



Spectrum Management Principles

Consultation on ACMA's draft spectrum management
principles

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Outline

This consultation paper seeks feedback on broad, high-level principles that the Australian Communications and Media Authority (ACMA) proposes to use in its management of the radiofrequency spectrum.

The first chapter provides information on ACMA's consultation arrangements, including details on how to make submissions on this consultation paper, and ACMA's policies on the publication of consultation submissions.

Chapter two provides introductory information including a description of the legislative and policy environment and the aims of the principles.

Chapter three sets out principles of good regulatory process and outlines the total welfare standard framework which ACMA will use to assess feasible options.

Chapter four discusses general regulatory issues.

Chapter five sets out the proposed spectrum management principles.

Appendix one outlines some recent initiatives towards spectrum liberalisation by regulators in other jurisdictions.

As set out in Chapter five, the principles that ACMA is proposing are:

- allocate spectrum to the highest value use or uses;
- enable and encourage users to move spectrum to its highest value use or uses;
- use the least cost and least restrictive approach to achieving policy objectives;
- balance certainty and flexibility; and
- balance the cost of interference and the benefits of greater spectrum utilisation.

Submissions about the principles should follow the requirements set out in chapter one.

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1 Consultation

ACMA invites comments and feedback on the spectrum management principles that are proposed in this paper. ACMA intends to use these principles to guide its approach to spectrum management initiatives.

At the same time as releasing the draft principles for comment, ACMA is also releasing:

- The *Five-year Spectrum Outlook 2009–2014*, which outlines issues affecting spectrum requirements of key radiocommunications services over the next five years and ACMA's proposed actions to address these issues.
- The *Independent Review of Government Spectrum Holdings* and ACMA's response to that document.
- *Spectrum Options: 403–520 MHz*, which is being released to stimulate discussion and solicit information from stakeholders to assist ACMA in developing future arrangements for the radiofrequency spectrum from the 400 MHz band.

The spectrum management principles, once finalised, will form the framework that will guide ACMA's response to the demand pressures identified in the Five-year Spectrum Outlook. These two documents are intended to describe the framework ACMA will apply and to place in context ACMA's approach to significant spectrum management issues over the next three to five years. These issues include, among others, any spectrum released following the cessation of analog television services¹, government spectrum holdings, expiring spectrum licences, the availability of spectrum for wireless access services and options for the 403–520 MHz band.

The release of these papers has been timed to precede ACMA's radiocommunications conference RadComms08, from 30 April to 2 May in Melbourne. This is to allow interested parties to familiarise themselves with the papers in order to facilitate discussion at the conference. In addition to the opportunities available during the conference and the invitation to provide written submissions, ACMA is interested in hearing from parties who would like to discuss the issues raised in these papers. ACMA will consider the value of meetings, workshops and seminars based on the level of interest and availability of resources. There will also be an opportunity for representatives of the various radiocommunications sectors to engage with ACMA on the issues covered in these papers

¹ ACMA recognises that, under s.31 of the Radiocommunications Act, decisions about the future requirements of broadcasting are made by the Minister. The principles and discussion in this paper apply to ACMA's radiocommunications decisions; such as spectrum that may be removed from the broadcasting services bands following the cessation of analog television services.

during the next meeting of ACMA's new advisory group, the Radiocommunications Consultative Committee.

The consultation strategy outlined here is in line with ACMA's new approach to consultation on spectrum matters, announced earlier this year.²

WRITTEN SUBMISSIONS

Submissions on the issues raised in this discussion paper may be made to ACMA as follows:

By email: spectrumprinciples@acma.gov.au

By mail: Mr Michael Poole
 Manager
 Regulatory Futures Section
 Australian Communications and Media Authority
 PO Box 78
 Belconnen ACT 2616

The closing date for submissions is 18 July 2008.

Electronic submissions in Microsoft Word or rich-text format are preferred. Please direct any questions about this discussion paper to Michael Poole on telephone: 02 6219 5505 or email to spectrumprinciples@acma.gov.au.

Publication of submissions

In general, ACMA publishes all submissions it receives. However, ACMA will not publish submissions that it considers contain defamatory or irrelevant material.

ACMA prefers to receive submissions that are not claimed to be confidential. However, ACMA accepts that a submitter may sometimes wish to provide information in confidence. In these circumstances, submitters are asked to identify the material over which confidentiality is claimed and provide a written explanation for confidentiality claims.

ACMA will not automatically accept all claims of confidentiality, but will consider each claim on a case-by-case basis. If ACMA accepts a confidentiality claim, it will not publish the confidential information unless required to do so by law.

When can ACMA be required by law to release information?

ACMA may be required to release submissions by law under the *Freedom of Information Act 1982* (Cth) or for other reasons, including for the purpose of parliamentary processes or court subpoena. ACMA will seek to consult submitters of confidential information before providing that information to another body or agency, but ACMA cannot guarantee that confidential information will not be released through these or other legal means.

Sharing of information

Under the *Australian Communications and Media Authority Act 2005* (the ACMA Act), ACMA is able to disclose submissions to the Minister; the Department, including authorised officials; Royal Commissions and certain Commonwealth authorities such as the Australian

² More detail can be found at: <http://www.acma.gov.au/WEB/STANDARD/pc=PC_310939>.

Competition and Consumer Commission (ACCC) and Australian Securities and Investments Commission (ASIC).

If information is accepted by ACMA as confidential, ACMA will seek to consult with the submitter of the information where ACMA intends to share that information.

2 Foreword

The purpose of this paper is to consult on the principles ACMA is proposing to use to guide its approach to a range of significant spectrum management initiatives in the next three to five years.

One important aim in developing these principles is to provide increased transparency to stakeholders about the framework ACMA will adopt in fulfilling its statutory spectrum management functions.

2.1 Background

Governments have regulated spectrum to facilitate the provision of wireless services since radiocommunications services began in the early 20th century. Governments and operators determined that the frequencies used by wireless services needed to be systematised to gain maximum benefit from the new technology and to prevent interference. Common frequencies were assigned for distress and safety communications, and radio broadcasts were assigned unique frequencies to control interference.

Technical regulations to control interference were seen as the key to making spectrum more usable. Interference control was based on grouping like services into bands and assigning different channels to different users. Transmitters and receivers relied on frequency separation and guard bands to operate effectively and reduce the risk of excessive interference.

Radiocommunications technology has been in continuous development. In recent decades, wireless technologies have utilised the ongoing increases in speed and capability of microprocessors to provide a range of new and advanced services. Technology has also extended the useable spectrum into higher and higher frequency bands, and made more efficient use of existing frequency bands through greater tuning abilities, more precise rejection of unwanted signals, better noise suppression, greater antenna directionality and enhanced signal compression.

Advanced services created by technological developments have been readily taken up by consumers and industry, leading to increasing demands for access to spectrum for commercial applications. This has been accompanied by greater demands for spectrum from advances in radio astronomy, weather and climate information services, and satellite and space services. The communications requirements of defence, security services, police and emergency services have become increasingly sophisticated, necessitating greater bandwidth and increased access to spectrum.

Developments in technology and demand for new services have created excess demand for spectrum in some frequency bands and geographic areas. Increasing the supply of spectrum

that can be used by applications in highest demand is complicated by the presence of legacy technologies and the slow but necessary process of harmonising spectrum allocations internationally. Competition for spectrum is most acute in the UHF and SHF bands below 5 GHz, where propagation characteristics are most advantageous and bandwidth is available. However, this demand is concentrated in dense population areas. There is often ample spectrum available in less populated areas and at higher frequencies.

There has been growing international recognition that the best outcome for areas of excess demand may be achieved if the regulator facilitates the application of market forces to help allocate the spectrum. Economists have been advocating market approaches since the 1960s, and spectrum regulators have become progressively more sophisticated in applying these approaches since the late 1980s. Technical regulation has increasingly been seen as necessary but insufficient to maximise the public benefit from use of the spectrum.

Australia has been in the forefront of developments in spectrum regulation. Administrative incentive pricing³ has been used since the 1980s; trading and technologically flexible spectrum licences were introduced in the *Radiocommunications Act 1992* (the Radiocommunications Act) and implemented from the late 1990s. Regulators in other jurisdictions have also been applying these approaches (see Appendix 1). The Federal Communications Commission (FCC) in the US has been at the forefront of spectrum auctions, while the Office of Communications (Ofcom) in the UK has developed frameworks for setting administrative incentive prices and from around 2004 has been progressively moving towards greater use of market and regulatory mechanisms.

2.2 Legislative and policy environment

The ACMA Act sets out the spectrum management functions of ACMA, including:

- managing the radiofrequency spectrum in accordance with the Radiocommunications Act; and
- to advise and assist the radiocommunications community.

In managing the radiofrequency spectrum, ACMA is guided by the object of the Radiocommunications Act. The object of the Act is to provide for management of the radiofrequency spectrum in order to:

- a) maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum;
- b) make adequate provision of the spectrum:
 - i) for use by agencies involved in the defence or national security of Australia, law enforcement or the provision of emergency services; and
 - ii) for use by other public or community services;
- c) provide a responsive and flexible approach to meeting the needs of users of the spectrum;
- d) encourage the use of efficient radiocommunication technologies so that a wide range of services of an adequate quality can be provided;

³ Administrative incentive pricing is the setting of prices for licences allocated over the counter above the level of cost recovery in order to encourage efficient use of the spectrum. ACMA does this through the tax on apparatus licences.

- e) provide an efficient, equitable and transparent system of charging for the use of spectrum, taking account of the value of both commercial and non-commercial use of spectrum;
- f) support the communications policy objectives of the Commonwealth Government;
- g) provide a regulatory environment that maximises opportunities for the Australian communications industry in domestic and international markets;
- h) promote Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.

ACMA also has related spectrum management obligations under the *Broadcasting Services Act 1992*, which guide the use of spectrum in the broadcasting services bands⁴. ACMA will continue to be guided by the objects of that Act in making decisions on matters that fall under that Act.

ACMA must consider government policies in the performance of its functions. The Minister may also give written directions to ACMA about the performance of its functions under the Radiocommunications Act.

Radiocommunications licences are also subject to provisions in the *Trade Practices Act 1974*, which prohibit acquisitions that result in a substantial lessening of competition.

ACMA has a number of agency-wide policies, including a corporate plan. This includes policies such as:

- help identify and remove unnecessary regulatory barriers to the delivery of communications products and services;
- take appropriate regulatory action to achieve policy objectives, with actions that are evidence-based, proportionate, consistent, accountable and transparent;
- regulate in a technology-neutral manner wherever appropriate to enable industry to determine how products and services are provided; and
- work with all stakeholders to maximise the extent to which the regulatory framework addresses the broad concerns of the community.

The spectrum management principles articulate how ACMA will manage the spectrum, subject to the statutory framework and the policies outlined in its corporate plan.

2.3 Aims of the principles

The principles are designed to increase the transparency, predictability and consistency of ACMA's decision-making in a climate of rapid technological change and increasing demand for new services. While technical progress has always been a feature of radiocommunications, new sharing technologies such as cognitive radio and the demand for wireless access services—including broadband—mean that the future is likely to be qualitatively different from the past.

In light of the increasing demand for spectrum, and the significant planning and allocation decisions to be made over the next three to five years, it is timely to seek industry views on the best principles on which to base these decisions.

⁴ The broadcasting services bands are those parts of the radiofrequency spectrum that, under s.31 of the Radiocommunications Act, are designated as being primarily for broadcasting purposes.

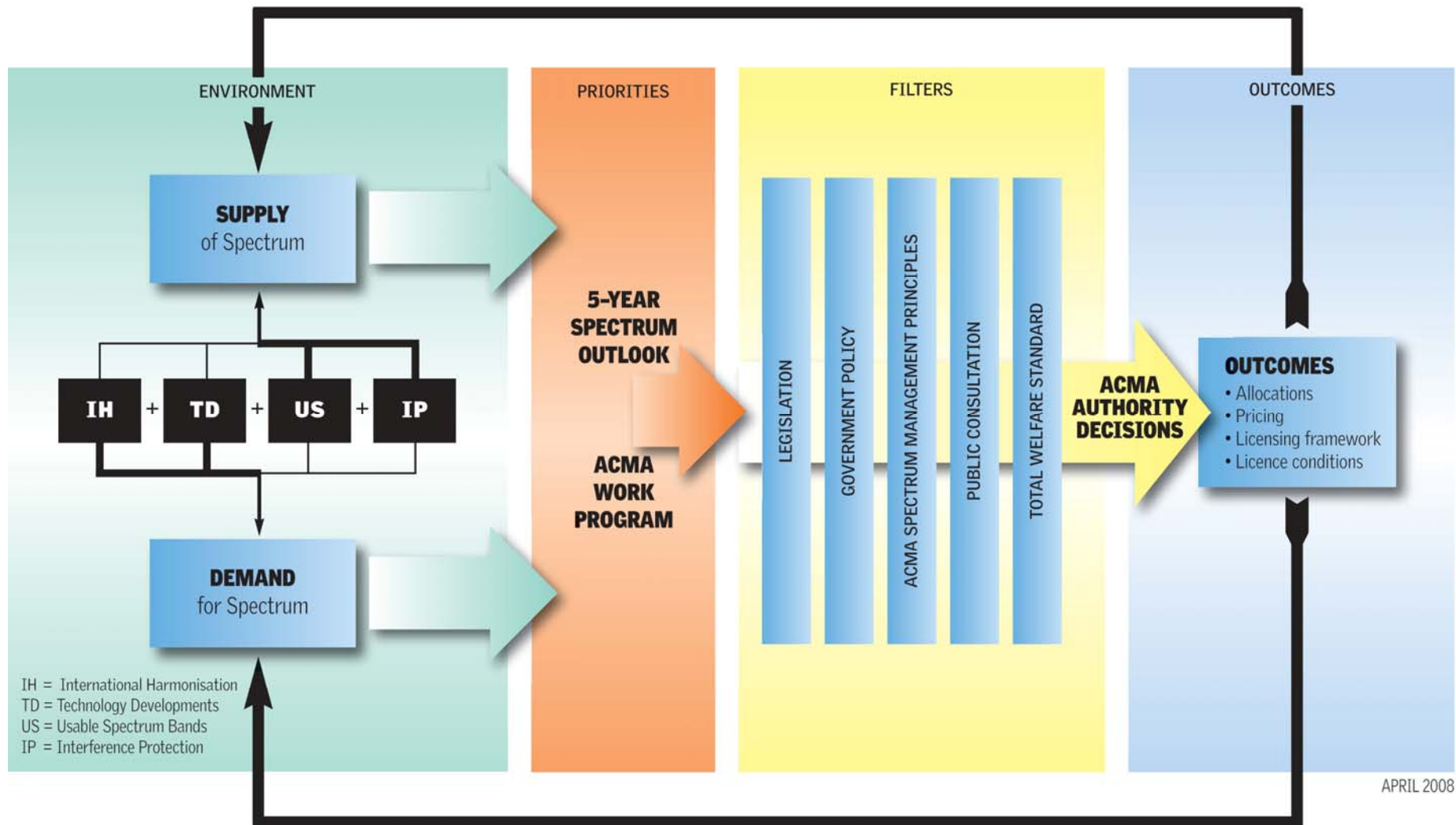
The spectrum management principles are intended to help ACMA optimise the use of market mechanisms and regulatory intervention, in order to maximise the overall public benefit derived from the radiofrequency spectrum.

The principles aim to:

- promote consistency, predictability and transparency in ACMA’s decision-making;
- provide guidance for major planning and allocation decisions to be made over the next few years; and
- increase ACMA’s ability to respond to challenges, including the impact of new technologies and increasing demand for spectrum for advanced services.

Figure 1 illustrates ACMA’s spectrum management decision framework. It shows the use of the spectrum management principles and other filters used in making decisions on spectrum management.

Figure 1 ACMA Spectrum management decision framework



3 General regulatory principles

3.1 Principles of good regulatory process

In 2006, the government endorsed the following six principles of good regulatory process identified by the *Taskforce on Reducing Regulatory Burdens on Business* (Regulation Taskforce 2006):

1. Governments should not act to address ‘problems’ until a case for action has been clearly established. This should include establishing the nature of the problem and why actions additional to existing measures are needed, recognising that not all ‘problems’ will justify (additional) government action.
2. A range of feasible policy options—including self-regulatory and co-regulatory approaches—need to be identified and their benefits and costs, including compliance costs, assessed within an appropriate framework.
3. Only the option that generates the greatest net benefit for the community, taking into account all the impacts, should be adopted.
4. Effective guidance should be provided to relevant regulators and regulated parties in order to ensure that the policy intent of the regulation is clear, as well as the expected compliance requirements.
5. Mechanisms are needed to ensure that regulation remains relevant and effective over time.
6. There needs to be effective consultation with regulated parties at all stages of the regulatory cycle.

ACMA will take account of these principles for its regulatory process in relation to spectrum management.

3.2 ACMA’s framework for the assessment of options

The second principle of good regulatory process suggests using an appropriate framework to assess a range of feasible options. ACMA will adopt a *total welfare standard* as its overarching framework for assessing the optimal approach to individual spectrum management issues. Consistent with this, ACMA will consider the impact of the alternative regulatory approaches on affected parties, including the organisations that use or would like to use spectrum, consumers, government and other members of the public. Where a spectrum management decision will have a significant economic impact, ACMA may draw on quantitative or qualitative analysis to assess the impact of alternative allocations on total welfare.

The total welfare standard has been used by other regulators, such as the Australian Competition Tribunal and in some of the recent reviews conducted by Ofcom in the UK (see

Appendix 1). It is also consistent with the approach outlined by the Office of Best Practice Regulation for government entities that review or make regulations.⁵

Background: Welfare economics basis for a total welfare standard

The Kaldor-Hicks compensation principle provides a framework for analysing whether or not regulatory intervention enhances welfare for society as a whole.⁶ This principle leads us to conclude that a regulatory intervention is economically efficient and welfare-enhancing if, in theory, it is possible for the winners to compensate the losers and not be worse off.

This principle provides the foundation for the concept of economic surplus and the basis of most of the economic public interest tests used by competition authorities and other regulatory authorities in Australia and New Zealand, among others.

Components of economic surplus

Economic surplus is the difference between willingness to pay and opportunity cost. The effects of a regulatory change on economic surplus can be considered in terms of its effects on:

- consumers acquiring goods or services in the affected market;
- producers operating in the affected market;
- others in society who are not parties to transactions in the relevant market but are affected nonetheless, including through the impact on the provision of public goods⁷; and
- government revenue.

The effect of a regulatory change on total welfare can be described as the sum of these effects.

In considering the impact on total welfare of alternative approaches to a spectrum management matter, the expected benefits and costs to all parties are accorded the same weight irrespective of the identity of the affected party.

In spectrum management it is also likely to be particularly important to ensure the regulatory framework promotes dynamic efficiency. In this context, this is likely to be associated with the speed at which new applications reach consumers (households and firms), contributing to enhanced production and consumption possibilities, and economic growth.

Subject to the statutory framework, ACMA will adopt a *total welfare standard* as its overarching framework for assessing the optimal approach to individual spectrum management issues.

⁵ See for example, the Best Practice Regulation Handbook, August 2007, P XI, p 54-55, and p 68

⁶ The Kaldor-Hicks compensation principle was initially developed in Kaldor, Nicholas, 1939. "Welfare propositions in economics and interpersonal comparisons of utility." *Economic Journal* 49 pp 549-52, and Hicks, J. R., 1939. "The foundations of welfare economics." *Economic Journal* 49 pp 696-712.

⁷ A public good is one that is 'non-rival' (more than one person can benefit from a good and one person's consumption does not prevent others from consuming the good) and 'non-excludable' (that is, it is not possible to exclude people from consuming the good). Some of the goods and services that use spectrum can be characterised as public goods; for example, some defence or radio astronomy services.

4 Regulatory issues

When certain conditions hold, markets can be expected to distribute goods and services in a way that maximises total value to society from the use of the relevant resources. When these conditions do not hold, markets may fail to achieve outcomes that maximise public benefit. Regulatory intervention is often employed to address anticipated or actual market failures.

However, intervention by the regulator may also produce inefficient outcomes. Regulatory failure may lead to inefficient allocation of resources, unnecessary costs, reduced dynamic efficiency, less technological innovation and lower investment. The solution to regulatory failures may involve greater use of market mechanisms, or more targeted and considered regulatory intervention.

The principles that ACMA is proposing in the next two sections of the paper will guide its decision-making in relation to spectrum management, so that the balance between regulation and use of market mechanisms will be achieved.

4.1 Market failure

Sources of market failures most relevant to spectrum management include externalities, transaction costs and market power. Each is described below.

Externalities

Externalities are spill-over effects onto third parties and can be positive or negative. The result of these may be that the private costs and benefits to the participants in an economic transaction differ from the overall costs and benefits of the activity to society as a whole. The participants generally do not take into account the spill-over effects that they are causing.

Interference from other users of the spectrum can be classified as a negative externality. The actions of one agent can lead to another agent experiencing interference. The agent causing interference does not take into account the cost of the interference that is imposed on others. One of the principal reasons why spectrum use is regulated is to manage interference.

Interference can occur across national boundaries, which can create a need for international coordination.

The broader social benefits or costs resulting from some uses of the spectrum can be described as another form of externality. These are likely to remain an important element of the overall public benefit derived from the use of the spectrum. Any approach to managing the spectrum needs to consider the expected impact on parties to the transaction and any broader impacts on society more generally.

Transaction costs

Large transaction costs in exchange and disputes may prevent agents reaching mutually beneficial solutions through markets alone. The transaction costs associated with gaining access to spectrum may prevent some potential users from accessing the spectrum, even when the provision of access could be in the interest of all the relevant parties.

Further, a large number of small users may have high search and coordination costs, if they were required to act as a group to secure access to the spectrum.

Market power

A potential spectrum user who has significant market power in a downstream market may be willing to pay more for spectrum due to their ability to earn higher profits. This may not result in spectrum being allocated efficiently.

4.2 Regulatory failure

The presence of market failure does not necessarily mean that regulation will improve the situation. There are costs associated with regulation and it can fail to achieve the desired result.

Regulatory failures may arise from:

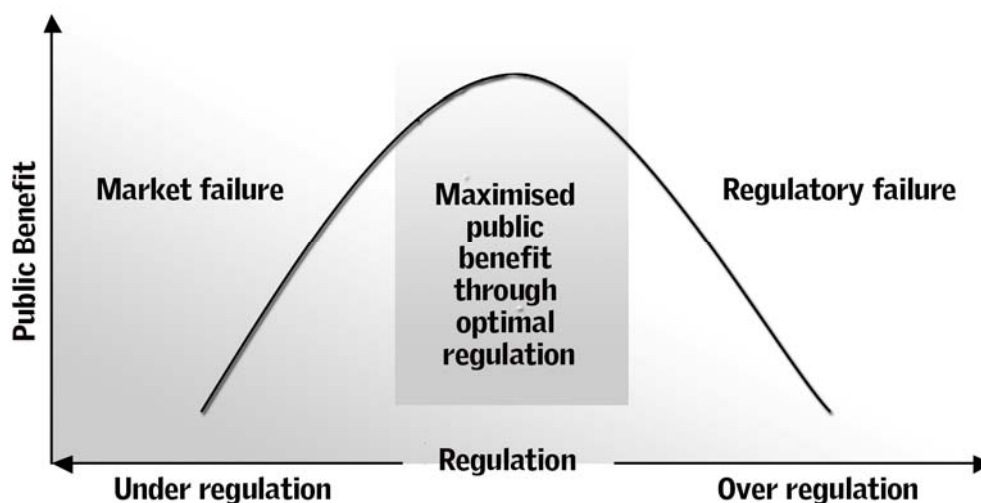
- a lack of clarity about the objectives of regulation;
- the lack of information available to the regulator about the costs, revenues and economic trade-offs facing business, government entities and individuals;
- the cost of analysing data may be prohibitive for the regulator;
- changing technology and demand, which makes it difficult for the regulator and regulation to keep pace with change;
- a lack of incentives for the regulator to make the right decisions, compared to those for industry;
- overly stringent rules by the regulator that hamper innovation and prevent resources from being use in the most valuable way;
- excessive complexity;
- risk aversion; for example, the desire to eradicate rather than manage risk;
- the creation of distortions; that is, the creation of incentives that result in diversion of resources to less efficient activities; and
- regulatory duplication; that is, more than one scheme designed to produce the same outcome.

4.3 ACMA's regulatory approach

ACMA will intervene where it is expected to be net beneficial. Generally, ACMA will intervene where there is a market failure, and the expected cost of correcting the market failure is less than the expected cost of the market failure.

This point is illustrated in Figure 2. The optimal level of regulation is achieved by balancing the risk of market failure and regulatory failure to maximise public benefit.

Figure 2: Maximising public benefit through optimal regulation



4.4 Spectrum regulation

The primary source of market failure applying to spectrum is the externality of the interference caused by a spectrum user transmitting too close in frequency and location to a receiver used by another person. To manage this interference and facilitate efficient spectrum use, the government passed the Radiocommunications Act, which sets out a system of planning, licensing, standards, enforcement and charging for spectrum use.

The traditional approach to spectrum management has been characterised as ‘command and control’; that is, centralised management by a regulator or an ‘administrative approach’. Alternative approaches to spectrum management include:

- defining enforceable private property rights for spectrum;
- flexible licensing rules;
- allowing trading; and
- using price-based mechanisms, such as auctions, to allocate spectrum.

These approaches are sometimes referred to as ‘market-based’. A commons model could also be used where multiple users share spectrum, which can have flexible or restrictive rules, making it more or less ‘market-based’.

Advantages and disadvantages of market and administrative approaches to licensing frameworks and assigning scarce licences are summarised in Table 1 (see p. 14) and some examples are discussed below.

Large networks may be more efficiently managed by spectrum users with property rights and liberalised licensing frameworks. On the other hand, centralised frequency coordination with strict rules of operation may be preferable for multiple users with narrow spectrum bands over small, specific geographic areas. For spectrum uses that have a low potential to cause interference, a commons approach with minimal rules and no barriers to entry may be optimal.

Where private firms existing in the same downstream markets compete for spectrum, their willingness to pay will reflect the value to society, so allocation by auction would be appropriate. However, market failures may occur in a price-based allocation of spectrum if a user's willingness to pay does not reflect the total value generated by its use of the spectrum. For example, if a competing use for a spectrum band is astronomical or environmental research conducted using protected receivers on non-substitutable frequencies, the broader benefits to society of such a use may mean an administrative allocation or a modified market mechanism could be preferable.

Other market failures may occur in a spectrum market regime in which access rights are assigned to spectrum users. For example, the transaction costs generated by having to negotiate spectrum access with a large number of owners may prevent secondary markets from operating effectively to allocate spectrum to a higher value use. Another problem, known as the 'anticommons' or 'hold up' critique, arises when a potential spectrum user needs to negotiate access with existing licence holders who may have incentives for strategic behaviour. If it is a problem because existing spectrum users exercise excessive market power, resolution may lie with the ACCC rather than ACMA. If it is a problem of spectrum scarcity, ACMA may be able to allocate alternative spectrum bands.

Table 1: Advantages and disadvantages of market and administrative approaches

	Advantages	Disadvantages
Market-based approaches		
Flexible licensing frameworks	<ul style="list-style-type: none"> • More flexibility for licensees • Greater ability to move to highest value use • More innovation 	<ul style="list-style-type: none"> • Higher risk of interference
Allocation by auction	<ul style="list-style-type: none"> • Opportunity cost revealed • Bids at auction reflect total value in absence of market failures; therefore, auctions will usually result in allocation to the highest value user • Uses information from spectrum users, who generally have superior information and incentives to use it accurately 	<ul style="list-style-type: none"> • Uses with high social value not reflected in the service providers' revenues may not secure spectrum • Market power may lead to an inefficient allocation • Costs of small users coordinating bids
Administrative approaches		
Restrictive licensing frameworks	<ul style="list-style-type: none"> • More certainty for licensees • More flexibility for regulator • Interference resolution may be cheaper 	<ul style="list-style-type: none"> • Time delays in regulator responding to market changes
Administrative allocation	<ul style="list-style-type: none"> • Regulator can explicitly consider social value (assuming it has access to enough information) 	<ul style="list-style-type: none"> • Lack of transparency about opportunity costs • Regulator unlikely to have sufficient information on total value now or into the future

5 ACMA's spectrum management principles

The spectrum management principles are intended to guide ACMA's management of spectrum within its existing legislative responsibilities and government policy settings. The key theme of the principles is to optimise the use of market mechanisms with regulatory intervention to maximise the total welfare of Australians.

As mentioned in previously, ACMA will take account of the principles of good regulatory process outlined in the *Report of the Taskforce on Reducing the Regulatory Burden on Business* and will use a total welfare standard as its overarching framework for assessing the optimal approach to individual spectrum management issues. However, in most cases, a precise estimate of total welfare is very difficult, and welfare will often only be maximised if market mechanisms are utilised to help determine optimal spectrum use.

ACMA's spectrum management principles are consistent with the principles of good regulatory process and the total welfare standard. They provide directions that will generally result in welfare being maximised and articulate ACMA's proposed standard approach to spectrum regulation.

1. ALLOCATE SPECTRUM TO THE HIGHEST VALUE USE OR USES

The first object of the Radiocommunications Act is to maximise the overall public benefit derived from using the radiofrequency spectrum, by ensuring the efficient allocation and use of the spectrum.

Public benefit will be maximised where spectrum is allocated to the highest value use or uses. That is, the use that maximises the value derived from the spectrum by potential licensees, consumers and wider Australian society. At times it may be efficient to share parts of the spectrum, in which case the benefits may be maximised where there are two or more users. The highest value use will sometimes be a commercial use, and will sometimes be use by government or community organisations.

The second object of the Radiocommunications Act explicitly requires that adequate provision of spectrum be made for use in the defence or national security of Australia, law enforcement or emergency services, and for use by public or community services. ACMA will also consider this object of the Act in assessing the highest value use/s for the spectrum.

At present it is difficult to be entirely technology-neutral—ACMA's planning and allocation decisions are likely to affect the shape of the market and the value of spectrum to different parties. When constructing arrangements for spectrum bands, ACMA will consider what is

likely to be the highest-value utilisation for the band and implement arrangements accordingly (for example, the service types for the band, the licence system, entry barriers, restrictions on usage and the sharing arrangements). However, in doing so, ACMA will aim to construct arrangements that are consistent with principles two and three.

If frequency coordination and interference protection requirements are low, ACMA will consider allowing multiple users to occupy the same spectrum space collectively, with minimal entry barriers.

Where scarcity does not exist, simple over-the-counter allocation is likely to be appropriate. Where demand exceeds supply, ACMA considers that in general the market is likely to be more effective than the regulator in achieving an efficient allocation. Users are generally better placed than regulators to determine their willingness to pay for spectrum. Where firms are competing to provide similar services, higher willingness to pay will reflect higher value to society—for a given set of market conditions, the firm with the highest willingness to pay will be the one who can supply the service most efficiently. Such market-based allocations reduce the risk of regulatory failure arising from the lack of information available to the regulator about the costs, revenues and economic trade-offs facing spectrum users.

In some circumstances, a simple price-based allocation may not efficiently allocate spectrum to its highest-value use. This may be the case if bidders' willingness to pay does not reflect the total value generated by their use of the spectrum, and may arise if:

- broader social value is derived from a particular use of the spectrum that is not, or cannot be, incorporated into the price that a licensee is willing to pay;
- firms are seeking to acquire spectrum to compete in different downstream markets. Differences in the level of competition in the downstream markets will affect the proportion of total value a firm expects to capture and therefore affect its willingness to pay; or
- significant transaction or coordination costs affect the ability of small users to bid effectively in a price-based allocation process.

Where these conditions exist, it may be appropriate to design the allocation mechanism to address risks of market failure.

ACMA seeks to facilitate the operation of the market by reducing information asymmetry. In particular, ACMA will continue to publish information on current spectrum use and trading, and planned changes to spectrum planning rules to assist auction bidders to develop accurate valuations.

2. ENABLE AND ENCOURAGE USERS TO MOVE SPECTRUM TO ITS HIGHEST VALUE USE OR USES

The highest value use of spectrum will change over time as technology develops and consumer and social preferences evolve, and as the competitive positions of licensed spectrum users change. Maximising the overall public benefit derived from the spectrum means that spectrum must be allowed to move to the highest value use as quickly and easily as possible following its initial allocation. This requires a regime that has the flexibility to enable users to adapt spectrum access and usage to both market requirements and technological advances in a timely way.

Encouraging changes in use to be effected by spectrum users themselves is likely to:

- promote the economically efficient use of the spectrum over time;
- reduce the costs and time required to change the use of the spectrum; and
- reduce the risk of regulatory failures (such as delays) caused by a lack of information available to the regulator about the changing value of spectrum.

A change in use may be facilitated through trading or third-party authorisation, or may be a result of the same licensee employing its spectrum for a different use. Licence conditions and technical frameworks need to be as general as possible to allow quick and efficient changes in use. Allowing spectrum to move to the highest-value use quickly and easily will ensure that the costs of transfer incurred by the regulator and licensee are minimal, and that the benefits of allocation to the highest-value use are realised quickly without the delay and costs of regulatory intervention.

Providing information on spectrum that has been traded and current spectrum uses and owners will help to facilitate spectrum trading. For example, if licensees are able to determine the market price for spectrum similar to their own, and that price is higher than their valuation of their spectrum, licensees may decide to seek out opportunities to trade.

An object of the Radiocommunications Act requires ACMA to provide an efficient, equitable and transparent system of charging for use of the spectrum. ACMA will apply administrative incentive prices to licences allocated over-the-counter to try to ensure that spectrum is used efficiently. Where there is excess demand, ACMA will aim to set administrative incentive prices that reflect the opportunity cost, in order to encourage spectrum to be used by the licensees who most value the spectrum.

3. USE THE LEAST COST AND LEAST RESTRICTIVE APPROACH TO ACHIEVING POLICY OBJECTIVES

Planning, licensing, allocation and compliance measures should aim to minimise the total cost of achieving spectrum management policy objectives, including the cost to government, licensees and the community. Good regulatory practice means that all benefits and costs of regulations, including compliance costs, are rigorously assessed. The least cost and least restrictive approaches will reduce regulatory burdens and allow greater freedom for spectrum users to optimise spectrum utilisation.

Minimising the total cost of spectrum management will require ACMA to improve efficiency across the range of its spectrum management functions—through planning, allocation, licensing, compliance and enforcement. It will mean improved systems and processes.

Equally importantly, minimising the total cost of spectrum management will require a focus on the effectiveness of regulation, taking into account developments in technology and conditions in affected markets. Only regulations that generate the greatest net benefit for the community, taking into account all the impacts, will be adopted.

Using the least restrictive approach possible to achieve policy objectives will help to construct a regime with the flexibility to adapt to changing circumstances. It will also minimise unnecessary restrictions on spectrum users.

4. BALANCE CERTAINTY AND FLEXIBILITY

In order to allow licensees to change the use of their spectrum or trade to another licensee for a different use, licences need to be flexible. This reduces the risk of regulatory failure caused

by overly stringent rules hampering innovation and preventing spectrum being put to its highest-value use. It also satisfies the Radiocommunications Act’s object of a responsive and flexible approach to meeting the needs of users of the spectrum. Flexibility may not necessarily mean that the licence conditions can be easily changed, but that the conditions are broad enough to allow any use that will not significantly devalue the licences of other spectrum users.

At the same time, licence parameters need to be sufficiently clear and understood so that licensees feel confident about investing in equipment, knowing the kind and extent of interference they may expect from other users. This reduces the risk of market failures arising from uncertainty and risk aversion.

Table 2: Some characteristics of flexibility and certainty

Flexibility	Certainty
<ul style="list-style-type: none"> • Broad, generic licence conditions • Minimal entry barriers • Ability to trade licences • Modified allocations if the risk of market failure is significant • Changing regulatory rules to suit circumstances 	<ul style="list-style-type: none"> • Fully specified technical conditions • Long periods of tenure • Guaranteed protection from interference • Clear, simple allocation rules • Stable regulatory rules and full consultation before change is implemented • Comprehensive information on spectrum use, trading and vacant spectrum bands

In order for licensees to have sufficient certainty about their rights to use the spectrum to support long-lived assets, licensees must have sufficient tenure and stable, flexible regulatory frameworks. However, at the same time, ACMA can, when it is expected to provide a net benefit, change the technical or regulatory conditions governing use of parts of the spectrum to facilitate a change in use. At times, these concerns will conflict. ACMA will seek to balance the need for certainty and flexibility in regulating use of the spectrum.

The ideal balance between certainty and flexibility may be at different points for different licensees. For example, while a commercial user may value broad licence parameters to facilitate rapid change of use, a safety-of-life service is likely to value strict frequency coordination to ensure that transmissions are clear and reliable 100 per cent of the time.

A licensee employing a device that uses innovative sharing technology may appreciate minimal entry barriers while not requiring frequency coordination. Licensees with legacy services may be prepared to pay for security of tenure and protection from interference.

5. BALANCE THE COST OF INTERFERENCE AND THE BENEFITS OF GREATER SPECTRUM UTILISATION

ACMA will balance the risk of interference and the benefits of greater spectrum utilisation to ensure the most efficient result that maximises total welfare. This means that where the risk or consequences of interference are low, measures that seek to limit interference will be minimal.

The primary reason for regulating spectrum use is to prevent excessive interference from devaluing the resource. However, where demand is high, a completely interference-free transmission may prevent the introduction of a second service where both could exist with a tolerable level of interference.

Depending on the benefit derived from each service and the losses caused to the first service by the introduction of a second in the same spectrum space, guaranteeing a complete lack of interference may decrease overall welfare.

Where total welfare can be increased by amending regulatory rules but is accompanied by a tolerable increase in levels of interference, ACMA will consider relaxing frequency coordination and interference mitigation measures.

The point at which the cost of regulation outweighs the benefits of protection from interference will be different for different services. For example, devices using self-coordinating, underlay or overlay technologies may not require restrictions to ensure they do not interfere with other services, and may not require protection from interference. Regulating such devices may be inefficient and decrease overall public benefit. In contrast, interference to services that perform safety-of-life functions may be at great detriment to public benefit and the cost of regulation may be small in comparison.

Do you have any comments on the five principles listed above?

Are there principles other than these five that ACMA should use to guide spectrum management decisions?

Appendix 1

Spectrum liberalisation in other jurisdictions

A number of countries have developed spectrum management principles to provide a policy basis for their planning and management of spectrum. These countries include the United States, the United Kingdom, New Zealand, the European Union, Canada, Hong Kong and Malaysia.

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

UNITED STATES

The Federal Communications Commission (FCC) released spectrum management principles in 1999. The US is a world leader in the use of market-based mechanisms in spectrum licensing and allocation. In recent years, the FCC has promoted spectrum liberalisation 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.

UNITED KINGDOM

Ofcom published its Spectrum Framework Review (SFR) in November 2004 and announced a general preference for the use of market mechanisms to manage the spectrum. In recent years, Ofcom has been progressively applying market mechanisms to commercial sectors and, more recently, to government sectors. It is planned that 71.5 per cent of the spectrum will be managed using market-based approaches by 2010. Ofcom believes that market mechanisms, such as spectrum trading, liberalisation, administered incentive pricing (AIP) and auctions are in most cases more likely to secure optimal use of spectrum than 'command and control' based on regulation and administrative decisions.

Of relevance to ACMA's decision to adopt the total welfare standard, we note that Ofcom adopted a total welfare standard to inform its approach in its recent Digital Dividend Review and its Public Service Broadcasting Review, amongst others.⁸

Ofcom sees spectrum trading and spectrum liberalisation as two key policy initiatives for maximising the use of spectrum. Spectrum trading allows licensees to buy and sell spectrum in the market, and spectrum liberalisation reduces unnecessary restrictions and constraints on spectrum use. The significant policy decisions are as follows:

- 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.

NEW ZEALAND

In 1989, New Zealand was one of the first countries to introduce market mechanisms and administer spectrum as a tradable property right. Reforms included providing technical flexibility for spectrum rights holders to determine uses of the spectrum. The government uses a combination of auctions and administrative approaches in spectrum licensing and allocation.

The Ministry of Economic Development (MED) completed a review of radio spectrum policy in 2005. It concluded that the objectives of spectrum management were promoting competition, maximising the value of spectrum to society, satisfying growing demand, and meeting the government's economic, social and cultural policy outcomes.

In 2007, the MED proposed a number of measures to improve the efficiency of market mechanisms in the current regulatory environment. The key proposals included:

- introducing perpetual rights or statutory presumption renewal;
- extending spectrum management rights to government agencies, including participation in the market and sharing with private users;

⁸ See for example, Ofcom, *Digital Dividend Review*, Consultation Annexes, December 2006.

- 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.

EUROPEAN UNION

In recent years, the European Union (EU) has initiated spectrum reform following the recommendations of a report by the Radio Spectrum Policy Group (RSPG) to implement spectrum trading and liberalisation.

Most EU member states use an administrative assignment approach, and some states resolve competing applications with auctions. However, in the majority of jurisdictions, command and control is still the dominant licensing approach. Spectrum reform aims to make the regulatory regimes in Europe less restrictive and spectrum management more consistent across member states. According to the European Commission, the introduction of market-based spectrum management, combined with more flexible usage rights, could add €8–9 billion per year to the telecommunications sectors of member countries.

The opening-up of frequency bands reserved for mobile phone communications, such as those for 3G mobile services, is one of the Commission’s initiatives. The release of broadcasting spectrum from the digital switchover will be the next strategy.

CANADA

In 2007, Industry Canada conducted a public consultation on a revised spectrum management framework that will rely on market forces as much as possible with minimal regulatory intervention. The framework was first introduced in 1992 and was reviewed in 2002 and 2005 to reflect changing government policy, as well as to respond to challenges arising from rapid technological changes and increasing spectrum demand.

The commitment to greater use of market forces has already led to some deregulation of VoIP and local telephone markets. The Canadian Radio-television and Telecommunications Commission (CRTC) determined that it would regulate VoIP services only when they are provided as local telephone services.

HONG KONG

The Office of the Telecommunications Authority (OFTA) follows the guiding 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. The Hong Kong Government released a consultation paper discussing a proposed spectrum policy framework in January 2007. The framework was designed to achieve the policy objectives of providing transparency of decision-making and promoting Hong Kong’s economic competitiveness in the world.

In 1997, OFTA issued a mobile carrier licence by auction in the 800 MHz band after two CDMA and TDMA licences expired. The new mobile carrier licence was sold at the reserve price of HK\$76 million (AU\$11 million). New entrants and existing carrier licensees were allowed to participate in the auction. PCCW-HKT Telephone Limited was the only applicant. The licence term is 15 years and the licensee is not obliged to provide open network access or comply with domestic roaming requirements.

OFTA has adopted the ‘technology neutrality’ principle by introducing new mobile carrier licences that allow either UMTS900 or HSDPA900 to be deployed in the current GSM900 bands.

MALAYSIA

The Malaysian Communications and Multimedia Commission (MCMC) released a spectrum management strategic review paper for public consultation in December 2007. The paper proposed new spectrum management approaches and strategies, which were benchmarked against leading regulators such as ACMA and Ofcom. The MCMC spectrum management framework consists of dominant concepts including the use of market-based mechanisms, efficient use of the spectrum and technology neutrality.

The new framework was designed to align with Malaysia’s national development plan to develop Malaysia as a global ICT hub and regional leader in the communications and multimedia industry. The following are MCMC’s key proposals for spectrum management changes:

- 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.