum and the remainder did not comment.²¹

The respondents were in agreement that the regulatory regime must be flexible enough to encourage innovation and new technologies. Respondents further agreed that it was critical to guarantee quality of service under spectrum or apparatus licensing and vital for commercial viability. Low to moderate costs for apparatus licences made such arrangements particularly attractive in rural areas. In terms of the broad technology issues, the majority of respondents favoured globally harmonized spectrum allocations utilising technology-neutral or technology flexible regulatory frameworks.²²

Apparatus, Spectrum and Class Licensing Arrangements

Opinion on the effectiveness of the present regulatory framework varied. Some respondents were satisfied with the current licensing regime (apparatus, spectrum and class) but the majority preferred a combination of only two regimes for WAS with spectrum being preferred for high density areas and apparatus licensing having more support in rural areas.

The greatest divergence of opinion was in relation to the adequacy of the present class licensing arrangements. Some respondents suggested it was not suitable for WAS due to its inability to guarantee quality of service.²³ Sixteen submissions suggested that spectrum allocation was preferable for WAS with a number of

respondents favouring auctions in higher density areas. Nevertheless, some respondents suggested auctions were unsuitable in rural areas because they did not stimulate competition and they often resulted in high bids. Regardless of allocation method, many respondents commented that licence prices should not be a barrier for entry.

Bands

The *Wireless Access Services Report* identified several bands that could be made available for WAS in the short, medium and long term. Most comment was received on some of the medium bands including the 2500-2690HZ band - potentially a spectrum that is suitable across Australia for WAS applications using technologies such as WiMAX. The overwhelming majority of comments from both small and large WAS operators, manufacturers and interest groups supported this band for reasons including, as outlined by ACMA:

- a) the global identification of the band for WAS, in particular INT-2000 and WiMAX
- b) the economies of scale and reduced equipment costs that would result from global harmonisation;
- c) the potential for interoperable equipment and international roaming
- d) the potential for the band to accommodate a range of licensing frameworks
- e) the suitability of the band for regional and rural areas due to its propagation characteristics.²⁴

Perhaps the greatest divergence of opinion was on the proposal relating to the creation of "private parks" licensing. It is useful to consider this proposal in some detail.

4. THE "PRIVATE PARKS" PROPOSAL

A central component of ACMA's 2006 proposal was a new option for the creation "private parks" which combines elements of apparatus, class and spectrum licences.²⁵ Under this framework, each licensee could use the entire spectrum band and interference would be controlled by specifying the conditions of how the licence can be used.

ACMA suggest that in order for this new framework to function efficiently, limits would be needed to prevent overpowering, and these limits could be regionally specific. The private park licence differs from the class licence in terms of control.

In class licensed bands, anyone can operate within the boundaries of the licence, whereas in a private park, entry would be restricted to those who hold a licence and this number would be controlled by varying factors such as geography.

In the *Wireless Access Services Report*,²⁶ ACMA suggested three possible park licence options:

- a) a business class option that covered an entire state or territory;
- b) an economy class option that covered low and remote spectrum demand areas within a region or state; and
- c) a discount economy class option covering remote density areas.

Respondents to the discussion paper expressed the need for caution in relation to implementing a private park framework. Although the majority of 21 responses commenting on private park did not explicitly indicate support or opposition for the concept, issues of concern were raised including the need to further clarify the rights and responsibilities of licensees and the

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need for a transparent process for managing conflict.

Five submissions explicitly opposed the private park concept.²⁷ It was doubted whether the proposed framework would offer more than what was currently being offered. There were concerns that a private park framework would not offer licensees the necessary quality of service to deliver a viable commercial service. Concern was also expressed that such a scheme would lead to a considerable increase in cost of equipment which would be passed onto end users.²⁸ Finally, there was concern as to whether contention based protocols would effectively mitigate interference.

In December 2006, ACMA released the discussion paper *Strategies for Wireless Access Services: Spectrum Access Options* for public comment. The purpose of the paper, which follows on from the *Strategies for Wireless Access Services* discussion paper released in February 2006 was to provide a brief overview of demand for wireless access services and the estimated future spectrum required to support it, and provide a brief summary of the responses received to the discussion paper released in February. The report also sought to identify bands that ACMA believes are currently the most suitable candidates for WAS in the short, medium and long term and discuss and seek detailed comments on the identified bands, including some high-level options for band segmentation and licensing.

The full ramifications of the report have yet to be considered at the time of publication. In light of the change in Government at the end of 2007, there is yet to be a considered follow up of this report at the time of publication. Instead attention in the area has switched

to the drafting of a new Australian Radiofrequency Spectrum Plan.

5. THE NEW AUSTRALIAN RADIOFREQUENCY PLAN

In August 2008 however, the ACMA released a draft of a new *Australian Radiofrequency Spectrum Plan* (the Spectrum Plan) for public comment.²⁹ The Australian Radiofrequency Spectrum Plan divides the radiofrequency spectrum into frequency bands, and specifies the purposes for which the bands may be used, in accordance with the requirements of s 30 of the *Radiocommunications Act 1992*. It is intended to:

- a) provide a basis for management of the radiofrequency spectrum in Australia;
- b) inform radiocommunication users about the services allocated to each frequency band, and of any conditions attached to those allocations;
- c) reflect Australia's treaty obligations as a member of the International Telecommunication Union (ITU); and
- d) provide details of international frequency allocations agreed by the ITU for the three world regions as contained in the ITU Radio Regulations.

The proposed changes in the draft Spectrum Plan provide new spectrum opportunities for international mobile telecommunication, space research activities, radio astronomy, mobile-satellite services and harmonisation between space and future terrestrial services. The changes were agreed internationally at the International Telecommunication Union World Radiocommunication Conference held in October to November 2007.

Changes have also been proposed to reflect domestic developments considered in the earlier ACMA reports, mainly associated with enhancing future flexibility for anticipated growth in radiocommunication services in Australia.

The ACMA suggest proposed changes to the plan will provide protection of space research activities while allowing the use of new high data-rate meteorology satellite services and upgrade of the radiolocation service to primary and allocating additional spectrum to the existing space research activities. The plan will also regulate the sharing of spectrum between the mobile-satellite service and space research services and between the mobile-satellite service and mobile service. Issues to be addressed will also include improving satellite coordination and notification procedures, achieving spectrum harmonisation between space services and future terrestrial services, and designing effective sharing arrangements between the fixed service and satellite systems using highly inclined orbits. Finally, the plan will seek to ensure spectrum compatibility between the radio astronomy service and active space services.³⁰

6. SPECTRUM MANAGEMENT ACROSS A SELECTION OF JURISDICTIONS

In an April 2008 report proposing a new framework of spectrum management principles for Australia, the ACMA examined comparative plans across a number of jurisdictions.³¹ The regulator observed:

Most jurisdictions face similar spectrum management challenges despite differences in their regulatory regimes and markets. The traditional command and control

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approach of spectrum management has become problematic as spectrum demand has started to exceed supply in some areas. These selected countries have implemented market-based spectrum planning approaches to varying degrees. Their recently released frameworks indicate that there is an emerging consensus for increasing use of market mechanisms and less focus on command and control.

Nevertheless, most regulators acknowledge that regulatory intervention is still necessary—although it should be used judiciously. An appropriate balance between market mechanisms, and command and control, is seen to lead to efficient use of spectrum, while ensuring the availability of spectrum for public interest needs such as security and public safety.³²

The United States

In the United States, the Federal Communications Commission has promoted "spectrum liberalization" by way of market based approaches. The ACMA report that in recent years such an approach has occurred in the following ways:

- establishing the Spectrum Policy Task Force (SPTF) to provide specific recommendations for ways to evolve the 'command and control' approach to spectrum policy into a more integrated, market-oriented approach;
- developing the secondary markets initiative to remove regulatory barriers and facilitate the development of secondary markets;
- allocating Advanced Wireless Services (AWS) in the 1710–1755 MHz and 2110–2155 MHz bands. Simple,

minimal interference mitigation rules are enforced and migration from 2G and 3G (or 4G) is simplified;

- approving software-defined radios (SDRs) in several bands (for example, 217–200 MHz). The SDRs identify unused bandwidth and use a selection of available channels.³³

Despite the impressive deployment of wireless access technology and services, an issue that continues to deeply challenge US regulatory development is whether consumers are more likely to benefit from market based carrier practices adopted in response to competition or, as Kennedy and Purcell state "well intended, but often misguided, assistance provided by regulators and judges."³⁴ There has been a considerable amount of commentary,³⁵ but unfortunately limited adoption in terms of government policy.

In an effort to encourage innovation, critics of the current model have proposed significant reforms. Some say spectrum should be treated like 'property',³⁶ giving purchasers the same rights afforded any property owner, including the right to exclude others from using it, and the right to transfer ownership.³⁷ In contrast, proponents of a 'commons' model argue that spectrum belongs to all of us, and that current technological innovations allow sharing of the resource.³⁸

United Kingdom

ACMA report that since late 2004 the national UK regulator Ofcom have favoured "the use of market mechanisms to manage spectrum."³⁹ The report suggests that Ofcom "sees spectrum trading and spectrum liberalisation as two key policy initiatives for maximising the use of spectrum."⁴⁰ The key policy initiatives ACMA

acknowledge that Ofcom have undertaken include:

- Ofcom undertook a spectrum management review for the public sector in 2007 and has finalised a framework to allow commercial usage of military frequencies. The objective is to improve public sector spectrum efficiency through market mechanisms. According to Ofcom, the Ministry of Defence holds about one-third of the spectrum below 15 GHz and will release a significant proportion of its spectrum holdings for commercial uses.
- Ofcom has proposed to remove restrictions from licences that currently prevent the use of 900 MHz and 1800 MHz spectrum for the provision of mobile services, including 3G services and mobile services other than 3G.
- Ofcom has proposed tradable spectrum holdings for public bodies in order to promote spectrum efficiency and encourage spectrum release and sharing.⁴¹

New Zealand

The ACMA suggest that New Zealand was at the forefront of policy development in terms of introducing market mechanisms and administrative initiatives to manage spectrum as a tradable property right. Since 1989 the Ministry of Economic Development (MED) has continued to promote market based objectives including "promoting competition, maximising the value of spectrum to society, satisfying growing demand"⁴² while at the same time "meeting the government's economic, social and cultural policy outcomes." In line with these dual goals, in 2007 the MED proposed:

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- introducing perpetual rights or statutory presumption renewal;
- extending spectrum management rights to government agencies, including participation in the market and sharing with private users;
- improving auction tools and the register system;
- applying bidding caps or competition limits when necessary;
- removing regulatory constraints such as 'use it or lose it' provisions; and
- introducing an annual fee for management rights.⁴³

Japan

In the past 10 years, the Japanese communication industry has seen enormous change. It has transformed itself from a monopoly to a competitive industry and has seen the establishment of a new wireless industry dominated by Nippon Telephone and Telegraph Corporation (NTT Docomo). As the Japanese telecommunications industry was historically characterised by a structural dependence on NTT, Japanese manufacturers received protection from foreign competition at the expense of limiting opportunity for sales abroad. However, with respect to the new technologies of wireless - in particular 3G wireless standard - NTT adopted different tactics and, in fact, strengthened the strategic global alliance with European standardization bodies for 3G systems as well as with Ericson. It has been suggested that in the context of Japan's strong economic growth in the early 1990s, the major motivation for the global alliances initiated by NTT was its objective of enabling international roaming services for the wireless telephone.⁴⁴

Malaysia

The ACMA report The Malaysian Communications and Multimedia Commission (MCMC) "released a spectrum management strategic review paper for public consultation in December 2007."⁴⁵ The MCMC's key proposals for spectrum management include:

- MCMC is considering using market-based approaches to licensing instead of the existing first-come first-serve approach;
- MCMC has commenced an online licensing assignment facility to reduce costs to business and the government; and
- MCMC is considering applying market mechanisms to government spectrum use. In the initial stage, MCMC intends to encourage government users to return under-used spectrum. The next stage will request that sufficient government funding be provided to agencies so that they can pay market prices for spectrum.⁴⁶

CONCLUSION

The *Wireless Access Services Report* is to be welcomed as setting an agenda for the reform of WAS spectrum allocation and licensing. The adequacy of the present class licensing arrangements to support WAS is a matter that requires the urgent attention of the regulator. With nearly half of the industry respondents indicating that there is presently insufficient spectrum to support WAS, this issue needs to be addressed to support the proper deployment of WAS.

The next necessary step in the reform discourse is the formulation of specific options for reform by ACMA to support the effective allocation and licensing of spectrum to support WAS. Further,

with universal agreement amongst respondents to the ACMA *Wireless Access Services Report* on the need for technology flexible arrangements, it would be useful for more detail to be provided on the nature and ambit of operation of the proposed private parks option. It is therefore regrettable that no further action has been taken on the ACMA investigation into developing specific strategies for the regulation of wireless access services.

Whilst the reforms to the *Radiofrequency Plan* are necessary and to be welcomed as they provide a platform for global harmonisation in spectrum allocation, the reforms in this area should not distract from the issue of effective spectrum regulation in the domestic economy.

¹ See further Y Benkler, 'Some Economics of Wireless Communications' (2002) 16(1) *Harvard Journal of Law and Technology* 25; and P Kolodzy, 'Dynamic Spectrum Policies: Promises and Challenges' (2004) 12 *CommLaw Conspectus* 147.

² See further P Weiser, 'Regulatory Challenges and Models of Regulation' (2003) 2 *J. on Telecomm. & High Tech. L.* 1; G Faulhaber, 'Question of Spectrum: Technology, Management, and Regime Change' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 123; and T Hazlett, 'Spectrum Tragedies' (2005) 22 *Yale J. on Reg.* 242.

³ Australian Competition and Communications Authority, *Strategies for Wireless Access Services Report*, February 2006. Available at : <http://www.acma.gov.au/web/wr/_assets/main/lib100639/>

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- was_discussion_paper_feb_06.pdf>.
- ⁴ Radiocommunications Act 1992 (Cth), s 30.
- ⁵ See further P Kolodzy, 'Dynamic Spectrum Policies: Promises and Challenges' (2004) 12 *CommLaw Conspectus* 147; J Berresford, W Leighton, 'Law of Property and the Law of Spectrum: A Critical Comparison' (2004-2005) 13 *CommLaw Conspectus* 35 ; E Goodman, 'Spectrum Equity' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 217; G Faulhaber, 'Question of Spectrum: Technology, Management, and Regime Change' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 123.
- ⁶ G Faulhaber, 'Question of Spectrum: Technology, Management, and Regime Change' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 123; T Hazlett, 'Spectrum Tragedies' (2005) 22 *Yale J. on Reg.* 242.
- ⁷ Australian Communications and Media Authority, above n 3, at 4.
- ⁸ The 1920-1960 MHz bands have been primarily used in Australia to support the increasingly popular 3G telecommunications services in capital cities.
- ⁹ Australian Communications and Media Authority, above n, 3, at 4.
- ¹⁰ Australian Communications and Media Authority, *Strategies for Wireless Access Services: Spectrum Access Options*, Spectrum Planning Discussion Paper SPP 10/06, December 2006. Available at: <http://www.acma.gov.au/web/wr/_assets/main/lib100639/was_discussion.pdf>
- ¹¹ Australian Communications and Media Authority, above n 10, at 1.
- ¹² *Radiocommunications Act 1992* (Cth) Pt 3.3.
- ¹³ *Radiocommunications Act 1992* (Cth) s 103(3).
- ¹⁴ *Radiocommunications Act 1992* (Cth) Pt 3.4.
- ¹⁵ *Radiocommunications Act 1992* (Cth) Pt 3.2.
- ¹⁶ *Radiocommunications Act 1992* (Cth) s 65(3).
- ¹⁷ Australian Communications and Media Authority, above n 10, at 24.
- ¹⁸ Ibid.
- ¹⁹ Australian Communications and Media Authority., above n 3.
- ²⁰ Australian Communications and Media Authority, above n 10, at 1.
- ²¹ Ibid 5.
- ²² Ibid 6.
- ²³ However report at page 12 suggests some respondents felt it a suitable regime for rural areas.
- ²⁴ Ibid 9.
- ²⁵ Ibid 24-25.
- ²⁶ Australian Communications and Media Authority, above n 3, at 49.
- ²⁷ Australian Communications and Media Authority, above n 10., at 13.
- ²⁸ This additional cost would come from the requirement to use contention based protocols: a communications protocol for operating wireless telecommunication equipment that allows many users to use the same radio channel without pre-coordination.
- ²⁹ A draft of the report is available at the ACMA website: <www.acma.gov.au/WEB/STANDARD/pc=PC_311349> The ACMA routinely updates the plan after each ITU World Radiocommunication Conference. When completed, the new Spectrum Plan is intended to replace the current Spectrum Plan developed in January 2005.
- ³⁰ Ibid.
- ³¹ See ACMA, *Spectrum Management Principles: Consultation on ACMA's draft spectrum management principles*. Available at : <http://www.acma.gov.au/web/wr/_assets/main/lib310643/smp.doc>.
- ³² Ibid appendix 1, at 20.
- ³³ Ibid 20.
- ³⁴ L Kennedy, H Purcell. 'Wandering along the Road to Competition and Convergence - The Changing CMRS Roadmap' (2003-2004) 56 *Fed. Comm. L.J.* 489. at 498.
- ³⁵ *Recent discussion includes* G Faulhaber, 'Question of Spectrum: Technology, Management, and Regime Change' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 123; E Goodman. 'Spectrum Equity' (2005-2006) 4 *J. on Telecomm. & High Tech. L.* 217; T Hazlett, 'Spectrum Tragedies' (2005) 22 *Yale J. on Reg.* 242; H Feld, 'From Third Class Citizen to First among Equals: Rethinking the Place of Unlicensed Spectrum in the FCC Hierarchy' (2006-2007) 15 *CommLaw Conspectus* 53 ; J Ellig, 'Costs and Consequences of Federal Telecommunications Regulations' (2006) 58 *Fed. Comm. L.J.* 37; C Jackson; R Pickholtz; D Hatfield, 'Spread Spectrum Is Good - But It Does Not Obsolete NBC v. U.S.' 58 *Fed. Comm. L.J.* 245 (2006).
- ³⁶ See further W Leighton, 'Law of Property and the Law of Spectrum: A Critical Comparison' (2004-2005) 13 *CommLaw Conspectus* 35.
- ³⁷ See for example, G Faulhaber, D Farber, 'Spectrum Management: Property Rights, Markets and the Commons' at Telecommunications Policy research Conference Proceedings (2003): paper available at

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< rider.wharton.upenn.edu/~fau
lhabe/research.html > .

³⁸ Proponents of a commons model include world renowned legal scholars including Yochai Benkler and Lawrence Lessig; *See in particular* Y Benkler, 'Some Economics of Wireless Communications' (2002) 16(1) *Harvard Journal of Law and Technology* 25.

³⁹ ACMA, *Spectrum Management Principles*, above n 31, at 21. Canada went through similar changes in policy around the same time as the UK "to respond to challenges arising from rapid technological changes and increasing spectrum demand." (Ibid 22). A more "market liberalised" approach has already resulted in deregulation of VoIP and local telephone markets.

⁴⁰ Ibid 21.

⁴¹ Ibid 21.

⁴² Ibid 21.

⁴³ Ibid 21-22.

⁴⁴ Maeda, Amar, Gibson, 'Impact of Wireless Telecommunications Standards and Regulation on the Evolution of Wireless Technologies and Services over Internet Protocol' (2006) 30 *Telecommunications Policy* 587, at 595.

⁴⁵ ACMA, *Spectrum Management Principles*, above n 31, at 23.

⁴⁶ Ibid 23. The ACMA also report that Hong Kong released a consultation paper for the management of spectrum in early 2007 designed to "achieve the policy objectives of providing transparency of decision-making and promoting Hong Kong's economic competitiveness in the world." The Office of the Telecommunications Authority (OFTA), the National regulator appears to be guided by the "principle of employing market-based approaches when

there are strong demands for spectrum, on the condition that these approaches are not focused on the maximisation of revenue".