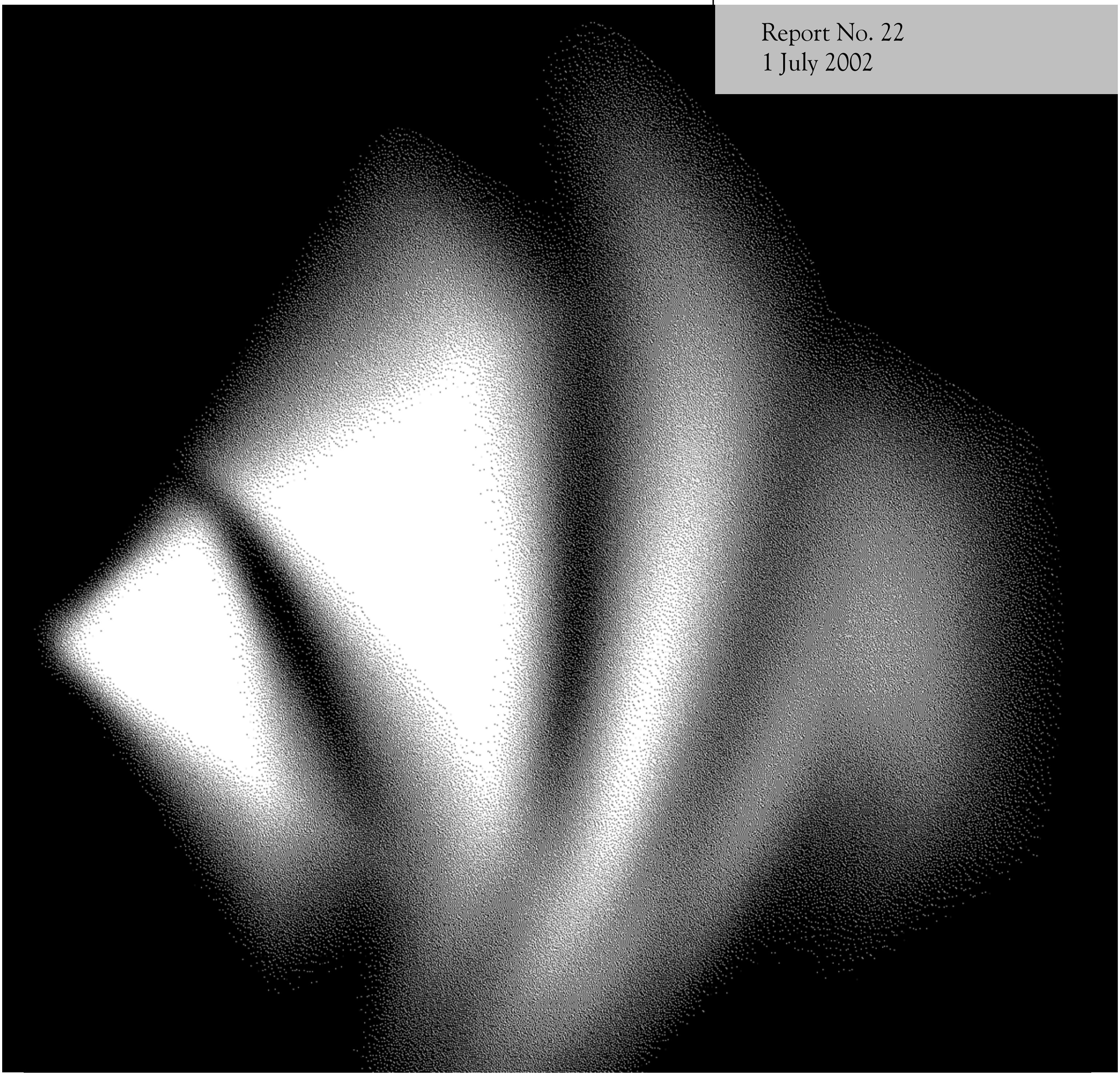
Radiocommunications

Inquiry Report

Report No. 22
1 July 2002



PRODUCTIVITY COMMISSION

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PRODUCTIVITY COMMISSION

1 July 2002

The Honourable Peter Costello MP
Treasurer
Parliament House
CANBERRA ACT 2600

Dear Treasurer

In accordance with Section 11 of the *Productivity Commission Act 1998*, we have pleasure in submitting to you the Commission's final report into radiocommunications.

Yours sincerely

Dr David Robertson	Dr Neil Byron
Presiding Commissioner	Commissioner

Terms of reference

Review of Radiocommunications Acts and of the Market Based Reforms and Activities Undertaken by the Australian Communications Authority

PRODUCTIVITY COMMISSION ACT 1998

I, ROD KEMP, Assistant Treasurer, pursuant to Parts 2 and 3 of the *Productivity Commission Act 1998*, hereby refer the attached list of legislation and associated regulations, relating to spectrum management processes which are provided for under radiocommunications and other legislation, to the Commission for inquiry and report within 12 months of receipt of this reference. The Commission is to focus on those parts of the legislation that restrict competition, or that impose costs or confer benefits on business. The Commission is to hold hearings for the purpose of the inquiry.

Background

2. This review fulfils a commitment made in the Commonwealth Legislation Review Schedule to undertake National Competition Policy reviews of the *Radiocommunications Act 1992* (the Act) and related Acts and of the market based reforms and activities undertaken by the Australian Communications Authority (ACA) (formerly Spectrum Management Authority).

Scope of Inquiry

3. The Commission is to report on appropriate arrangements for spectrum management taking into account the following:

(a) legislation/regulation which restricts competition should be retained only if the benefits to the community as a whole outweigh the costs; and if the objectives of the legislation/regulation can be achieved only by restricting competition. Alternative approaches which may not restrict competition include quasi-regulation and self-regulation;

(b) in assessing the matters in (a), regard should be had, where relevant, to effects on the environment, welfare and equity, occupational health and safety, economic and regional development, consumer interests, the competitiveness of business including small business, and efficient resource allocation;

(c) the need to promote consistency between regulatory regimes and efficient regulatory administration, through improved coordination to eliminate unnecessary duplication;

(d) there should be explicit assessment of the suitability and impact of any standards made under the legislation and any standards referenced in the legislation, and justification of their retention if they are to remain; and

(e) compliance costs and the paper work burden on small business should be reduced where feasible.

4. In making assessments in relation to the matters in (3), the Commission is to have regard to the analytical requirements for regulation assessment by the Commonwealth,

including those set out in the Competition Principles Agreement. The report of the Commission should:

(a) identify the nature and magnitude of the social, environmental or other economic problem(s) that the legislation seeks to address;

(b) clarify the objectives of the legislation;

(c) identify whether, and to what extent, the legislation restricts competition;

(d) identify relevant alternatives to the legislation, including non-legislative approaches;

(e) analyse and, as far as reasonably practical, quantify the benefits, costs and overall effects of legislation and alternatives identified in (d);

(f) identify the different groups likely to be affected by the legislation and alternatives;

(g) list the individuals and groups consulted during the review and outline their views, or reasons why consultation was inappropriate;

(h) determine a preferred option for legislation, if any, in light of the objectives set out in 3 above; and

(i) examine mechanisms for increasing the overall efficiency, including minimising the compliance costs and paper burden on small business, of the legislation, and where it differs, the preferred option.

5. The Commission should also report on:

(a) how effective the reforms introduced in the legislation have been in:

(i) removing structural obstacles to the introduction of new communications technologies and services;

(ii) encouraging innovation and investment in radiocommunications services; and

(iii) facilitating access to spectrum by users, including public and community services as defined in the legislation;

(b) the effectiveness of provisions in the *Radiocommunications Act 1992* as a way by which to control market domination and increase competition; and

(c) the effectiveness of the ACA's implementation of the reforms introduced in the legislation;

and in doing so have regard to international arrangements for spectrum planning and development of standards (including the implications of these on the availability of radiocommunications equipment).

6. The Commission should take account of any recent substantive studies relevant to the inquiry.

7. In undertaking the review, the Commission is to advertise nationally and consult with key interest groups and affected parties.

8. The Government will consider the Commission's recommendations, and the Government's response will be announced as soon as possible after the receipt of the Commission's report.

ROD KEMP

Schedule

The following Acts and their associated Regulations are to be Reviewed

Radiocommunications Act 1992

Australian Communications Authority Act 1997

Radiocommunications (Transmitter Licence Tax) Act 1983

Radiocommunications (Receiver Licence Tax) Act 1983

Radiocommunications (Spectrum Licence Tax) Act 1997

Radiocommunications (Permit Tax) Act 1983

Radiocommunications Taxes Collection Act 1983

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Abbreviations

ABA	Australian Broadcasting Authority
ABC	Australian Broadcasting Corporation
ACA	Australian Communications Authority
ACCC	Australian Competition and Consumer Commission
ACIF	Australian Communications Industry Forum
AEEMA	Australian Electrical and Electronic Manufacturers Association
AMPS	Advanced Mobile Phone System
AMSA	Australian Maritime Safety Authority
APEC	Asia Pacific Economic Co-operation
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARSG	Australian Radiocommunications Study Group
ASDL	asynchronous digital subscriber line
ASIO	Australian Security Intelligence Organisation
ASIS	Australian Secret Intelligence Service
ATNF	Australia Telescope National Facility
ATO	Australian Taxation Office
ATUG	Australian Telecommunications Users Group
AUSTEL	Australian Telecommunications Authority
BoM	Bureau of Meteorology
BS Act	*Broadcasting Services Act 1992*

BTCE	Bureau of Transport and Communications Economics
CB radio	citizen band radio
CDMA	code division multiple access
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCITA	Department of Communications, Information Technology and the Arts
DSL	digital subscriber line
DTRS	Department of Transport and Regional Services
EDGE	enhanced data for GSM evolution
EHF band	extremely high frequency band
EMC	electromagnetic compatibility
EMR	electromagnetic radiation
EPIRB	Emergency Position Indicating Radio Beacon
ERC	European Radiocommunications Committee
FACTS	Federation of Australian Commercial Television Stations
FARB	Federation of Australian Radio Broadcasters
FCC	Federal Communications Commission (United States)
FDMA	frequency division multiple access
GHz	gigahertz
GPRS	general packet radio service
GPS	global positioning system
GSM	global system for mobile
GST	Goods and Services Tax
HF band	high frequency band

HFC cable	hybrid fibre coaxial cable
HORSCOTCI	House of Representative Standing Committee on Transport, Communications and Infrastructure
Hz	hertz
IAP	Internet access provider
ICAO	International Civil Aviation Organisation
IMO	International Maritime Organisation
IRAC	International Radiocommunications Advisory Council
ISDN	integrated services digital network
ISM	industrial, scientific and medical
ISP	Internet service provider
ITU	International Telecommunications Union
ITU-D	ITU telecommunications development sector
ITU-R	ITU radiocommunications sector
ITU-T	ITU telecommunications standardisation sector
kbps	kilobits per second
kHz	kilohertz
KPIs	key performance indicators
LAN	local area network
LF band	low frequency band
LMDS	local multipoint distribution system
LPON	low power open narrowcasting
Mbps	Megabits per second
MDS	multipoint distribution station

MF band	medium frequency band
MHz	megahertz
MMDS	multichannel multipoint distribution system
NECG	Network Economics Consulting Group
NEMMCO	National Electricity Market Management Company
NTIA	National Telecommunications and Information Administration (United States)
OFTA	Office of the Telecommunications Authority (Hong Kong)
ORR	Office of Regulation Review
PABX	private automatic branch exchange
PCS	personal communications services
PMTS	public mobile telecommunications services
PSTN	public switched telephone network
RA	Radiocommunications Agency (United Kingdom)
RC Act	*Radiocommunications Act 1992*
RCC	Radiocommunications Consultative Council
RIS	regulation impact statement
RSAC	Radio Spectrum Advisory Committee (Hong Kong)
SAR	spectrum access right
SAT	Spectrum Access Tax
SBS	Special Broadcasting Service
SDR	software–defined radio
SEA	Spectrum Engineering Australia
SHF band	super high frequency band

SMA	Spectrum Management Agency (now the ACA)
SMAG	Spectrum Management Advisory Group (United Kingdom)
SMC	Spectrum Maintenance Component
SMG	spectrum map grid
SPAC	Spectrum Planning Advisory Committee (United States)
Spectrum Plan	Australian Radiofrequency Spectrum Plan
STU	standard trading unit
TARBS	Television and Radio Broadcasting Services Australia
TDMA	time division multiple access
TPA	*Trade Practices Act 1974*
UHF band	ultra high frequency band
UMTS	universal mobile telecommunications service
USO	universal service obligation
UWB	ultra–wideband
VHF band	very high frequency band
VLF band	very low frequency band
WAN	wide area network
WCDMA	wideband code division multiple access
WIA	Wireless Institute of Australia
WLL	Wireless Local Loop
WRC	World Radiocommuncations Conference
WTA	*Wireless Telegraphy Act 1905*
WTO	World Trade Organisation

Glossary

Items in bold are included individually in the glossary.

2G mobile	*Second generation mobile*. Mobile phone technologies that provide voice and low speed Internet access, using digital voice encoding and a mixture of circuit-switching and packet-switching techniques that support data transmission rates around 9.6 kbps (for example, **GSM** and **CDMA**).
2.5G mobile	*2.5 generation mobile*. An evolutionary **cellular** mobile technology on the way to third generation (**3G**) **mobile,** using packet-switching techniques that can support data transmission rates up to 384 kbps (for example, **GPRS** and **EDGE**).
3G mobile	*Third generation mobile*. An emerging cellular mobile technology employing more advanced digital switching technologies than **2G** and **2.5G** mobile systems. 3G technologies include **WCDMA** and **CDMA2000** and offer the prospect of data transmission rates up to 2 Mbps.
ADSL	*Asymmetric digital subscriber line*. A technology that enables simultaneous voice and data transmission over copper wire networks (for example, for voice telephony).
Allocation	Mainly refers to the division of the radio **spectrum** into bands of **frequencies** dedicated to particular services, as documented in the Australian Radiofrequency Spectrum Plan. However, in the context of licensing, allocation can also refer to the process of assigning licences to different users (especially via auctions).
AMPS	*Advanced mobile phone system*. The analogue **cellular** mobile phone system that operated in Australia until 2000 and still operates in other countries.
Any-to-any connectivity	The ability of a customer of one network to communicate with customers of other networks (for example, on mobile phones).

Apparatus licence	A licence authorising the operation of specific devices that use radiofrequency **spectrum**, subject to licence conditions.
Assignment	The process of issuing the right to access **spectrum** to spectrum users. The method of assignment is through licences and may be administrative or market-based (principally auctions).
Band manager	Agents who manage **spectrum** on a commercial basis. Band managers may hold portfolios of licences which are leased to third parties or traded on secondary markets.
Bandwidth	The range of **frequencies**, expressed in hertz (**Hz**), over which a **spectrum** user can transmit or receive radio signals. In general, the greater the bandwidth, the more information that can be sent through the spectrum in a given amount of time.
Bit	A binary digit with a discrete value of 0 or 1. Bits are used to store data on computers and to sequence digital transmissions. A kilobit equals one thousand bits.
Bps	*Bits per second*. The number of **bits** transmitted each second. Kbps is the number of kilobits transmitted each second.
Bluetooth	A short-range (10 to 100 metres), low-power radio technology that allows wireless communication between devices such as mobile handsets and computers.
CDMA	*Code Division Multiple Access.* A second generation (**2G**) digital **cellular** mobile phone technology that uses **spread spectrum** techniques to transmit coded signals across several **channels,** rather than allocating each signal to an individual channel.
CDMA 2000	*Code Division Multiple Access 2000.* A standard for third generation (**3G**) **mobile** phone technology that employs advanced **spread spectrum** techniques.
Cellular	A mobile communications service using cells that are each served by a base station transmitter, and connected to a switching exchange that is connected to the fixed network. It allows **frequency** re-use across the service area and greater frequency-use intensity than conventional mobile phone coverage.

Channel	A path through which communications can flow. The **bandwidth** of a communications channel influences the amount of information that can be carried.
Class licence	Open, standing authorities that allow anyone to operate specified devices, within the conditions of the licence (for example, CB radios, mobile phone handsets, cordless phones and remote controls). Device users do not have to apply for a class licence and do not pay a fee.
Congestion	Too many **spectrum** users crowding into the same **frequencies** in the same location. Congestion can cause **interference** which reduces effective communication.
Convergence	The ability of similar types of information to be transmitted using different **platforms** and different **radiofrequencies.**
Co-primary use	An allocated use in which the **primary use** rights to the band are shared. **Secondary uses** can co-exist with co-primary uses but are unable to claim protection from or cause interference with the co-primary uses.
Datacasting	A range of interactive services available through digital television, including access to the Internet, video on demand and games.
Device registration	Radiocommunications devices must be registered with the ACA. The ACA may refuse registration for devices that do not meet relevant technical standards and that are likely to cause undue **interference** with other devices.
EDGE	*Enhanced data for global system for mobile (***GSM***) evolution*. A packet-based data technology for **cellular** mobile phones that overlays **GSM** networks and supports data transmission rates of up to 384 kilobits per second.
EMC standard	*Electromagnetic compatibility*. A standard that sets technical limits for emissions from electrical and electronic products and services in order to minimise electromagnetic interference.
EMR standard	*Electromagnetic radiation*. A standard that limits human exposure to electromagnetic radiation emitted from radiocommunications transmitters.

Externality	An indirect cost or benefit resulting from a transaction that is not covered or captured by either party to the transaction. In radiocommunications, **interference** is an externality.
FDMA	*Frequency division multiple access*. An analogue technique that increases the intensity of **spectrum** use by splitting a single **channel** (allowing one signal) into a number of sub-channels (each supporting one signal).
Fixed links	See **point-to-point services**.
Frequency	The number of complete electromagnetic cycles or waves per second, as measured in cycles per second or hertz (**Hz**). The range of frequencies used for radiocommunications is called the **radiofrequency spectrum**.
Frequency agile	The ability of radiocommunications devices to operate in a number of different **frequency** bands.
Frequency band plan	A legal instrument made under s.32, *Radiocommunications Act 1992*, that subdivides the broad **spectrum** allocations of the Australian Radiofrequency Spectrum Plan into specific service types.
GPRS	*General packet radio service*. A packet-based data technology for **cellular** mobile phones that overlays global system for mobile (**GSM**) networks and supports data transmission rates up to 114 kilobits per second.
GPS	*Global positioning system*. A network of 24 satellites that orbit the earth enabling people with ground receivers to pinpoint their geographic location. The GPS is provided by the United States Department of Defense but can be used by civilians in Australia and other countries.
GSM	*Global system for mobile*. A second generation (**2G**) digital **cellular** mobile technology based on time division multiple access (**TDMA**).
Guard band	Spectrum that is deliberately left fallow to reduce the risk of interference between two or more spectrum users.

HFC cable	*Hybrid Fibre Coaxial cable*. A network of fibre optic and coaxial cable that connects customers' premises to pay-TV services, high speed Internet access and voice services, mainly in metropolitan areas of Australia.
Hz	*Hertz*. A unit of **frequency**, equal to one cycle per second. A kilohertz (kHz) equals one thousand hertz. A megahertz (MHz) equals one million hertz. A gigahertz (GHz) equals one billion hertz. A terahertz (THz) equals one thousand billion hertz.
Interference	The effect of unwanted energy colliding with transmitted signals. Interference can arise from artificial sources (for example, two or more radio signals colliding) or natural sources (for example, lightning). Interference is a negative **externality**.
ISDN	*Integrated services digital network*. A set of standards for digital transmission over copper wire and other **platforms** using a circuit-switched technology to allow both voice and data over the same network.
LAN	*Local area network*. A group of computers and associated devices that share a common communications connection. LAN's typically share the resources of a single processor or server within a small geographic area (for example, within an office building). A LAN may serve as few as two or three users (for example, in a home network) or as many as thousands of users (for example, in a large corporate network)
LMDS	*Local multipoint distribution system*. A terrestrial radio system using radio **frequencies** of around 25 to 40 gigahertz to provide interactive video, Internet and voice services (usually limited to customers residing within a 3 km radius of a transmission tower).
Management rights	Rights that allow a **spectrum** holder to sub-lease rights to use spectrum in much the same manner as the sub-leasing of a building by a licensee.
MDS	*Multipoint Distribution Station*. One-way radio services operating from a fixed location and generally transmitting to multiple receiving facilities at fixed locations, generally used for terrestrial broadcasting.

MMDS	*Multichannel multipoint distribution system*. A terrestrial radio system utilising radio **frequencies** between 2 and 3 gigahertz that is used for television broadcasting and increasingly for two-way, high-speed Internet access (usually limited to customers within a 50 km radius of the transmission tower).
Multiplexing	A range of techniques that enable transmission of multiple signals (voice or data) simultaneously along a single **channel** (for example, **FDMA** and **TDMA**).
Narrowcasting	Specialised radio and television transmissions intended for a specifically defined group.
Non-assigned licence	A licence that does not require an individual **frequency assignment**, but allows the licensee to operate equipment on a shared frequency basis (for example, for amateurs and some aircraft, maritime and scientific applications).
Open access resource	A resource that is non-excludable (no-one can be excluded from benefiting from it) but is rival (one person's benefit reduces benefits for others). In the absence of property rights, strong incentives exist for over-use of the resource and government intervention may be required.
Passive services	Services that receive radio signals but do not transmit them (for example, radioastronomy).
PCS	*Personal Communications Services*. A generic term for mobile phone services, including technologies such as **GSM** and **CDMA**.
Platforms	The type of system or network used to transmit communications, including copper wire, **HFC cable**, fibre optic cable, terrestrial microwave and **satellites**.
Point-to-multipoint services	Wide area services that transmit signals from a central distribution point to multiple points, for example, broadcasting transmitters, **LMDS**, **MMDS** and mobile services.
Point-to-point services	Fixed links that transmit information between two fixed points in the form of directed beams of radio waves.

Primary use	The single use which takes precedence over others in a given **frequency**. **Secondary uses** are unable to claim protection from or cause interference with the primary use.
Propagation	The area or distance of 'service coverage' that can be achieved from a transmitting device. The propagation of radio signals depends on factors including the communications equipment, power, time of day, time of year, solar activity and topography and weather conditions.
Public good	A good or service that is both non-excludable and non-rival. That is, once the good is produced, it is not possible to withhold its benefits from anyone, and the benefits for one person do not reduce the benefits available to others. This means that private producers may not supply public goods, or may produce less than is desirable.
Radio-frequency spectrum	The part of the electromagnetic **spectrum** that is regarded as useful for radiocommunications (currently between the **frequencies** of 3000 **hertz** and 300 gigahertz). For the purposes of the *Radiocommunications Act 1992*, radiocommunications is any radio emission (emission of electromagnetic energy) of **frequencies** less than 420 terahertz (ss. 6[1] and 8[1]).
Re-allocation	The process of changing the **allocation** of **spectrum**, as defined in the Australian Radiofrequency Spectrum Plan, from one use to another. Incumbent users who do not conform to the new allocations must be re-located to other **frequencies**.
Resource rent tax	Payments to owners of natural resources are often referred to as royalties. A resource rent tax is a particular form of royalty that charges a percentage of the expected profit, rather than a fixed amount per unit used or taken.
Safety-of-life services	Emergency service providers such as police, ambulance and fire services, the Royal Flying Doctor Service and life saving associations. Other services with potential safety-of-life functions include maritime and aeronautical services.

Satellites	A wireless receiver and transmitter that orbits the earth. Satellites are used for weather forecasting, television broadcasting, amateur radio communications, Internet communications and other services.
SDR	*Software-defined radio*. Equipment using digital techniques and stored program controls that allows users to choose the type of service and the service mode from those stored in the device. An SDR device, for example, could incorporate a mobile phone, **GPS**, wireless fax, e-mail and Internet.
Secondary use	A use that shares **frequencies** allocated to **primary** and **co-primary uses**, but is unable to claim protection from or cause **interference** with the primary or co-primary uses.
Shadow pricing	A technique used by regulators to mimic market-based valuations, in the absence of actual market-based methods of valuing goods, services and resources (for example, calculating apparatus licence fees based on annualised auction prices).
Spectrum	The set of all **frequencies** (or electromagnetic waves) produced in electric and magnetic fields. Spectrum can be defined according to frequency, space and time.
Spectrum licence	A licence authorising the use of **spectrum** space for any device from any site within that space, subject to the conditions of the licence and relevant technical regulations. They are issued for a fixed, non-renewable term and may be sub-divided, combined and traded.
Spread spectrum	A digital technique that combines **FDMA** and **TDMA** technologies to allow many users to occupy several **channels** at the same time. Signals are distributed (or spread) over the whole range of channels and each user is assigned a unique code that differentiates it from other users simultaneously carried over the same **spectrum** (for example **CDMA** technology).
STU	*Standard trading unit*. The smallest unit of **spectrum** space for which the ACA will issue a **spectrum licence** or register trading. STUs are defined in terms of radiofrequency **bandwidth** and geographic area.

TDMA	*Time division multiple access*. A digital technique used to increase the intensity of **spectrum** use. TDMA splits a single **channel** (allowing one subscriber) into eight time slots (each supporting one subscriber).
UWB	*Ultra-wideband radio*. A wireless technology that uses advanced **spread spectrum** techniques to transmit large amounts of data over a wide range of **frequency** bands. UWB operates at very low power levels, potentially allowing some UWB devices to co-exist in frequencies already occupied by radio services without causing undue levels of **interference**.
WCDMA	*Wideband Code Division Multiple Access*. A standard for third generation (**3G**) **mobile** technology that employs advanced **spread spectrum** techniques.
Wide area services	See **point-to-multipoint services**.

EXECUTIVE SUMMARIES

OVERVIEW

Key messages

- Radiofrequency spectrum is vital for modern communications. Traditionally, Government regulation has been necessary to manage signal interference that would result from open access to spectrum.
- Advances in technology have led to more intensive use of spectrum and have provided new flexibility for its management.
- Australia was one of the first countries to recognise the potential for market-based reforms, using property rights, to increase efficiency in spectrum use. The *Radiocommunications Act 1992* went beyond the traditional, equipment-specific licensing approach to introduce class licences and technology-neutral spectrum licences to meet the needs of new technologies.
- Spectrum licences form the foundation of this market-based approach. For a variety of reasons, progress has been slower than expected. With minor amendments, however, the Radiocommunications Act has the capacity to establish competitive markets in spectrum.
- The Commission recommends relaxing the regulations applying to all three licence types:
  - Apparatus licences should be granted a presumption of renewal, but remain subject to resumption on two-years' notice.
  - Spectrum licences should be issued in perpetuity, leaving a developing secondary market to establish resale prices and effective tenure.
  - Class licences should be extended to accommodate new technologies on a 'no protection, no interference' basis.
- The following steps are needed to improve efficiency and transparency:
  - More spectrum licences should be issued through improved conversion and re-allocation processes (including auctioning of encumbered spectrum).
  - Competition limits imposed at spectrum licence auctions should be discontinued and bidding made consistent with section 50 of the *Trade Practices Act 1974*.
  - Public interest tests for re-issuing existing spectrum licences should be used only in exceptional circumstances. All new spectrum licences should be issued using market-based mechanisms.
- Regulatory measures will still be needed to meet the spectrum needs of defence, safety-of-life and essential services, but, as far as possible, these services should also be subject to price disciplines, with budget support to meet spectrum costs.
- Spectrum planning will be needed to meet International Telecommunications Union commitments, but equipment availability would in any case encourage service providers to comply with the ITU spectrum plan.

Overview

Inquiry background

This inquiry reviews the regulatory regime governing the use of Australia's radiofrequency spectrum, under the framework specified in the Competition Principles Agreement (CPA). It focuses on the *Radiocommunications Act 1992* (RC Act) and related Acts and regulations. It addresses market reforms introduced in this framework and their implementation by the Australian Communications Authority (ACA) and its predecessor, the Spectrum Management Agency (SMA).

This inquiry reviews the regulation of radiocommunications.

The guiding principle of a CPA review is that legislation should not restrict competition unless it can be demonstrated that the benefits of the restriction, to the community as a whole, outweigh the costs, and the objectives of the legislation can only be achieved by restricting competition. This inquiry aims to identify ways of promoting economic efficiency in the use of spectrum for the benefit of the whole Australian community.

It aims to promote the efficient use of spectrum for the benefit of the Australian community.

Before the RC Act, Australian spectrum use was determined according to prescribed spectrum plans and licences were issued administratively, usually on a 'first-in' basis (as in most countries). Licences were short term and non-tradeable, and most were highly prescriptive. In 1992, the RC Act introduced significant market-based reforms.

The current regime introduced radical change in 1992.

Although the RC Act has been in place for a relatively short period (major amendments were made as recently as 1997), radiocommunications is a rapidly evolving, high technology sector. The costs of an inappropriate regulatory structure could accumulate quickly. There is sufficient experience to gauge the strengths and weaknesses of the current system

This review is timely.

and to assess whether alternative approaches would improve outcomes.

Spectrum use and markets

Demand for spectrum derives from a wide variety of applications.

The radiofrequency spectrum is a valuable natural resource. The demand for spectrum derives from many different applications. Spectrum is used for: radio and television broadcasting services; defence communications and surveillance services; mobile telephony and other personal communications systems (for example, pagers and SMS services); two-way radio (an essential input to air, sea, rail and road transport services); remote control devices (for example, garage door openers); and point-to-point communications (fixed links).

New uses of spectrum continue to arise.

New options for spectrum use emerge continually. For example, wireless local loops provide an alternative means of linking homes and businesses to the telecommunications network, and wireless systems are used to communicate between computers. Some commentators regard broadband wireless technologies as the future of communications systems.

The market for spectrum is segmented.

The market for spectrum is complicated by its heterogeneous nature. Useable spectrum covers a large range of frequencies, but some frequencies are better suited to particular purposes than others. Even where the technical characteristics of different frequencies are similar, substitution possibilities are constrained by planning rigidities and equipment availability. Wired technologies, including copper wire and fibre optic and coaxial cables, can be substitutes for spectrum in some uses. But where mobile communication is required, there is no substitute. These characteristics mean that the market for spectrum is highly segmented. Access to spectrum therefore has different implications for competition in different end-markets.

Radiocommunications Act 1992 reforms

The RC Act introduced three broad reforms:

The RC Act reformed spectrum management.

- market-based allocation and assignment of some rights to use spectrum, including the use of auctions;
- administrative reforms, including an incentive-based formula for setting licence fees; and
- creation of an independent regulator, the SMA. The SMA merged with the Australian Telecommunications Authority to form the ACA, on 1 July 1997.

The RC Act established three types of licence to use spectrum: apparatus licences, spectrum licences and class licences.

Apparatus licences continue the old approach.

Apparatus licences closely resemble the traditional, technologically-specific permits to use spectrum applied under the pre-1992 regime. Typically, they prescribe the equipment to be used, its location, power and radiofrequency. They have terms of up to five years, and annual fees are payable. Reforms in 1995 made them tradeable, but the secondary market is limited by their degree of specificity.

Spectrum licences are more flexible.

Spectrum licences assign less prescriptive spectrum rights. They have: terms up to 15 years; freedom to decide spectrum use (within international constraints); the ability to trade or lease licences; and provision for compensation if they are compulsorily revoked. These licences are assigned primarily by auction. To facilitate secondary trading, spectrum licences can be subdivided or combined in either the frequency or geographic domains.

Class licences allow low interference devices to share spectrum.

Class licences accommodate the use of low power devices where interference problems are managed on a ‘no protection, no interference’ basis. Devices using class-licensed spectrum do not need to be individually licensed.

Australia is at the forefront of spectrum regulation.

The RC Act and subsequent amendments put Australia at the forefront of spectrum regulation worldwide. Only New Zealand has implemented such a market-oriented approach to spectrum allocation. An indication of Australia's progressive approach is that the United Kingdom has yet to make licences tradeable. A major review of the UK legislation has recently suggested the adoption of a market-based approach very similar to that taken by Australia a decade ago.

Why the Government is involved

Government intervention to address interference is justified

In the absence of any rules governing access to spectrum, competing users would crowd into the most desirable parts of the spectrum, interfering with the reception of each others' signals. Interference is an example of a negative spillover, where the actions of one user impinge on the interests of others.

… where there are net benefits.

Government intervention of some sort is justified to limit interference, but it must be carefully constrained to maximise net benefits to the community. Even if it were practical, regulating spectrum to eliminate all interference would not maximise social benefits. The way in which the government intervenes also needs to be considered carefully.

Central planning was the traditional approach.

Central planning was the traditional approach to interference management, nationally and internationally. Spectrum use must be coordinated between countries to minimise cross-border interference and to ensure inter-operability of 'safety-of-life' services, such as aviation and maritime radio services. Member countries of the International Telecommunications Union (ITU) agree on an international spectrum plan, which becomes the blueprint from which individual countries plan their spectrum use. In Australia, the ACA prepares a detailed Spectrum Plan (which sets out the permissible uses of spectrum), and licenses spectrum users.

Competitive markets tend to allocate resources where they are most valued.

The planning approach has come under pressure from rapid technological changes and the development of new uses for spectrum. Even the best informed government regulator would find it difficult to keep abreast of all new opportunities for using spectrum. Regulation also encourages rent seeking and impedes change. The alternative is for the government to create an institutional framework within which individuals can trade in rights to use spectrum. Enforceable property rights would allow individuals to deal with spillovers, and encourage efficient allocation and innovation. Many inquiry participants expressed views on the potential for markets to allocate rights to use spectrum (box 1).

Box 1 **For or against a market for spectrum?**

Some inquiry participants supported market-based approaches to spectrum allocation, focussing on the economic efficiency advantages of markets:

> We broadly support the overall legislative framework of the radiocommunications Acts …. This includes the licensing system with allocation of the type of licence to be based upon the spectrum use and the promotion of market-based allocation mechanisms for spectrum licences. (Vodafone Australia, trans., p. 47)

> A market-based approach to spectrum allocation yields substantial efficiency gains in rapidly changing telecommunications markets. (Optus, sub. 17, p. 6)

> This submission argues that the private sector can play a much greater role in managing the spectrum allocation process, and that fully tradeable perpetual spectrum property rights may play a significant role in promoting good outcomes in ... spectrum use and management. (Market Dynamics, sub. 33, p.12)

Several inquiry participants supported the approach adopted in the draft report:

> Telstra supports the overall tenor of the Commission's observations and agrees with the Commission's evident strong preference for increased use of market-based solutions and the operation of market forces to better ensure efficient spectrum management. (Telstra, sub. DR323, p. 1)

> Unwired welcomes the Commission's views on market-based allocation; the assignment of technically neutral property rights; and the call for a strengthening of property rights allowing the market rather than administrative actions to manage spectrum. (Unwired Australia, sub. DR319, p. 3)

Other inquiry participants did not object to market-based approaches *per se*, but were concerned about their ability to compete with commercial users of spectrum:

> … there is a degree of nervousness amongst non-commercial spectrum users, both in Australia and internationally, that market-based reforms to spectrum management, such as the auctioning of spectrum, could have serious implications for emergency and safety-of-life services. (Australian Maritime Safety Authority, sub. 4, p. 2)

> As a non-commercial, public good organisation, the Bureau would be unable to compete at public auction for spectrum. (Bureau of Meteorology, sub. 5, p. 7)

> The Department considers that, in recognition of their public benefits, spectrum requirements for safety-of-life services should not be subject to the market-based allocation process for spectrum. (Department of Transport and Regional Services, sub. 62, p. 1)

> [The Country Fire Authority] is not in a position to compete on a commercial basis for use of the spectrum. Indeed, it could be argued this may result in inappropriate pressures in relation to provision of resources required for safety-of-life situations. (CFA, sub. 29, p. 2)

Technology promises to improve spectrum efficiency.

Technological developments may reduce the role of governments in spectrum regulation. Some commentators advocate extending the class licensing concept to allow unlicensed access to spectrum. 'Smart' receivers and transmitters and voluntary protocols would coordinate shared, multiple, unplanned use of the spectrum. These technologies are promising, but it remains to be seen whether they can completely eliminate interference problems. While they will increase the technical efficiency of spectrum, they are unlikely to remove the need for property rights.

The reforms in practice

The RC Act reforms were ambitious and implementation has been slower than expected.

The emphasis on market-based allocation in the 1992 reforms represented a marked change in spectrum management. Spectrum licensing was the most important of these reforms. The outcomes have been mostly favourable, but implementation has proved more difficult than expected. In consequence, the licensing system remains dependent on prescriptive apparatus licences and administrative intervention.

Implementing spectrum licensing proved difficult and time consuming.

Inquiry participants that hold spectrum licences value the freedom to use different technologies, to aggregate licences into service networks and to trade them on the secondary market. Spectrum users favour more spectrum licensing, but the deployment of spectrum licences has been slower than anticipated. About 7 per cent of the radiofrequency spectrum is licensed in this way (although this includes virtually all spectrum devoted to high value telecommunications).

Transforming the theoretical concept of spectrum licences into a practical instrument was difficult. Each spectrum licence is defined in four dimensions — two dimensions for geographical coverage, one each defining frequency and time. The SMA had difficulty finding ways to define and enforce geographic and spectral boundaries.

Spectrum licences are configured for an expected use.

Boundary conditions were intended to be technology and use neutral. However, complete neutrality was deemed to be impractical and the SMA (and subsequently the ACA) defined the boundaries in terms of an assumed use (for example, mobile telephony). These assumptions maximise the technical efficiency of particular licences at a particular point in time. However, they render the licences less suitable for other uses, and hence may reduce the efficiency of spectrum use over time. This is exacerbated if, as some inquiry participants claimed, the technical specifications go beyond an assumed use to bias licence conditions in favour of a particular technology (for example, a specific technology for providing mobile telephony). Furthermore, since different assumed uses have been used to configure each issue of spectrum licences, the potential for substitution is reduced.

This could create problems in the future.

To date, these technical constraints have not been a major problem and there is evidence of different technologies being planned for spectrum licences in the same band. But as technology progresses and markets develop, the degree of prescription imposed on spectrum licences may compromise one of their key features — their flexibility to adapt to new uses.

Enforcing compliance raised problems and led to reliance on device registration.

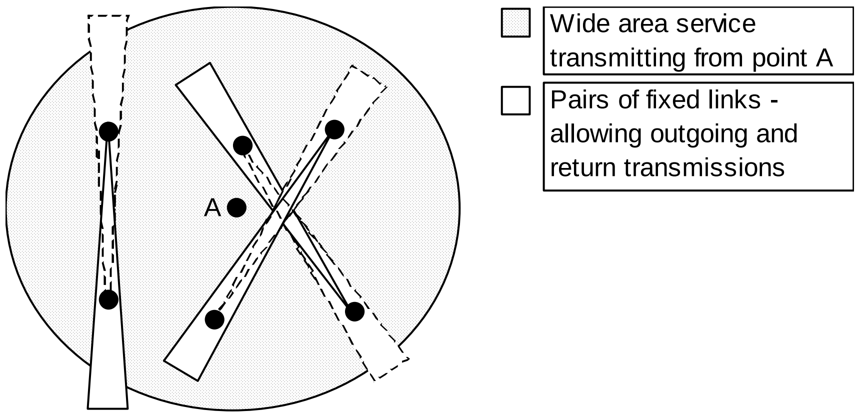
The SMA also had to decide how to ensure compliance with the boundary conditions. It decided that policing those boundaries was impractical, and relied instead on device registration to ensure that spectrum licensees did not breach the conditions of their licences. Devices would only be registered if licensees could demonstrate that they would not create unacceptable levels of interference.

Converting apparatus licences proved difficult.

The original process for converting apparatus licences to spectrum licences proved clumsy and slow. Some uses, such as radiocommunications links between two fixed points (that is, 'fixed links'), were deemed unsuited to spectrum licensing (see box 2). But virtually all point to multi-point (or wide area) services were suitable. Yet only two bands, out of 84 deemed suitable, have been converted. The obligation to offer all incumbent apparatus licensees a right to take out a spectrum licence delayed conversion. Negotiating prices for the new spectrum licences also proved difficult.

Box 2 **Spectrum denial**

Accommodating wide area and fixed link services in the same geographic location presents particular challenges for spectrum management. Fixed links and wide area services cannot easily coexist on the same frequency in the same geographic area. However, it is possible to locate multiple, overlapping fixed links operating on the same frequency in the one region. The establishment of a wide area service, such as broadcasting or cellular mobile services, effectively denies the use of that spectrum for fixed link services on the same frequency, particularly when the wide area service uses mobile devices that can transmit from any location. The footprint of the fixed link may only affect a relatively small part of the wide area service, but this will affect the overall utility of both services.



The high value of many wide area services, particularly cellular mobile services, has resulted in many fixed link services being displaced to other frequencies. In other cases, services previously provided via fixed links are being provided by fibre optic cable.

Re-allocation was introduced in 1997.

These difficulties prompted the Government to amend the RC Act in 1997, to introduce a mechanism for clearing apparatus licences and re-allocating spectrum bands. This has helped, but progress in spectrum licensing remains modest. The process of clearing bands for re-allocation has been controversial. While the ACA is not required under the RC Act to find new spectrum to relocate incumbent apparatus licensees, it has become a matter of practice to do so. But there are still costs to incumbents from being relocated. They have rarely gone quietly, and usually argue for compensation.

The first spectrum licence auctions were held in 1997.

The first auctions of Australian spectrum licences were held in 1997. The auctions attracted public attention, because of the amount of revenue raised and the large spread in prices achieved for similar spectrum at different auctions. The speculative boom and bust of the telecommunications industry in the past decade brought similarly diverse results around the world.

Revenue raising is not a good measure of the success of these auctions. Their principal purpose was the efficient allocation of spectrum, which they appear to have achieved.

Auctions have been generally successful.

Even with auctions providing efficient primary allocation of spectrum, a mechanism is required to re-allocate licences as circumstances change. Well-functioning secondary markets would allow spectrum to be allocated to its most valued uses. Secondary markets are taken for granted in most of the economy.

Healthy secondary markets are important

Both apparatus and spectrum licences are tradeable and may be leased to third parties. However, secondary markets for licences are not well developed.

… but for various reasons are not well developed.

- Many apparatus licences are technically prescribed and site specific, and may be resumed with two years notice. They therefore have little market appeal.
- Limited secondary trading of spectrum licences is a result of the small number of spectrum licences; the short time they have been available; limited substitutability; the long life of the associated equipment; and uncertainties about rights of renewal. Spectrum licensees purchased spectrum almost exclusively for their own use, and, with some notable exceptions, are still rolling out their services.

Most of the focus of this inquiry has been on spectrum licensing. This should not detract from the quiet success story of class licensing. It has proved to be an important regulatory model for devices that can coexist without causing interference problems.

Class licensing has been a success.

Guiding principles

The Commission endorses market-based allocation and assignment of technologically-neutral spectrum property rights. However, the market-based approach may not meet all the Government's objectives.

The Commission favours a market-based approach.

There is still a role for the Government.

The Government's role should be confined to creating and maintaining the institutional framework within which the spectrum market would work, dealing with international obligations and ensuring reasonable access to communication services for public and community users. The Government also has a role in providing class licensed spectrum for low interference radio devices, and supporting self-regulation of interference by setting interference boundaries, declaring mandatory standards where necessary and mandating registers of licences and devices.

Several basic principles have guided the Commission's recommendations.

The RC Act provides a solid foundation.

First, the current market-based approach is a solid base on which to build. The RC Act significantly improved the regulation of radiocommunications. But the slow implementation of spectrum licensing and the limited development of secondary markets suggest that it is time to re-invigorate this process.

Pricing should be based on opportunity cost.

Second, efficient allocation of spectrum, rather than revenue raising, should be the over-riding objective of spectrum pricing. All spectrum users should be charged the opportunity cost of that spectrum — that is, the value placed on it in the best alternative use. Public and community users should have some safeguards to ensure access to spectrum, but they should face the same price signals as other users of similar spectrum.

Regulation should avoid second guessing technologies and uses.

Third, regulations should avoid 'second guessing' technologies and uses, and leave these choices to the market. Arbitrarily defined planning boundaries reduce the benefits of market-based assignment and should be kept to a minimum. Planning constraints can be overcome to some extent through spectrum licences, but these licences should be as technologically neutral as possible.

Technically prescribed uses must be accommodated for the time being.

Fourth, the different characteristics of wide-area services and fixed links require different approaches to licensing. Most wide-area services are suitable for conversion to spectrum licences. But a strategy to accommodate technically prescribed rights to use spectrum is needed. Apparatus licences still have a role to play, at least in the short to medium term, as they can allow a greater number of tightly prescribed services to be licensed in closer proximity to each other than may be possible or cost effective under individual spectrum licences.

Fifth, security of tenure over the rights to use spectrum is important to encourage secondary markets and investment by licence holders. But it should not limit flexibility of spectrum use. Different approaches therefore are required for spectrum and apparatus licences.

Security of tenure is important.

Sixth, change should not be initiated for its own sake. For example, spectrum licences offer important long term efficiency benefits, but these benefits must be weighed against the costs of change on a case by case basis.

Reform is justified where the benefits outweigh the costs.

What changes are needed?

The Commission's recommendations build on the RC Act's original purpose.

The objectives of the legislation

The terms of reference for this inquiry require the Commission to clarify the objectives of the legislation. Although the objects of the Act have not been a major hindrance, there are many objects and some ambiguities.

The RC Act objects should be clarified.

The Commission considers that promoting the efficient use of spectrum was, and remains, the primary objective of the RC Act, and this should be given greater prominence. The community benefits from the efficient use of spectrum.

Promoting the efficient use of spectrum is the primary objective.

Objects relating to the Government's desire to make spectrum available for public and community users and to promote Australia's international interests should remain, but be made subordinate to promoting efficient spectrum use. Other objects of the RC Act are ambiguous and potentially weaken the primary object and should be deleted.

Public and community users and promoting international interests are also important.

Charging for spectrum

Pricing should encourage the efficient use of spectrum.

Charging on the basis of opportunity cost (the value of the best alternative forgone) will promote the efficient use of spectrum. In a well functioning market this will be the market price. Where markets are not functioning well and administrative pricing is required, charging should attempt to emulate opportunity cost.

Scarce spectrum should be allocated using market-based mechanisms.

If the demand by all potential users could be satisfied by the available supply, charges would be limited to recovering the cost of administering the Act. Where spectrum is scarce, it should be allocated among competing users through the market, rather than administrative mechanisms. The ACA's preferred market-based approach has been to use auctions, which the Commission supports. These have allowed spectrum to be allocated to its highest-value uses quickly and transparently, which ensures that community benefits are maximised.

Simultaneous ascending auctions are the preferred design but others should be explored.

To achieve efficient allocations, auction design should be tailored to circumstances. The introduction of simultaneous ascending auctions has been a positive step, designed to allow bidders greater flexibility in constructing efficient aggregations of spectrum. However, flexibility and efficiency are restricted by licence-by-licence bidding. There may be benefits from the introduction of combinatorial auctions, which allow bidders to choose a package of lots on an all-or-nothing basis. Overseas developments in combinatorial auctions should be monitored closely.

Administrative pricing requires accurate valuation of the spectrum.

The expansion of spectrum licensing, using market mechanisms, would reduce the need for administrative pricing, but would not immediately remove it. Distortions can be created if substitutable spectrum is subject to different charging mechanisms. As far as possible, administrative prices should represent the market value of the spectrum.

The current formula should be more flexible and transparent.

The ACA has adopted an incentive-based formula for administrative pricing of apparatus licences, which attempts to account for the amount of spectrum used and its value. But it can result in marked differences in the prices of contiguous bands of spectrum. It should be modified so that prices for contiguous spectrum vary smoothly, rather than in discrete steps. The formula should be transparent, and it should not be manipulated for revenue-raising purposes, which could lead to inefficient use of spectrum. Apparatus licences that are priced without the use of the formula should not be amended without justification.

Licensing

Class, spectrum, and apparatus licences should be retained.

The current system of licensing provides a flexible means of defining the rights and obligations of spectrum users. The Commission supports retention of the current three licence types: spectrum; apparatus; and class licences.

A single licence approach is not recommended.

The ACA proposed a single licence approach that would accommodate the three different types by varying licence conditions to suit different circumstances. The Commission considers that it would be difficult for a single licence to accommodate all cases. For example, class licences would have to be addressed separately, as they do not require the licensing of individual devices. Apparatus licences and spectrum licences also have very different characteristics, particularly with respect to technical specificity, tenure and rights to compensation. A single licence approach would blur distinctions between market-based, flexible property rights and the administrative allocation of prescriptive licences. Such a change would rely on ACA discretion to vary licence conditions, rather than giving scope to market forces.

The flexibility the ACA seeks to achieve with its single-licence proposal could be achieved through improvements to spectrum licensing, and the wider deployment of spectrum licensing. This would allow private band managers to develop leases with varying conditions (see below).

Conversion and reallocation processes should be improved.

Spectrum licensing could be promoted in a variety of ways. Amendments to the conversion process, to accommodate overlapping apparatus licences and to allow the aggregation of a number of apparatus licenses into one spectrum licence, would help. The re-allocation process should also be improved. While re-allocation has been criticised by some participants as a return to central planning — and experience has shown it can be a disruptive process — once spectrum licences are created the need for further planning disappears.

The sale of encumbered spectrum

The Commission considers that private band managers could develop innovative leasing arrangements to replace some apparatus licences and encourage efficient use of spectrum. The Commission recommends that barriers to the development of private band managers, such as restrictions on issuing spectrum licences over encumbered spectrum, should be removed. The development of private band managers would reduce the role of apparatus licences. Spectrum licences would become the norm, supported by class licences.

… and the issue of spectrum licences for any vacant spectrum

The ACA need not wait until competition emerges for vacant spectrum before issuing spectrum licences. The ACA should sell vacant spectrum to anyone wishing to take out a spectrum licence, subject to calling for expressions of interest. This will encourage entrepreneurial interest in spectrum.

… will increase the supply of spectrum licences.

Increasing the supply of spectrum held under spectrum licences would stimulate the secondary market and improve the efficient allocation of spectrum.

Licence tenure

Poor tenure creates uncertainty, distorts investment

The duration of radiocommunications licences, and the conditions under which they may be renewed, influence tenure and hence the certainty with which licensees can plan their investments. For example, long licences give licensees more time to recoup the costs of their investments and give more flexibility in choosing between investment options. Short licences distort investment decisions if licensees choose investment projects that match the term of the licence, rather than those that use spectrum most efficiently.

… and discourages secondary markets.

Limited terms also discourage trading on the secondary market. Purchasing a licence part-way through its term leaves less time to recoup investment costs. If purchasers lack assurance that they will be able to regain the licence after it expires, they will be less inclined to enter the secondary market. This concern would become more pronounced as the term of the licence approaches expiry.

The different characteristics of spectrum and apparatus licences indicate that different approaches to tenure are appropriate.

Apparatus licences

Longer terms are not appropriate for apparatus licences

In the Commission's view, increasing the notional term of apparatus licences, as recommended by a recent DCITA review, would not be appropriate. When the Radiocommunications Consultative Council considered this proposal, there was a marked lack of consensus on the desirability of longer apparatus licence terms. The vast majority of current apparatus licensees currently choose to pay for one-year licences, although they could pay for licences of up to five years.

… but they should have a positive presumption of renewal.

The technically-prescribed nature of apparatus licences limits their flexibility. For a change in use to be accommodated, a mandatory power to resume those licences is necessary. It is the period of notice given to licensees, combined with conditions on renewal, that determine licence tenure, not the nominal term of the licence. The RC Act should be amended to give apparatus licences a positive presumption of renewal, subject to explicit and transparent resumption conditions. This would give apparatus licensees greater certainty, but without the inflexibility of longer licence terms,

Spectrum licences

A cautious approach gave spectrum licences 15 year terms

While the RC Act was a major step forward, it adopted a cautious approach to the duration of spectrum licences. A maximum ten year term was originally enacted, later amended to 15 years. There was some concern that long term or perpetual licences would lock in spectrum uses. It was presumed that spectrum licences would be limited to specified uses, and hence that a limited term might still be needed to give the regulator scope to change spectrum use when licences expire.

… but they are conducive to perpetual rights.

But as explained previously, the RC Act does not require that spectrum licences be limited to a specified use. They are not linked to the spectrum plan and have considerable latitude to adopt different uses and technologies. With some attention to creating core conditions that are as technologically neutral as possible, spectrum licences would have the characteristics required for perpetual licences.

Concerns about foreclosing future opportunities are misplaced.

Even so, there is some reluctance to take this additional step. Traditionally, governments have acted cautiously in allocating perpetual rights to publicly owned resources, fearful that they might close off unforeseen future opportunities. But perpetual rights would not lock in spectrum use. On the contrary, their greatly improved marketability would emphasise the opportunity cost of not using licences efficiently. Competing users, new technologies and changing market opportunities would impose a discipline on incumbents to use the spectrum efficiently or sell or lease it to others who can.

Perpetual rights would encourage secondary markets.

Perpetual licences would allow market participants to choose if and when they enter or exit the industry. Instead of facing an arbitrary cut off date, licensees could match their licence holdings to their business plans. Perpetual licences should also result in a wide variety of leasing arrangements as band managers respond to the needs of the market place for leases of different terms and conditions.

Government can safeguard the interests of public and community users.

Markets are generally better at anticipating and adapting to unforeseen uses than governments. But if a new public or community use emerges that requires access to spectrum, the Government could fund targeted users to purchase the spectrum needed in the market place.

Sale of perpetual licences will bring forward government revenue.

The government may also be reluctant to introduce perpetual licences because this would mean giving up future revenue raising opportunities. The Commission has emphasised that revenue raising should not be a major consideration, but a consequence of efficient spectrum allocation. Selling perpetual rights to use spectrum would involve some trade-offs. Less revenue in future years but — to the extent that perpetual licences are more valuable than 15 year licences — more now.

Perpetual spectrum licences seem a big step to take, but they are a logical consequence of the path taken in spectrum management. They would create more certainty, thus promoting investment and secondary markets. They would remove the need to re-allocate licences periodically, and reduce costs associated with industry lobbying, and government administration. Issuing perpetual licences would complete the market-based reform process started in 1992.

This reform builds on the 1992 market reforms.

The Commission has concluded that, after a date to be specified, all new spectrum licences, and any re-issued licences, should be issued with perpetual rights (except for any re-issued under the 'public interest' tests). Some lead-time is required. The RC Act will need amendment and the ACA will need time to devise suitable core conditions. However, committing to a specific date would provide certainty and create a more robust market. The first spectrum licences issued are due for expiry in 2007. Their re-issue would be a suitable occasion for the introduction of perpetual licences. Under the Commission's recommendations, this would be at auction three years before expiry, in 2004.

The Government should introduce perpetual spectrum licences.

The public interest tests

Until all spectrum licences are issued with perpetual rights, the issue remains — what to do when current licences expire? Under the RC Act, replacement spectrum licences may be allocated by market-based means no more than two years before expiry, or they may be re-issued to incumbents if it is in the 'public interest'. While not explicitly stated, market-based allocation appears to have been the default approach when the Act was drafted.

Spectrum licences can be re-issued to incumbents if it is in the public interest.

The RC Act specifies two public interest tests: one by which the Minister can determine a class of services for which re-issuing licences would be in the 'public interest'; and one by which the ACA can re-issue licences in 'special circumstances'. Uncertainty about the application of these tests, and their conjunction with the market-based alternative, is creating concern among industry participants.

Uncertainty about renewal may affect investment.

Concerns about disruptions to services are overstated.

The public interest tests address concerns about potential disruption to services. However, this is unlikely to be a major problem, and must be weighed against the potential cost of licences not being allocated to their highest value uses. Incumbents have significant advantages over new entrants in a competitive bidding process, and hence stand a good prospect of winning sufficient licences to retain a viable business. And even if they were unsuccessful, their customers should be able to migrate to another provider. Locking out the potential for new providers to offer better services is an inefficient means of addressing a problem that may be more perceived than actual.

There are several problems with the public interest tests

There are several problems with the public interest tests. The lack of definition in the RC Act provides scope for discretion in their application. The Act provides no guidance on what might constitute a class of service, let alone on why it would be in the public interest to reissue licences to everybody in that class. The very act of defining a class of services is at odds with the technological neutrality of spectrum licences. Similarly, ‘special circumstances’ are not defined. The existence of the tests will lead to increased lobbying activity by incumbents and potential entrants. Moreover, the Act is silent on the price that an incumbent should pay for re-issue of a spectrum licence even if it met one of the tests.

… they should be tightly controlled

Such are the problems with these tests that the Commission considered recommending their outright repeal. The Commission notes the argument that existing licences were sold with some expectation that the tests might subsequently apply. This provides a case for the tests to be grandfathered; that is, they should not apply to any future spectrum licences. If the tests are applied to existing licences, they should be tightly controlled. To avoid locking in uses for long periods, the tests should be applied once only, and licences re-issued under the tests should be limited to five year terms.

… and transparent processes followed.

If the Ministerial test is applied, it should be informed by a public inquiry, where the incumbents are required to demonstrate why competitive allocation would not be in the public interest. The ACA ‘special circumstances’ test should only apply to unique circumstances applying to a particular licence at a particular point in time. If the ACA applies this test, it should publish the reasons for its decision.

The public interest should be defined in accordance with the primary objective of the RC Act.

In keeping with the Commission's interpretation of the objects of the RC Act, the public interest should be defined in terms of the efficient allocation of spectrum. Some participants suggested that the test should be based on a range of output-based measures, including the number of customers, geographic reach and importance to the national economy. The Commission considers that such criteria shed little light on the public interest, and would strongly favour incumbents over other potential providers.

The tests should apply just before an auction would otherwise be held

There were many opinions about the timing of the public interest tests. Some argued that they should be applied around the middle of the term of spectrum licences (that is, around years 7 to 8). In the Commission's, view this is far too soon, as it would prejudice the chances of alternative uses being properly considered. Given that the preferred approach is to re-issue licences at auction, the public interest tests should be considered just before this date.

… which the Commission recommends be three years before expiry.

In its draft report, the Commission sought comment on the appropriate time to hold auctions, suggesting that three years before expiry might be more appropriate than the current maximum of two years. Many inquiry participants agreed. The application of the public interest tests for a current licence should be considered just prior to that.

This reasserts the role of auctions as the preferred approach.

Integrating the two avenues for re-issue in this way would put incumbents and potential entrants on a more even footing. By creating greater certainty about the processes to be followed, it should also reduce pressure on the Minister and ACA to invoke the public interest tests, and reassert the role of market-based means for allocating spectrum licences as the preferred procedure. As perpetual licences take over from time-limited licences, the public interest tests will become increasingly irrelevant.

The competition limits

A competition limits provision, introduced in 1997,

Competition limits were introduced into the RC Act in 1997. These gave the Minister power to limit the participation of some bidders in auctions and to specify the amount of spectrum that specific bidders could acquire. ACCC advice is sought, but the Minister may take other matters into consideration. The amendments also defined the issue of a licence as the purchase of an asset for the purposes of s. 50 of the *Trade Practices Act 1974* (TPA), which addresses the competitive effects of mergers and acquisitions. However, there is no explicit link between the competition limits and the TPA.

… has applied to several auctions and coincided with some new entrants.

There are mixed views on the need for these limits.

The competition limits were introduced when the telecommunications sector was being opened up to competition. They were designed to prevent incumbent operators from gaining dominant positions in mobile telephony and related services. Competition limits have been applied to several auctions of spectrum licences and have coincided with the entry of some new firms. The two regulators (the ACCC and the ACA), and some firms that have benefited from the limits, argued for their retention. Others thought limits had served their purpose, or were inconsistent with the TPA, and should be repealed (box 3).

The general provisions of the TPA apply.

The need for an industry specific regime such as this should be carefully assessed when general competition laws also apply. In principle, the Commission prefers general to industry specific regulation, because this allows more consistent treatment and thus promotes the efficient allocation of resources across the economy.

The competition limits create more certainty, but are not consistent with the TPA.

The competition limits have some advantages, but several disadvantages. *Ex ante* limits add certainty to the auction process. Compared with the *ex post* application of s. 50 of the TPA, they may also result in a more timely allocation of licences. But because they are discretionary, competition limits may be used to engineer industry structures that appear pro-competitive, but prove to be unsustainable. There are also no avenues for appeal. To the extent that the limits are more restrictive than s. 50 of the TPA, they may be subverted in the secondary market. This has already occurred.

Box 3 **Inquiry participants' views on competition limits**

Few inquiry participants wanted to retain the current system of competition limits in spectrum auctions:

> The ACCC considers that the current arrangements work well… ss 60 and 106 of the RC Act … provide a means of preventing one party from becoming dominant and using its position to manipulate prices or to exclude competitors. They also provide opportunities for new operators to enter the telecommunications market and compete with existing operators. (Australian Competition and Consumer Commission, sub. DR334, pp. 2)

> The removal of competition limits and reliance solely upon s. 50 of the Trade Practices Act will be prejudicial to small and medium enterprises. (Electronic Frontiers Australia, sub. DR318, p. 6)

Many inquiry participants argued the competition limits are arbitrary and create market distortions. Some said they should be removed:

> … the market is best placed to decide the optimal number of competitors in any market. Unless Government can identify a clear market failure, it should not use competition rules to shape the market. (Optus, sub. 17, p. 8)

> … any limits should only be those that come from the application of the Trade Practices Act's significant lessening of competition test as applied to mergers and acquisitions. (Australian Electrical and Electronic Manufacturers Association, sub. 36, pp. 2–3)

> … the limitations imposed on bidding for spectrum at auction are unnecessary. … the existing spectrum auction format seeks to artificially structure and constrain the natural development of the market. (Telstra, trans. p. 507)

Others said competition limits should apply only in limited circumstances:

> The ACA supports the retention of competition limits within the [RC Act] but would agree that the competition limits should be used sensitively and only to achieve clear policy objectives. (ACA, sub. DR324, p. 6)

> There should be some retention of competition limits … Actually excluding a party from bidding altogether, I think, is going too far. (Centre for Telecommunications Information Networking, trans., p. 488)

> In limited circumstances, it may be necessary to impose *ex-ante* competition rules for spectrum auctions to protect against anti-competitive outcomes. This may occur in markets that are yet to develop as competition law is best suited to deal with competition in existing markets. … such rules should be transitory in nature to provide for the time period needed for the market to emerge. (Vodafone Australia, sub. DR326, p. 2)

> Unwired welcomes the … abolition of *ex ante* bidding limits from spectrum auctions except in one very specific set of circumstances, and that is where there is a dominant incumbent, and that dominant incumbent has the capacity and motivation to extend its monopolistic coverage in order to limit competition. (Unwired Australia, sub. DR319, p. 4)

There is no compelling case for competition limits. The general provisions of the TPA should suffice.

Competition in telecommunications and related markets is an important objective, but artificially engineered outcomes are not the answer. The Commission is not convinced that there are compelling reasons in this case for having different rules for spectrum users. Knowing that s. 50 of the TPA applies to the purchase of spectrum licences should be sufficient warning to participating companies to take appropriate action. The perceived disadvantages of relying solely on s. 50 could be ameliorated by informing potential auction participants of what is likely to be permissible behaviour, before the auction takes place.

The competition limits provisions should be repealed

… but if they are not, they should be made consistent with s. 50 of the TPA.

The Commission considers that the competition limits provisions should be deleted from the RC Act. But if the government chooses to retain them, the Commission strongly recommends that they be amended to make their effect consistent with s. 50 of the TPA. This would retain the benefits of *ex ante* application and align the competition regulation of the primary allocation of licences and the secondary market. The Commission proposes various measures to make the application of the limits more transparent and to establish a review process. By amending the limits to make them consistent with the TPA, it would also be possible to have them administered by the ACA and the ACCC, without the need for Ministerial involvement.

The limits will become redundant once perpetual licences have replaced all of the time-limited licences already in circulation. But this will take many years. The competition limits could remain an important issue for many years to come.

Non-commercial spectrum users

Access to spectrum and its pricing concern many non-commercial spectrum users.

Many public and community users argued for preferential access to spectrum and/or preferential pricing. These users were concerned that commercial pressures for access to spectrum are growing and that they will not be able to match the high prices that have been associated with recent spectrum auctions. However, the encroachment on frequencies used by non-commercial operators has been very limited to date, and with a marked correction in telecommunications markets, spectrum prices have subsided.

Special access is appropriate in some cases

In a limited number of cases, preferential access is appropriate. For national security reasons, Australia's defence forces need exclusive access to some spectrum. And there are some arguments for special arrangements for radioastronomy, which is particularly sensitive to even low levels of interference. But for the most part, public and community users can be accommodated readily within the same framework as other users.

… but concessional pricing reduces incentives to use spectrum efficiently.

Some non-commercial operators argued that they produce public goods and should not be charged for spectrum. But this confuses arguments for government funding of these services (public goods may be under-provided, or not provided at all by the private sector) with the pricing of inputs used by those providers. Irrespective of the nature of the outputs of public and community users, spectrum should be treated like any other input and priced accordingly. Concessional pricing dulls incentives to use spectrum efficiently and discourages searches for alternative ways of meeting communication requirements.

Any assistance to public and community users should be through explicit budget funding.

The list of organisations currently receiving concessions or exemptions is short, and the net cost to the budget is small. The Commission makes no comment on the eligibility of organisations for assistance, but favours an approach that meets their communication needs more directly, rather than providing free or discounted access to spectrum. Explicit budget funding, which provides direct support to targeted organisations and is not tied to spectrum use, would provide incentives to economise on spectrum use and make the true cost of support transparent. If this is not acceptable, the Government should limit the subsidy to the taxation component of licence fees, and the costs of the exemptions and concessions should be highlighted in the ACA's annual report.

Broadcasting

Broadcasters are treated differently.

Broadcasters are treated differently to other spectrum users. Under s. 31 of the RC Act, the Minister designates which part(s) of the spectrum will be used primarily for broadcasting, and responsibility for planning and licensing the 'broadcasting services bands' is delegated to the Australian Broadcasting Authority (ABA).

They pay licence fees based on revenue not spectrum use.

Unlike other spectrum users, broadcasters pay licence fees related to their revenue, not their spectrum use. Therefore, they face no financial incentive to economise on spectrum use, which, in the case of television broadcasting in particular, can be substantial. As the Commission argued in its broadcasting report of March 2000, there would be benefits from changing these arrangements.

The Commission recommended changes in its broadcasting report.

The Commission considers that the analysis contained in that report remains valid, and reiterates the relevant recommendations, including:

- transferring responsibility for planning and licensing the broadcasting services bands of the spectrum to the ACA for management under the RC Act;
- separating content-related licences to broadcast from licences to use the spectrum; and
- basing licence fees for spectrum on the opportunity cost of spectrum used, not a proportion of the user's revenue.

The Commission's approach should not affect social and cultural objectives.

Some participants were critical of this approach, arguing that it gives undue emphasis to economic efficiency objectives at the expense of social objectives. They are right to point out that the government is pursuing a range of social and cultural objectives in broadcasting policy (including the content and coverage of services). The Commission does not question the importance of these and other non-economic objectives, such as those contained in the Competition Principles Agreement. But the Commission has consistently argued that these objectives should be pursued independently of the technical planning and licensing of the spectrum in the broadcasting services bands. The changes recommended to the management of broadcasting spectrum will not of themselves undermine the fulfillment of social objectives.

Effectiveness of the ACA

The ACA has implemented the reforms effectively,

The inquiry's terms of reference require the Commission to assess the effectiveness of the ACA in implementing the reforms contained in the RC Act and associated legislation. Much of the discussion above informs this assessment. In general, the Commission considers that the ACA has done a commendable job in a challenging technical and commercial environment. Minor amendments to the RC Act would enable the ACA to progress implementation of the 1992 reforms more effectively.

… although spectrum licences have become more prescriptive than first envisaged,

The ACA showed initiative and flexibility in translating the spectrum licence concept into a workable instrument. The ACA adopted innovative solutions to difficult technical problems, although they placed more restrictions on the licences than initially envisaged by the RC Act. It is difficult for the Commission to assess whether the degree of technical prescription that has crept into spectrum licensing has been wholly necessary. The ACA's intention to hold a workshop on these issues later this year is a positive step.

… and their deployment slower than expected.

These technical difficulties led to delays in the introduction and issue of spectrum licences. By the ACA's own standards, the spread of spectrum licences has not been as rapid and comprehensive as anticipated.

Nevertheless, the ACA has matched international rates of spectrum release.

Although conversion of existing services to spectrum licensing has been slow, the ACA has matched or bettered international rates of spectrum release for new services. While it appears that sufficient spectrum licences have been issued to meet needs of new services, wider application would have helped to promote markets in spectrum and added greater flexibility to the system.

Auctions have been well designed but spectrum release has been questioned.

Using international expertise and building on the technical make-up of spectrum licences, the ACA has implemented an auction model which is superior, in many respects, to those used overseas. However, some inquiry participants claimed that the timing of spectrum auctions and the quantity of spectrum released has been motivated on occasion by revenue-raising considerations.

The ACA has made significant administrative reforms.

The RC Act permits the ACA to delegate a number of functions that were previously the sole prerogative of the spectrum regulator. This devolution has been largely successful, leading to the creation of a spectrum assignment and accreditation industry. Some minor amendments to the RC Act would provide scope for further delegation of ACA functions.

Implementation of the reforms rests with the Minister and the ACA.

It is not possible to examine the effectiveness of the ACA without reference to the role of the Minister. In many areas, such as the timing of declarations for spectrum licensing, actions by both parties are required. Some inquiry participants expressed concerns about the effects of these arrangements on transparency in decision making. If the Government adopts the Commission's recommendations, some of these processes will be streamlined and the respective roles of the Minister and the ACA clarified (see below).

The changing role of the ACA

A regulator would still be required

As Australian spectrum management moves to a more market-based system, the role of the ACA is changing.

… for international co-ordination.

What will not change is the need for the regulator to represent Australia in international bodies, such as the ITU, and coordinate international safety-of-life and satellite services.

There will be less need for domestic planning.

The shift toward spectrum licences, particularly if the Government accepts the Commission's recommendation that they be issued in perpetuity, will diminish the need for detailed domestic spectrum planning and allow the market to play a greater role in allocating and assigning spectrum. The current approach of unshackling spectrum licences from the spectrum plan, but making licensees responsible for any breaches of international interference obligations, is appropriate. The spectrum plan should act as a guide to spectrum use rather than a straitjacket.

Class licences may become more important.

The regulator will also have to create and manage class licensed 'public parks', for spectrum uses with limited interference concerns. This role will become more important if new technologies deliver on promises to provide expanded communications services with limited interference.

Apparatus licences will require pricing, planning and a power of resumption.

As long as apparatus licences exist, there will be a need to plan their efficient distribution across the spectrum and to set prices administratively. The existence of apparatus licences also requires a regulator with the powers to resume and re-plan the spectrum over time. In future, many current apparatus licensees will pay private band managers (rather than the ACA) for access to spectrum, under commercial leases.

More responsibility could be given to spectrum licensees to solve their own interference problems.

Spectrum licensees should be given more responsibility to manage compliance with licence conditions. Compulsory registration of devices used in spectrum licences helps licensees identify possible sources of interference when planning and managing their spectrum and should be retained. However, the ACA's discretion to refuse registration where an accredited person has certified that a device will not breach licence core conditions should be removed. Moreover, accredited persons should be free to use other methods to calculate likely signal propagation, rather than being required to apply ACA determined device boundaries.

The regulator still has a role in managing interference disputes.

The causes of some interference problems are not easy to identify or solve, and in some cases may require statutory powers of investigation. This suggests an ongoing role for the ACA in investigating interference complaints between licensees not willing or able to manage their own interference concerns. Guidelines to help resolve interference disputes between licensees would help.

The Minister should focus on broad policy, not operational decisions.

Under the Commission's recommendations, the regulator would take on more of the operational responsibilities currently vested in the Minister. The RC Act currently includes a variety of checks and balances, which add to delays in implementing spectrum licences. Some of these may have seemed necessary when the reforms were first introduced. They are less necessary now that the ACA's credentials as an independent regulator have been established, and experience of (and confidence in) their spectrum management processes has been gained. The Commission recommends a higher level role for the Minister in endorsing a broad program for the roll out of spectrum licences, rather than being involved in operational decisions. Once approved by the Minister, it would be the ACA's responsibility to implement the program.

Conclusion

The nature of spectrum requires some Government intervention.

In keeping with the principles of a legislative review, the Commission has examined the legislative framework: first, to establish whether intervention is required; and second, to assess whether current arrangements are appropriate and promote efficient outcomes. There is little dispute that clear and substantial market failures in the form of interference warrant some form of intervention in the management of spectrum.

The current approach is still prescriptive

Having decided that some form of intervention is required, the Commission considered whether the current framework is appropriate, and whether its benefits outweigh the costs. Some provisions, such as the competition limits and the public interest tests, are potentially anti-competitive. And it is apparent that, despite the market-based reforms of recent years, the regulatory framework is still highly prescriptive. It includes spectrum plans, frequency band plans, mandatory standards, and licences with varying degrees of technical constraints, all of which may hinder competition.

… but some technical prescription remains necessary.

There are good social and economic reasons for some of the prescription that the regulations entail. For instance, the spectrum plan summarises binding Australia international commitments (for example, for aviation and maritime use), and gives some guidance to spectrum users. Its effects on competition and economic efficiency will become increasingly irrelevant if spectrum licences (which are not tied to the spectrum plan) become more widespread.

Relatively few amendments to the RC Act are required.

The Commission does not recommend major rewriting of the RC Act. Rather, the Commission suggests that, with relatively few amendments, the Act provides a good framework within which to pursue significant further reform.

The most substantial is to introduce perpetual spectrum licences,

The most fundamental reform that the Commission considers necessary is to turn spectrum licences into perpetual rights. Until such time as this happens, some interim amendments to the RC Act are required. The most substantial of these include: improving spectrum licence conversion and reallocation processes; tightening the public interest tests; and abolishing or substantially amending the competition limits.

… which in conjunction with some relatively minor amendments

Other amendments that would promote competition include: clarifying the objects of the RC Act; introducing an explicit presumption of renewal for apparatus licences; allowing the sale of encumbered spectrum licences; and normalising spectrum use by broadcasters.

… and some administrative reforms

A range of administrative amendments are also recommended, including revising the incentive based formula for administrative pricing and replacing concessional pricing with explicit budget funding.

… will remove constraints on competition.

These and other supporting amendments will increase the public benefit from using spectrum. Constraints on competition will diminish over time as the extension of spectrum licensing allows greater scope for market-based spectrum allocation and assignment. Introducing perpetual licences will reinforce this process by creating more certainty in the secondary market.

Recommendations and findings

Chapter 5 Objectives of radiocommunications legislation

FINDING 5.1

The objects section of the Radiocommunications Act 1992 *lacks clarity because it does not identify a single primary objective, supported by subsidiary objectives.*

FINDING 5.2

The primary object of the Radiocommunications Act 1992 *is 'to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum' (clause [a]).*

FINDING 5.3

In the objects section of the Radiocommunications Act 1992*, clause (c) (to provide a responsive and flexible approach to meeting the needs of spectrum users) and clause (d) (to encourage the use of efficient radiocommunications technologies) are superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

FINDING 5.4

In the objects section of the Radiocommunications Act 1992*, clause (e) (to provide an efficient, equitable and transparent system of charging for the use of spectrum) is unclear and may be superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

FINDING 5.5

Clause (b) of the objects section of the Radiocommunications Act 1992 *clearly states the Commonwealth Government objective of making 'adequate provision of the spectrum for use by public or community services'. Additional, specific objects clauses for individual classes of public and community services are not necessary.*

FINDING 5.6

In the objects section of the Radiocommunications Act 1992*, clause (f) (to support the communication policy objectives of the Commonwealth Government) and clause (g) (to provide a regulatory environment that maximises opportunities for the Australian communications industry) are unclear and superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

FINDING 5.7

Clause (h) of the objects section of the Radiocommunications Act 1992 *clearly states the Commonwealth Government objective of promoting Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.*

RECOMMENDATION 5.1

The primary object of the* Radiocommunications Act 1992 *should be to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum.

The Act should also require the spectrum regulator to have regard to:

- ***making adequate provision of the spectrum for use by public or community services; and***
- ***promoting Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.***

Chapter 6 Licensing

FINDING 6.1

While the reforms to apparatus licences in the 1990s have led to some improvements, apparatus licences generally remain highly prescriptive and inflexible with respect to changes in spectrum use and new technologies. Apparatus licensing requires management by the Australian Communications Authority to enable licensees to adapt to new uses and technologies.

FINDING 6.2

Spectrum licences are not entirely technology or use neutral at the time of issue, but are much more flexible than apparatus licences in responding to changing uses and technologies over time.

FINDING 6.3

Class licences, by authorising the use of devices with low interference potential, provide an important mechanism for increasing the technical efficiency of spectrum use.

FINDING 6.4

A single licence type would have significant net disadvantages, compared with the current licence types in the Radiocommunications Act 1992.

RECOMMENDATION 6.1

The* Radiocommunications Act 1992 *should be amended to allow the Australian Communications Authority to issue spectrum licences in unencumbered spectrum without the need for a Ministerial designation under section 36.

FINDING 6.5

Using a market-based approach only when there is excess demand for spectrum may unnecessarily restrict the issue of spectrum licences. From an efficiency perspective, it may be beneficial to sell spectrum licences even when there is only one prospective buyer.

RECOMMENDATION 6.2

The Australian Communications Authority should issue spectrum licences in unencumbered spectrum even if only one party is interested in using that spectrum, after establishing the level of demand by calling for expressions of interest and allowing a suitable period for responses.

FINDING 6.6

Competition limits imposed under sections 60 and 106 of the Radiocommunications Act 1992 *are unnecessary, potentially distortionary and procedurally deficient.*

RECOMMENDATION 6.3

Competition limits should not apply to the primary issue of radiocommunications licences. Therefore:

- ***the competition limit provisions in sections 60 and 106 of the* Radiocommunications Act 1992 *should be repealed; and***
- ***the Australian Competition and Consumer Commission should amend its merger guidelines to address the assessment of the acquisition of***

***radiocommunications licences under section 50 of the* Trade Practices Act 1974.**

In the event that the Government decides to retain the competition limit provisions, the* Radiocommunications Act 1992 *should be amended to specify that:

- ***competition limits be applied consistently with section 50 of the* Trade Practices Act 1974*;***
- ***determinations imposing competition limits be issued by the Australian Competition and Consumer Commission;***
- ***determinations imposing competition limits be disallowable instruments for the purposes of section 46A of the* Acts Interpretation Act 1901*; and***
- ***determinations be subject to appeal to the Australian Competition Tribunal.***

FINDING 6.7

The effective tenure of apparatus licensees is determined by renewal conditions and the possibility of spectrum re-allocation or re-planning. Increasing the maximum nominal term of apparatus licences would not affect this.

RECOMMENDATION 6.4

Section 130 of the* Radiocommunications Act 1992 *should be amended to specify that apparatus licences generally will be renewed unless:

- ***licensees have failed to comply satisfactorily with their licence conditions; or***
- ***renewal on the same conditions would be inconsistent with the Australian Radiofrequency Spectrum Plan, frequency band plans, or spectrum re-allocation declarations.***

FINDING 6.8

Apparatus licences are short-term permits to access a public resource that may need to be cancelled periodically, or not renewed, to make way for higher value uses. Therefore, it is not appropriate to provide compensation to apparatus licensees whose licences are cancelled or not renewed.

FINDING 6.9

Re-assignment of spectrum licences within the two-year period before licence expiry does not provide sufficient certainty for incumbents to plan investment and maintenance over the latter part of their licence terms. This could result in a run down of assets and diminish the level and quality of services provided to customers.

RECOMMENDATION 6.5

The* Radiocommunications Act 1992 *should be amended so that the Australian Communications Authority is required to complete the market-based re-assignment of spectrum licences three years before they are due to expire.

FINDING 6.10

The 'public interest' tests create scope for arbitrary and inconsistent outcomes. The Australian Communications Authority's 'special circumstances' test lacks transparency.

FINDING 6.11

The 'public interest' is served by spectrum licences flowing to where they are most valued. This is best facilitated by market-based re-assignment.

RECOMMENDATION 6.6

The 'public interest' tests in section 82 of the* Radiocommunications Act 1992 *should be amended to:

- ***restrict the scope for their use to spectrum licences issued before a date to be set by the Government; and***
- ***allow licences to be re-issued once only and for a maximum term of five years.***

The amendments should also direct the Australian Communications Authority to:

- ***hold a public inquiry before the Minister makes any determination under section 82(3) that must:***
  - ***demonstrate why it would not be in the 'public interest' to use market-based assignment for the re-issue of licences;***
  - ***apply a cost-benefit approach when considering licence re-issue to the same person; and***
  - ***be completed within the twelve months before the scheduled market-based assignment of the potentially affected spectrum licences;***
- ***use shadow pricing, where feasible, to price spectrum licences re-issued under section 82;***
- ***publish the prices paid for spectrum licences re-issued under section 82(1)(a); and***
- ***publish its reasons for re-issuing spectrum licences under section 82(1)(b) and the prices paid for those licences.***

FINDING 6.12

The conversion process has been hampered by technical complexities and legislative impediments.

RECOMMENDATION 6.7

The conversion process in the **Radiocommunications Act 1992** ***should be amended to allow the Australian Communications Authority to:***

- ***convert a designated band to spectrum licences while allowing for certain apparatus licences to remain in that band; and***
- ***offer, where practicable, a spectrum licence for the same frequency range in cases where an apparatus licensee operates on different frequencies in contiguous geographic areas.***

RECOMMENDATION 6.8

Where it is cost-effective to do so, the Australian Communications Authority should convert wide area apparatus licences into spectrum licences.

FINDING 6.13

Given the characteristics of apparatus licences and to avoid the risk of hold-out, it is appropriate to retain the spectrum re-allocation process to facilitate the clearing of bands for the introduction of spectrum licences and new services and technologies.

RECOMMENDATION 6.9

The **Radiocommunications Act 1992** ***should be amended to allow the sale of encumbered spectrum licences. The Australian Communications Authority should develop the necessary arrangements and identify suitable bands for its implementation.***

Chapter 7 Secondary markets

FINDING 7.1

Secondary markets can improve the allocation of rights to use spectrum.

FINDING 7.2

The turnover rate for spectrum licences is around four times that for apparatus licences and similar to that of the residential property market. Some commercial leasing arrangements exist within both spectrum and apparatus licensing.

FINDING 7.3

The level of trading in spectrum and apparatus licences indicates a restricted range of substitution possibilities created by the natural properties of the spectrum, planning arrangements and equipment availability.

FINDING 7.4

The technology and site specific nature of many apparatus licences reduces the opportunities for trade in these licences.

FINDING 7.5

Given that stamp duties contribute to transaction costs, they may slow the transfer of radiocommunications licences and therefore, of spectrum, to more efficient users and/or uses.

FINDING 7.6

The public register of radiocommunications licences is an important tool which facilitates secondary trading by reducing search costs and transaction times.

FINDING 7.7

Price information on traded licences would help the Australian Communications Authority to determine the prices to charge for some new or converted licences in the primary market. The publication of trading information, such as volumes traded and prices paid, will improve the functioning of secondary markets.

RECOMMENDATION 7.1

The* Radiocommunications Act 1992 *should be amended so that:

- ***purchasers of traded licences are required to notify the Australian Communications Authority of the prices paid for licences; and***
- ***the Australian Communications Authority publish on a regular basis the volumes of licences traded and the prices paid for traded licences in an aggregated form to preserve the confidentiality of transacting parties.***

FINDING 7.8

'Use it or lose it' provisions generally are not warranted as supplementary conditions in radiocommunications licences because of the protection afforded by the Trade Practices Act 1974*.*

Chapter 8 Charging for spectrum

RECOMMENDATION 8.1

The Australian Communications Authority should re-assess the advantages of combinatorial auctions over simultaneous ascending auctions in the light of forthcoming overseas evidence. If combinatorial auctions prove a workable and effective way of reducing significant exposure, the Authority should, following consultation, consider this format for future spectrum auctions where strong synergies between lots exist.

FINDING 8.1

Spectrum auctions appear to have met the objectives assigned to them by the Government: efficient allocation of spectrum; accurate pricing of the resource; increased competition; and revenue raising.

RECOMMENDATION 8.2

The Australian Communications Authority should clarify the purpose of the spectrum licence tax. If the tax is intended to reflect the value of the spectrum denied, it should be discontinued. If the tax is intended — even notionally — for the cost recovery of indirect costs, its purpose should be made clear to spectrum licensees.

FINDING 8.2

Recovery of the direct and indirect costs of spectrum management is appropriate, as long as it is administratively efficient, consistent with radiocommunications policy objectives and minimises cross-subsidies between groups of users.

RECOMMENDATION 8.3

The Australian Communications Authority should examine the cost effectiveness and policy consistency of introducing a new system for recovering indirect costs of spectrum management, using a suite of levies designed to recover the costs imposed by different categories of users.

RECOMMENDATION 8.4

To achieve efficient outcomes, spectrum charges should be based on opportunity cost, that is, on the value of the best forgone alternative use of that spectrum. If no such alternative exists, charges should not exceed full cost recovery. Charges should not be aimed at raising government revenue or providing a return to the community.

FINDING 8.3

It is difficult to design an administrative pricing framework that replicates market prices closely. The apparatus licence charging model in use by the Australian Communications Authority has some deficiencies.

RECOMMENDATION 8.5

The Australian Communications Authority should implement a more transparent and flexible model for calculating the apparatus licence tax. In particular, it should ensure that all the elements required for the calculation of fees are given to licensees, and that, as far as possible, fees vary in a continuous — rather than discrete — fashion.

RECOMMENDATION 8.6

Shadow pricing of apparatus licences is a suitable technique for avoiding distortions between different types of licence, but it should be undertaken in a transparent and predictable manner that incorporates necessary adjustments to make comparisons meaningful.

Chapter 9 Managing interference

FINDING 9.1

Registration of devices to be operated under spectrum licences is an important element of the interference management framework. Inquiry participants supported the current list of details required for device registration.

RECOMMENDATION 9.1

Spectrum licensees should be required to certify compliance with core conditions when registering devices. However, the requirement that devices comply with the device boundary as set out in the relevant determinations under section 145 of the **Radiocommunications Act 1992** ***should not be mandatory.***

RECOMMENDATION 9.2

The Australian Communications Authority should not be able to refuse registration of a device where an accredited person certifies that the device will not cause unacceptable interference, except in cases of possible interference with devices on the classified register.

FINDING 9.2

As civil actions are unlikely to provide a practical means of settling most interference disputes, the Australian Communications Authority will continue to have a role in managing these disputes.

RECOMMENDATION 9.3

In the case of 'lawful' interference, the Australian Communications Authority should continue to recover the costs of interference investigation according to the cost recovery arrangements for indirect costs.

In the case of 'unlawful' interference, the Australian Communications Authority should endeavour to recover the reasonable costs of interference investigations from the person making the unlawful transmissions.

RECOMMENDATION 9.4

The Commission recommends that the Australian Communications Authority, in consultation with industry, develop and publish dispute resolution guidelines setting out the principles to be applied in interference disputes.

Chapter 10 Managing spectrum for non-commercial and broadcasting services

RECOMMENDATION 10.1

The Commission recommends that:

- ***section 31(1b) of the*** **Radiocommunications Act 1992** ***should be repealed, transferring responsibility for the broadcasting services bands of the spectrum to the Australian Communications Authority, to be managed under the provisions of the Act;***
- ***licences granting access to spectrum should be separated from content-related licences that grant permission to broadcast;***
- ***licence fees for existing commercial broadcasters should be converted to fees that reflect the opportunity cost of spectrum used;***

- ***the value of broadcasting services bands reserved for non-commercial broadcasting services should be estimated and reported publicly; and***
- ***the Australian Broadcasting Authority should retain responsibility for issuing licences to broadcast and for determining the number of national and community broadcasting licences in a licence area. It also should retain responsibility for regulating content, enforcing codes of practice and monitoring ownership.***

RECOMMENDATION 10.2

A system of explicit budgetary support should replace the current system of granting exemptions and concessions from spectrum charges to targeted spectrum users. These users should be funded to the full value of their current spectrum use, that is, the value of licence fees and the cost recovery charges levied by the Australian Communications Authority.

RECOMMENDATION 10.3

The criteria for eligibility for government assistance to meet the costs of spectrum access should be reviewed periodically.

FINDING 10.1

Changes to the Radiocommunications Licence Conditions (Amateur Licence) Determination No. 1 of 1997 to allow the use of technologies such as WinLink 2000 would not appear to undermine the integrity of the amateur bands or Australia's obligations under international agreements.

RECOMMENDATION 10.4

Radioastronomy facilities should be designated as 'radio sensitive sites' under the Australian Radiofrequency Spectrum Plan. These facilities must be notified that another user has applied for a transmitter licence wholly or partially within the bands specified in footnote AUS 87.

Chapter 11 Operations of the Australian Communications Authority

FINDING 11.1

The administrative efficiency of the Australian Communications Authority would be improved if minor changes made to a spectrum re-allocation declaration following public consultation did not require further consultation.

FINDING 11.2

The Australian Communications Authority's public consultation procedures generally give adequate opportunity for interested parties to have their views taken into account in a balanced manner.

FINDING 11.3

Frequency assignments made by accredited agents have increased significantly since their introduction in 1997. The Australian Communications Authority has applied competitive neutrality principles to the frequency assignment activities it still undertakes directly.

RECOMMENDATION 11.1

The Australian Communications Authority should delegate the conferring of amateur radio operator certificates.

FINDING 11.4

Spectrum licensing provides greater flexibility of use than the concept originally envisaged, but it is more prescriptive than was potentially provided for in the Radiocommunications Act 1992.

FINDING 11.5

The deployment of spectrum licences has proceeded more slowly and has been applied in far fewer bands than was envisaged in 1995.

FINDING 11.6

The timing and volume of spectrum released at auction by the Australian Communications Authority have been similar to or better than those implemented by comparable countries. Auctions do not appear to have delayed or hindered the introduction of new telecommunications technologies into Australia.

RECOMMENDATION 11.2

The Australian Communications Authority should consult potential bidders prior to setting reserve prices in spectrum auctions. In particular, it should communicate to interested parties any relevant pricing information it proposes to use when setting reserve prices.

FINDING 11.7

The design and implementation of spectrum auctions by the Australian Communications Authority have followed — and, in some cases, set — world's best practice.

Chapter 12 The way ahead

RECOMMENDATION 12.1

The provisions in the* Radiocommunications Act 1992 *which require the Minister to designate bands for spectrum licensing and issue spectrum re-allocation declarations should be removed. A new section should be inserted allowing the Minister to approve the forward work program of the Australian Communications Authority.

RECOMMENDATION 12.2

Spectrum licences issued after July 2004 should be made perpetual.

1 Reviewing radiocommunications regulation

Radiofrequency spectrum is vital for modern communications. This inquiry reviews the regulatory environment shaping the use of Australian radiofrequency spectrum. It focuses on the *Radiocommunications Act 1992* (RC Act), related acts and regulations, and the associated market reforms undertaken by the Australian Communications Authority (ACA) and its predecessor, the Spectrum Management Agency (SMA). It identifies ways of improving radiocommunications regulation to promote competition and efficiency in services using spectrum, including access for public and community services.

Economy-wide efficiency is usually best achieved through a decentralised, competitive market rather than by administrative means. However, it is not a simple choice in the case of spectrum management, because some level of regulation is necessary to set the ground rules for a competitive market in the context of international treaties and the management of signal interference.

The RC Act and associated reforms have been in place for only a short time. The 1992 reforms represented the first attempt to introduce market mechanisms to radiofrequency spectrum management in Australia and some of the key reforms were not implemented until 1997. At the same time, radiocommunications is a rapidly evolving, high technology sector. Damage from an inappropriate regulatory structure can occur quickly. While some market mechanisms have been introduced in accordance with the RC Act, much of the spectrum remains under a highly regulated system of allocation and assignment.

1.1 How are radiocommunications regulated?

Radiofrequency spectrum is not purchased and privately owned in the same way as most other production inputs. Instead, licences issued by the ACA confer the right to use spectrum. Unlicensed use of spectrum for radiocommunications is illegal, except in cases of emergency.

Access to radiofrequency spectrum is regulated in all countries, primarily to manage interference between users. In Australia, the first radiocommunications legislation was enacted in 1905 (see chapter 3). The RC Act was introduced into Parliament in 1992 as part of a package of reforms:

- to introduce a market-based system of management for parts of the spectrum;
- to improve administrative processes; and
- to establish the SMA, which was merged with the Australian Telecommunications Authority to form the ACA on 1 July 1997.

The RC Act and associated legislation set out the rules and procedures governing the planning, allocation, assignment, licensing and ongoing management of all non-broadcasting radiocommunications spectrum in Australia (box 1.1).

Box 1.1 **Radiocommunications regulation terminology**

Allocation — the division of the entire radio spectrum into blocks, or bands, of frequencies for particular uses. These allocations are documented in the Australian Radiofrequency Spectrum Plan.

Assignment — the final subdivision of the spectrum which grants licences to use specific parts of the spectrum.

Licence — the legal right to use a designated piece of spectrum. The ACA issues three types of licence: spectrum, apparatus and class licences. All licences are listed in the Register of Radiocommunications Licences.

Device registration — mandatory registration of specified radiocommunications devices with the ACA. The ACA may refuse registration for devices that do not meet relevant technical standards and regulations, and are likely to cause unacceptable interference with other devices.

Re-allocation — the process of changing the allocation of spectrum from one use to another, as defined in the Australian Radiofrequency Spectrum Plan. Incumbent users of a band that do not conform to the new allocation must be cleared from the band.

The RC Act applies to all spectrum used for radiocommunications purposes. The first stage of radiocommunications regulation is the planning process, whereby the different frequency bands are allocated for particular uses (for example, mobile services, fixed services or broadcasting). Evolving radiocommunications technologies and applications mean that spectrum planning is an ongoing process, requiring consultation among regulators, users and other interested parties. At the international level, the International Telecommunications Union (ITU) co-ordinates planning, while the ACA plans at a national level (box 1.2).

Box 1.2 **Radiocommunications regulatory agencies**

International

Australia is a signatory of the Constitution and the Convention of the International Telecommunications Union (ITU), an agency of the United Nations. ITU members agree to international spectrum plans which co-ordinate broad spectrum allocations across each of three international planning regions. These spectrum plans are updated every two to three years to reflect allocation changes negotiated at the regular ITU World Radiocommunications Conferences. The ITU also has direct responsibility for managing certain international spectrum users, such as satellites and space objects.

Australian

The Minister for Communications and the Department of Communications, Information Technology and the Arts (DCITA) have responsibility for general radiocommunications policy development, as well as some specific regulatory duties.

The Australian Communications Authority (ACA) is responsible for managing and regulating radiocommunications and telecommunications within Australia, including the planning, allocation and assignment of all radiofrequencies (except for the broadcasting bands). The ACA is a statutory authority within the portfolio of Communications, Information Technology and the Arts and is responsible to the Minister for Communications.

The ACA convenes several industry consultative bodies. These include the Radiocommunications Consultative Council, which focuses on regulatory policies and procedures, and the International Radiocommunications Advisory Council, which consults on international aspects of radiocommunications, including Australia's participation in ITU planning conferences.

The Australian Broadcasting Authority (ABA) regulates the broadcasting bands of the spectrum under the *Broadcasting Services Act 1992*. The broadcasting bands are designated by the Minister for this purpose under the terms of the RC Act.

The Australian Competition and Consumer Commission (ACCC) undertakes some telecommunications and radiocommunications competition policy functions under the *Trade Practices Act 1974,* the RC Act and various telecommunications acts.

Once allocated under the spectrum plans, radiofrequency spectrum is assigned via licences issued by the ACA administratively or by auction. There are three types of licence, each with different terms and conditions of use:

- spectrum licences;
- apparatus licences; and
- class licences.

Australia was one of the first countries to introduce market-based approaches to spectrum management (see chapter 3).

1.2 Scope of this inquiry

The subject of this inquiry is the current system of regulating radiocommunications in Australia. The terms of reference require a review of:

- the RC Act, and more particularly, those parts of the Act with potential to restrict competition or to create costs for business and the community;
- the *Australian Communications Authority Act 1997*;
- four taxation acts authorising the collection of licence revenues;
- radiocommunications regulations and standards attached to the RC Act; and
- the market-based reforms undertaken by the ACA and its predecessor, the SMA, including (but not limited to) the introduction of spectrum licences and auctions.

Under s. 31 of the RC Act, the Minister may designate parts of the spectrum for broadcasting purposes, to be managed separately by the Australian Broadcasting Authority (ABA) under the *Broadcasting Services Act 1992* (the BS Act). This inquiry examines this arrangement and the effects it may have on competition and efficiency in spectrum use. It does not otherwise examine the BS Act or broadcasting regulation. The Commission assessed the BS Act separately in an inquiry into broadcasting regulation (PC 2000).

The telecommunications acts — which regulate several major spectrum users and parts of which the ACA administers — are also outside this inquiry. The Commission examined aspects of the telecommunications acts, including competition, access and universal service obligation arrangements in an inquiry into telecommunications competition regulation in 2001 (PC 2001f).

This inquiry does not specifically assess the activities and procedures of the ITU. Australia’s role in the ITU and the ACA’s consultation procedures for ITU conferences and other international fora, however, are relevant (see chapter 11). Similarly, the inquiry does not examine the targeting of subsidies to some spectrum users, although concessional pricing practices are reviewed in the context of general pricing practices for radiofrequency spectrum (see chapter 8).

1.3 Policy guidelines

This inquiry is guided by the terms of reference, the Competition Principles Agreement under which the inquiry was scheduled (box 1.3) and the Commission's own Act (box 1.4). This framework requires the Commission to take an economy-wide view in assessing the efficiency and appropriateness of spectrum regulation.

Box 1.3 **Legislation review requirements**

Under the Competition Principles Agreement, all Australian governments agreed to review and, where appropriate, reform existing legislation that restricts competition. The Commonwealth Government released its review timetable in June 1996, nominating 98 separate reviews and foreshadowing the review of the *Radiocommunications Act 1992*. In announcing the Legislation Review Schedule, the Government also outlined the requirements for reviews. In particular, it stipulated that each review is to be approached according to clause 5(1) of the Competition Principles Agreement, which states that:

> The guiding principle is that legislation (including acts, enactments and Ordinances or regulations) should not restrict competition unless it can be demonstrated that:
>
> a) the benefits of the restriction to the community as a whole outweigh the costs; and
>
> b) the objectives of the legislation can only be achieved by restricting competition.

The agreement also states that legislation reviews should be conducted:

- to clarify the objectives of the legislation;
- to identify the nature of the restriction on competition;
- to analyse the effect of the restriction on competition and on the economy generally;
- to assess and balance the costs and benefits of the restriction; and
- to consider alternative means of achieving the same result, including non-legislative approaches.

Sources: Competition Principles Agreement (1995); Legislation Review Schedule (1996).

In this context, 'efficiency' refers to allocating spectrum to its most highly valued use in the economy, taking into account the community's demand for commercial, government or other goods and services (for example, mobile phone coverage or emergency services). 'Appropriate' regulatory arrangements are those that are necessary to address an identified problem or issue, and which provide benefits to the Australian community that are greater than the costs of the regulation (and greater than the costs of not regulating at all).

As noted in the Competition Principles Agreement (box 1.3), regulatory arrangements that restrict competition should be retained only if their benefits to the whole community outweigh their costs and if their objectives cannot be achieved in a more efficient, less anti-competitive manner. Competitive market reform has been introduced into many areas of the economy previously managed administratively, including electricity, telecommunications, water rights and radiocommunications.

Box 1.4 Productivity Commission policy guidelines

The Commission's governing Act sets out that:

> The Commission must have regard to the need:
>
> (a) to improve the overall economic performance of the economy through higher productivity in the public and private sectors in order to achieve higher living standards for all members of the Australian community; and
>
> (b) to reduce regulation of industry (including regulation by the States, Territories and local government) where this is consistent with the social and economic goals of the Commonwealth Government; and
>
> (c) to encourage the development and growth of Australian industries that are efficient in their use of resources, enterprising, innovative and internationally competitive; and
>
> (d) to facilitate adjustment to structural changes in the economy and the avoidance of social and economic hardships arising from those changes; and
>
> (e) to recognise the interests of industries, employees, consumers and the community, likely to be affected by measures proposed by the Commission; and
>
> (f) to increase employment, including in regional areas; and
>
> (g) to promote regional development; and
>
> (h) to recognise the progress made by Australia's trading partners in reducing both tariff and non-tariff barriers; and
>
> (i) to ensure that industry develops in a way that is ecologically sustainable; and
>
> (j) for Australia to meet its international obligations and commitments.

Source: *Productivity Commission Act 1998*, s. 8.

The objectives of the regulations — and the nature of the problems they seek to address — must be clear, as must the link between the objectives and the legislation and regulations they support. Several important questions must be answered. What are the objectives of the regulatory system? What are the underlying problems it seeks to address? Are the objectives clear and appropriate? What is the most efficient, least restrictive way of achieving these objectives?

In addressing these questions, the terms of reference (and the Commission's own Act) require this review to take into account relevant effects on the environment, equity, occupational health and safety, regional development, consumers, small business, compliance costs, regulatory consistency, administrative efficiency and efficient resource allocation across the economy.

The terms of reference require the Commission to report on the removal of 'structural obstacles' to new communications technologies, investment, innovation, access and competition. In the fast-moving radiocommunications sector, avoiding such obstacles requires carefully balanced regulatory arrangements. Ideally, radiocommunications regulation should be flexible and technologically neutral to facilitate the application of new technologies. At the same time, the regulatory system should provide sufficient certainty and predictability to facilitate industry investment — for example, certainty for investors choosing between competing technologies. Poorly articulated rights to spectrum can be a serious impediment to investment in expensive infrastructure and new technologies.

1.4 Principles guiding this inquiry

In applying the broad guidelines in section 1.3 to this inquiry, the Commission considers that radiocommunications regulation should:

- have clear objectives that address identified problems in spectrum management;
- encourage the efficient allocation of spectrum and not be aimed at maximising revenue;
- enable public and community access to spectrum and radiocommunications;
- not seek to address policy objectives which are better targeted by other policy instruments;
- be as technology neutral as possible, so that choices about new technologies and applications are left to the market (that is, to industry and consumers);
- be effective, equitable, transparent and predictable for all spectrum users. This may require different licence types for different spectrum uses; and
- co-ordinate with other regulatory regimes to minimise regulatory duplication or inconsistency, particularly in view of the rapid technological convergence of the radiocommunications, telecommunications and broadcasting sectors.

These principles are intended to achieve the best regulatory outcomes for the community. They also provide an important conceptual benchmark for assessing the case for further reform of Australia's radiocommunications regulations. The direction of radiocommunications regulatory reform over the past decade has been broadly consistent with these principles, but further improvement is possible.

1.5 Other radiocommunications reviews

Several recent reviews by the Commonwealth Government and its agencies are relevant to this inquiry. These include:

- the Bureau of Transport and Communications Economics (BTCE) paper on managing radiofrequency spectrum (BTCE 1990);
- the House of Representatives Standing Committee on Transport, Communications and Infrastructure (HORSCOTCI) report on managing radiofrequency spectrum (HORSCOTCI 1991);
- the Commission's inquiry report on broadcasting (PC 2000);
- the Commission's inquiry report on cost recovery (PC 2001a);
- the Commission's inquiry report on telecommunications competition regulation (PC 2001f);
- the Government taskforce's Radiocommunications Review (DCITA 1998; DCITA 2001a);[1]
- a review of apparatus licence fees by the Ad Hoc Revenue Committee of the Expenditure Review Committee (following the Radiocommunications Review);[2]
- a review of apparatus licence tenure and associated issues by a working group set up for this purpose by the Radiocommunications Consultative Council (RCC) (in response to the Radiocommunications Review) (RCC 2002); and
- an inquiry by the House of Representatives Standing Committee on Communications, Information Technology and the Arts into wireless broadband technologies (House of Representatives 2002).

A recent review of spectrum management in the United Kingdom (Cave 2002) also provided relevant background material to this inquiry and helped give a contemporary, international perspective on Australia's regulatory system.

The BTCE and HORSCOTCI reports both recommended a greater role for markets in assigning and managing spectrum, along with various measures to improve the administrative efficiency of radiocommunications regulation. The Government adopted many (but not all) of the HORSCOTCI's recommendations, with the introduction of the RC Act and the SMA in 1992 (see chapter 3).

The Commission addressed some spectrum management issues in its report on broadcasting (PC 2000) and recommended that spectrum management for the broadcasting bands be undertaken by the ACA instead of the ABA, in line with the

1 The Radiocommunications Review was conducted by a Government taskforce comprised of officers from the ACA, DCITA, Department of Defence and Department of Transport and Regional Services, and overseen by an Independent Reference Group established for the Review.

2 The Expenditure Review Committee is a committee of Cabinet that considers various new policy and savings proposals and makes Budget recommendations to Cabinet.

management of all other spectrum bands. This issue is re-examined in this inquiry (see chapter 10). The Commission also described the ACA's cost recovery arrangements in its report on cost recovery by government agencies (PC 2001a).

The Commission's review of telecommunications competition regulation (PC 2001f) considered issues relevant to this inquiry. Many telecommunications platforms use radiofrequency spectrum to deliver their services and both telecommunications and radiocommunications are regulated by the ACA. The telecommunications inquiry found that mobile phone services in Australia — one of the key sources of demand for spectrum — is 'an effectively competitive market', and is likely to become more so, due to technological and regulatory developments (PC 2001f, pp. 131–2; see chapter 6).

The final report of the Radiocommunications Review (DCITA 2001a) examined some (but not all) aspects of spectrum regulation. It made several findings and recommendations, but not on issues it perceived to have competition implications or the implementation of reform by the ACA, because the present inquiry was to cover these matters. The Government has been considering its response to the Radiocommunications Review and consulting with the RCC about apparatus licence tenure and other issues. The RCC convened a working group for this purpose, which conducted further consultations and reported its findings in April 2002 (RCC 2002).

The Commission was concerned about the overlap between the Radiocommunications Review process and this inquiry. The Commission was obliged by the terms of reference of this inquiry to revisit most of the issues raised in the Radiocommunications Review. It was not possible to put aside important issues such as licence tenure and exclude them from a competition principles review of the RC Act. Licence tenure affects certainty and predictability — and therefore investment choices — for licence holders (see chapter 6). It has important implications for competition and efficiency in radiocommunications.

In addition to this inquiry and the Radiocommunications Review, the House of Representatives Standing Committee on Communications, Information Technology and the Arts commenced an inquiry into wireless broadband technologies on 15 April 2002. It is due to report its findings in late 2002.

The terms of reference for the Committee focus on the effect on wireless broadband technologies of the RC Act, the *Telecommunications Act 1997* and Parts XIB and XIC of the *Trade Practices Act 1974,* and whether these acts should be amended 'to ensure that Australia extracts the maximum economic and social benefits from the use of wireless broadband technologies' (House of Representatives 2002). These terms of reference overlap significantly with this inquiry, the Commission's recent telecommunications competition inquiry (PC 2001f) and the ongoing Radiocommunications Review (DCITA 2001a).

With so many inter-related inquiries having occurred recently or still under way, the policy making environment has become complex and confusing. This overlap comes at a cost to the many participants in the inquiries and is in danger of creating a general weariness of further regulatory review. The Government indicated in its terms of reference for this inquiry that it will respond to this report as soon as possible. This will provide a valuable opportunity for Government to draw together these various sources of policy advice on improving Australia's radiocommunications regulations.

1.6 Consultation procedures for this inquiry

The Commission provides independent analysis and advice to the Commonwealth Government. In undertaking this inquiry, the Commission was bound by its Act and the inquiry terms of reference to use processes that are open and public, including receiving submissions and conducting public hearings.

The Commission received 304 submissions before releasing the draft report and a further 47 submissions before the final report (351 submissions in total). The Commission held informal discussions in Sydney, Canberra and Melbourne with firms, government agencies and other organisations with interests in radiofrequency spectrum and radiocommunications. In October and November 2001 and April 2002, the Commission held public hearings in Melbourne, Sydney and Canberra which included video conference links with participants in Adelaide and Hobart. All transcripts of hearings are available to the public (see appendix A).

The ACA provided considerable assistance and technical advice (including data and other information) to this inquiry. The Commission also appointed Pondarosa Communications following an open tender process, to provide additional independent technical advice to the inquiry on radiocommunications technologies, devices and interference. Pondarosa Communications provided technical advice prior to the draft report for the inquiry and was not responsible for the Commission's policy recommendations.

1.7 Structure of this report

As discussed above, under the Competition Principles Agreement and the terms of reference, radiofrequency spectrum regulation should not restrict competition unless its benefits to the community as a whole outweigh its costs, and there are no other means of achieving its objectives.

As a first step, chapter 2 describes the market in which spectrum regulation operates, and the context in which it may restrict competition. Chapter 3 explains the international and Australian regulatory framework for spectrum management.

Chapter 4 discusses the rationale for government intervention in spectrum management, the nature of that intervention and relevant policy options. Chapter 5 clarifies and refines the objectives of the RC Act, in line with the terms of reference and the Competition Principles Agreement (box 1.3).

Chapters 6, 7, 8 and 9 discuss particular aspects of spectrum regulation — licensing, secondary trading, pricing methods and interference management respectively. These chapters examine the current arrangements, their effects on various spectrum users, and possible alternative approaches.

Chapter 10 examines spectrum management issues of particular concern for certain spectrum users, including non-commercial users of spectrum (such as defence, emergency services and amateur radio users) as well as commercial and non-commercial radio and television broadcasters. Chapter 11 examines the ACA's effectiveness in undertaking its regulatory responsibilities and implementing the reforms associated with the RC Act. Chapter 12 looks to the future of radiocommunications and draws some conclusions about options for improving radiocommunications regulation in Australia.

The appendices provide further information on spectrum planning (appendix B), international spectrum management arrangements (appendix C), alternative market-based mechanisms (appendix D) and special users of the radiofrequency spectrum (appendix E).

2 Characteristics of spectrum markets

Spectrum use is pervasive in the modern, technology-driven economy. Spectrum is used for many purposes, including broadcasting, mobile telephony, radioastronomy, medicine, navigation, surveillance and remote-controlled devices. The uses of spectrum increase daily and new technologies place pressure on the efficient management of the radiofrequency spectrum.

This chapter describes the nature of spectrum (section 2.1), how it is used and who uses it (section 2.2), and the prices paid for it (section 2.3). Section 2.4 considers factors that influence the supply of spectrum, and section 2.5 examines the impact of emerging technologies. Section 2.6 examines characteristics of the spectrum market and their implications for competition for both spectrum and final services.

2.1 Spectrum characteristics

The radiofrequency spectrum is a natural resource with many potential uses. Spectrum can be used for the transmission of voice and data, and as a substitute for, or complement to, wired communications systems. It is also used for ‘non-communications’ purposes, such as research, radioastronomy and surveillance.

Defining spectrum

Electromagnetic energy can be transmitted at different frequencies. The set of all possible frequencies is called the electromagnetic spectrum and stretches from very short-wavelength gamma rays through x-rays, ultraviolet light, visible light and infra-red waves, to long-wavelength radio waves. The radiofrequency spectrum is the part of the electromagnetic spectrum that is regarded as useful for radiocommunications (currently between 3000 Hz and 300 GHz). Each unit of spectrum can be defined according to its frequency, geographic coverage and time of transmission.

Spectrum has the following characteristics which, together, make it unique as a resource.

- *It is non-homogeneous*. Different frequencies have different characteristics that make specific frequencies more suitable for certain uses (box 2.1).

- *It is finite*. For the purposes of the *Radiocommunications Act 1992* (RC Act), radiocommunications is all radio emissions (emissions of electromagnetic energy) of frequencies less than 420 terahertz (s. 8[1]).
- *It is non-depletable*. While use may be limited at any time, using the spectrum today does not prevent use of spectrum tomorrow.
- *It is non-storable*. It cannot be stockpiled — that is, spectrum not used today is lost forever.

These features influence both the allocation and the management of the spectrum resource.

Box 2.1 **Spectrum characteristics**

Different frequencies have different characteristics, described as propagation, bandwidth and interference.

Propagation refers to the area (or distance) of 'service coverage' that a transmitting device can achieve. The propagation of radio signals depends on the communications equipment in use, the time of day, time of year, solar activity, topography and weather conditions. Lower frequency radio signals tend to propagate over long distances and penetrate some materials, while higher frequency signals are more suited to shorter range 'line-of-sight' applications. High powered signals propagate further than low powered signals.

Bandwidth refers to the range of frequencies (expressed in hertz) being used to transmit or receive radio signals. In general, the greater the bandwidth, the more information that can be transmitted in a given period.

Interference refers to the inability of radiocommunications receivers to distinguish wanted signals from unwanted signals. Unwanted signals may be artificially or naturally generated. For example, transmissions in the same spectrum space generate artificial unwanted signals, while lightning generates natural unwanted signals. Interference reduces the quality of voice communication, reduces data rates and can even eliminate the communications connection. Some spectrum uses are more susceptible to interference than others; for example, rainstorms can affect the performance of satellite systems at frequencies above 10 GHz (CSIRO, trans., p. 16). Interference depends, in part, on the technology used and more sophisticated equipment can improve receiver performance.

By international agreement, the radiofrequency spectrum is categorised into eight broad frequency bands (table 2.1). While frequency bands comprise sections of radiofrequency spectrum with similar characteristics, band divisions are set arbitrarily. Similar services may be provided in more than one band, especially at the edges of adjacent frequency bands.

Table 2.1 **Radiofrequency spectrum: broad frequency bands**[a]

Frequency bands	*Frequency range*
Very low frequency (VLF)	3–30 kHz
Low frequency (LF)	30–300 kHz
Medium frequency (MF)	300–3000 kHz
High frequency (HF)	3–30 MHz
Very high frequency (VHF)	30–300 MHz
Ultra high frequency (UHF)	300–3000 MHz
Super high frequency (SHF)	3–30 GHz
Extremely high frequency (EHF)	30–300 GHz

[a] 1 kHz equals 1000 Hz; 1 MHz equals 1000 kHz; 1 GHz equals 1000 MHz.

The widths of frequency bands differ greatly, with each frequency band being ten times larger than the preceding band. The VLF band, for example, has a bandwidth of 27 kHz, while the EHF band has a bandwidth of 270 million kHz. Bandwidth determines the amount of information that can be transmitted. Therefore, higher frequency bands can potentially carry more information than lower frequency bands.

2.2 Spectrum users

Spectrum facilitates a wide range of communications. The main uses of spectrum are for fixed links, broadcasting, mobile phones, defence and radionavigation; other spectrum uses include radioastronomy, meteorology and satellite (box 2.2). The share of spectrum allocated to major spectrum uses in Australia is presented in figure 2.1.

Different spectrum uses have different requirements; some require large amounts of bandwidth in particular parts of the spectrum, and some are more susceptible than others to interference. Generally, lower frequency bands are good for long-distance communications, while higher frequency bands are better suited for transferring large amounts of data over short distances.

Box 2.2 Spectrum uses

Broadcasting services include short wave radio, AM radio, FM radio, narrowcasting,[a] datacasting[b] and terrestrial and satellite television.

Mobile communications are used for a range of voice and data services. The four main categories of mobile communications use are:

- mobile — communications between mobile users and a fixed network, and between mobile users (for example, cellular mobile communications);
- land mobile — communications between a base station (that is, a fixed site) and a mobile station (that is, a moving site). Examples include taxi fleets, courier companies, citizen band (CB) radio and paging services;
- maritime mobile — communications for distress and port safety operations, and general communications between land and vessels, between vessels, and sometimes, for internal communications on board vessels; and
- aeronautical mobile — communications between land and aircraft, and between aircraft.

Fixed services can be point-to-point or point-to-multipoint services. Point-to-point services are generally referred to as fixed links and are often used to connect mobile base stations to the telecommunications network, and to transmit broadcasting content to transmission towers. These services also provide communications for some utilities (for example, to provide signalling for rail transport).

Radionavigation and radiolocation systems use terrestrial and satellite systems to aid the navigation and detection of submarines, ships and aircraft (including landing and take-off) and other moving objects, such as missiles.

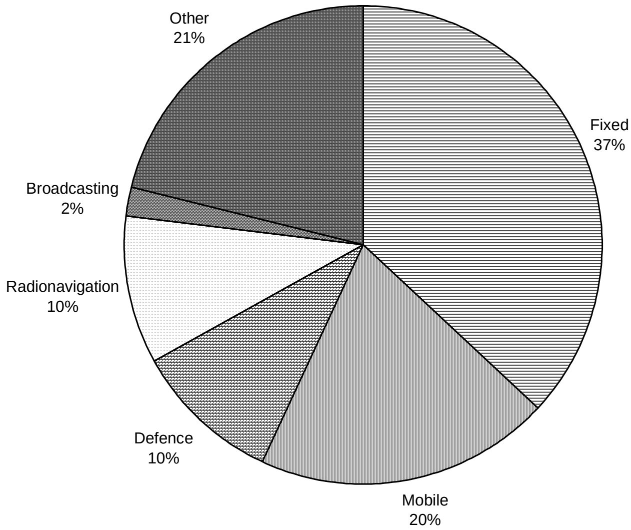
Satellites are used to provide telecommunications and broadcasting services, and increasingly, Internet services. These systems are particularly effective for communication over long distances (for example, international communication) and in remote areas.

Amateur radio operators use the spectrum for personal ‘hobby’ use. The activities of amateur operators include communications, technical experimentation and assistance to emergency service providers when required (for example, through the Wireless Institute Civil Emergency Network).

Other uses include meteorology, radioastronomy, industrial, scientific and medical (ISM), security and military (such as weapon systems) and domestic (such as remote-controlled devices).

a Specialised radio and television transmissions intended for a defined group. **b** A range of interactive services made possible by digital television, including Internet access, video-on-demand and games.

Figure 2.1 **Frequency allocations to major spectrum uses in Australia[a]**



[a] Data based on 'All spectrum' totals in table 2.2.

Data source: ACA (unpublished).

All spectrum between 9 kHz and 300 GHz is allocated to different spectrum uses (not users) according to the Australian Radiofrequency Spectrum Plan (the Spectrum Plan). This does not mean that all spectrum is being used. Bands of spectrum are allocated to spectrum uses under three sharing arrangements — frequencies are allocated on either an exclusive use basis, or primary or co-primary use basis, where they share with a secondary use (box 2.3).

Individual spectrum users are then licensed to use bandwidth within these bands. A licence may be either assigned or non-assigned. An assigned licence is used where each licensee requires an individual frequency assignment. Non-assigned licences are used where individual frequency assignment is not required, or the frequency is selected from a pre-defined suite (ACA 1997, p. v). Examples of non-assigned licences include amateurs, where users 'share' frequencies.

General frequency allocations by band, type of use and sharing arrangement are presented in table 2.2.

Box 2.3 **Spectrum plan sharing arrangements**

The Australian Radiofrequency Spectrum Plan allocates all frequency bands to one or more uses under the following arrangements.

Exclusive use — the band is allocated to a single spectrum use.

Primary use — the band is allocated to two or more spectrum uses but only one of those uses is defined as the 'primary' use. Remaining uses are classified as secondary, and are unable to claim protection from, or cause interference with, the primary use.

Co-primary use — the band is allocated to two or more spectrum uses and two (or more) uses are defined as co-primary uses. They share the primary 'rights' to the band. Remaining uses are classified as secondary uses. These uses are unable to claim protection from, or cause interference with, the co-primary uses.

Secondary uses are not allocated spectrum. They operate on a 'shared basis' in frequencies allocated to primary and co-primary uses.

Broadcasting

Broadcasting services include both commercial and non-commercial radio and television broadcasting, narrowcasting and, potentially, datacasting. Broadcasters are allocated exclusive use of certain defined broadcasting services bands, designated by the Minister under s. 31 of the RC Act. They also use a large amount of other spectrum — for example, spectrum for outside broadcast, satellite transmission and fixed links to transfer broadcasting content to transmission towers.

The dedicated broadcasting services bands account for 38 per cent of the frequencies allocated in the VHF band. They also make up 15 per cent of the frequencies allocated below 30 MHz and 15 per cent of the frequencies allocated in the UHF band. They account for 509 MHz (or 17 per cent of frequencies allocated) in the highly congested VHF and UHF bands. The value of these bands is reflected in the high spectrum access tax weights given to them by the Australian Communications Authority (ACA) when determining licence fees for non-broadcasting uses of these frequencies (see chapter 8).

Table 2.2 **Frequency allocations by band, type of spectrum use and sharing arrangement**[a]

Frequency band/ spectrum use	*Exclusive use*	*Primary use*	*Co-primary use*	*Secondary use*[b]	*Share of total frequencies allocated*
	%	%	%	%	%
Below 30 MHz					
Defence	18	0	0	0	18
Broadcasting[c]	10	4	1	0	15
Mobile[d]	5	0	5	29	10
Fixed[e]	1	26	5	3	32
Radionavigation[f]	1	–	–	1	1
Amateur[g]	1	0	22	1	23
Other[h]	1	–	–	–	1
Total	**36**	**31**	**33**	**34**	**100**
VHF					
Defence	26	2	0	0	28
Broadcasting[c]	0	37	1	0	38
Mobile[d]	7	–	10	20	17
Fixed[e]	0	0	10	20	10
Radionavigation[f]	4	0	–	0	4
Amateur[g]	1	0	1	–	2
Other[h]	0	0	1	2	1
Total	**38**	**39**	**23**	**42**	**100**
UHF					
Defence	3	2	0	0	5
Broadcasting[c]	0	11	4	0	15
Mobile[d]	11	6	16	10	32
Fixed[e]	6	0	14	15	21
Radionavigation[f]	10	15	6	10	31
Amateur[g]	0	0	0	2	0
Other[h]	0	0	17	3	17
Total	**27**	**20**	**53**	**39**	**100**
SHF					
Defence	6	13	0	0	19
Broadcasting[c]	2	0	1	1	3
Mobile[d]	0	0	16	8	16
Fixed[e]	4	10	28	3	41
Radionavigation[f]	3	2	4	3	9
Amateur[g]	0	0	–	4	0
Other[h]	0	0	12	21	12
Total	**15**	**24**	**61**	**41**	**100**

(Continued on next page)

Table 2.2 **(continued)**

Frequency band/ spectrum use	*Exclusive use*	*Primary use*	*Co-primary use*	*Secondary use*	*Share of total frequencies allocated*
	%	%	%	%	%
EHF[i]					
Defence	8	25	0	0	33
Broadcasting[c]	0	0	0	0	0
Mobile[d]	0	0	10	3	10
Fixed[e]	3	0	20	3	23
Radionavigation[f]	0	0	9	0	9
Amateur[g]	0	0	0	0	0
Other[h]	0	0	25	37	25
Total	**11**	**25**	**64**	**43**	**100**
All spectrum[j]					
Defence	7	15	0	0	10
Broadcasting[c]	1	1	1	1	2
Mobile[d]	1	–	14	7	20
Fixed[e]	4	7	25	4	38
Radionavigation[f]	3	2	5	3	10
Amateur[g]	0	0	–	3	–
Other[h]	0	0	15	23	21
Total	**15**	**24**	**61**	**41**	**100**

a Frequency allocation differs from use. Frequencies are allocated to spectrum uses via the Spectrum Plan. Individual users are then assigned the right to use spectrum within these bands. Columns may not add to total due to rounding. **b** Secondary uses operate on a shared basis in frequencies allocated to primary and co-primary uses. **c** Includes broadcasting and broadcasting satellite. **d** Includes mobile, mobile satellite, land mobile, maritime mobile and aeronautical mobile. **e** Includes fixed, fixed satellite and fixed wireless access. **f** Includes radionavigation, radionavigation satellite, radiolocation, maritime radionavigation and aeronautical radionavigation. **g** Includes amateur and amateur satellite. **h** Includes meteorological aids, meteorological satellite, radioastronomy, space research, space operation, earth exploration satellite, radiodetermination satellite, satellite, inter-satellite, and standard time and frequency signals. **i** The portion of the EHF band between 30–40 GHz. **j** The portion of the spectrum between 9 kHz–40 GHz. **–** Negligible.

Source: ACA (unpublished).

Cellular mobile providers

Cellular mobile providers use spectrum to run mobile phone networks. They also use spectrum to operate fixed services between mobile base stations and local exchanges.

Cellular mobile services account for the majority of the spectrum allocated to mobile communications in the UHF band (excluding co-primary allocations). These services have evolved from analogue standards supporting voice communications to digital ‘cellular’ standards supporting both voice and data communications.

Growing demand for mobile communications has led the ACA to clear some other uses out of the UHF band to free spectrum for these mobile services.

Fixed service providers

Fixed service providers use spectrum for point-to-point or point-to-multipoint services. A large range of users — including telecommunications providers, broadcasters and some utilities — employ fixed services. These services are allocated spectrum in all frequency bands. They account for 41 per cent of spectrum allocated in the SHF band and 32 per cent of the frequencies below 30 MHz.

Point-to-point services are often referred to as fixed links and account for the majority of spectrum allocated to fixed services. They transmit information between two fixed points in the form of directed beams of radio waves. The shape of transmitted beams resembles a narrow cone more than a straight line. This has implications for the amount of spectrum denied to other uses, especially over long distances.

Fixed links provide inter-city connections — a substitute for fibre optic cable (BIS Shrapnel 2001). Other uses include connecting mobile base stations to the telecommunications network, and creating regional networks for defence and some electricity, gas and railway utilities. Fixed links are also used to provide studio-to-transmitter links for television broadcasting (ACA 2000c).

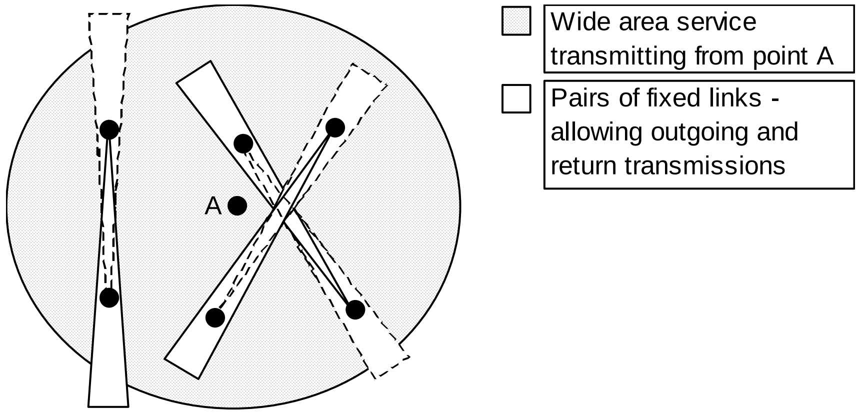
Point-to-multipoint services are wide area services. They transmit signals from a central distribution point to multiple fixed points. A single wide area broadcasting transmitter located on Mount Dandenong, for example, is able to serve most of the Melbourne metropolitan area.

Other examples of point-to-multipoint services are the local multipoint distribution system (LMDS) and multichannel multipoint distribution system (MMDS). LMDS operates in the SHF and EHF bands and provides an alternative to fibre optic cable in the provision of high speed data services. MMDS operates in the UHF band and is a substitute for hybrid fibre coaxial cable in the provision of voice and data services to households (so-called ‘wireless local loop’ services). These services account for 3 per cent of frequency allocations in both the SHF and EHF bands, and 7 per cent of frequency allocations in the UHF band.

Accommodating point-to-point and wide area services in the same geographic location presents particular challenges for spectrum management (box 2.4).

Box 2.4 **Point-to-point versus wide area services**

Point-to-point and wide area services cannot easily coexist on the same frequency in the same geographic area. The establishment of a wide area service, such as broadcasting or cellular mobile services, effectively denies the use of that spectrum for point-to-point services on the same frequency, particularly when the wide area service uses mobile devices that can transmit from any location. The footprint of the point-to-point service may only affect a relatively small part of the wide area service, but this will reduce the overall utility of both services. However, it is possible to locate multiple point-to-point services operating on the same frequency in the one region.



The high value of many wide area services, particularly cellular mobile services, has resulted in many point-to-point services being displaced to a different frequency in the same band, or into other bands of the spectrum. In other cases, services previously provided via point-to-point services are being provided by fibre optic cable.

Source: adapted from Pondarosa Communications Pty Ltd (unpublished).

Defence

Defence uses spectrum for fixed services, mobile communications, radionavigation and radiolocation services, as well as non-communications services, such as surveillance, security and weapons systems. Defence is a large user of spectrum, particularly in the VHF band (28 per cent of frequencies) and EHF band (33 per cent of frequencies).

Defence is allocated spectrum on an exclusive use or primary use basis, reflecting the high priority and low tolerance to interference of many defence activities. Some defence allocations are placed on a ‘classified’ register which is not publicly available.

‘Other’ spectrum users

The ‘other’ spectrum users category accounts for 21 per cent of spectrum allocations (table 2.2). It includes other commercial organisations, government agencies, community organisations and recreational users of spectrum.

Taxi and courier companies are examples of other commercial organisations that use spectrum, typically land mobile services. Some manufacturers, wholesalers and retailers also use spectrum, typically for factory and store security, and inventory management.

Some utilities use spectrum to control equipment in remote locations. Hydro Tasmania (an electricity generator), for example, uses fixed links to facilitate the control of its power system and mobile radio for field operations (Hydro Tasmania, sub. 24, p. 4).

Many government agencies use spectrum.

- Police and ambulance services use land mobile services for communications between vehicles and stations.
- Metropolitan fire authorities use land mobile services for communications between stations and vehicles, and for field operations. They also use some aeronautical mobile and fixed services.
- National security organisations — the Australian Security Intelligence Organisation (ASIO) and the Australian Secret Intelligence Service (ASIS) — use spectrum for national security purposes. The Spectrum Plan does not reserve spectrum for these users, and their use of spectrum is maintained on a classified register which is not made available to the public.
- The CSIRO uses spectrum for radioastronomy and research. Some of these services are unusual because they are concerned only with receiving radio signals, not transmitting (see chapter 10).
- The Bureau of Meteorology uses radar, satellites, fixed links and a range of mobile communications to collect data to provide weather forecasting and warning services.
- Airservices Australia uses mobile, fixed, radionavigation and satellite services for communication with aircraft, including landing, take-off and en-route communications.
- The Australian Maritime Safety Authority uses satellite services, radar, land mobile services and fixed links to provide maritime search and rescue activities.

Community organisations that use spectrum include the country fire authorities, the Royal Flying Doctor Service, surf life savers and community broadcasters. These users account for a very small share of spectrum use. The country fire authorities primarily use land mobile services for communications between vehicles and central offices, and some aeronautical mobile and fixed services. The Royal Flying Doctor Service uses aeronautical mobile services for communications between land and aircraft. Surf life savers use maritime mobile services for communications between land and vessels, and land mobile services for communications on land.

Recreational users include amateurs, citizen band (CB) radio users and operators of small boats. Amateur users receive spectrum allocations under the Spectrum Plan. They are allocated 23 per cent of the frequencies below 30 MHz (mostly on a co-primary basis) and a small allocation in the VHF band. Amateurs also have secondary use allocations in the UHF and SHF bands. Other recreational users tend to use different forms of mobile communications. CB radio users, for example, principally operate in the HF band on a shared basis, with many like-users sharing the same base stations. Selective calling and receiving techniques are used to minimise interference. Small boats also share frequencies.

Planning, licensing and charging arrangements for non-commercial and broadcasting services are discussed in chapter 10.

2.3 Spectrum revenue

Most spectrum users are licensed by the ACA and pay licence fees (see chapter 8). The prices paid for licences differ among spectrum users because:

- some spectrum users are granted the use of spectrum free of charge or on a concessional basis (see chapter 10);
- some spectrum users are charged indirectly for their use of spectrum (for example, broadcasters) (see chapter 10);
- most spectrum is assigned and charged for on an administrative basis (see chapter 8); and
- the remaining spectrum is assigned and priced according to market-based mechanisms (principally auctions) (see chapter 8).

Licence payments may be once-off transactions for the purchase of licences at auction or annual payments.

Auctions are used to assign licences where the ACA considers that demand exceeds supply (see chapter 8). The ACA collected over $3 billion in revenue from auctions between 1994 and 2001. The majority of this revenue related to the 2000 auction of spectrum in the 1.8 GHz band — the so-called PCS 2000 auction.

Annual licence fees and the distribution of spectrum by use are summarised in table 2.3.

Table 2.3 **Annual licence fees and the distribution of spectrum by use (or user), 1999-2000[a]**

Spectrum use	*Licence fees*	*Share of total licence fees*	*Share of spectrum allocations*[b]
	$ million	%	%
Broadcasting[c]	232.1	71	2
Mobile[d]	39.0	12	20
Defence	8.1	2	10
Fixed[e]	39.0	12	38
Amateur	0.7	0	0
Other[f]	7.2	2	30
Total[g]	**326.1**	**100**	**100**

[a] Licence fees exclude revenue from auctions. [b] Includes spectrum allocated on an exclusive use, primary use and co-primary use basis (see final column in table 2.2). [c] Relates to dedicated broadcasting services bands. Broadcasting licence fees are based on the amount of revenue earned by broadcasters, not on the amount of spectrum they use. [d] Includes licence fees from cellular mobile and land mobile systems. [e] Includes licence fees from point-to-point, point-to-multipoint and multipoint distribution systems. [f] Includes licence fees from satellite, meteorology, radioastronomy, standard time and frequency signals; industrial, scientific and medical uses; and non-assigned licences for amateur, maritime, aircraft and outpost uses. [g] Columns may not add to total due to rounding.

Source: ACA (unpublished).

The Commonwealth Government collected 71 per cent of spectrum-related licence fees ($232 million) from commercial broadcasters in 1999-2000 (ABA, unpublished data). These charges are based on the revenue earned by the broadcasters, not on the amount of spectrum they used. Broadcasters are ‘granted’ spectrum as an input in the production of broadcast services. Broadcasting is the only significant spectrum use for which licences are charged in this way.[1] In addition, broadcasters paid licence fees of $5.2 million in 2001 for the use of spectrum outside the broadcasting bands, on the same basis as other spectrum users. The treatment of broadcasting is examined in chapter 10.

Mobile communications accounted for 12 per cent of total licence fees collected in 1999-2000. However, this figure underestimates payments by mobile users for access to spectrum, because auction revenues are not included in table 2.3. In 1999-2000, mobile communications accounted for all revenue from auctions ($1.3 billion). Mobile communications accounted for eight of the fourteen auctions

1 Datacasting by broadcasters is similarly charged but is inconsequential at the moment.

run by the ACA between 1994 and 2001, and 90 per cent of auction revenue collected in that time (see chapter 8).

Defence, fixed services, amateurs and 'other' spectrum uses accounted for 12 per cent of total licence fees but almost 80 per cent of total spectrum allocations. The shares of spectrum assigned under different arrangements are summarised in box 2.5.

Most administrative charges are calculated using a formula that attempts to reflect the market value of the spectrum covered by the licence, acknowledging that different licences may grant access to different amounts of spectrum with different values.[2] Imputed apparatus licence fees and the number of assigned licences by industry in November 2001 are summarised in table 2.4.

Table 2.4 **Imputed apparatus licence fees by industry, November 2001[a]**

Industry	*Licence fees*	*Share of total licence fees*	*Assigned licences*	*Share of total licences*
	$ million	%	No.	%
Telecommunications	80.7	71	27 001	26
General government	12.7	11	18 829	18
Broadcasting	5.2	5	4796	5
Transport and storage	3.4	3	9809	9
Manufacturing	3.1	3	5954	6
Electricity, gas or water supply	1.4	1	4999	5
Education	1.0	1	1103	1
Health services	0.7	1	2998	3
Mining	0.5	0	4450	4
Safety services	0.5	0	4376	4
Wholesale or retail trade	0.4	0	2338	2
Recreational and amateur activities	0.4	0	4958	5
Agriculture, forestry and fishing	0.2	0	2790	3
Construction	0.2	0	1461	1
Finance and insurance	0.1	0	125	0
Other	3.3	3	9328	9
Total[b]	**113.7**	**100**	**105 315**	**100**

a Licence fees are imputed by applying current ACA methods of charging for apparatus licences to the stock of apparatus licences held in November 2001, assuming all licences had a duration of one year. **b** Columns may not add to total due to rounding.

Source: ACA (unpublished).

2 A small number of apparatus licences are priced 'off-formula' (see chapter 8).

Box 2.5 **Spectrum under different arrangements**

Spectrum is assigned to users under different arrangements.

Some spectrum bands are designated exclusively for broadcasting and defence uses (see chapter 10). Broadcasters and defence are then assigned apparatus licences for equipment using spectrum within those bands. In the VHF band, 67 per cent of frequencies are reserved for these users.

Other spectrum bands are assigned to a variety of users via spectrum licences and apparatus licences (see chapter 6).

Spectrum licences are defined in terms of bandwidth and geographic dimensions. These licences are most prevalent in the UHF band, accounting for 12 per cent of frequencies in that band. There are no spectrum licences below the UHF band at present.

Apparatus licences are not defined in terms of bandwidth. Therefore, it is difficult to determine the amount of spectrum under apparatus licences. The amount of spectrum can be estimated by subtracting designated broadcasting and defence bands and spectrum licences from the total available spectrum. Remaining spectrum is either apparatus licensed or unlicensed (that is, the spectrum is idle). In addition, some apparatus licences overlap with class licences, where low-interference devices have ‘open access’ to specific parts of spectrum on a shared basis. In total, 69 per cent of the spectrum is either apparatus licensed or unlicensed.

Shares of spectrum under different arrangements

	Below 30 MHz	*VHF*	*UHF*	*SHF*	*EHF*[a]	*All spectrum*[b]
	%	%	%	%	%	%
Spectrum licences	0	0	12	7	3	7
Apparatus licences:						
in the defence bands	4	28	5	22	33	23
in the broadcasting services bands	4	40	11	0	0	1
other[c]	93	33	71	71	64	69
Total[d]	**100**	**100**	**100**	**100**	**100**	**100**

a The portion of the EHF band between 30–40 GHz. **b** The portion of the spectrum between 9 kHz-40 GHz. **c** Includes apparatus licensed or unlicensed spectrum not in the defence or broadcasting bands. **d** Columns may not add to total due to rounding.

Sources: ABA (sub. 31, p. 3); ACA (unpublished).

Over 100 000 assigned apparatus licences were on issue in November 2001. Applying ACA methods of charging to this stock of licences, the sum of imputed licence fees was $113.7 million. The telecommunications industry was the major user of apparatus licences, accounting for 71 per cent of total imputed licence fees collected by the ACA, and 26 per cent of the total number of assigned licences.[3]

General government (including defence) accounted for 11 per cent of imputed apparatus licence fee revenue and 18 per cent of the number of assigned licences in November 2001. In addition, the Spectrum Plan reserves certain bands of spectrum for defence. Defence paid $8.4 million for the use of these bands in 2000-01 (see chapter 10).

Broadcasting accounted for 5 per cent of imputed apparatus licence fee revenue and a similar share of the number of assigned licences in November 2001. These licences relate to spectrum outside the dedicated broadcasting bands. All other industries accounted for 12 per cent of imputed apparatus licence fee revenue and 51 per cent of the number of assigned licences.

2.4 Supply

Although the supply of spectrum is finite at a point in time, its productive capacity changes with improvements in technology, and investment in infrastructure that intensifies use of spectrum. Further, the heterogeneous nature of spectrum makes some frequencies more suitable for some uses than others. This results in scarcity in some frequency bands but not in others. The Government influences the effective supply of spectrum by the way it plans, assigns and charges for spectrum.

Technology

Technological advances can increase the intensity of spectrum use (that is, increase its information carrying capacity) and extend both the lower and the upper boundaries of useable frequencies.

The development of digital transmission has affected profoundly the supply of, and demand for, spectrum. Digital transmission allows larger amounts of information to be transmitted at greater speeds and by more flexible means than is possible with analogue systems. It simultaneously increases the capacity of spectrum to carry information and the range of potential uses. Digital transmission for television

3 The number of licences held by an industry does not necessarily indicate the amount of spectrum used, because licence holders may be able to send and receive signals on a range of frequencies for each licence held. For example, a fixed link may allow an operator to send and receive signals at the same time (requiring at least two different frequency bands). The fixed link would be recorded as a single licence. In addition, an apparatus licence may authorise the use of a number of transmitters in a specified area.

broadcasting, for example, allows up to four times the content using the same amount of spectrum compared with a single analogue channel. It may also allow the development of ‘single frequency networks’ where the same frequency can be used in adjacent areas without overlapping interference problems. For digital television, this would mean a single channel could be used to cover a licence area which presently requires multiple channels for analogue transmission.

The evolution of mobile network standards is another example of improved spectrum efficiency resulting from digital transmission. Under the analogue standard, one subscriber at a time was assigned to a channel. The growing demand for mobile services provided the incentive for the development of more spectrum-efficient technology that would allow a greater number of users for a given amount of spectrum. Digital standards emerged, such as the global system for mobiles (GSM), which allowed eight simultaneous telephone conversations on the same channel. A more recent digital standard, code division multiple access (CDMA), employs ‘spread spectrum’ techniques that allow even greater numbers of simultaneous conversations. Importantly, these standards have the potential for application beyond mobile communications. Most radiocommunications equipment now employ digital techniques.

Emerging technologies that promise further improvement in spectrum use are discussed in section 2.5.

Equipment

The characteristics of individual services determine the ‘effective supply’ of spectrum for that use. Some services can be provided only using specific parts of the spectrum. Other services are more ‘frequency agile’ (that is, they can operate in a number of different frequency bands). GSM technologies in Australia, for example, can operate in the 900 MHz, 1.8 GHz and 1.9 GHz frequency bands.

There is a trade-off between the cost of equipment and the efficiency with which it uses spectrum. High-gain antennae used for fixed links, for example, may enable greater re-use of spectrum in a region by minimising wasteful interference. Similarly, transmitters can be designed to operate with smaller ‘guard’ bands.

Technology trade-offs

Operators trade off different inputs (spectrum, infrastructure and labour) in the production of wireless communications services. The information-carrying capacity of a given amount of spectrum can be increased by employing more infrastructure.

Shortages of suitable spectrum encourage users to increase the intensity of their spectrum use by increasing expenditure on other inputs. A mobile phone carrier, for example, could increase expenditure on mobile base stations (allowing greater spectrum re-use) rather than purchase additional spectrum (box 2.6).

Box 2.6 **Infrastructure and spectrum substitution possibilities**

Many spectrum users can substitute between spectrum and infrastructure in providing communications services. A mobile phone carrier, for example, could hypothetically serve 12 000 customers in an area using one base station and 9 MHz of spectrum (figure A). To meet growing demand for services in this area, the carrier could either purchase more spectrum (increasing the capacity of the single base station) or increase expenditure on additional base stations (allowing greater spectrum re-use). For example, the carrier could split its 9 MHz of spectrum into three frequency bandwidths (each of 3 MHz and each able to serve 4000 customers). When combined with 19 base stations, this allows the carrier to re-use spectrum up to seven times and serve 76 000 customers (19 times 4000) within the service area (figure B).

Figure A **No spectrum re-use**

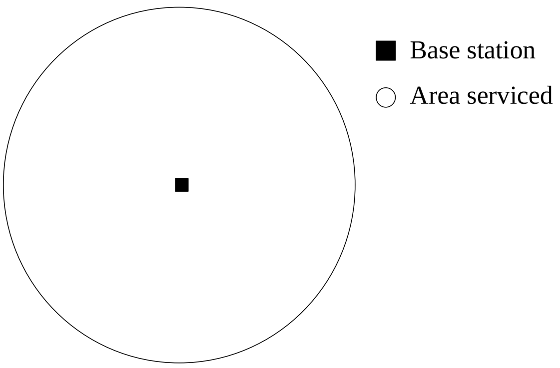
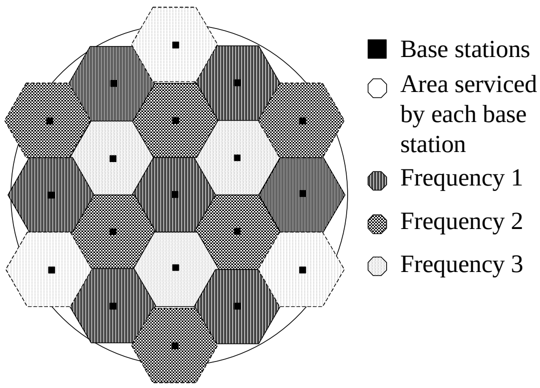


Figure B **Spectrum re-use**



Spectrum planning and licensing

Spectrum planning and licensing can influence the effective supply of spectrum. Planning occurs at both international and domestic levels, and allocates bands of spectrum to certain uses. The process of allocation can reduce the effective supply of spectrum by denying particular uses access to certain frequencies — that is, constraining them to specific parts of the spectrum. Setting conservative boundary conditions between different spectrum uses (for example, to manage interference) also limits the useable supply of spectrum.

Licence characteristics also affect the supply of spectrum. Licences that are rigidly defined and difficult or impossible to trade may lock-in historical uses and constrain the availability of spectrum for new more efficient uses.

The difficulty of accommodating changing spectrum uses can exacerbate these constraints. Changing a spectrum use may involve international planning, domestic planning, licence assignment and a licence commencement date. The process for the 2 GHz spectrum for third generation (3G) mobile communications in Australia, for example, took almost 10 years.[4] The long time lag for accommodating changing spectrum uses potentially constrains the supply of spectrum for these services and may reduce the incentives for innovation.

2.5 Emerging technologies

New options for spectrum are emerging continually, and demand for spectrum exceeds supply in many areas. This may create a need for mechanisms to accommodate changes in spectrum use over time. For example, the proliferation of mobile telephones in Australia (and overseas) over the past decade has caused considerable interest in emerging 3G mobile phones, offering voice and high speed data communications. Other spectrum users were cleared from the 2 GHz band to make way for 3G services.

Software-defined (SDR) radio allows a range of services and service modes to be provided in a single device. Other technologies are designed to 'share' spectrum, rather than require exclusive use (see chapter 4).

Broadband is a generic term used to describe technologies that allow the transfer of data at high speed. Broadband services can be provided via spectrum or wired communication. Broadband services, for example, support high quality video streaming and allow the downloading of complex graphics and the transfer of large files at high speed.

Software-defined radio

SDR is a general term given to equipment using digital techniques and stored program control (similar to storing files on a computer). With the movement from analogue to digital, more functions of radiocommunications devices are implemented in software. An SDR device allows the user to choose the type of service and the service mode from those stored in the device.

4 The International Telecommunications Union agreed on 3G standards in 1992. Successful bidders in the Australian 3G auction in March 2001 are not permitted to deploy services until October 2002.

Current wireless systems tend to employ a single standard; for example, GSM or CDMA. These standards are mutually incompatible (that is, GSM users cannot make calls on CDMA networks). SDR offers, for example, the possibility of one device providing services via either GSM or CDMA. Moreover, an SDR device could be used for a range of different wireless services, including mobile phone, cordless phone, fax, email, global positioning systems (GPS), Internet and video conferencing.

Wireless local area networks

WLANs provide short-range, low power, high speed data access to local area networks. The Institute of Electrical and Electronics Engineers (IEEE) has approved four standards for WLANs. The Wi-Fi standard, for example, (otherwise known as IEEE 802.11b), is an established standard that operates in class licensed spectrum in Australia (in the 2.4 GHz industrial, scientific and medical (ISM) band).

Wi-Fi allows laptop users to access the Internet (amongst other things) at data rates up to 11 megabits per second (that is, five times faster than data rates proposed via 3G mobile phones and 200 times faster than data rates via basic Internet access). Wi-Fi service providers are deploying ‘hot spots’ in airports, hotels, conference centres and a range of other outlets around the world.

Commercial Wi-Fi service offerings are currently limited in Australia. iPass and inter-touch provide Wi-Fi services in some hotels in major capital cities. SkyNetGlobal has installed ‘hot spots’ in some airport lounges in Sydney. A number of other companies (for example, Azure Wireless and Pacific Wireless Australia) intend to offer similar Wi-Fi services in the near future.

WLANs can compete with fixed networks in providing broadband Internet access. However, WLANs are more likely to act initially as an adjunct to fixed network access. For example, employees could access the Internet using the wired network when at work, and using WLANs when travelling.

Ultra-wideband radio

UWB radio has the potential to improve spectrum efficiency. It uses advanced ‘spread spectrum’ techniques to send short duration bursts, or pulses, of data at high speed. The principal advantage of UWB radio is that it operates over a wide range of radio frequencies at very low power levels. These characteristics may allow UWB radio devices to co-exist in frequencies already occupied by radio services, without causing undue levels of interference. This technology has potential for a wide range of applications; for example, high speed Internet access, video-on-demand and even short-range broadcasting.

Although UWB radio devices currently are not licensed in Australia, some inquiry participants were optimistic about the prospects of UWB radio. OzProspect (sub. DR317, pp. 1–2) suggested that UWB technology would allow an open access, ‘commons’ approach to managing parts of the radio spectrum (see chapter 4). Electronic Frontiers Australia (sub. DR318, p. 8) stated that ‘of all the new technologies, it is UWB that is the most paradigm shifting’.

Other inquiry participants were more cautious about the influence of UWB devices on spectrum management. The ACA noted that:

> Ultra wide band radio…remain[s] largely untested, both technically and commercially. Full commercial application is likely to be many years off. Nor is it yet obvious to what extent they could replace rather than complement 'traditional' radio systems. For the moment there is no evidence of any decline in the demand for spectrum as a result (indeed demand continues to increase). In the meantime, the existing spectrum management tools remain relevant and necessary. (sub. 9, p. 37)

Airservices Australia (sub. DR322) and the Department of Transport and Regional Services (sub. DR335) expressed concern about the potential for interference caused by UWB radio devices. Airservices Australia (sub. DR322, p. 2) noted that the United States Department of Transport and the National Telecommunications and Information Administration were conducting tests on the compatibility of UWB radio devices and other devices, including aviation systems. The results indicated that under some conditions interference to devices, including GPS and aviation systems, could occur.

The United States Federal Communications Commission (FCC) provided the opportunity for the public to comment on the likely impact of UWB radio on their activities. A number of organisations, representing a wide range of spectrum uses, provided submissions. The FCC concluded that:

> … with appropriate technical standards, UWB devices can operate using spectrum occupied by existing radio services without causing interference, thereby permitting scarce spectrum to be used more efficiently. (FCC 2002b, p. 2)

The FCC then adopted standards for the use of specific types of UWB radio on 14 February 2002 (box 2.7). The FCC noted that the standards adopted ‘represent a cautious first step with UWB technology’ (FCC 2002c). The FCC intends to review these standards within the next six to twelve months and to explore options for increasing the flexibility of current arrangements.

Box 2.7 **Ultra-wideband (UWB) radio in the United States**

Federal Communications Commission (FCC) standards allow the use of UWB radio devices in three frequency ranges (below 960 MHz, 1.99–10.6 GHz and 24–25 GHz). Broad categories of UWB radio devices are allocated specific frequencies within these bands. UWB devices include:

Imaging systems which detect objects underground, through walls, or within 'walls' (such as the side of a bridge or the wall of a mine). Imaging systems may also be used for a variety of health applications to 'see' inside the body of a person or animal. Specific imaging system operations are limited to certain users.

Vehicular radar systems which use antennae attached to motor vehicles to detect the location and movement of objects near a vehicle. These devices enable features including near collision avoidance, improved airbag activation and improved suspension systems.

Communications and measurement systems which encompass a wide range of other UWB uses; for example, providing high speed data rates for residential and business users and storage tank measurement devices.

Source: FCC 2002d.

2.6 Implications for competition in spectrum markets

The multiple uses of spectrum and its different supply characteristics influence the 'market' for spectrum. These characteristics include the derived nature of demand for spectrum and the heterogeneous nature of spectrum (that is, some spectrum is better suited to some uses than others). Current institutional arrangements also create artificial barriers to competition for spectrum. Spectrum planning, for example, can deny particular uses access to certain frequencies, while licence characteristics can lock-in historical uses.

As an intermediate input in the production of final goods and services, the demand for use of spectrum is a 'derived' demand. Demand for final products, such as mobile phones and navigation and aviation communications, generates demand for use of spectrum. Some uses compete for similar spectrum (for example, cellular mobile communications and certain fixed services) while other uses face little competition (for example, radionavigation used for submarine communication.

In addition, some spectrum users can substitute wired communications for spectrum. These users can choose either spectrum or wired platforms, or a combination of the two, in the production of final goods and services.

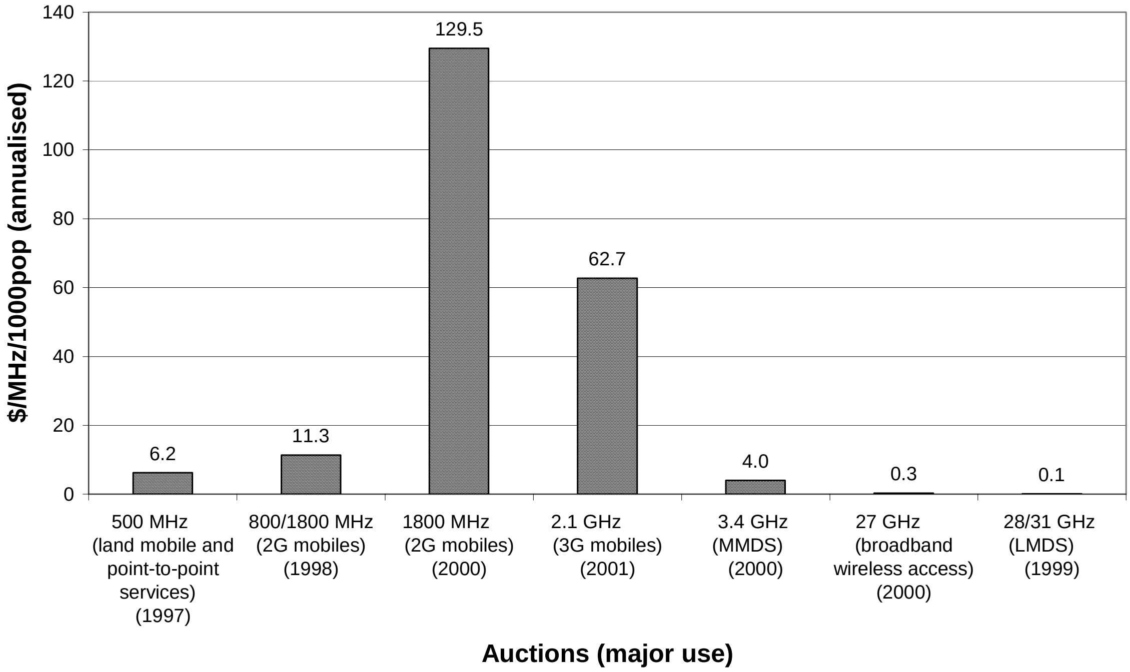
Substitution possibilities may be limited in some geographic areas. Customers residing in major urban centres may be able to access a large range of communications services (PC 2001c). People in many remote areas, however, are not serviced by wired communications services or are constrained by bandwidth limitation (for example, users may receive slow Internet access). In such circumstances, wired and wireless services may not amount to close substitutes.

Substitution possibilities may also be limited by the requirements of end users. Users requiring communications at a fixed location — for example, an Internet connection at home — can be serviced via spectrum or wired communications. Users requiring mobility, and some non-communications uses (such as radioastronomy and surveillance), can be serviced only via spectrum. For these users, spectrum is an essential input in the production of final products.

These influences mean that there is currently no single market in spectrum. Different parts of the spectrum and different final products may have different markets, with implications for the level of competition. There may be strong competition in some parts of the spectrum but not in others, and competition for certain parts of the spectrum may be stronger in some geographic areas than others.

There is some evidence of this in the wide range of prices paid at auction for spectrum in different frequency bands. In auctions held between 1997 and 2001, prices ranged from 10 cents to 130 dollars per MHz per thousand head of population (figure 2.2). However, these numbers should be treated with some caution. The auctions occurred over a 4 year period, during which spectrum prices were volatile. The spectrum lots auctioned had different technical frameworks, and spectrum lots in the 1800 MHz auction only included capital cities (see chapter 6).

Figure 2.2 **Prices paid at auction for spectrum in different bands, 1997–2001**[a, b, c]



a Data reflect simultaneous ascending bid auctions only. **b** Current dollars. **c** The 1800 MHz auction included only capital city lots.

Data source: See table 8.1 in chapter 8.

Growing demand for spectrum and technological advances are gradually breaking down this segmentation, allowing greater competition for spectrum. While some technological advances work to increase the effective supply of spectrum, others help to relieve demand pressures by either making it possible to supply the same services in different parts of the spectrum, or by allowing more than one service to operate in the same piece of spectrum. Technological convergence is a term that is sometimes used to describe the ability of like-information to be transmitted (and received) using different parts of the spectrum and different platforms (box 2.8). For example, both satellites and wide area services can be used to provide Internet access to customers.

While the current segmented nature of the market for spectrum poses challenges for regulation, technological advances are reducing the natural barriers to competition and opening up new possibilities. The following chapters propose ways to accommodate technological progress and remove institutional barriers to competition. This should help create a more unified and efficient market in spectrum.

Box 2.8 **Convergence of delivery platforms**

Convergence is allowing services that used to be exclusive to particular platforms (for example, broadcasting, telecommunications and information technology) to be delivered using alternative platforms.

Broadcasting — traditionally, broadcasting services in Australia have been delivered using dedicated spectrum via terrestrial means. Now, however, these services can be provided using hybrid fibre coaxial (HFC) cable and, in some cases, copper wire. They can also be provided using different wireless technologies operating on different frequencies, for example, satellite and fixed services (such as the multichannel multipoint distribution system) and, potentially, wireless local area networks (WLANs).

Basic Internet access — traditionally, basic Internet access has been delivered over the fixed telephone network. Now, Internet services can be provided over a range of wireless platforms, including satellites, terrestrial wireless and mobile phones. So-called two and a half generation (2.5G) mobile technologies provide data transmission rates commensurate with those of the fixed telephone network.

Broadband Internet access — normally refers to technologies allowing Internet access above 200 kilobits per second (at least four times greater than the data transmission rates available via basic Internet access). These services can be provided over fixed networks, including HFC cable, fibre optic cable and enhanced copper wire. They are increasingly being provided using wireless platforms (especially in rural and remote areas), including two-way satellite and two-way multichannel, multipoint distribution systems (MMDS). Emerging third generation (3G) technologies offer the prospect of broadband mobile Internet access.

3 Current regulatory arrangements

This chapter discusses the international and domestic regulatory framework for managing radiofrequency spectrum. Australia has regulated radiocommunications for close to a century (section 3.1). The international framework is set by the International Telecommunications Union (ITU) which co-ordinates and regulates international spectrum (section 3.2). Current regulatory arrangements are based on the *Radiocommunications Act 1992* (RC Act) and related regulations and legislation. They are administered by the Australian Communications Authority (ACA) and other government agencies (section 3.3).

3.1 History of radiocommunications regulation in Australia

Governments have had an important role in managing spectrum in almost all countries since radiocommunications commenced (see appendix C). The primary rationale for government intervention stems from the need to manage the negative externalities arising from interference between spectrum users (see chapter 4).

In Australia, the Commonwealth Government has introduced various legislation and regulations to allocate spectrum and to manage interference. Since Federation in 1901, legislative authority for radiocommunications and spectrum management has been vested in the Commonwealth rather than in the State governments. In 1905, Australia became one of the first countries to introduce legislation to manage spectrum. By contrast, the first legislation in the United States occurred in 1927. This first Australian Act of 1905 was not entirely replaced until 1983 (box 3.1).

Reform in the 1980s

By 1980, broadcasting, defence and telecommunications dominated Australia's radiocommunications, which was by then regulated by the Department of Communications (replacing the old Postmaster-General's department). A user-pays policy was introduced in 1980, aimed at collecting sufficient fees from users to cover administration costs (BTCE 1990).

Bramex stated:

> Before about 1980, the issue of a licence was regarded as an exceptional privilege to operate communications outside the monopoly of the Postmaster General's Department, later Telecom Australia. Pressure from the private land mobile industry, organisations wanting to use microwave links, paging companies and a few others led to policy changes and a rapid expansion of radiocommunications. (Bramex, sub. 64, p. 2)

Box 3.1 **Early radiocommunications legislation in Australia**

The legislative basis for regulating spectrum lies in the constitutional powers of the Commonwealth under s. 51(v) of the Constitution to make laws governing 'postal, telegraphic, telephonic and other like services'.

The first radiocommunications legislation enacted was the *Wireless Telegraphy Act 1905.* This legislation managed interference by allocating each band of spectrum for a specific use. The Postmaster-General's department administered the Act, but the Minister had the exclusive right to grant licences to operate radiocommunications devices. Unlicensed operation of radiocommunications devices was prohibited. Licences were assigned to users on a first-come, first-served basis and administrative fees were charged.

Separate radio broadcasting regulations were introduced in 1923 under the powers of the Act. These regulations aimed to: prevent interference between stations; ensure the availability of frequencies for services throughout the country; and establish mechanisms for financial compensation of service providers.

As the importance of radio broadcasting increased, the *Broadcasting Services Act 1942* eventually replaced the 1923 regulations and the broadcasting provisions from the *Wireless Telegraphy Act 1905*. The remaining parts of the 1905 Act were not replaced until the introduction of the *Radiocommunications Act 1983.*

Sources: Albon and Papandrea (1998); FuturePace Solutions (trans., p. 246).

In 1983, the *Radiocommunications Act 1983* replaced the *Wireless Telegraphy Act 1905*. However, it maintained the traditional administrative arrangements of the earlier Act. Licences (referred to as apparatus licences) were still assigned on a first-come, first-served basis and were not transferable. Licences were usually renewed every 12 months and annual licence fees were charged.

A range of taxation acts were introduced with the 1983 Act. For the first time, the Commonwealth Government charged for the use of spectrum, beyond the collection of fees that covered only administrative costs. From 1983-84 to 1987-88, the licence fees collected under the new charging structure exceeded administrative costs by an annual average of 77 per cent (BTCE 1990). This was justified by the notion of charging a 'fair return' for the private use of a community resource (see chapter 4).

The 1983 Act was developed in an era of relatively low spectrum demand and a slow rate of technological change. However, market conditions changed dramatically over the coming years, increasing the pressure to reform the traditional approaches to spectrum management.

Reform in the 1990s

The RC Act replaced the 1983 Act following a report (BTCE 1990) and a public inquiry into spectrum management by the House of Representatives Standing Committee on Transport, Communications and Infrastructure (HORSCOTCI 1991).

The Bureau of Transport and Communications Economics (BTCE) report was the first economics-based review of spectrum regulation. It highlighted inefficiencies in spectrum regulation and management, and found that the existing administrative fees were unable to reconcile the supply of spectrum with demand. It recommended the creation of spectrum access rights and the use of auctions to encourage the development of markets to allocate those rights (BTCE 1990).

The HORSCOTCI agreed with the thrust of the BTCE findings and recommendations. Both the BTCE and HORSCOTCI reports stressed the importance of achieving greater efficiency in spectrum use, so as to accommodate the ever-increasing range of applications for radiocommunications and manage the consequent demands for spectrum (see chapter 2). The HORSCOTCI report envisaged a dual approach to spectrum management, consisting of:

- a market-based system of assigning some, but not all spectrum, so as to promote efficiency and competition among the increasing number and type of commercial spectrum users; and
- reformed administrative arrangements to provide spectrum for ‘public and merit goods’ (such as defence and emergency rescue services) and non-commercial spectrum users (such as public sector and community users) (box 3.2).

In seeking to improve efficiency and introduce a greater role for the market, the HORSCOTCI had long-term goals for Australian spectrum management that were similar to those listed in this inquiry’s terms of reference. Importantly, these included economy-wide efficiency, competitive outcomes and efficient, equitable and accountable regulation (see chapters 1 and 4).

Box 3.2 **Recommendations of the 1991 HORSCOTCI report**

The report listed recommendations under three categories: (1) spectrum management objectives; (2) government charging; and (3) future spectrum management.

1. Spectrum management objectives should include:
   - dynamic efficiency;
   - technical efficiency;
   - the provision for public and merit goods;
   - the allocation of spectrum to the highest value uses;
   - the promotion of Australia's interests with regard to international agreements; and
   - a system of charges that is efficient and equitable, and takes account of the value of both non-commercial and commercial uses of the spectrum.
2. Government charging for spectrum should be transparent and should include:
   - a cost recovery component, whereby the actual costs incurred by the spectrum manager are identified and recovered from the individual users; and
   - an 'economic rent' component (that is, a derived market price component).
3. Future spectrum management should be based on:
   - a reformed administrative system, with reforms to include: developing a system for auditing spectrum use; developing a detailed on-line database of all spectrum assignments; accrediting private sector engineers to provide frequency co-ordination services; and reviewing consultative processes to assess their impact on dynamic efficiency; and
   - a market-based system, with reforms to include: introducing tradeability in spectrum resources for commercial users of the spectrum (for unencumbered spectrum or where there is high commercial demand); giving non-commercial users of spectrum the option of remaining under the current system or having their licences converted to a tradeable resource; introducing regular auditing of spectrum used by public sector users; introducing fixed-term tenure for tradeable spectrum; and determining whether capital gains would apply to any windfall gains accruing to incumbent users from the conversion of existing licences to tradeable rights.

Source: HORSCOTCI (1991).

In line with the HORSCOTCI recommendations, the Commonwealth Government adopted a three-part spectrum management reform strategy with the introduction of the RC Act. This strategy involved:

(a) the selective and progressive introduction of a market-based system of spectrum management to operate in defined spectrum segments alongside the administrative system;

(b) improvements in the efficiency and effectiveness of the current administrative system; and

(c) the establishment of a spectrum management agency. (DOTAC 1992, p. 8)

The market-based reforms included a new category of licence, called ‘spectrum licences’. (Spectrum licences and the two other approaches to licensing access to spectrum are discussed in section 3.4). Other reforms included the selective and progressive introduction of auctions for some licences in some frequency bands (see chapter 6). Collectively, these reforms were expected to increase flexibility for users, increase planning and operational efficiency, and provide greater transparency and accountability in the use of spectrum. Over time, they were expected to lead to the development of a secondary market in spectrum licences (see chapter 7).

Another important element of the 1992 reforms was the establishment of the Spectrum Management Agency (SMA). A statutory agency within the Transport and Communications portfolio, the SMA was established on a cost recovery basis.[1] The Minister for Transport and Communications retained responsibility for, and general policy control over, the agency (SMA 1994). At the same time, the establishment of the Radiocommunications Consultative Council helped to strengthen consultation with the radiocommunications industry.

Following a change of government in 1996, further substantial reforms were introduced in 1997. The SMA was merged with the Australian Telecommunications Authority to create a new statutory authority, the ACA, and the RC Act underwent several significant amendments. These reforms led to the current regulatory arrangements described in section 3.3.

3.2 International regulatory arrangements

The international spectrum arrangements of the ITU provide the basic shape of Australia’s spectrum regulation. They act as a template for spectrum planning and allocation. Examples of regulatory arrangements in other countries that are members of the ITU are discussed in appendix C.

International Telecommunications Union

Australia is a signatory to the Constitution and Convention of the ITU, which is a specialist agency of the United Nations with over 180 member nations. The ITU

[1] The SMA was intended to recover all its own costs through fees paid by users of its services.

was created by the International Telecommunications Convention in 1947, but traces its predecessors back to around 1865 (ITU 2001).

The key functions of the ITU are international co-ordination of spectrum planning, interference management and standards setting at a global level. It allocates certain frequencies and even whole bands for specific purposes worldwide. These include frequencies for aviation, shipping, satellites and other services that require global access to spectrum and global inter-operability. The ITU organises these allocations through its international spectrum plans and standards, which are updated every two to three years at its World Radiocommunications Conferences.

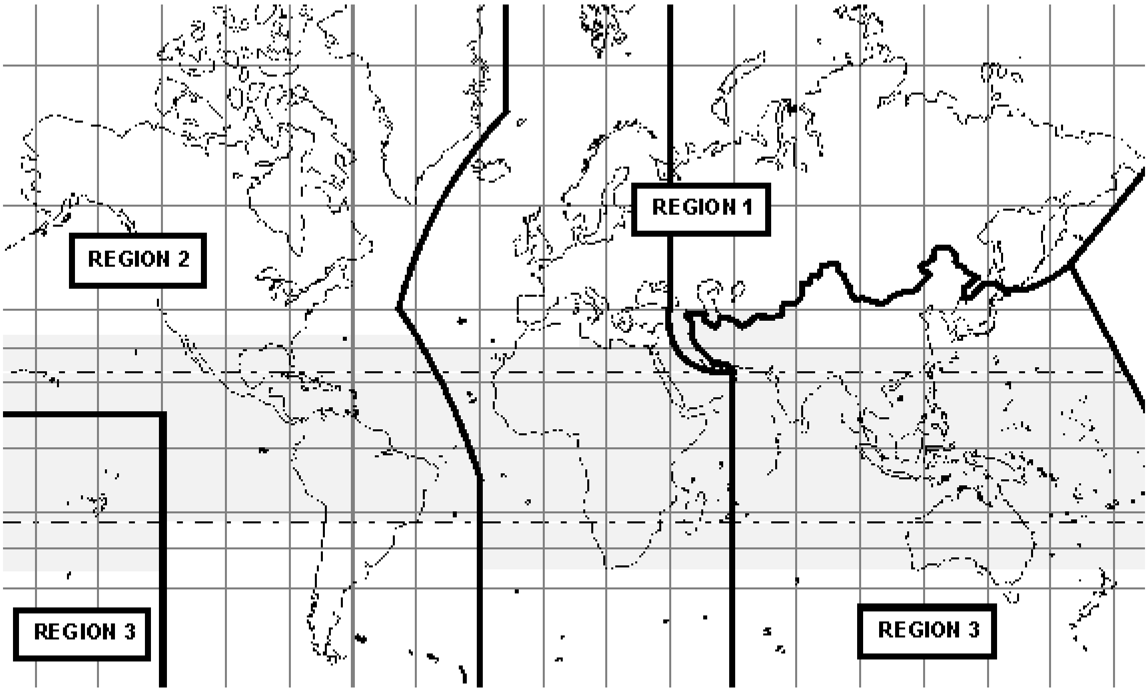
The ITU develops international spectrum allocation plans and standards based on three regions (figure 3.1). Equipment designed to meet the frequency plans and standards of one region will not necessarily work in the other two regions. Australia is located in Region 3, which incorporates Asia and the South Pacific. The United States and Europe are in different regions. Australia’s imports of radiocommunications equipment are sourced from all three regions. This can have important implications for the way Australian spectrum is used.

The ITU also manages international interference management across national borders. This function is less relevant to Australia than to other ITU member countries that have concentrated populations along boundaries with their neighbours (for example, in Europe).

Since 1992, the ITU has been structured into three sectors of responsibility covering radiocommunications (ITU-R), telecommunications standardisation (ITU-T) and telecommunications development (ITU-D). Of these, the ITU-R has most relevance to radiocommunications regulation. It is responsible for the regulation of international radiocommunications services such as mobile broadcasting, space research, meteorology, global positioning systems, environmental monitoring and communications services (see chapter 2). It also manages satellite orbits.

The ITU-R holds a World Radiocommunications Conference every two to three years. This is the peak decision-making body and the main forum for developing and updating the ITU-R spectrum plans (see appendix B). The ACA represents Australia in the World Radiocommunications Conference. It consults industry and other interested parties before each conference through the International Radiocommunications Advisory Council and a series of Australian Radiocommunications Study Groups (see chapter 11).

Figure 3.1 **International Telecommunications Union spectrum plan regions**



Source: ITU Radio Regulations.

Many scientific, industry and other organisations participate directly in ITU planning processes through sub-committees, advisory panels and industry representation. For example, organisations with an interest in radioastronomy, such as the CSIRO and universities have their own ITU advisory group. The CSIRO noted that radioastronomy:

> … often features prominently in discussions at ITU levels where it even has a dedicated working group (Working Party 7D). (CSIRO, sub. 13, p. 4)

For maritime and aeronautical 'safety-of-life' services, the ITU coordinates with several other international organisations (ITU Radio Regulations, article 9). These include the International Maritime Organisation, the International Civil Aviation Organisation (ICAO)[2] and the World Meteorological Organisation — all of which count Australia among their members. Airservices Australia stated:

> ICAO performs a co-ordinating function to ensure safe and efficient use of spectrum allocated to the aeronautical services. It also develops technical planning standards/requirements and approves operational standards and recommended practices for aeronautical radio systems. (Airservices Australia, sub. 19, pp. 2-3)

2 ICAO is accorded treaty status by contracting states to the Convention on International Civil Aviation (in Chicago in 1944), to which Australia is a signatory (Airservices Australia, sub. 19, attachment 1, p. 3).

These international organisations have an interest in spectrum coordination and consultation roles in their respective fields. However, all of them feed back into the ITU planning system. For its treaty members, the ITU retains ultimate responsibility for planning, co-ordinating and allocating spectrum for international maritime, aeronautical, satellite and other radiocommunications functions.

Implications of international spectrum regulation for Australian spectrum management

The ITU's international spectrum plans and standards form the basis of Australia's regulatory system. Certain other treaties and agreements are also relevant (for example, those of the ICAO), but the ITU plans effectively set the minimum level of planning and co-ordination necessary for Australia to meet its international obligations.

As an ITU member, Australia is obliged to ensure Australian nationals and companies do not cause interference in other countries operating in accordance with the ITU plan. In return, Australia is protected from international interference.

In practice, the ITU's table of frequencies for Region 3 is the default for the Australian Radiofrequency Spectrum Plan (box 3.3). The Australian plan is updated regularly to take account of changes in ITU plans, particularly following the World Radiocommunications Conferences (see appendix B).

Australia's obligation to harmonise its regulatory environments with other signatories to the World Trade Organisation's Code on Technical Barriers to Trade is also relevant to radiocommunications regulation. This Code requires signatories to harmonise technical regulation and to accept mutual recognition of technical standards (ACA, sub. 9, p. 17). In Australian radiocommunications, this Code potentially applies to technological standards and regulations (see section 3.5 and chapter 9).

3.3 Current Australian legislation

The international spectrum plans and regulations of the ITU shape Australian spectrum regulation (and particularly spectrum allocation) (see section 3.2). Australia's plans and agreements are given domestic force through a number of Australian regulatory instruments, including primary legislation and subordinate legislation in the form of regulations, standards, declarations, notices and determinations.

Box 3.3 Australian Radiofrequency Spectrum Plan (Spectrum Plan)

Under s. 30 of the *Radiocommunications Act 1992* (RC Act), the Australian Communications Authority (ACA) may produce a Spectrum Plan. The current Spectrum Plan took effect on 1 January 2002. It divides the Australian radiofrequency spectrum into a number of frequency bands and specifies the purposes for which the bands may be used.

The Spectrum Plan is revised every three years to account for changes in international allocations. These revisions enable regulators to respond to the emergence of new technologies or changes in demand for services. Section 33 of the RC Act requires the ACA to publish a draft of the proposed plans for public comment.

As a signatory to the International Telecommunications Union, the ACA uses the international spectrum plan for Region 3 as a template for its allocations. However, the Spectrum Plan has flexibility in designating the status of services and adding footnotes.

The ACA may also produce frequency band plans (RC Act, s. 32). These are developed for areas of the spectrum that have been identified as requiring closer management. Such bands are often characterised by multiple uses, each with different interference characteristics. Plans also may be introduced to facilitate the re-location of existing uses and to accommodate anticipated demand for new services.

Source: ACA (2002a).

The RC Act is the main legislation governing Australian spectrum management. The RC Act is supported by the *Australian Communications Authority Act 1997* (the ACA Act), a set of four taxation acts for revenue collection purposes and various technical standards, regulations and determinations. Other relevant legislation includes the *Trade Practices Act 1974* (TPA) and, for the broadcasting bands of the spectrum, the *Broadcasting Services Act 1992* (BS Act).

The ACA has primary responsibility for managing radiofrequency spectrum in Australia, with the exception of the broadcasting frequency bands, which are managed by the Australian Broadcasting Authority (ABA). The Australian Competition and Consumer Commission (ACCC), the Department of Communications, Information Technology and the Arts (DCITA) and the Minister for Communications also have direct roles in aspects of radiocommunications regulation (box 3.4).

Radiocommunications Act 1992

The RC Act is a comprehensive piece of legislation. It empowers the ACA and, in some instances, the Minister to make technical regulations, declarations and determinations across a broad range of issues relating to spectrum.

Box 3.4 Australian spectrum regulation agencies

The *Minister for Communications* has authority under the *Radiocommunications Act 1992* (RC Act) to, among other things, designate spectrum for broadcasting purposes, to determine competition limits for spectrum licence auctions, and to re-allocate spectrum, subject to advice from the Australian Communications Authority (ACA), the Australian Competition and Consumer Commission and the Department of Communication, Information Technology and the Arts (DCITA). The *Australian Communications Authority Act 1997* (ACA Act, s. 12) also enables the Minister to direct the ACA in the administration of its duties.

The *Department of Communications, Information Technology and the Arts* (DCITA) is responsible for providing radiocommunications policy advice to the Minister. This is a normal function of a Government department, but it may duplicate some duties of the ACA, which also prepares advice and information for the Minister.

The *Australian Communications Authority* (ACA) is a statutory authority formed in 1997 from a merger between the Spectrum Management Agency and the Australian Telecommunications Authority. It regulates radiocommunications and telecommunications under the ACA Act, the RC Act, the *Telecommunications Act 1997* and related legislation. It has international liaison duties in the International Telecommunications Union and other international fora.

The *Australian Broadcasting Authority* (ABA) is responsible for managing spectrum in the designated broadcasting bands. It has other regulatory responsibilities which are not directly related to spectrum management, such as broadcasting and Internet content regulation. The ABA manages spectrum under the *Broadcasting Services Act 1992* and has different objectives and criteria from those of the ACA (see chapter 10).

The *Australian Competition and Consumer Commission* (ACCC), the Government's general competition regulator, has responsibility for administering the *Trade Practices Act 1974* to control restrictive trade practices (for example, in suspected cases of spectrum hoarding). The ACCC also provides advice to the Minister and the ACA on competition limits for spectrum licence auctions (see chapter 6).

Coverage

The RC Act applies to all forms of radio emission whether intentional or not (s. 8[1]) and to all radiocommunications, defined as all radio emissions for the purpose of communicating between people and/or things (s. 6[2]). As in all previous radiocommunications legislation, unlicensed radiocommunications activities are unlawful (s. 46) except in cases of emergency (s. 49).

The RC Act does not apply to foreign space objects, vessels or aircraft receiving or transmitting radio signals while travelling through Australian territory (subject to international treaty arrangements — s. 23), or to radiocommunications activities for the purposes of defence research and intelligence, and certain other defence activities (ss. 24–27). In addition, s. 31 of the RC Act allows the Minister to designate spectrum bands for broadcasting and refer them to the ABA for planning and management under the BS Act.

Content

The RC Act addresses all aspects of spectrum management, either directly or through the regulations enabled by it. Compared with its predecessor (the 1983 Act), it introduced the following key changes to spectrum management:

- two new types of licence — spectrum and class licences — in addition to existing apparatus licences, each with different conditions and purposes (see chapter 6);
- market-based assignment (including auctions) for spectrum and some apparatus licences. The RC Act does not specify the type of auction process, but requires the ACA to consider the merits of different approaches on a case-by-case basis (see chapter 8); and
- new arrangements for developing and determining technical regulations and standards (see chapter 9).

Specific provisions of the RC Act, relating to spectrum allocation, licensing, pricing and ongoing management, are discussed in the following chapters.

Amendments

The RC Act has been amended several times since 1992. The most significant amendments were made in 1997. These included revised procedures for licence auctions and new spectrum re-allocation procedures. The spectrum auction procedures were amended to allow the Minister to impose competition limits on auction participants, including geographic, range and other limits. Spectrum re-allocation procedures were introduced to allow frequency bands to be re-allocated from one particular use to another, in line with changing technologies and demands (see chapter 6).

Other amendments have included mandatory health and safety standards for electromagnetic radiation exposure (see chapter 9).

Australian Communications Authority Act 1997

The ACA Act provides the ACA with its powers as a statutory authority, including powers to determine and enforce regulations, hold inquiries, impose and collect taxes, set times for their payment and impose penalties. The ACA Act requires the ACA to establish the Consumer Consultative Forum to advise on consumer matters (s. 52) and authorises the ACA to establish other advisory committees as necessary (for example, for international negotiation purposes) (see chapter 11).

Ministerial directions

Section 12 of the ACA Act enables the Minister to give written directions to the ACA in relation to the performance of its functions and the exercise of its powers. These directions must be gazetted.

In 2000–2001, the Minister gave nine directions to the ACA, covering use of radiocommunications devices, spectrum licences and spectrum allocations. For example, the *Australian Communications Authority (Allocation of 2 GHz and 800 MHz Spectrum) Direction No. 1 of 2000*, defined the procedures for allocating spectrum licences in the 2 gigahertz (GHz) and 800 megahertz (MHz) bands; and the *Australian Communications Authority (Datacasting Transmitter Licence Allocation) Direction No. 1 of 2001*, which cancelled the proposed auction of datacasting transmitter licences.

Section 56(1) requires the ACA to maintain a public register of all Ministerial directions made under s. 12. These sections provide an element of transparency in Ministerial directions to the ACA. However, some inquiry participants considered that other aspects of Ministerial directions lack sufficient transparency, because the advice on which the Minister is acting (from DCITA or the ACCC) is not published or made public (see chapters 6 and 12).

Radiocommunications revenue collection acts

The terms of reference for this inquiry also include the following taxation acts:

- *Radiocommunications (Transmitter Licence Tax) Act 1983*;
- *Radiocommunications (Receiver Licence Tax) Act 1983*;
- *Radiocommunications (Spectrum Licence Tax) Act 1997;* and
- *Radiocommunications Taxes Collection Act 1983*.[3]

[3] The *Radiocommunicaions (Permit Tax) Act 1983* has been repealed.

These acts are revenue collection instruments for the licences issued by the ACA. A separate tax act is legally required whenever the Commonwealth Government wishes to raise revenue beyond recovering the costs of an activity (see chapter 8).

Links to other legislation

Several other pieces of legislation are relevant to radiocommunications regulation, mainly the TPA and the BS Act. Other legislation may apply in some situations, such as environmental and planning legislation for the installation of transmitters and other fixed equipment.

Trade Practices Act 1974

Several sections of the RC Act make specific reference to the TPA. These sections require spectrum and apparatus licences to be treated in law as the acquisition of an asset for TPA purposes (ss 68A, 71A, 106A, 114A and 312). This requirement opens licences to the same competition law scrutiny that applies to other assets, including investigation by the ACCC and the potential prohibition of acquisitions that would result in a substantial lessening of competition (see chapter 6).

The ACA said the application of the TPA to radiocommunications competition regulation is appropriate:

> … the promotion of competition is better handled at the level of general trade practices legislation rather than specifically through the [RC] Act. Note that the *Trade Practices Act 1974* applies to the issue of radiocommunications licences except those in the broadcasting services bands, but we are not aware that the ACCC has ever used its powers to stop acquisition of a licence. (ACA, sub. 9, p. 35)

Broadcasting Services Act 1992

The broadcasting services bands are managed separately to all other radiofrequency spectrum. The Minister declares these bands, which are then administered by the ABA under the BS Act. The rules and procedures that apply to their planning, allocation and assignment are different to those that apply to other spectrum bands. In its report on broadcasting (PC 2000), the Commission recommended that the ACA be given direct responsibility for these bands, so all spectrum is managed consistently under the same rules (see chapter 10).

3.4 Licensing approaches

All use of spectrum in Australia is licensed. The licensing system defines the rights and obligations of users of spectrum. As discussed in section 3.2, assignment decisions take place within the administrative framework of spectrum planning, carried out internationally by the ITU's regional plans, and in Australia through the Spectrum Plan (box 3.3).

The RC Act provides for three types of licence: apparatus, spectrum and class licences. Of these, spectrum licences are the least prescriptive as licensees are able to determine which devices to operate within defined geographic and spectral boundaries.

All three types of licence specify: conditions of use (such as paying fees and charges, and complying with standards); technical conditions for spectrum use (such as frequency, bandwidth and power); and penalties for infringements. Apparatus, spectrum and class licences have different bundles of attributes (table 3.1). These attributes can influence the efficiency of spectrum use.

Table 3.1 **Key attributes of current licence types**

Attribute	*Apparatus licence*	*Spectrum licence*	*Class licence*
Licence period	≤ 5 years	≤ 15 years	Ongoing[a]
Renewable	Yes	No[b]	No
Tradeable	Yes	Yes	No
Divisible	No	Yes	No
Combinable	No	Yes	No
Third party use	Yes	Yes	na
Compensation	No[c]	Yes	No
Enforceable	Yes	Yes	Yes

a Until revoked. **b** Spectrum licences can be renewed where it is deemed by the Minister or ACA to be in the public interest (RC Act, s. 82). **c** Apparatus licensees may receive a partial refund of their licence fees. **na** Not applicable.

Apparatus licences

Apparatus licences closely resemble the licensing approach in place before the RC Act reform of 1992. Apparatus licences generally authorise the operation of a particular type of radiocommunications transmitter or receiver at a particular location. The licence specifies the category of service (such as aircraft, amateur, broadcasting, land mobile or maritime services) and technical conditions (including frequency, power, geographic area and emissions type). These technical conditions ensure apparatus licensees do not interfere unduly with other spectrum users.

The use to which apparatus licences may be put is tied directly to the Spectrum Plan and, is some cases, frequency band plans (see appendix B). This is intended to enhance the technical efficiency of spectrum by co-locating similar uses.

Apparatus licences can be issued for periods up to five years. They also can be transferred or leased to other parties. Around 158 000 apparatus licences were on issue at May 2002 (table 3.2). They account for most radiocommunications licences on issue and cover most of the spectrum.

Spectrum licences

Spectrum licences authorise the operation of any radiocommunications device within a specified frequency bandwidth, geographic area and time. Licensees may use any type of equipment for any purpose, subject only to broad technical requirements designed to minimise interference with other spectrum users.

Table 3.2 **Spectrum and apparatus licences[a]**

	Spectrum licences	*Apparatus licences*		
Year		Assigned[b]	Non-assigned[c]	Total
	no.	no.	no.	no.
1995-96	0	94 664	111 273	205 937
1996-97	228	99 291	107 549	206 840
1997-98	336	101 838	104 633	206 471
1998-99	362	104 481	101 083	205 564
1999-2000	407	110 556	95 978	206 534
2000-01	608	111 113	89 166	200 279
2001-02[d]	609	109 510	48 656	158 166

[a] The number of licences does not necessarily equate to the amount or value of spectrum held. [b] Assigned licences are issued when individual frequency assignment is required. [c] Non-assigned licences are issued when individual frequency assignment is not required or the frequency is selected from a pre-defined suite. [d] The number of licences at 31 May 2002.

Source: ACA, pers. comm., 19 October 2001, 8 February 2002 and 13 June 2002.

However, spectrum licensees who use their frequencies for a purpose other than that stipulated in the ITU plans do so at their own risk. That is, if spectrum use differs from the ITU plan, then the spectrum licence holder is required to bear the cost of preventing interference to users in other ITU member states and to accept the cost of any interference they experience themselves.

Spectrum licences can be issued for periods up to 15 years and are not renewable except on ‘public interest’ grounds. They are tradeable and can be subdivided or combined in either the frequency band or geographic domain.

Spectrum licences were first issued in 1997. Around 600 licences were on issue at May 2002 (table 3.2), accounting for about 7 per cent of the spectrum. Spectrum licences are typically used for mobile phone services, broadband Internet, wireless local loop, pay television and other high speed data services (see chapter 2).

Class licences

Class licences provide open access to spectrum on a shared basis. They were introduced as a legal instrument to provide interference protection for what were previously unlicenced uses of the spectrum. Class licences create 'public parks' where anybody may operate equipment covered by the licences as long as they comply with the conditions. They are not issued to individuals and no licence fees are payable.

Devices authorised under class licences are typically low power transmitters providing short-range communications that do not require individual frequency co-ordination for interference management purposes.

Thirteen class licences were in force in June 2002. Millions of devices are operated under the authorisation of these licences. Examples of such devices are remote control devices, citizen band radio, cordless telephones, mobile phone handsets and 'spread spectrum' devices.

Licence issue and re-assignment

Several mechanisms are used to issue and re-assign apparatus and spectrum licences:

- primary assignment of licences;
- secondary trading; and
- administrative re-assignment.

The initial assignment of licences can occur through administrative or market-based procedures. Apparatus licences can be issued using either method, but they normally are issued administratively on a first-come, first-served basis. Spectrum licences generally are assigned through market-based procedures such as auctions.

Once issued, apparatus and spectrum licences can be traded on secondary markets (see chapter 7). The RC Act allows apparatus licences to be transferred between parties, provided that the ACA approves the transfer. Spectrum licences have design features that are intended to facilitate trade.[4] Both apparatus and spectrum licences can be leased to third parties.

Spectrum also may be re-assigned by administrative means. The ACA can re-plan (that is, clear and re-assign) apparatus licensed spectrum using frequency band plans. To make way for new services and technologies, the ACA may clear bands by not renewing existing apparatus licences and placing embargoes on those bands.

In addition, changes in spectrum use can be put into effect through spectrum re-allocation. Under this process, the Minister issues a spectrum re-allocation declaration after the ACA has consulted with apparatus licensees likely to be affected by the re-allocation. Following a period of notice, the apparatus licences in the designated band are cancelled. The spectrum is re-assigned using either spectrum or apparatus licences. No compensation (beyond a refund of the proportion of licence fees) is payable to apparatus licensees whose licences are not renewed. The re-allocation process can take several years to complete (see chapters 6 and 11).

Spectrum licences also can be compulsorily resumed to enable re-assignment, but full economic compensation would be payable to the affected licensees. The RC Act sets out mechanisms by which compensation may be determined.

3.5 Current regulatory instruments

The RC Act empowers the ACA and the Minister to make many types of subordinate legislation, including standards, regulations, declarations, directions, notices and determinations. Subordinate legislation comprises all instruments that have the force of law, or alternatively have been made by an authority to which Parliament has delegated its legislative power (PC 1999). These may take the form of disallowable or non-disallowable instruments.

Disallowable instruments are rules that are generally made by Ministers or government agencies (such as the ACA). These must be tabled in Parliament. If there are no objections, they are passed within 15 sitting days of Parliament, but may be subject to review by the Senate Standing Committee on Regulations and Ordinances.

[4] While an apparatus licence must be used for the same purpose in the same manner when transferred to another owner, a spectrum licence may be used in a different manner or for a different purpose.

Non-disallowable instruments are forms of subordinate legislation that are not subject to parliamentary scrutiny, so there is no obligation for them to be tabled or gazetted.

There are no formal guidelines in determining which parts and sections of an act are disallowable or non-disallowable. However, disallowable instruments with their parliamentary scrutiny promote transparency and accountability better than non-disallowable instruments.

Declarations

Various sections of the RC Act empower either the Minister or the ACA to make declarations. For example, s. 153B of the RC Act enables the Minister to declare parts of the spectrum for re-allocation (see chapter 6), and s. 190 of the RC Act enables the ACA to declare the operation or supply of specified devices to be prohibited. In both cases, these declarations are disallowable instruments.

Directions

Section 60(10) of the RC Act enables the Minister to give written directions to the ACA with regard to setting limits on the amount of spectrum participants in an auction may purchase and on the participation of particular parties (see chapter 6). As discussed in section 3.3, the ACA Act also gives the Minister powers to direct the ACA.

Determinations

Like declarations, determinations may be made in some cases by the Minister and in others, by the ACA. Depending on how they are made, they may be non-disallowable or disallowable instruments. Determinations are regulations for specific spectrum users, charges or radiocommunications devices.

Under the RC Act, the ACA may make determinations about space objects (s. 10A), spectrum licences (s. 60[1]), transmitter and receiver licences (s. 98), third party users (s. 115), operator qualifications (s. 119), unacceptable levels of interference (s. 145) and other areas.

Once gazetted by the ACA (including the details of any superseded determinations), determinations become legally enforceable regulations until they are revoked or superseded.

A variety of determinations made by the ACA are in force. Most are applicable to a limited number or type of spectrum licences or users. Examples include:

- space objects that are determined to be Australian for the purposes of the RC Act — *Radiocommunications (Australian Space Objects) Determination 2000*;
- procedures to be applied in allocating spectrum licences by auction, and in certain circumstances, at a pre-determined price — *Radicommunications (Spectrum Licence Allocation) Determination 1999*;
- the types of transmitter and receiver licences that may be issued — *Radicommunications (Transmitter and Receiver Licences) Determination 2000*;
- labelling for certain types of transmitter operating under apparatus and spectrum licences — *Radiocommunications (Labelling) Determination 1997*;
- qualifications for operators of certain types of transmitter — *Radiocommunications (Qualified Operators) Determination No. 1 1993*; and
- application fees, registration, bidding and payment procedures for applying for multipoint distribution station licences at auction — *Determination No. 1 1994*.

The Minister is also able to make determinations under the RC Act, one of the most notable examples being whether it is in the public interest to re-issue spectrum licences (s.82[3]).

Details of particular directions, declarations and determinations which impact on competition are discussed in later chapters.

Radiocommunications standards and technical regulation

Under part 4.1 of the RC Act, the ACA can develop — and, where necessary, mandate — standards and technical regulation for equipment that uses, or is affected by, radio emissions. The technical standards are intended to:

> … set the minimum performance requirements necessary to minimise interference and optimise use of the radiofrequency spectrum. (ACA, sub. 9, p. 14)

The ACA presently administers four technical standards regimes designed to meet specified technical or health and safety objectives under s. 155 of the RC Act (see chapter 5). These apply to:

- radiocommunications — these standards apply to the compliance and labelling of radiocommunications specific devices and transmitters;
- electromagnetic compatibility (EMC) — these standards are designed to minimise the potential interference between electrical and electronic equipment with the radiofrequency spectrum;

- electromagnetic radiation (EMR) — this standard is designed to protect the health of those likely to be affected by radiocommunications emissions; and
- telecommunications (telecommunications standards are not applicable to radiocommunications and are not discussed further here).

The RC Act prescribes the procedures for developing standards and regulations. The ACA must ensure adequate opportunities for consultation and give due consideration to any representations made (s. 163). Urgent standards (for example, to ensure public health and safety) may be made without consultation (s. 163) (see chapter 11).

The Radiocommunications Regulations 1993 set out the penalties payable for infringements of licence conditions. They also set out the criteria for granting concessions and exemptions for licence fees, such as those for volunteer safety organisations (see chapter 10).

The ACA is authorised to delegate development of standards to other bodies (RC Act, s. 163[2]). In practice, a Standards Australia committee develops most standards for radiocommunications equipment (see chapter 11). However, the ACA modifies these standards to ensure they meet the requirements of the RC Act and the limits set out in s. 162 (ACA, sub. DR333, p. 3).

Standards are not mandatory unless they are formally adopted by the ACA. In most cases, suppliers and importers of products are responsible for their own self-assessment. The ACA conducts random audits to ensure compliance with these standards.

Radiocommunications

Radiocommunications standards in compliance and labelling arrangements have been implemented to ensure products meet relevant mandatory standards and to limit potential interference to radiocommunications services (ACA 2001c). These technical standards can apply to all spectrum users or only certain frequencies, devices or applications.

Types of equipment covered by these standards include VHF and UHF land mobile equipment, VHF maritime mobile equipment and 406 MHz satellite distress beacons.

Electromagnetic compatibility (EMC)

The EMC standard was introduced in 1997 as a voluntary measure and became mandatory in 1999.

Manufacturers and importers of equipment complete a 'Declaration of Conformity' and undertake the required testing, record-keeping and labelling themselves. The ACA has approved four labelling formats to indicate that a product complies with the relevant standards. This system is intended to minimise the cost of technical regulation for manufacturers and importers (ACA, sub. 9, p. 14).

Electromagnetic radiation (EMR)

The EMR standard is a mandatory 'human exposure standard' which sets maximum limits for human exposure to radiofrequency fields between 3 kilohertz and 300 GHz. Standards Australia developed the technical limits of the EMR in accordance with World Health Organisation recommendations. The EMR is mandatory for all radiocommunications equipment, but the ACA requires evidence of compliance only for 'devices that have a genuine potential to exceed the radiation exposure limits' (ACA, sub. 9, p. 17). For all other devices, compliance is largely self-managed. The role and potential effects on industry of these and other technical standards are discussed further in chapter 9.

The ACA is currently (as at June 2002) considering adopting a new EMR standard, as developed by the Australian Radiation Protection and Nuclear Safety Agency.

3.6 Summary

The RC Act introduced major reform to the regulation of radiocommunications in Australia. These reforms included greater flexibility in assignment with the introduction of spectrum licences (as distinct from more prescriptive apparatus licences), as well as the introduction of market-based tools such as auctions. Further reforms were implemented in 1995 when apparatus licences were made tradeable, and in 1997 when competition limits and re-allocation were introduced.

Chapter 4 outlines the Commission's rationales for intervention in radiocommunications. Subsequent chapters examine the current regulatory framework against the principles identified in chapter 4.

4 Rationales for intervention

This chapter examines how the broad principles of good regulation should apply to the particular circumstances of spectrum use. It discusses the rationale for government intervention in spectrum management, the nature of that intervention and relevant policy options. The chapter concludes with a summary of the Commission's preferred approach — one that seeks to achieve the Commonwealth Government's objectives through an efficient and effective regulatory structure.

4.1 The case for government intervention

The Commission's goal is to enhance overall community benefit by establishing the conditions for the efficient use of spectrum as a valuable natural resource. Under the Competition Principles Agreement, legislation should not restrict competition unless the benefits to the community as a whole outweigh the costs and there are no other means of achieving the objectives of the legislation. A first step in applying this framework to the regulation of radiocommunications spectrum is to understand why the Commonwealth Government intervenes in this area, given that such intervention may restrict competition.

A well-functioning market co-ordinates the interactions of buyers and sellers, facilitating the production of goods and services which people want. Market prices convey information about the ability and willingness of consumers to pay for goods and services, and the ability and willingness of firms to produce them. In most cases, this promotes the efficient allocation of society's resources, and facilitates innovation, technical change and progress in the economy as a whole. Historical evidence shows that even less-than-perfect markets can produce more efficient outcomes than central planning. As noted in chapter 1, efficient outcomes generally are best achieved by limiting regulation to areas where there are clearly identified problems and where regulation is an effective remedy.

Radiofrequency spectrum remains highly regulated, with the Government still heavily involved in the planning, licensing, use and pricing of spectrum. The major economic rationale for this intervention is the need to manage interference:

> Spectrum use is regulated in order to manage interference and thus maximise spectrum utility. (ACA, sub. 9, p. 2)

The same interference problems that arise domestically can also arise internationally, requiring a degree of international co-ordination.

Managing interference

Interference can occur in several ways, with different implications for spectrum management. There is a certain level of natural background noise from sources such as solar flares and lightning. This cannot be managed beyond developing immunity standards, which set minimum levels of protection (for example, insulation) that must be built into susceptible products.

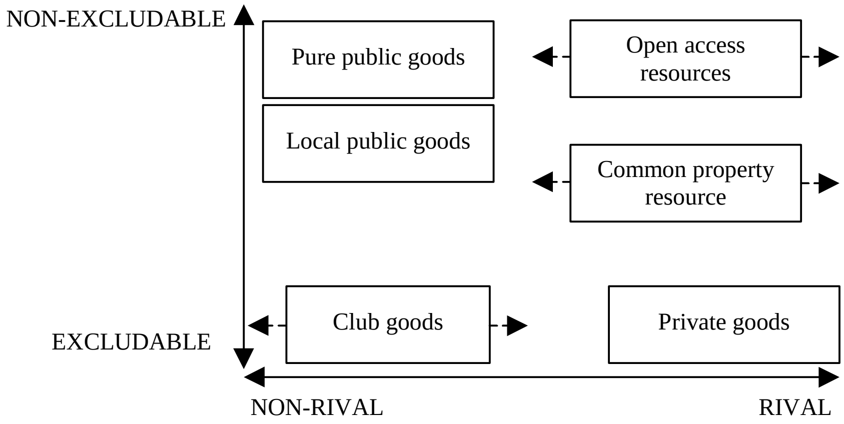
There is also a degree of human-made background noise from power lines, industrial processes and electric and electronic devices. Reception can also be affected by other radio transmissions on different frequencies, through mechanisms such as harmonics (unwanted emissions at multiples of the desired frequency) and intermodulation products (where the signals from two transmitters in close proximity mix and produce more emissions at mathematically related frequency intervals. Such interference is typically managed through emission standards which set acceptable limits on radiofrequency emissions from electrical products, and immunity standards, which set protection levels for susceptible products (ACA 1997, pp. 45-9).

Spectrum has the characteristics of an ‘open access resource’ (box 4.1). In the absence of effective management, such resources are liable to overuse, reducing the potential benefit to the community. In the case of spectrum some frequencies are in high demand. If there were no controls on entry, people would crowd into those frequencies. This congestion leads to interference, which reduces effective communication. Much like conversation at a noisy party, everyone is shouting but no-one can hear.

Interference can be characterised as a negative externality. Externalities occur when one party’s actions have unintended effects on others (positive or negative) and there is no compensation. More precisely, there is a divergence between the private cost (or benefit) and the social cost (or benefit) associated with an activity.

Box 4.1 **Categorising types of products**

Products and resources can be characterised according to their degree of excludability and rivalry. Goods (and services) are excludable if the owner can control who may benefit from them. Goods (and services) are rival if only one person can benefit from them at any one time.



Private goods (most conventional goods and services) are both excludable and rival. The owner may determine who benefits from the good at any particular time and if one person benefits, others cannot benefit at the same time.

Public goods (and services, such as defence) are both non-excludable and non-rival: once the good is produced, it is not possible to prevent people from benefiting; and one person benefiting from the good does not reduce others' ability to benefit. This means that private producers may not supply public goods or may produce less than is desirable.

Local public goods (and services, such as fire breaks) are non-rival and non-excludable in a defined area. *Club goods* (and services, such as gym membership) are a sub-set of local public goods. They provide benefits to a group whose membership can be controlled. They may become rival if the club becomes too large.

Open access resources (such as spectrum) are non-excludable: once the good or service exists, it is not possible to prevent people from using it without paying for it. They are also rival: one person using the good or service reduces others' ability to use it. In the absence of property rights, strong incentives exist for the overuse of the resource. Government intervention may be required to ensure efficient management.

Common property resources (such as a local fishery) are similar to open access resources (non-excludable and rival), but there is a defined group of users. If non-members of the group can be excluded, mutually beneficial group management of common property resources may develop.

Source: Adapted from PC (2001b, pp. 11–12).

Severe interference may degrade the quality of a signal enough to make voice and data traffic worthless and, in the case of emergency services, life threatening. The use of properly designed equipment, good site engineering, careful frequency assignment and the installation of filters can minimise problems, but interference cannot be eliminated completely, only controlled to an acceptable level (ACA 1997, pp. 45–8). Interference management is not an exact science. Many considerations (including geography, weather conditions, engineering and technical specifications) mean that the actual propagation of a radiocommunications signal may not match that predicted by a spectrum engineer.

Even if practical, managing spectrum to eliminate all interference may not maximise the social benefits of its use. Interference-free transmissions may require, for example, large buffer zones between users (known as guard bands), which would significantly reduce the number of users who could be accommodated. The most efficient use of spectrum is likely to result in spectrum users experiencing some tolerable level of interference.

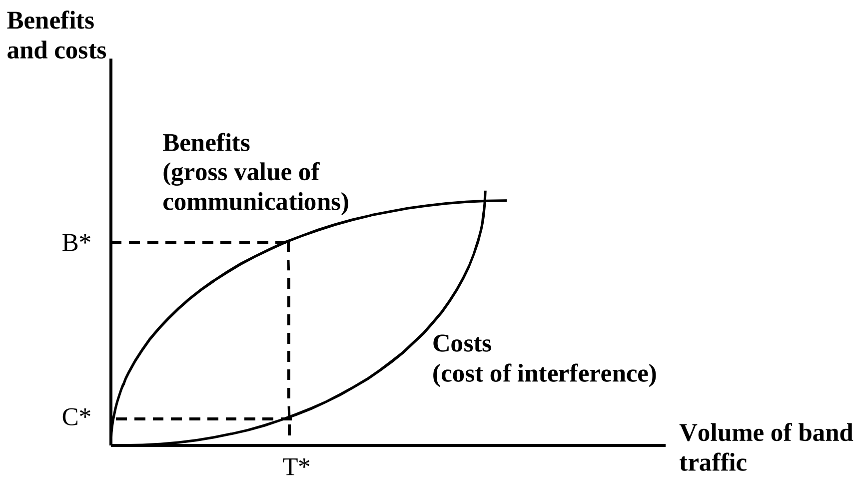
The potential for interference tends to increase with the number of users (referred to as ‘congestion’). Where efficient use of the spectrum is the objective, however, the number of users should not be limited until the benefits received by the latest user are just offset by the interference problems they create for incumbents (box 4.2). If too many new users are accepted, the harmful interference reduces the total value of spectrum use. Alternatively, if too few users are accepted, potentially valuable uses of the spectrum are unrealised and the total benefit from spectrum use is less than it could have been.

The ‘efficient’ level of interference is likely to depend on the type of service using the spectrum. Radioastronomy, for example, can tolerate only very small amounts of interference, while mobile communications can operate effectively with larger amounts of interference. A service with a wide area coverage may create unacceptable interference for a fixed link service, but multiple fixed links may be able to co-exist in the same general area. New technologies such as ‘spread spectrum’ devices promise to increase the productive capacity of spectrum without causing undue interference (see chapter 2).

For all these reasons, administratively set levels of interference may be too high for some users and too low for others. If there was a well-functioning market for spectrum, users could negotiate to achieve their preferred outcome, trading off protection from interference against price.

Box 4.2 **The efficient level of interference**

Radio transmissions generate benefits but they can also cause interference. In theory, the benefits of radio transmissions can be depicted as the gross value of communications in a frequency band. These benefits rise with the quantity of transmissions, but at a decreasing rate because the most valuable communications are conducted first and increasing traffic volumes reduce the spectrum available for other users (that is, marginal utility decreases as the volume of traffic increases). The cost of radio interference reduces the (total private) value of communications in a band. These costs rise at an increasing rate with traffic volumes. At low traffic volumes there is little interference, but interference increases as the intensity of spectrum use rises. The net value of communications in a band, for a given volume of traffic, is the difference between the gross value of communications and the cost of interference (that is, the distance between the two curves).



The efficient level of spectrum use occurs (T*) when the distance between the two curves is greatest (that is, where marginal benefit is equal to marginal cost). To increase (or decrease) spectrum use above (or below) this level results in a reduction in the social value of the spectrum use.

The efficient level of spectrum use for an individual user may differ from T* because costs from interference are incurred *generally* whereas gains from communications use are captured *specifically*. That is, an extra user may benefit from using the band, even though interference from their transmission makes society as a whole worse off.

The cost of interference, although incurred generally, may be greater for some users than others (that is, there may be variation in the cost of interference curves for individual spectrum users). Nevertheless, the elimination of all sources of interference does not result in the efficient level of use of the spectrum resource.

Changing technology influences the efficient volume of spectrum use over time, because new technologies may offer higher value products and services or improve the efficiency of spectrum use. Changing technology tends to increase the efficient level of spectrum use over time.

Source: Adapted from Hazlett (2001, pp. 22–6).

The potential for interference creates a need for management, either through agreed industry self-regulation, government intervention or a combination of both.

The costs and benefits of intervention need to be carefully assessed. Externalities abound in the economy but these are often relatively minor and may not warrant government intervention. Sometimes, other mechanisms, such as accepted social customs, private negotiations or the common law, can be used to address externalities. In principle, if the transaction and compliance costs of intervention exceed the benefits, intervention would be undesirable. In practice, however, it can be difficult to predict and estimate the costs and benefits of government actions.

Government intervention has been a feature of the radiocommunications industry worldwide. There is an historical perspective to the level of government intervention. When radiocommunications was in its infancy, transmitters and receivers were relatively crude and interference management was unsophisticated. Extensive government intervention was expected to deal with interference problems. These administrative systems relied heavily on central planning to direct and co-ordinate the use of spectrum, to determine allowable uses (and users), to set prices and to change uses over time. In conjunction with planning and licensing, the Government mandated minimum standards and registration of certain types of equipment.

Over time, technological advances and better understanding of the nature of interference have greatly improved interference management. To a degree, this has been reflected in the regulation of spectrum, such as the introduction of class licensing. Class licences create ‘public parks’ where low-interference users share spectrum. Interference is managed by regulating the types of devices that can be used, rather than by licensing each individual user.

Some commentators, such as Noam (1997) and Lessig (2001) advocate greatly extending the concept of spectrum public parks, to create free spectrum commons, based on ‘smart’ receivers and transmitters and protocols that co-ordinate shared, multiple, unplanned use of the spectrum (see chapter 2). Noam stated:

> The new paradigm is not based on exclusive use, the technological and economic foundation of both the administrative and auction paradigms. … technology solves scarcity and spares much of the need to deal with allocation questions. (Noam 1997, pp. 462–3)

However, analysts such as Hazlett (1998, 2001) have questioned the extent to which these developments can overcome the basic problem of scarcity. In a critique of Noam, Hazlett stated:

> … the limits to 'open access' are immediately apparent: rights must still be auctioned, trespassers yet will be prosecuted. Technologies that yield greater communications capacity over a given bandwidth do not yield unlimited communications capacities; the possibility of sharing space previously only large enough for one does not end the necessity of determining who the marginal communicator will be. (Hazlett 1998, pp. 813–4)

Even those who propose 'open access' to spectrum 'commons' recognise that there is still a role for government. Noam acknowledged that:

> With open access, scarcity emerges, the resource needs to be allocated, and a price mechanism is required. But this does not require control over a specific slice of the rainbow. (Noam 1998, p. 769)

More recently, Lessig stated:

> … to say that spectrum should be in a commons is not to say that the government would leave spectrum 'unregulated'. There would be a role for regulation even if spectrum were 'free'. (Lessig 2001, p. 83)

The following sections examine other rationales for government intervention.

International co-ordination

The potential for international interference may require co-ordination by national governments. Satellites, for example, have international coverage and their use of spectrum must be co-ordinated globally. Other uses, such as radioastronomy, are highly sensitive to interference, including interference from international sources. Australia is a member of the International Telecommunications Union (ITU) which co-ordinates international planning of spectrum (see chapter 3).

International co-ordination is also important for 'safety-of-life' services such as emergency services and emergency transmissions (see chapter 10). Commercial aeronautical and maritime services also may involve safety-of-life issues. If spectrum use were not co-ordinated internationally, systematic communication would be difficult, and potentially life-threatening incompatibilities could result. The Australian Communications Authority (ACA) stated that alignment:

> … provides us with the ability to support international safety-of-life services and devices for example, Emergency Position Indicating Radio Beacons. (ACA, sub. 9, p. 7)

Therefore, a degree of government intervention is required to give effect to international commitments and to promote safety-of-life services. However, in many other areas, Australia's geographic isolation and low population density permit greater flexibility in determining spectrum planning arrangements than is possible for many other countries (ITU-R 2000, p. 32).

It is also argued that consistency with international planning (together with the adoption of consistent technical standards) can promote inter-operability and greater competitiveness across technologies. Australia is a net importer of radiocommunications equipment. If Australia were to depart from the spectrum plan developed by the ITU, Australian spectrum users could face the costs of developing unique equipment to meet Australia's unique spectrum allocation. Consistency with the ITU spectrum plan allows Australians to import technology from international manufacturers and benefit from their economies of scale. Inquiry participants such as NTL recognise this position:

> … a significant level of international consistency is essential particularly given the small size of the Australian market and the problems an independent Australian approach would cause the local industry, given that most telecommunications and broadcasting equipment is manufactured and supplied from the larger European and American markets. (NTL, sub. 22, p. 2)

In most cases, government intervention is not necessary to achieve international alignment. Commercial pressures tend to encourage equipment compatibility. There are numerous examples of industry convergence on common international standards through voluntary measures, without formal planning by intergovernment agencies. As a net technology importer, it is likely that market forces would lead to Australia adopting the same technology as other countries, even in the absence of spectrum planning and mandated standards. However, waiting for markets to bring about alignment could be undesirable where safety-of-life issues require the rapid uptake of services that are inter-operable between countries. Nevertheless, the need to align some small segments of the spectrum to ensure inter-operability of some services should not pre-determine use of the remainder of the spectrum.

Other possible rationales

Some inquiry participants argued that government intervention in spectrum markets is necessary because they regard spectrum as a public good. Others argued that spectrum scarcity requires government action to ensure it is allocated efficiently. Neither argument provides a persuasive case for intervention.

Public goods

The idea that spectrum is a public good may stem from its characteristics as a naturally occurring resource. As a natural resource, in a sense it belongs to everyone and is managed by the government on behalf of the public. But although it is appropriate to think of spectrum as a public asset, it is not a public good in the economic sense of the word. Public goods are goods and services which are 'non-excludable' and 'non-rival' (box 4.1). Once a public good has been provided to one person, it is not possible to prevent others from benefiting from it. And one person benefiting from a public good does not prevent others from benefiting at the same time. Therefore, it may not be profitable for the private sector to provide these goods.

But spectrum does not fit this description. First, as a natural resource, it 'exists' already and does not have to be produced. Second, it can be made excludable (for example, people can be prevented from using it through licensing) and is often rival (for example, multiple users can cause interference to each others' signals).

Much of the confusion over public goods seems to arise from confusing inputs and outputs. Spectrum is an important input in the production of a number of services, such as defence and emergency services, that may have public good characteristics. Some inquiry participants argued that this creates a rationale for government involvement in spectrum management.

The provision of public goods, however, is a separate issue from the regulation of their inputs. Just as producers of public goods pay commercial prices for other inputs, such as electricity and telephone calls, they could pay market prices for spectrum. Treating some spectrum users differently from others, because of the characteristics of their final product, is likely to create inefficiencies in spectrum use. These issues are discussed in more detail in chapter 10.

Allocating scarce resources

It has also been suggested that government involvement is required to ensure the 'efficient allocation' of scarce natural resources such as spectrum. Bramex, for example, stated:

> … where there is true scarcity … there is a justification for having a process where a judgment is made — and probably the ultimate judgments in the big ones ought to be made by the Cabinet — on advice and assessment of officials, that this is an appropriate use for this public resource. (Bramex, trans., p. 333)

'Spectrum scarcity' does not on its own necessitate government intervention. As Coase aptly observed some time ago, in this respect spectrum is no different from other goods, where the price mechanism is normally used for allocation:

> … it is a commonplace of economics that almost all resources used in the economic system (and not simply radio and television frequencies) are limited in amount and scarce, in that people would like to use more than exists. Land, labour, and capital are all scarce, but this, of itself, does not call for government regulation. It is true that some

> mechanism has to be employed to decide who, out of the many claimants, should be allowed to use the scarce resource. But the way this is usually done in the American economic system is to employ the price mechanism, and this allocates resources to users without the need for government regulation. (Coase 1959, p. 14)

Virtually all goods and services are scarce to some extent; their relative scarcity is evident in their price. This is a normal feature of a market for rival goods (that is, goods where consumption by one person prevents consumption of the same good by others at the same time). It is not a reason for government to intervene in the market for spectrum.

4.2 Managing spectrum

The preceding discussion argued that radiocommunications interference is the main economic rationale for government intervention in the market for spectrum, and that the potential for congestion and interference is not unique to spectrum. Usually, markets can deal with such problems where enforceable property rights exist.[1] In a well-functioning market, voluntary trades then ensure efficient outcomes. Krattenmaker and Powe explain:

> All resources are subject to interference in the sense that their value will decline if everyone attempts to use them at once. This is why governments recognise property rights (which include the right to exclude others from using) in resources exchanged through the marketplace. Interference will ... destroy the value of any resource, but usually the government does not choose to displace the market to prevent interference. Two people cannot comfortably sit at the same time in the same desk chair. Yet this fact has not led government to parcel out the right to sit in a chair. Rather, ownership of the chair is taken to confer authority to exclude others from sitting in it, no matter how eager they may be to do so. (*in* NECG, sub. 73, p. 9)

Market-based allocation of a scarce good ensures the good is allocated to the firm or person who values it most highly. The fact that a person is prepared to pay the highest price for a good indicates the capacity to use it most productively. A mobile phone company, for example, may be willing to pay a high price for spectrum because it is able to use that resource to provide services that are highly valued by consumers, and that will provide the company with a high return. A taxi company may be able to use the same spectrum for mobile radio services, but these services might earn a lower return. A lower prospective return means that the taxi company,

[1] Governments play a role in creating and enforcing property rights that govern access to resources and reflect the community's expectations about what resource uses are acceptable. These rights comprise the bundle of ownership, use and entitlement rights that an owner has over a good or resource, and include the owner's responsibilities to others.

for example, would be willing to pay less than the mobile phone company for the use of the spectrum.

Allocative efficiency provides a strong in-principle argument for all spectrum users (including government and non-commercial users) to pay for their use of spectrum. Where the Government wishes to support some users, explicit budget funding not only makes the cost of the support more transparent, but encourages more efficient use of a scarce resource (see chapter 10).

Allocative efficiency, as described above, is essentially static. It involves choosing the best use of resources at one point in time. New uses for spectrum are constantly being discovered. Dynamic efficiency requires mechanisms that allow resources to move to these new, more valuable uses over time. Markets promote dynamic efficiency by placing an opportunity cost on holding resources. If new uses of the resource promise to be more profitable than existing uses, the price of the resource should increase.

Traditionally, rights to use spectrum have been defined and allocated administratively, not by the market. Although the government has a necessary role in defining spectrum property rights, it may not need to direct and co-ordinate use of those rights. Hazlett notes:

> To confuse the definition of spectrum rights with the assignment of spectrum rights is to believe that, to keep intruders out of (private) backyards, the government must own (or allocate) all the houses. (Hazlett 1990, p. 138)

Markets are better informed than the government. Market Dynamics argued that spectrum users are likely to be better informed than the Government:

> … spectrum users, for the most part, are in a better position to understand efficiency and its associated trade-offs than Government because they have better access to private information about these issues than Government. (Market Dynamics, sub. 33, p. 10)

When there are multiple potential users of spectrum, administrative methods are not well suited to identifying the spectrum uses and users with the greatest social benefits. A well-functioning market could be expected to achieve better allocative and dynamic efficiency by allowing spectrum to identify and move to its most valued use.

Characteristics of property rights

For markets to work efficiently, an appropriate structure of property rights is needed. It may be difficult, if not impossible, to sell an asset that is not well-defined and whose ownership could be disputed. Without clear property rights, existing owners have little incentive to manage or use the resource in a way that maximises its longer term value (IC 1998). Ideally, four main characteristics would be present:

- universality — all resources are privately owned and all entitlements (rights over how they are used) are completely specified;
- exclusivity — all benefits and costs that result from owning and using the resource accrue only to the owner, either directly or indirectly by sale to others;
- transferability — all property rights are transferable from one owner to another in a voluntary exchange; and
- enforceability — property rights can be defended at law.

Most markets are not perfect, but to the extent that these features are present, individual rights holders accrue the benefits and incur the costs of their actions. What is in the best interests of an individual (that is, what is privately optimal) results in outcomes that are best for society as a whole. To the extent that these features do not exist or exist only weakly, decisions made by individual rights holders may not lead to the best outcomes for society as a whole.

This suggests that if property rights in spectrum had the features outlined above, a market for spectrum could develop, which would ultimately result in efficient allocation of spectrum. Network Economics Consulting Group stated:

> … the externality is the result of a missing market; when there is no market for an economic good, the price system cannot play its role in limiting interference or reducing congestion. What is required in such circumstances is a rule that assigns rights over the externality to a particular party. The price mechanism can then function as it does for all other goods and services. (NECG, sub. 73, p. 9)

In theory, a market-based approach would ensure owners of spectrum face incentives to maximise the efficient use of that spectrum. Market-based allocation (for example, through an appropriately designed auction) would allocate the right to use spectrum to those who valued it most highly. If new uses arose over time, then spectrum rights could be traded until they reached their most valuable use. Additional uses would be accommodated until the costs of increased interference outweighed the benefits of those new uses. Users could bargain with each other for the level of interference they preferred. There would be incentives to discover new and innovative ways of increasing spectrum efficiency and minimising interference.

Markets in spectrum are relatively immature (see chapter 7). One reason is that the property rights defined under the system of apparatus licences are weaker than those for most goods and services traded through markets. They place strict conditions on allowable uses and have limited tenure. Although permitted by the

Radiocommunications Act 1992 (RC Act), there is relatively little trade in apparatus licences (see chapter 7). Spectrum licences are more amenable to trade on the secondary market, but make up a small proportion of licences on issue.

Many of the difficulties associated with a spectrum property rights regime can be addressed. The RC Act strengthened property rights in spectrum and introduced a greater role for the market. Auctions are increasingly being used to assign spectrum to competing users and new licence types (called spectrum licences) allow spectrum users greater flexibility in the technology they use and the services they provide.

4.3 Ongoing interference management

In theory, once property rights in the use of spectrum have been defined, market forces can be left to achieve efficient outcomes, without further government intervention. If necessary, owners of property rights defend their interests using generally available mechanisms, such as the common law.

In practice, property rights are a necessary, but not sufficient, response to managing interference. In some circumstances, where the consequences of interference are so serious, or the costs of resolving disputes after the event so high, intervention to prevent interference is preferable to individuals enforcing property rights after the event. A technical framework is necessary to define spectrum space and to manage interference between licensees across frequency and geographic boundaries. This framework is further supported by mandatory standards and registration of certain types of equipment.

Virtually all spectrum users appear to prefer the certainty of *ex ante* rules to avoid interference where possible, rather than dealing with the consequences if (and when) interference occurs. Vodafone Australia summarised the views of many inquiry participants:

> We think it's important at the very time of the allocation that the risks of interference are dealt with so that those risks are minimised. (Vodafone, trans., p. 538)

Inquiry participants argued that the consequences of interference are serious and that the costs of investigating and resolving interference disputes are high. Therefore, prevention is preferable to attempts to fix the damage after the event. Inquiry participants argued that these arguments applied equally to safety-of-life services (where the consequences of interference can be life-threatening) and to commercial services (where continuity and reliability of service are important). It was further argued that, as in the case of food and therapeutic products, voluntary self-regulatory schemes would not provide the desired level of certainty and industry-wide coverage. Mandatory mechanisms — such as minimum technical standards for equipment and compulsory registration of devices — were regarded as necessary.

The potential for information failures provides another rationale for *ex ante* rules for managing interference. Information failures occur when there is insufficient or inadequate information for parties to make informed decisions. There are generally strong incentives to acquire the information necessary to protect valuable property rights, and in some instances, markets can address these problems through intermediary products — for example, consumers purchasing advisory services. However, where issues are highly technical (such as managing interference), the government may perceive a role to complement or verify market supplied information — for example, government licensing, registration and labelling regulations.

Information failures also arise where spectrum users are not able to establish the likely sources and causes of interference. Spectrum users need this information both at the design stage (when developing products and communication systems) and once systems are in operation. Investigating and resolving interference disputes can be costly. The Government can reduce users' transaction costs by mandating registration and providing relatively inexpensive conciliation and arbitration services. In other instances, the Government may act on behalf of those affected by interference, particularly where individuals lack investigative powers or a single source of interference affects many individuals.

As discussed above, in some cases individual property rights may not be the most efficient way to manage spectrum. Where multiple users can share spectrum without creating unacceptable interference, it may be more efficient to class licence the devices that may be operated in the shared spectrum, than to individually license all users.

4.4 Charging for spectrum

If property rights in spectrum could be developed with the features outlined above, a well-functioning market in the rights to spectrum could be expected to improve spectrum allocation. If these rights were perpetual (rather than time-limited), once they were initially allocated, there would be no need to charge to ensure their efficient allocation over time (although charges may be justified for other reasons). Rather, the price mechanism would operate to place a market value on rights to use spectrum. The rights would be traded until they reached their most efficient use.

In the absence of perpetual property rights, the issue of charging arises (see chapter 8). A number of rationales for charging for spectrum have been put forward, with different implications for economic efficiency and revenue raising.

Demand rationing

When several potential users are competing for the right to use the same piece of spectrum, spectrum scarcity arises. Where there is scarcity, it is necessary to choose between competing uses, or ‘ration’ demand. Rationing devices include queuing, administrative quotas, sharing and prices.

Prices are a flexible and effective rationing device. If excess demand exists initially, price rises will eliminate some demand and encourage further supply until the two balance. Although the physical supply of spectrum is fixed, price signals can encourage users to adopt technologies that increase the productive capacity of spectrum.

The way prices are set affects how well they ration demand. Prices set by a well-functioning market are likely to have different allocative efficiency effects from those of prices set administratively. In a market, the price level at any point in time is a function of prevailing demand and supply conditions, and prices can constantly adjust to meet variations in demand and supply. Where prices are set administratively, at best they can only mimic market prices; they can adjust only with lags and some imprecision.

Although some licences to use spectrum are auctioned (that is, sold at market prices), most are assigned administratively, on a first-come, first-served basis. Prices are also set administratively and changes in price are relatively rare (see chapter 8). These factors limit the effectiveness of prices as a rationing mechanism.

Chapter 8 discusses the appropriate (theoretical) level for administratively set prices, along with ways of addressing the difficulties of setting administrative prices in the real world.

The ‘fair return’ argument

The discussion above focuses on the role of prices as a rationing device where there is spectrum scarcity. Some inquiry participants argued that the Commonwealth Government should charge for spectrum irrespective of its scarcity, to provide a return to the community for use of a community resource — the so-called ‘fair return’ argument. The origins of the ‘fair return’ rationale for spectrum charges can be traced back to the 1993 Spectrum Management Agency (SMA) inquiry into the apparatus licence system, which stated:

> The basis for a tax on spectrum users, above the costs of spectrum management, is that the spectrum is a valuable community resource and the community is entitled to a monetary return — or a rent — for its private use. … A direct monetary return, via government, is intended to compensate the community where a user is benefiting from access to scarce spectrum. (SMA 1993, p. 15)

The ACA still holds the view that community resources should provide a return to the community. It stated that 'charges to users of spectrum should … deliver a fair return to the community for the private use of a community resource' (ACA, sub. 9, p. 17). Other inquiry participants agreed that the spectrum is a national asset owned by the Australian people (Telstra, sub. 63; NECG, sub. 73; SEA, trans., p. 279; Market Dynamics, trans., p. 107).

The principle that the owners of the spectrum should receive compensation for the private use of a scarce resource is a sound one. Governments often adopt this approach when selling or leasing public assets to private operators; for example, forests and fisheries. But spectrum has some important distinguishing characteristics that affect its pricing.

Unlike other resources, such as forests or minerals, spectrum is non-depletable. This has important implications for the pricing of spectrum. As there is no need for pricing to address the social welfare effects of trade-offs between consumption today and consumption tomorrow, pricing can focus on maximising the economic use of spectrum at a given point in time. If spectrum charges discouraged otherwise viable uses, the community as a whole would be worse off.

A general caveat applies though — it is not costless to move in and out of spectrum use on a short-term basis. Where substantial fixed and sunk costs are associated with spectrum use, it may be efficient to persist for the time being with a particular use of spectrum even where an alternative use offers better long-term prospects. Transaction costs also mean that it may be efficient to set aside some unused spectrum in anticipation of a valuable future use. But, as in other areas of the economy, it is not necessary for the Government to do this. Private speculators may choose to purchase spectrum and leave it unused, anticipating more valuable uses in the future.

The efficient use of spectrum maximises the benefit to the community. Efficient use is best achieved where spectrum charges are based on opportunity cost; that is, the value of the best alternative forgone. Given that spectrum is heterogeneous — some parts of the spectrum are scarce while others are relatively abundant — the opportunity cost of spectrum will vary from one band to another.

In all cases, spectrum users should be charged the direct administrative costs associated with managing their use of spectrum. If that spectrum use had not been undertaken, those costs would not have been incurred. Spectrum users as a group should also be charged the indirect costs associated with spectrum management that cannot be directly attributed to a particular user.

Where spectrum is scarce, a charge above the costs of administering the spectrum is appropriate. Where there are competing demands for spectrum, the opportunity cost is the value of the spectrum in the best alternative forgone. This can mean either the value of the spectrum to another person using it to provide similar services, or its value in some alternative use. In these cases, market-based assignment results in both efficient allocation and, generally, a return to the government. The person with the highest willingness to pay gains the use of the spectrum and the government receives the market price for the spectrum.

Where spectrum is not scarce, there is no opportunity cost beyond the spectrum management costs. Because it is preferable that the spectrum be used, rather than be left idle, charges should be limited to the relevant administrative costs. Spectrum is not storable, and so charges that may discourage otherwise desirable uses of spectrum should be avoided. If inappropriate charges mean that otherwise useful spectrum is left idle, net benefits to the community are reduced. These benefits include the value to the community of the goods and services the efficient use of spectrum could have provided.

In theory, if the ‘willingness to pay’ of a prospective spectrum user could be identified, the Commonwealth Government could charge up to that amount without discouraging consumption. This would be a non-distortionary way of raising government revenue. However, this approach is difficult to apply to spectrum allocation.

It assumes that the government can discover individuals’ willingness to pay. Where there is no competition for spectrum this would involve difficult negotiations or arbitrary administrative decisions on pricing. This lacks principles of good administration such as transparency, consistency and certainty. It also encourages ‘gaming’ by purchasers, who would benefit from disguising their true identity or intentions, to purchase the spectrum at a lower price. In its purest form, this approach also assumes that different users can be charged different prices, depending on their willingness to pay. This is not possible if the existence of a secondary market creates opportunities for arbitrage. The secondary market would price spectrum at its opportunity cost.

In summary, to achieve efficient outcomes, spectrum charges should be based on opportunity cost. If there is no scarcity, there is no opportunity cost and charges for spectrum should be limited to recovering relevant administrative and regulatory costs. Any use of spectrum is preferable to no use (subject to compliance with regulations governing interference, and relevant cost recovery charges).[2]

4.5 Policy approach

The RC Act introduced some significant market-based reforms to spectrum management. Following this review, a number of policy approaches are available to the Commonwealth Government. These range from retaining the status quo with only minor procedural modifications; to making more significant amendments to the existing regime; to introducing radical change such as the 'privatisation' of the spectrum.

Status quo

The RC Act marked a profound change in the way in which radiocommunications were managed, making Australia a pioneer in the field. Many of the most significant changes have happened relatively recently; for example, the first spectrum licences were issued only in 1997. Retaining the current system would allow more time for industry participants to adjust and for the effectiveness of the reforms to date to be evaluated. It is already apparent, however, that some modifications would improve the current system. It would be counterproductive not to make amendments where these clearly would be beneficial.

Incremental change

A second approach would be to retain the general thrust of the current regulatory system (a mix of market-based and administrative mechanisms), but to make incremental changes to maintain the momentum of reform. The most important issues to address would be to strengthen property rights in spectrum, increase the proportion of spectrum with such rights and create the conditions necessary for the secondary market to develop.

2 The Commission's cost recovery report (PC 2001a) contains an analysis of the cost recovery of direct and indirect costs of regulatory intervention.

A market-based system

A more radical approach would involve significant reform to the current system, moving immediately to a completely market-based system. This would involve the imposition of a minimalist regulatory model based on the same principles that govern most resources in a market economy:

- well-defined property rights;
- a functioning secondary market; and
- reliance on general property, business, contract and common law to enforce property rights and recognise trades.

Granting spectrum users indefinite property rights would give the market much greater control over which parts of the spectrum are used for what purpose and by whom, and facilitate the introduction of new technology. A market-based approach would permit innovation in the way in which rights are bundled and re-sold, and permit the emergence of private spectrum managers to augment or potentially replace the government manager.

However, the nature of spectrum appears to be such that, even under a market-based model, there will inevitably be a need for some government involvement (box 4.3). The same ‘open access’ problem that leads to interference among domestic users also applies at the international level. A certain amount of international co-ordination is necessary and traditionally has been undertaken among governments in the ITU (see section 4.1 and chapter 3).

In addition, as in other areas of the economy, the Commonwealth Government may act to facilitate market mechanisms. Just as the system of property rights in land rests on a mandatory register of land titles, interference management and secondary trading may require a mandatory register of interests in spectrum (see chapter 7).

The Government may also intervene to pursue other social and cultural objectives For example, it reserves spectrum for classified uses such as defence, and ensures access to communications for public and community services such as broadcasting. Further, the Government would have a significant role in managing the transition from the current administrative arrangements to a more market-based system.

Box 4.3 **A minimalist role for government**

A market-based approach to spectrum management, based on a minimalist model of regulation, would retain a considerable role for government, including:

- defining property rights (ensuring they are stable and tradeable);
- undertaking the initial spectrum allocation (including deciding on units of allocation);
- mandating a register of spectrum rights (facilitating trade and interference dispute resolution);
- providing for classified uses of spectrum, such as defence;
- providing for public and community access to communications services (which may require rights to spectrum);
- participating in the International Telecommunications Union;
- co-ordinating international safety and satellite services; and
- managing the transition from the current arrangements to a market-based system.

Summary

The following chapters address different aspects of radiocommunications regulation. The Commission's approach outlined in this chapter provides the basis for this analysis. The Commission considers that the principles outlined in chapter 1 and the Competition Principles Agreement strongly endorse a market-based approach to managing spectrum. Where practical, a market-based approach to managing spectrum can be expected to generate net benefits to the community. Such an approach, based on strengthened property rights, would allow the market, rather than administrative actions, to allocate and assign spectrum. This, in turn, would encourage the efficient use of spectrum and maximise community benefit.

5 Objectives of radiocommunications legislation

The terms of reference require the Commission to clarify the objectives of radiocommunications legislation. Clear objectives help to promote consistency and certainty in the application of legislation. In this context, ‘objectives’ refers to both the Commonwealth Government’s original intentions (as revealed in Parliamentary and policy statements) and the formal ‘objects’ clauses of the relevant legislation. These are examined in the light of broad principles of good government regulation — efficiency, equity and consistency (see chapters 1 and 4).

5.1 Objectives of the *Radiocommunications Act 1992*

As discussed in chapter 3, two Government reviews of radiocommunications regulation in the early 1990s found that Australia’s regulatory framework required significant revision (BTCE 1990 and HORSCOTCI 1991). These reviews led to the introduction of the *Radiocommunications Act 1992* (RC Act) and the establishment of the Spectrum Management Agency (SMA). The HORSCOTCI said this new system was intended:

> … to convert an inflexible, administratively based system of spectrum management to one where, for commercial users, spectrum access has become a tradeable commodity. It also provides protection for non-commercial users of the frequency spectrum, and it recognises that the Government cannot abdicate its role in protecting the radiofrequency spectrum, nor its international obligations and responsibilities. (House of Representatives 1992, p. 3760)

To ensure these original intentions for the legislation were clear, the HORSCOTCI recommended the inclusion of explicit objectives in the RC Act:

> A vital starting point for any assessment of spectrum management is the setting of clear, definable and relevant objectives. (HORSCOTCI 1991, p. 17)

This was implemented with the objects section of the RC Act (box 5.1). The RC Act also has a separate objects clause for establishing standards and technical regulations (s. 155), which aims:

> … to establish an efficient, flexible and responsive system for technical regulation of equipment that uses, or is affected by, radio emissions.

Under this section, radiocommunications standards and regulations are to address technical issues such as compatibility, interference, certification and compliance, and/or the health and safety of people operating, using, or otherwise affected by radiocommunications devices. It is this section of the Act, rather than the general objects section, that underpins, for example, the compulsory electromagnetic compatibility and electromagnetic radiation standards (see chapters 3 and 9).

Objects sections such as ss 3 and 155 of the RC Act are considered good practice for legislation. They appear in most recent Commonwealth legislation. In this respect, the RC Act is an improvement on the preceding *Radiocommunications Act 1983*, which did not include any objects sections.

Box 5.1 **Objects of the *Radiocommunications Act 1992***

The object of the *Radiocommunications Act 1992* is to manage the radiofrequency spectrum so as to:

(a) maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum;

(b) make adequate provision of the spectrum for use by 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;

(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; and

(h) promote Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.

Source: *Radiocommunications Act 1992*, s. 3.

5.2 Purpose of the objects section

The purpose of an objects section in legislation is to guide Ministers, government agencies and others in interpreting and applying the legislation. The objects also may be used to guide the parameters of legal power under the legislation (Armstrong 1999, vol. 1, para. 60 020). The Australian Communications Authority (ACA, sub. 9, p. 6), Vodafone Australia (sub. DR326, p. 4) and Australian Electrical and Electronic Manufacturers Association (AEEMA, sub. 36, p. 6) noted that the objects have an important practical function in guiding the interpretation and implementation of the RC Act.

In general, the objects of legislation should identify the underlying issues that the legislation is intended to address. As identified by the Office of Regulation Review (ORR):

> The objective[s] should not be specified so as to align with (and thus pre-justify) the particular effects of the proposed regulation. Rather, it should be specified in relation to the underlying problem. (ORR 1998, p. B1)

The ACA said the objects of the RC Act are effective in identifying the underlying concerns of the legislation, and provide a clear and useful guide to implementing the RC Act:

> The objectives of the Act adequately describe at least the social and economic concerns that the legislation needs to address. … We do not believe that the Act's objectives are too broad or insufficiently clear. They enable the ACA to make decisions about spectrum use by bringing in all relevant factors. It is hard to see how they could be made much more explicit without tending to undermine the very flexibility they are designed to promote. (ACA, sub. 9, pp. 5–6)

Other inquiry participants argued that the objects do not appear to guide the practical implementation of the RC Act. Vodafone Australia said:

> There is a lack of consistency between the objectives of the RC [Act] and the management of spectrum in practice. The regulators should have regard to the principles of efficiency, certainty, consistency and transparency in each step of the management process. (Vodafone Australia, sub. 23, p. 3)

2KY Broadcasters said the objects of the RC Act were too subjective, 'value laden' and not meaningful enough to give practical guidance to implementing the Act (sub. 10, pp. 8–9). The New South Wales Government said:

> … the objectives are open to interpretation and contain potential conflict. … On the other hand, more specific objectives could limit public policy options by failing to encompass an appropriate range of matters. (NSW Government, sub. 27, p. 3)

These comments highlight the need for clarity and consistency in the objects of the RC Act. The ORR says an objects section should:

> … be clear, concise and as specific as possible. It should be specified broadly enough to allow consideration of all relevant alternative solutions, but should not be so broad or general that the range of alternatives becomes too large to assess, or the extent to which the objective has been met becomes too hard to establish. If applicable, a distinction should be made between the primary and subsidiary objectives. (ORR 1998, p. D3)

Ideally, an objects section should be as short, clear and direct as possible, while still allowing sufficient flexibility in the practical application of the legislation.

Addressing multiple objectives

The RC Act contains a number of separate objectives (box 5.1). As noted by the ORR, where several objectives are deemed necessary to an Act, a clear hierarchy among them is desirable. This can significantly reduce any uncertainty which might otherwise arise regarding which objectives are relevant to which circumstances, and with what priority.

According to principles of statutory interpretation, s. 3 of the RC Act (box 5.1) gives equal weight to all objects, rather than giving priority to one or more objects. Unlike objects clauses in other legislation, s. 3 is not prefaced by the common formulations ‘have regard to’, ‘take into consideration’ or ‘take into account’ in introducing the clauses. Instead, the objects are simply stated, implying that all must be addressed equally. Simpson observed of the RC Act, ‘arguably, the objects embody some potential tensions between competing policy priorities’ (Armstrong 1999, vol. 1, para. 60 020). Similarly, AEEMA noted that:

> There is a question of whether they are to be understood as a hierarchy of objectives and if so what are the priorities. (AEEMA, sub. 36, p. 2)

The ACA stated that in practice, it looks to the first object (a) — efficient allocation and the maximising of public benefit — as taking priority over the others (ACA, sub. 9, p. 7). However, if the objects of the RC Act conflict, or a choice between objects must be made, the ACA said that different objects have taken priority at different times, according to the circumstances:

> The ACA does not operate in a vacuum in this area — it has regard and gives weight to the Government’s policy objectives and current community attitudes in dealing with these trade-offs. (ACA, sub. 9, p. 7)

While some flexibility in applying the objectives appears necessary (for example, in deciding between incompatible spectrum uses in congested bands), too much flexibility reduces the value of the objectives as clear and consistent guides in the application of the Act. In practice, this does not appear to have been a problem for the ACA. The ACA claimed that the way it had responded ‘to these various objectives has remained remarkably constant over the years’ (ACA, sub. 9, p. 6).

Nevertheless, Vodafone Australia was concerned about the possibility of an overly discretionary approach leading to inconsistent or selective outcomes:

> The greater the number of objectives, the greater the chance of conflicting outcomes or confusion as regulators cherry-pick objects. … There’s not enough guidance for the regulator about what the most important factor is. We would really push for a much clearer primary objective for this Act. (Vodafone Australia, trans., pp. 526 and 539)

As noted by Vodafone Australia and the ORR above, a clear order of priority, with a single primary object followed by subsidiary objects will improve clarity and certainty. This structure is found in comparable legislation. The *Telecommunications Act 1997* (also administered by the ACA) has a single main object and other, subordinate objects. A similar structure for the RC Act would enable the ACA and spectrum users to identify a clear order of priorities for spectrum regulation.

FINDING 5.1

The objects section of the Radiocommunications Act 1992 *lacks clarity because it does not identify a single primary objective, supported by subsidiary objectives.*

5.3 Efficiency objectives

The main objective in introducing the RC Act (and associated reforms) was to improve the efficiency of spectrum use. In a statement to Parliament, the then Minister for Transport and Communications identified the objectives of the new RC Act and associated reforms as to:

> … provide incentives for efficiency in spectrum use, flexibility for users in the way in which they use spectrum, greater responsiveness of the system to technological developments and service innovation, increased competitiveness and the ability of new users to buy out incumbent users ... (Collins 1992, p. 5)

These aims are consistent with an overall objective of improving efficiency in spectrum use and are evident in several clauses of the objects section. The key clause for this objective is (a), but clauses (c), (d) and (e) also relate to promoting efficiency in spectrum use (box 5.1).

Clause (a) aims to maximise the ‘public benefit’ derived from spectrum for the Australian community by ensuring efficient spectrum allocation. This alludes to an intention to achieve ‘allocative efficiency’ in spectrum use.[1] In this context, the ‘public benefit’ means the benefit of the ‘Australian community’ (explanatory memorandum, p. 6). That is, spectrum management and regulation should benefit the whole Australian community, not just discrete interest groups such as incumbent spectrum users or consumers. The Commission considers that the public benefit is best pursued by promoting economy-wide efficiency in spectrum use (see chapters 1 and 4).

1 ‘Allocative efficiency’ refers to allocating resources to their most valued uses across the whole economy (see chapter 1).

Many participants agreed that clause (a) should be regarded as the primary objective of the RC Act (for example, ACA, sub. DR324; Ericsson Australia, sub. DR325; Bureau of Meteorology, sub. 5; AEEMA, sub. 36). Vodafone Australia went one step further, and argued that efficient allocation of spectrum for the benefit of all should be the only object of the Act, on the grounds that any additional objects reduce clarity and certainty of purpose (Vodafone Australia, sub. DR326, p. 4; trans., p. 526). The ACA said that, in practice, it already treats clause (a) as the primary object of the Act (see section 5.2). The Commission considers that efficient spectrum allocation, as expressed in clause (a), is the primary objective of the RC Act.

FINDING 5.2

The primary object of the Radiocommunications Act 1992 *is 'to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum' (clause [a]).*

Clause (c) refers to 'a responsive and flexible approach' to spectrum users' needs. The explanatory memorandum (p. 7) explains this objective in terms of introducing a 'flexible and responsive' market-based system of spectrum allocation, as well as 'flexible and responsive administration' of standards, licences, fees and registers. A responsive and flexible approach to allocation and administration is consistent with promoting the market-based allocation of licences and their re-allocation through the secondary market to those who value them most. Clause (c) appears to be superfluous to the promotion of efficient spectrum allocation, as already expressed in clause (a).

Clause (d) is also closely related to the introduction of market-based reforms. It refers to encouraging efficient radiocommunications technologies (for example, technologies that use less spectrum) to provide a wide range of services (explanatory memorandum, p. 7). This may be an important outcome, but it is likely to result from efficient spectrum allocation (clause [a]). It is unclear how efficient spectrum technologies could be pursued as an objective separate to efficient spectrum allocation. Like clause (c), clause (d) is a desirable aim, but appears to be superfluous to clause (a). Clauses (c) and (d) could be considered for deletion.

FINDING 5.3

In the objects section of the Radiocommunications Act 1992*, clause (c) (to provide a responsive and flexible approach to meeting the needs of spectrum users) and clause (d) (to encourage the use of efficient radiocommunications technologies) are superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

Clause (e) describes the need to implement an efficient, equitable and transparent system of charging for spectrum use. An efficient and transparent charging system is a desirable feature of spectrum regulation, but is not an objective *per se*. Rather, pricing is a means to an end — a mechanism for achieving the primary objective of improving efficiency in spectrum allocation (clause [a]). Revenue raising should not be encouraged beyond that necessary for efficient allocation (see chapter 4).

The Commission acknowledges the importance of equity in regulation. However, pricing mechanisms should be primarily concerned with allocating resources efficiently. They are blunt instruments for pursuing equity objectives. In the context of price, 'equity' can be ambiguous. For example, a pricing system that charged all like users on the same basis could be said to be horizontally equitable, whereas a system that charged different prices according to perceived ability to pay could be said to be vertically equitable. Equity may also be interpreted in terms of access to spectrum rather than its price. The Commission considers that issues of users' ability to pay and access to spectrum are better addressed through explicit subsidies rather than price concessions or exemptions for some users (see chapter 10).

FINDING 5.4

In the objects section of the Radiocommunications Act 1992, *clause (e) (to provide an efficient, equitable and transparent system of charging for the use of spectrum) is unclear and may be superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

5.4 Public and community access objectives

HORSCOTCI (1991) proposed that non-commercial users should be able to choose between entering the new market system or remaining under existing administrative arrangements. However, the Commonwealth Government chose to exclude non-commercial spectrum users from participating in market-based spectrum allocations (see chapter 3). The then Minister for Transport and Communications regarded 'protecting' non-commercial spectrum users from the potential effects of the market as an explicit objective of the new legislation:

> A better approach … is to include special measures to protect continued access to spectrum by non-commercial users. … the objectives for spectrum management, which will be included in the legislation, will expressly recognise the need for adequate provision of spectrum for public and community services … (Collins 1992, p. 5)

Special recognition for non-commercial users was again emphasised in the second reading speech for the introduction of the RC Act (Senate Australia 1992, p. 2843). The primary objective of achieving greater efficiency in spectrum allocation and use was therefore tempered with a second objective of maintaining access to spectrum for non-commercial users.

Clause (b) of the objects section is most relevant to this objective. The wording of clause (b) does not imply anything more than allowing access to spectrum (for example, by identifying non-commercial uses in band plans). However, concessional pricing and other assistance also appear to have been intended at the time the RC Act was introduced. These included reserving spectrum ‘exclusively for such services’, reserving ‘spectrum licences for sale to public and community services at concessional rates’ and giving the spectrum regulator ‘the power to buy spectrum licences on the open market or resume them’ (Collins 1992, p. 5). This package of safeguards appears to have been designed to reassure non-commercial licensees that the new market-based system for spectrum licences would not affect them. Such safeguards are consistent with, but are not required by, clause (b).

In favouring access for some spectrum users over others, clause (b) has the potential to conflict with the primary objective of achieving efficient spectrum use for the whole community. Where the two conflict, clarity and consistency could be enhanced by regarding clause (b) as secondary to clause (a).

Some inquiry participants argued that clause (b) was not specific enough to guarantee access for individual public or community spectrum users. In particular, the Department of Defence (Defence) said access to spectrum for defence and national security services should be given priority in a separate objects clause (Defence, sub. 25; sub. DR329). Defence was concerned the lack of such a clause:

> … could limit the importance [the] ACA attaches to fulfilling national security requirements. In the extreme, it could result in the ACA treating Defence requirements with the same priority as it accords any commercial company. (Defence, sub. DR329, p. 2)

Defence maintained that the ACA is ‘not adequately empowered to make any distinction’ in spectrum for national security and defence purposes (sub. DR329, p. 3). Similarly (though with far less urgency), the Department of Transport and Regional Services suggested emergency and ‘safety-of-life’ services should be highlighted with a separate objects clause (DTRS, sub. 62, p. 4).

Although there is no special objects clause addressing defence, national security or safety-of-life services, Defence and other national security services are public sector agencies and would be included as ‘public services’ for the purposes of clause (b). The RC Act defines a ‘public or community service’ as one which has been designated by the Minister by written instrument and may include all agencies, departments and authorities of ‘the Commonwealth, a State or a Territory’ (s. 10).

Elsewhere, the Act defines all Government authorities as public or community services for the purposes of the Act (s. 294).

The RC Act includes many special access provisions for defence and national security services, including designated ‘defence bands’, a separate and confidential licence register, exemptions from certain provisions and, for safety-of-life services, concessions and exemptions from some licence fees (see chapter 10). It therefore seems extremely unlikely that the ACA would — or could — ignore legitimate national security, defence or safety-of-life requirements for spectrum, as argued by Defence (sub. 25 and sub. DR329).

Given the need for clarity and brevity in objectives, it is not appropriate or necessary to include a greater level of detail — or attempt to cover all eventualities — in the objects of the RC Act. These special uses for spectrum are adequately covered elsewhere in the RC Act and in other legislation (see chapter 10).

FINDING 5.5

Clause (b) of the objects section of the Radiocommunications Act 1992 *clearly states the Commonwealth Government objective of making ‘adequate provision of the spectrum for use by public or community services’. Additional, specific objects clauses for individual classes of public and community services are not necessary.*

5.5 Government and policy objects

The remaining clauses of the objects section, (f), (g) and (h), do not directly relate to either of the key objectives of efficiency or access. Rather, they incorporate other Commonwealth Government issues and responsibilities in spectrum management.

Clause (f) calls for the ACA, as a statutory authority, to ‘support Government communications policy objectives’ (explanatory memorandum, p. 8). One participant described clause (f) as ‘the odd one out’ in the objects of the RC Act (Dougal Johnston, sub. 3, p. 5). The New South Wales Government was concerned that:

> It is possible for clause (f), i.e. the policy objectives of the Government of the day, to be completely opposed to objectives (a) to (e) and (g) and (h). (NSW Government, sub. 27, p. 3)

Including Government policy objectives as the stated object of an Act is not unusual, but could be regarded as superfluous, because all government agencies are subject to Ministerial direction, within the terms of their act(s).

The ACA Act empowers the Minister for Communications to give the ACA written directions regarding its operations (see chapter 3). The RC Act gives an explicit and direct role to the Minister in several important areas, including the setting of auction competition limits (see chapters 6 and 12). These avenues for Government direction are more transparent and direct than object clause (f) and do not require the ACA to ‘second guess’ Government policy. Their existence renders clause (f) unnecessary.

Similar contemporaneous legislation (such as the *Broadcasting Services Act 1992* and the *Telecommunications Act 1997*) do not contain such an objects clause. The inclusion of the clause in the RC Act may indicate a need to assuage any initial fears or doubts among spectrum users about the RC Act and associated reforms at the time of their introduction. If so, clause (f) would have no current purpose, now that the reforms are bedded down.

Clause (g) aims for a regulatory environment that ‘assists Australian industry to become and remain internationally competitive’ (explanatory memorandum, p. 8). This clause is ambiguous and appears unnecessary. It could be interpreted as introducing a competitive spectrum market regime to assist industry competitiveness. However, there is a risk that it could also be interpreted to mean that overt industry assistance is an objective of spectrum management.

The Commission’s view is that objectives aimed at assisting particular industries or groups are not appropriate in legislation that is concerned primarily with the efficient use of an important resource. While there is little evidence that the administration of the RC Act has been affected by the pursuit of industry assistance, this ambiguous clause leaves open the prospect of the RC Act being compromised. Where justifiable, industry assistance is best addressed through explicit and transparent measures, not through the RC Act. Given that clause (g) is unclear and could be interpreted in an undesirable way, it should be deleted.

The ACA raised the possibility of adding an object to address environmental policy issues to the RC Act. However, as the ACA acknowledged, this is the subject of other legislation and would be superfluous if included in the RC Act (sub. 9, p. 6). Health and safety objectives for standards and regulations are covered elsewhere in the RC Act (s. 155).

FINDING 5.6

In the objects section of the Radiocommunications Act 1992*, clause (f) (to support the communication policy objectives of the Commonwealth Government) and clause (g) (to provide a regulatory environment that maximises opportunities for the Australian communications industry) are unclear and superfluous to the primary objective of ensuring efficient spectrum allocation (clause [a]).*

Clause (h) recognises the international context and boundaries for Australian spectrum management, along with the 'need to promote Australia's interests in international fora' (explanatory memorandum, p. 8). This object provides a useful reminder of the importance of the ITU and other international bodies in shaping Australia's spectrum planning and management systems (see chapter 3). Clause (h) clearly reflects Australia's interests and obligations in international spectrum management. It is an appropriate object of the RC Act.

FINDING 5.7

Clause (h) of the objects section of the Radiocommunications Act 1992 *clearly states the Commonwealth Government objective of promoting Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.*

5.6 Improving the objects of the *Radiocommunications Act 1992*

In its draft report, the Commission suggested that the primary object of the Act should be to maximise the overall public benefit derived from using radiofrequency spectrum by ensuring its efficient allocation.

It further suggested that the Act should require the spectrum regulator, in pursuing this primary objective, to have regard to:

1. the adequate provision of the spectrum for use by public or community services; and
2. promoting Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.

Many participants who responded to this suggestion in the draft report supported it (for example, Vodafone Australia, sub. DR326; ACA, sub. DR324; Ericsson

Australia, sub. DR325). The ACA agreed with the draft report findings and said that although the ACA was satisfied that the current objects clause fulfilled its purpose:

> … we note the rationale underlying the findings and have no objection to the re-casting of the Act's objectives in the manner suggested. (ACA, sub. DR324, p. 3)

Others agreed that efficient spectrum allocation is the primary objective, but that ‘public interest considerations’ and access for non-commercial users must be acknowledged as objectives of the legislation (Centre for Telecommunications Information Networking, trans., p. 489; Bureau of Meteorology, trans., p. 351; NSW Government, sub. 27, p. 3).

The Commission considers the objects of the RC Act should be clear and concise. Although the existing objects have not impeded the ACA, other participants said the current objectives may give the ACA too much discretion in how the RC Act is interpreted and applied. There are several ambiguous or superfluous clauses. Clarification of the objects and a sharpened focus on economic efficiency would improve certainty in spectrum management, as it moves into a period of further technological change and new services of potential benefit to the whole community. Improved regulatory clarity and focus will be particularly important if the Commission’s recommendations for further reform are accepted.

RECOMMENDATION 5.1

The primary object of the **Radiocommunications Act 1992** ***should be to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum.***

The Act should also require the spectrum regulator to have regard to:

- ***making adequate provision of the spectrum for use by public or community services; and***
- ***promoting Australia’s interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.***

6 Licensing

Licensing has been used to regulate radiocommunications at the national level since early last century, and it remains a central element of Australia's system of spectrum management. The different licence types and licence assignment mechanisms are outlined in chapter 3. This chapter examines key issues arising from the current licensing system, including:

- the extent to which existing licence types enable flexible use of the spectrum and the ready adoption of alternative technologies;
- whether the distinction between licence types should be maintained;
- whether competition limits applying to the primary assignment of spectrum and apparatus licences are necessary;
- security of tenure stemming from licence terms, renewal arrangements and the risk of resumption; and
- the conversion and spectrum re-allocation processes.

6.1 Licence types and spectrum use

Licences must adapt to changes in spectrum use and accommodate new technologies over time. This flexibility is particularly important when technology and markets are changing rapidly. The flexibility of the licensing system is a function of the specification of licence types and the extent of their deployment.

The flexibility of apparatus and spectrum licences can be assessed according to the following criteria:

- use flexibility — the licensee's ability to change to different uses;
- technological flexibility — the licensee's capacity to switch between different technologies and/or equipment;
- spectral flexibility — the licensee's ability to subdivide or combine bandwidth;
- geographic flexibility — the licensee's ability to subdivide or combine licence areas and to place equipment within the licence area;

- transferability — the licensee's ability to trade or lease part or all of a licence; and
- temporal flexibility — the licensee's ability to match the licence term with the life of the investment.

Flexibility of apparatus licences

Apparatus licences specify the category of service to be provided and generally impose tight technical constraints on the operation of radiocommunications devices. By being so technically specific, this licensing approach can fit a large number of individual spectrum users within a given spectral and geographic area. For example, many fixed link services can be accommodated in a designated area, increasing the technical efficiency of spectrum use. However, this technical efficiency comes with a loss of flexibility.

Apparatus licences are considered spectrally and geographically inflexible because, generally, they cannot be subdivided or combined in terms of bandwidth and/or geographic area. Moreover, given that most apparatus licences are site-based, licensees cannot alter the location of their equipment without seeking changes to their licences. Some area-based apparatus licences were issued in the early 1990s. However, if such licences were to be issued today, it is likely that they would be issued as spectrum licences.

Following an inquiry by the Spectrum Management Agency (SMA 1993, 1995b), improvements to the apparatus licensing system were introduced. The number of licence categories was rationalised. More flexible terms for apparatus licences were introduced to allow for short-term uses such as special events. The maximum licence period was increased to five years, improving the temporal flexibility of apparatus licences (see section 6.3). The RC Act initially did not permit transfers from one party to another. This may have prevented the transfer of licences to parties who had a more valuable use for a given licence. The 1995 amendments[1] allowed transfers (see chapter 7).

Despite some improvements in flexibility, a significant and continuing constraint on apparatus licensees is that they cannot change their use of spectrum or equipment without recourse to the ACA. Applicants for apparatus licences initially must choose from the licence categories and related licensing options developed by the ACA. These categories are based on the definitions in the Australian Radiofrequency Spectrum Plan (the Spectrum Plan). The subsequent use of

1 *Communications and the Arts Legislation Amendment Act 1995.*

apparatus licences must be consistent with the Spectrum Plan and any applicable frequency band plans.

Once licences are issued, licensees cannot unilaterally alter spectrum use in response to market or technical developments. To some extent, flexibility in use and technology can be achieved if an apparatus licensee seeks variations to their existing licence or applies for a new licence. However, this would depend on the availability of vacant frequencies and sites, and the ACA's ability and willingness to vary conditions or issue new licences. In this sense, apparatus licences are service and technology inflexible.

At present, the majority of released spectrum is covered by the apparatus licensing system. This means that changes in spectrum use are implemented primarily by administrative means; that is, through frequency band plans and spectrum re-allocation.

FINDING 6.1

While the reforms to apparatus licences in the 1990s have led to some improvements, apparatus licences generally remain highly prescriptive and inflexible with respect to changes in spectrum use and new technologies. Apparatus licensing requires management by the Australian Communications Authority to enable licensees to adapt to new uses and technologies.

Flexibility of spectrum licences

The introduction of spectrum licensing was a major element of the market-based reforms in the RC Act. This licence type was intended to be service and technology neutral. The ACA (1998b) defines technology neutrality as where a licence is not related to any particular technology, system or service. In principle, spectrum licences should allow the licensee to respond to changing demand patterns and to exploit new technologies. Importantly, spectrum licences were meant to allow the licensees — rather than the ACA — to determine the use of licences.

Some inquiry participants claimed that spectrum licences are not technology neutral in practice (see chapter 9). The experience with spectrum licensing indicates that complete neutrality of technology is difficult, if not impossible, to achieve.[2] The problem arises from the relationship between the boundaries established by the core conditions of spectrum licences and the technology that will be used in that

2 Early concepts of spectrum licences were defined in terms of permitted uses rather than full neutrality in use and technology (see chapter 11).

spectrum space.[3] To define the core conditions, the ACA found it necessary to assume a likely use for the licences. Because the ACA makes the decisions about likely uses, spectrum licences are not as technology neutral as is sometimes claimed. For example, while spectrum licences in the 1800-megahertz (MHz) band do not specify a global system for mobiles (GSM), the licences were drawn up on the assumption that the service would be GSM.

While technology neutrality is difficult to achieve in practice, spectrum licences are considerably more flexible than apparatus licences. Ericsson Australia (sub. DR325, p. 4) commented that spectrum licences offer the best approach towards technology neutrality. The spectrum licences in the 2-gigahertz (GHz) band, for example, have accommodated different services and technologies. Two companies are intending to use different technologies for supplying Third Generation (3G) mobile phone services (WCDMA and CDMA-2000) and another is planning to supply a portable wireless data service (ACA 2001c). The service and technological flexibility of spectrum licences is conducive to improving the efficiency of spectrum use.

Spectrum licences are inherently more spectrally and geographically flexible than apparatus licences because they can be amalgamated or subdivided to suit different types of services and technology as markets evolve over time. Spectral and geographic flexibility is enhanced by the tradeable nature of spectrum licences (see chapter 7). The temporal flexibility of spectrum licences is examined in section 6.3.

In addition, spectrum licences are less constrained than apparatus licences by planning instruments such as the spectrum and band plans. While apparatus licences are service specific and must accord with these plans, services operated by a spectrum licensee need not align with the plans (ACA 2002a). However, the licensee must accept interference from, and bear the costs of, any interference caused to services in accord with the plan.

The limited deployment of spectrum licences has constrained their overall influence on the flexibility and efficiency of spectrum use. Spectrum licences have been issued in far fewer bands than was originally envisaged (see chapter 11). The number of spectrum licences is small relative to the number of apparatus licences and, more importantly, they occupy a small proportion of the spectrum. The ACA (sub. DR340, p. 5) agreed that there is potential to extend significantly the number of spectrum licensed bands.

3 The core conditions of spectrum licences are defined in terms of frequency band; geographic area; emission limits outside the area; and emission limits outside the band (RC Act, s. 66). Frequency bandwidth and geographic area define spectrum space.

FINDING 6.2

Spectrum licences are not entirely technology or use neutral at the time of issue, but are much more flexible than apparatus licences in responding to changing uses and technologies over time.

Flexibility of class licences

Class licences are a flexible way of allowing multiple users to share spectrum. Unlike apparatus and spectrum licences, which normally assign bandwidth on an exclusive basis to individual users, class licences assign frequency bands on a shared basis to groups of users. Any person may use designated devices without the need for an individual licence. Class licensing is appropriate for devices which have low interference potential. It recognises that the assignment of exclusive rights to individual users may not be the most efficient approach where the costs of assigning and enforcing individual rights would outweigh the benefits of reducing interference.

Class licensing is a centrally administered system. The decision to class license certain equipment rests with the ACA. The ACA determines the conditions of class licences and has the power to vary conditions or revoke licences as circumstances change. Class licences are technology specific; that is, the licences cover the use of particular types of devices, such as cordless telephone handsets and remote control devices.

The number of devices operated under class licences has increased over time. The ACA (pers. comm., 22 January 2002) estimated that around 70 million class licensed devices operate in Australia. The uses of class licensed devices has also been widened.[4] The ACA recently converted some maritime and aviation apparatus licences into class licences where it assessed low potential for interference.

Some inquiry participants were satisfied with the class licensing system. Sony Australia (sub. 6, p. 1) indicated that it is happy with the arrangements that apply to its low power wireless microphone transmitters and receivers. The New South Wales Government (sub. 27, p. 8) noted that the class licensing system can service a wide range of devices that have low interference potential. Other inquiry

4 Originally, the Citizen Band class licence authorised voice communications but now it also authorises telecommand and telemetry operations. Similarly, the Cellular Mobile Telecommunications Devices class licence is being varied to authorise the operation of fixed devices using mobile telephone spectrum, such as vending machines, parking meters and ATM machines (ACA, pers. comm., 11 February 2002).

participants, such as the Australian Maritime Safety Authority (sub. 4 , p. 3), were concerned about the risk of interference and band degradation.

The Commission considers that the class licensing system has generally worked well. First, class licensing has simplified licensing for spectrum users and the ACA. It requires minimal administration compared with apparatus and spectrum licensing. Given the millions of devices operating under class licences, a major administrative burden would be created if users were required to be individually licensed. While some revenue is foregone because no fees apply to class licences, there are savings from a reduced administrative burden. The potential loss of revenue to the Commonwealth Government should not impede the application of class licensing in those situations where it is likely to result in greater efficiency of spectrum use.

Second, class licensing can increase the technical efficiency of spectrum use, allowing class licensed users to operate on the same frequency as apparatus licensed users. This is possible because the low power and short range of class licensed devices generally do not interfere with higher powered devices operated under apparatus licences.

However, there is uncertainty about the ACA's ability to issue class licences over the same frequency as spectrum licences. Although technically possible, legal considerations may arise if spectrum licences had been marketed as exclusive rights to particular bands. The ACA stated:

> While no such representations have been made, there would be a need for close consultation with spectrum licensees before class licences were issued/varied in the relevant spectrum. (ACA, sub. DR340, p. 8)

The RC Act is unclear on this issue. Section 138 of the RC Act prevents the ACA from issuing a class licence within a part of the spectrum that is designated under s. 36 for spectrum licensing. Section 138 is silent on issuing class licences within a part of the spectrum that is declared under s. 153B for re-allocation. Although s. 153B provides for re-allocation by spectrum or apparatus licences, it does not provide for re-allocation by class licences.

The ACA noted that these problems could restrict the adoption of new technologies:

> For example, the ACA has a proposal before it to authorise low-powered ultra-wideband technology for use, for example, as a ground penetrating radar. The Federal Communications Commission in the United States has approved this application for use below 960 MHz or in the frequency band 3.1 – 10.6 GHz. Currently, the ACA is unable to license these devices sensibly by virtue of the provisions of s. 138 of the Act. (ACA, sub. DR340, p. 8)

The ACA is preparing a submission to the Department of Communications, Information Technology and the Arts (DCITA) on this issue (ACA, sub. DR340, p. 6). The Commission encourages the early resolution of this issue, in a manner that will facilitate the efficient use of spectrum, and respects the rights and flexibility of spectrum licensees.

Other challenges for class licensing are being posed by new technologies. Some inquiry participants claimed that 'spread spectrum' technologies may reduce the need for licensing the exclusive use of bands. OzProspect stated:

> Recent advances in ultra-wideband (UWB) and 'spread spectrum' technologies (also called software-defined radio) mean an open access, 'commons' management approach to governing the airwaves is likely to be more efficient for many parts of the radio spectrum. (OzProspect, sub. DR317, pp. 1–2)

The current licensing system appears able to accommodate some spread spectrum applications. Australia has already issued class licences for some types of 'spread spectrum' devices. The ACA (sub. 9, p. 37) noted that, subject to concerns identified above about issuing class licences in spectrum licensed frequencies, an extension of class licensing may also handle ultra-wideband technologies.

Some inquiry participants argued that the class licensing approach should be extended. Electronic Frontiers Australia (sub. DR318, p. 3), for example, argued that there may be benefits from creating technology neutral public parks, rather than specifying class licences in terms of devices. This could be achieved by defining some class licences in terms of interference conditions rather than nominating specific devices.

Currently, the ACA class licenses products on a case-by-case basis:

> A new wireless product will be developed or an importer will wish to import a new piece of wireless equipment into Australia. This person will approach the ACA and seek access to spectrum in which the equipment can operate. The ACA will make a judgement on the level of interference that the equipment provides and if it is a low interference/low power device, the ACA may decide to class licence it within a certain band. (ACA, sub. DR340, p. 5)

In principle, the Commission considers that performance standards that set desirable outcomes are more likely to achieve efficient outcomes than prescriptive standards that limit flexibility. The current approach (licensing types of devices) creates uncertainty as to whether a device will be class licensed or not. This may discourage innovation and the introduction of new technologies.

However, the Commission recognises that developing performance standards for class licences is not an easy task. Determining the suitability of a particular device for class licensing is difficult enough, even with full information on all its characteristics and likely deployment. It is presumably much more difficult to devise broad performance standards that would provide the same level of assurance that unacceptable interference will not occur, especially if a large variety of devices can be expected to share the same spectrum. Nevertheless, the Commission encourages the ACA to examine the potential for establishing class licences based on a set of allowable interference conditions. In doing so, the ACA could draw on the expertise used to develop the technical framework for spectrum licences.

FINDING 6.3

Class licences, by authorising the use of devices with low interference potential, provide an important mechanism for increasing the technical efficiency of spectrum use.

Distinction between licence types

The RC Act does not specify the circumstances in which each licence type should apply. In practice, different licence types are appropriate in different circumstances.

Applicability of licence types

Class licensing is appropriate where there is a low risk of interference. The choice between apparatus and spectrum licences is less clear cut. The type of spectrum use generally determines which licence type is appropriate. Most spectrum uses can be categorised into two broad applications:

- point-to-point services (or fixed link services); and
- point-to-multipoint services (or wide area services).

For fixed link services, the locations of transmitters and receivers are fixed; however, for wide area services, a device can be placed virtually anywhere within the service area. Wide area services generally mean that a small number of service providers deliver services to a larger number of users in a given area. In contrast, fixed link services can support a large number of individual service providers in the same area (see chapter 2). The distinctions between these two applications are important for licensing purposes.

Apparatus licensing is most appropriate for fixed link services. It can accommodate a larger number of service providers within a given area than is possible with individual spectrum licences. With careful technical planning to minimise interference, the same frequency can be re-used many times in the same area

(Darling 2001). The ACA uses apparatus licences as the default form of licensing in most bands where there are many service providers in the same area.

Applying spectrum licensing to individual fixed link services could create significant problems in defining the boundaries of the spectrum space, particularly in the geographic dimension. Where two fixed link services operate on the same frequency and their transmissions intersect in the geographic area, it is not possible to define two exclusive pieces of spectrum space. In such cases, spectrum licences as currently configured cannot be issued. The same problem has arisen in the conversion process (see section 6.4). However, multiple fixed link services could be managed by a single spectrum licensee, who would lease bandwidth to fixed links within the spectrum space, using apparatus licence type agreements.

Spectrum licensing has generally been applied to wide area services. It is applicable to services such as trunked mobile, mobile telephony, wireless wide area networks and wireless local loop. According to the ACA (sub. 9, p. 12), industry has preferred spectrum licences for newer applications, which involve higher values and risk. Spectrum licensing allows licensees to manage their spectrum actively. This is important in areas such as mobile telephony, where cellular technology enables frequencies to be re-used many times in the same service area, thereby increasing the efficiency of spectrum use compared to traditional broad area coverage.

The single licence proposal

The distinction between licence types is blurred in some cases. Some apparatus licences have features normally associated with spectrum licences. These apparatus licences are area-based (rather than site-based), allowing licensees to choose their transmission sites within the licence area. There are also situations where the same use of spectrum is covered by different licence types. For example, GSM mobile phone systems in the 900-MHz band are covered by apparatus licences, whereas GSM systems in the 1800-MHz band are covered by spectrum licences. In addition, some apparatus licences have been converted into spectrum or class licences.

Given this blurring between licence types, some inquiry participants suggested a single licence type. The ACA (sub. 9, p. 13) noted that it may be worth exploring whether a single licence type might improve flexibility. Spectrum Engineering Australia (sub. 30, p. 18) supported this option, favouring a return to a single licensing framework.

A single licence approach could provide for different licence terms, renewal options, compensation options, interference management techniques and allocation methods to meet different users' needs. According to the ACA (sub. 9, p. 13), licence conditions could be varied to suit the particular case, rather than being pre-determined by the requirements of current licence types. Denis McNeill (sub. DR332, pp. 1–2) argued that a unified licensing system would remove anomalies in the RC Act.

Although a single licensing framework may enhance the ACA's flexibility to match some aspects of licences more closely to individual spectrum users' requirements, such gains would be offset by increased administrative costs. The ACA would need to determine the appropriate conditions for each new licence. Administrative costs would be greater if the conditions of licences currently on issue were also changed.

Some inquiry participants argued that this option simply constitutes a repackaging of the current system. FuturePace Solutions (sub. 18, p. 7) argued that the RC Act is already very flexible, allowing a continuous range of spectrum management between unbiased spectrum licensing and highly specific apparatus licensing. It also stated that the introduction of a single licensing system would impose unnecessary costs on industry (FuturePace Solutions, sub. DR314, p. 3). The Australian Electrical and Electronic Manufacturers' Association (AEEMA, sub. DR320, p. 2) and Vodafone Australia (sub. DR326, p. 2) supported the current three licence structure, provided that tenure and procedural issues were addressed.

A single licence could consolidate the RC Act. Currently, the Act sets out separate, detailed processes for the three different licence types (see chapter 3). This option would require major redrafting.

Whether the new Act would be any simpler or shorter would depend on the amount of discretion it gave to the Minister and the ACA. While some conditions (such as licence terms) have a continuum of options, other conditions have fewer or binary options. In some respects, a single licence approach might still have to devolve into groups of licences with quite distinct characteristics. For example, licences are either accorded the right to compensation or not. This alone would create two different kinds of licences. Furthermore, since class licences do not require the individual licensing of users, this would create another distinction between licences. If such distinctions were not made explicit (either in the RC Act or subordinate legislation), the single licence approach would give very little guidance to the Minister and ACA. This could result in inconsistent administrative decisions and pressure from licensees to vary licence conditions in an arbitrary manner.

The Commission notes the ACA's argument that a single licensing regime might bring the ACA greater flexibility (ACA, sub. DR324, p. 5). But it would increase the risk of a reversion towards administrative regulation of the spectrum. A single licence type, varied by administrative fiat could weaken the move towards spectrum allocation through market mechanisms introduced by the RC Act. Because the new licences would be a blend of features based on current licence types, it is possible that blended licences would be less tradeable than spectrum licences.

The single licensing regime appears to have been proposed as a way to reform licence tenure and procedural arrangements. The Commission considers that these issues are better addressed directly, whilst retaining the current three licence types. The assignment process for spectrum licences is examined in section 6.2. Tenure and renewal arrangements for apparatus and spectrum licences are discussed in section 6.3.

FINDING 6.4

A single licence type would have significant net disadvantages, compared with the current licence types in the Radiocommunications Act 1992.

6.2 Primary assignment

Inquiry participants were concerned about several areas of primary assignment of licences, including:

- the broad processes for deploying licences;
- the method of primary assignment; and
- the application of competition limits.

Processes for deploying licences

The processes for deploying apparatus and spectrum licences differ markedly. As Denis McNeill (sub. DR332, p. 1) pointed out, there are a number of provisions in the RC Act applying to spectrum licences that do not extend to apparatus licences. Spectrum Engineering Australia (sub. 30, p. 5) claimed that the implementation of spectrum licensing has been complicated unnecessarily.

The deployment of spectrum licences has been slow and limited to relatively few bands (see chapter 11). Generally, it takes several years to issue spectrum licences. In the case of the 2-GHz band, it took around two years between the release of public discussion papers and the auction of licences. According to the ACA (sub. DR324, p. 4), the long lead-time reduces the attractiveness of spectrum licences. In contrast, the primary assignment of apparatus licensing is relatively fast and simple, with licences typically issued within a matter of hours or days.

The lengthy period taken to deploy spectrum licences largely results from the time-consuming process required by the RC Act. The process has many steps. It involves identifying and designating frequency bands, developing technical frameworks and marketing plans, initiating spectrum re-allocation where necessary, determining auction rules, deciding upon competition limits and conducting the auctions. The process also requires extensive consultation with interested parties.

At various points in the process, the Minister is required to make decisions about certain regulatory instruments. The Minister may issue written notices designating bands for spectrum licensing (s. 36); make spectrum re-allocation declarations in relation to encumbered spectrum (s. 153B); and issue directions to apply competition limits (ss 60 and 106). There appears to be scope for streamlining this process. Options to facilitate the future issue of spectrum licences are outlined in chapter 12.

Currently, the ACA can only issue spectrum licences in unencumbered spectrum after the Minister designates the bands for spectrum licensing under s. 36 of the RC Act. (Conversion and spectrum re-allocation deal with encumbered spectrum.) Based on the ACA's accumulated experience with spectrum licensing and general performance (see chapter 11), the Commission considers that the ACA should now be permitted to issue spectrum licences in unencumbered spectrum without the requirement for a Ministerial designation.

RECOMMENDATION 6.1

The* Radiocommunications Act 1992 *should be amended to allow the Australian Communications Authority to issue spectrum licences in unencumbered spectrum without the need for a Ministerial designation under section 36.

Method of primary assignment

Sections 60 and 106 of the RC Act set out the procedures for issuing spectrum and apparatus licences respectively. The two main methods of primary assignment are:

- administrative assignment; and
- market-based assignment.

Both methods have been used for both licence types. However, almost all apparatus licences have been assigned administratively, while most spectrum licences have been assigned using market-based methods (principally auctions).

The choice of procedure appears to depend on the demand for the spectrum lots on offer. Where only one party is demanding an apparatus licence for a particular frequency, the ACA normally issues the licence administratively — that is, over-the-counter. The majority of apparatus licences are issued in this way. But, where there is strong demand for licences, administrative procedures based on the first-come, first-served rule are unlikely to ensure efficient allocation. As Hayne (1997) noted, if ‘latecomers’ are more efficient but are unable to gain access or must accept lower quality access, the outcome is reduced economic efficiency (although they may be able to acquire licences in the secondary market).

The ACA commented that administrative assignment is poorly suited to situations where demand for bands exceeds the supply at going prices:

> Spectrum managers then face difficult decisions about which applicants should gain access to a particular band when more companies or individuals wish to acquire spectrum to operate services than can be accommodated within that band. (ACA 2001h, p. 5)

Conversions aside, spectrum licences generally have been issued in situations of excess demand — that is, when the number of parties wishing to purchase licences is greater than the number of licences on offer at the going rate. Some inquiry participants argued that the ACA was holding back spectrum until demand was strong enough to assign licences by these methods. For example:

> Optus does not believe that the ACA should leave spectrum fallow in an effort to wait until demand for spectrum exceeds supply, nor should the ACA artificially restrict the supply of spectrum to foster competitive tension for an auction. (Optus, sub. 17, p. 8)

Waiting for demand pressures to build up may have the effect of increasing auction revenue for the Commonwealth Government at the expense of forgoing some worthwhile use of the spectrum. The ACA could beneficially issue spectrum licences over-the-counter even where only one party seeks a particular licence. The ACA should avoid unnecessarily reserving unencumbered spectrum. In most instances, market participants are well placed to determine the highest-value use of spectrum. As Rosston and Steinberg (1997) noted, to the extent that the best use of spectrum in some circumstances is for it to lie temporarily unused, the competitive market can reliably identify those situations.

The ACA (2001h) already has established a process for assessing the likely level of demand for spectrum. Where a party applies to purchase a spectrum licence for a given frequency, the ACA could use a similar process to gauge the demand for that licence. The ACA could issue a public notice that it intends to sell the licence. This would ensure transparency and equity of opportunity. If the ACA did not receive any other expressions of interest after a specified period (for example, one month), then it would sell the licence to the initial applicant at a price based on administrative costs. If other parties are interested in the licence, then the ACA would proceed with market-based assignment.

To enable over-the-counter sale of spectrum licences in unencumbered spectrum, the Commission has recommended that the ACA be able to issue spectrum licences without the need for a Ministerial designation under s. 36 of the RC Act.

FINDING 6.5

Using a market-based approach only when there is excess demand for spectrum may unnecessarily restrict the issue of spectrum licences. From an efficiency perspective, it may be beneficial to sell spectrum licences even when there is only one prospective buyer.

RECOMMENDATION 6.2

The Australian Communications Authority should issue spectrum licences in unencumbered spectrum even if only one party is interested in using that spectrum, after establishing the level of demand by calling for expressions of interest and allowing a suitable period for responses.

Competition limits

The assignment procedures in ss 60 and 106 of the RC Act allow the Minister to impose aggregate limits on parts of the spectrum that may be used by any one person, specified person or members of a specified group of persons. The limits may be expressed in terms of frequency, geographic area or population reach. These provisions were introduced in 1997.[5] At the time, the Government stated that the power to set limits would supplement the competition protection under the *Trade Practices Act 1974* (TPA) (House of Representatives 1996).

It appears that the main objective of the limits is to promote competition in end markets, which in most cases are telecommunications markets. For example, limits may be placed on the amount of spectrum that incumbent users may purchase at auction because they already hold numerous similar licences in that band. The limit provisions were intended to provide some opportunity for new entrants to purchase licences (House of Representatives 1996). To date, competition limits have been imposed on a number of spectrum auctions (table 6.1).

5 The *Radiocommunications Amendment Act 1997* (No. 41).

Table 6.1 **Competition limits applied to selected auctions**[a]

Auction	*Nominated party*	*Limit*	*Band*	*Geographic area*
		MHz	MHz	
800/1800 MHz	Any person or group	10	825–845	Australia
	Any person or group	10	870–890	Australia
	Telstra[b]	5	825–830	Australia (non-metropolitan)
	Telstra[b]	5	835–845	Australia (non-metropolitan)
	Telstra[b]	5	870–875	Australia (non-metropolitan)
	Telstra[b]	5	880–890	Australia (non-metropolitan)
	Any person or group	15	1710–1755	Any major capital city
	Any person or group	15	1805–1850	Any major capital city
1.8 GHz	Any person or group	20	1710–1785	Any major capital city
	Any person or group	20	1805–1880	Any major capital city
2 GHz	Any person or group	5	1900–1920	Selected cities[c]
	Any person or group	15	1920–1980	Selected cities[d]
	Any person or group	15	2110–2170	Selected cities[d]
	Any person or group	15	1935–1980	Canberra
	Any person or group	15	2125–2170	Canberra
	Any person or group	10	1960–1980	Eastern and western regions
	Any person or group	10	2150–2170	Eastern and western regions
3.4 GHz	Telstra[b]	0	3425–3492.5	Major population areas
	Telstra[b]	22	3442.5–3475	Outside major population areas
	Telstra[b]	22	3542.5–3575	Outside major population areas
	Any other person or group	67.5	3425–3492.5	Major population areas
	Any other person or group	67.5	3542.5–3575	Major population areas
28/31 GHz	Optus[e]	0	27500–28350	Australia
	Optus[e]	0	31000–31300	Australia
	Telstra[f]	0	27500–28350	Australia
	Telstra[f]	0	31000–31300	Australia

a Simultaneous ascending auctions of spectrum licences only. **b** Includes any related body corporate. **c** Includes Adelaide, Brisbane, Darwin, Hobart, Melbourne, Perth, Sydney and Canberra. **d** The same cities as listed in note (c), excluding Canberra. **e** The declaration applied to carrier licences granted to Optus Networks, Optus Mobile and Optus Vision. **f** The declaration applied to carrier licences granted to Telstra Corporation and Telstra Multimedia.

Sources: Radiocommunications (Spectrum Licence Limits — 800 MHz and 1.8 GHz Bands) Direction 1997; Carrier Licence Conditions (28 GHz and 31 GHz Bands) Declaration 1998; Radiocommunications (Spectrum Licence Limits — 1.8 GHz Band) Direction No. 1 1999; Radiocommunications (Spectrum Licence Limits — 3.4 GHz Band) Direction No. 1 2000; Radiocommunications (Spectrum Licence Limits — 2 GHz Band) Direction No. 2 2000.

Competition limits can be imposed only by Ministerial direction. The Minister acts on advice from DCITA and the Australian Competition and Consumer Commission (ACCC). The ACCC consults DCITA and the ACA[6] about competition limits to be applied to spectrum sales. The ACCC, together with DCITA, also consults industry participants to determine the likely use of spectrum and to gauge market sentiment about whether any potential bidders should be limited in purchasing spectrum (ACCC, sub. 282, p. 1). Using this information, the ACCC determines whether there are any potential concerns regarding s. 50 of the TPA and prepares advice for the Minister and ACA on any conditions that should apply to the spectrum sale. The Minister may then direct the ACA to apply the conditions.

Limits on spectrum holdings have been used in other countries. Spectrum caps are currently in force in the United States (US) and Canada. The US Federal Communications Commission (FCC) has applied a spectrum cap rule to commercial mobile radio services spectrum since 1994, so as to promote competition and protect consumers. The cap restricts the amount of spectrum an entity can hold in a particular geographic area to 55 MHz (FCC 2001). Similarly, Industry Canada (1999) imposed a spectrum cap on personal communications services spectrum to promote competitive conditions.

Some countries have set aside spectrum for new entrants as a means of increasing competition. In the United Kingdom (UK), the Department of Trade and Industry (1999) determined that five licences for 3G mobile phone services would be auctioned with the largest licence being reserved for a new entrant. The 3G auctions in Germany and the Netherlands also sought to introduce at least one new player into their respective markets (Coutts 2000).

The case for competition limits

A number of inquiry participants supported the retention of competition limit provisions in the RC Act. The ACCC argued that the limits act as an important supplement to the general powers under the TPA:

> … where required, competition limits may be employed to assist in controlling market dominance, increasing competition and bringing about pro-competitive spectrum allocations that might not otherwise be achieved under the TPA. (ACCC, sub. DR334, p. 2)

Other inquiry participants claimed that the TPA may not be the best instrument for addressing competition in future markets. Vodafone Australia (sub. DR326, p. 5)

6 Under ss 60 and 106 of the RC Act, the ACA may be required to provide the ACCC with specific information on the proposed assignment procedure.

argued that *ex ante* competition limits may be necessary to protect against anti-competitive outcomes in markets that are yet to develop. Similarly, Electronic Frontiers Australia (sub. DR318, p. 12) argued that s. 50 is not suited to spectrum sales that are intended to create new markets with unknown characteristics.

An argument for *ex ante* competition limits is that they create more regulatory certainty for auction bidders than would be provided by sole reliance on s. 50 of the TPA. The ACA (sub. DR324, p. 6) stated that the limits provide a degree of certainty for bidders. If *ex ante* limits were not applied, bidders may not know how much spectrum they could acquire before triggering s. 50 and would face the risk of regulatory intervention by the ACCC during or after the auction.

Some inquiry participants claimed that reliance on s. 50 alone may impede entry by new entrants. If incumbents have 'deep pockets', they might use their significant financial resources to acquire most or all of the spectrum on auction. According to the ACCC (sub. DR334, p. 3), s. 50 is unlikely to prevent existing market participants from purchasing all of the spectrum on offer. Unwired Australia (sub. DR319, p. 2) was concerned that, in the absence of limits, the prospect of bidding against a dominant incumbent may be enough to deter investors from financing an auction participant.

Another argument in favour of competition limits is that they minimise transaction costs. By imposing *ex ante* limits at the time of the spectrum sale, this may avoid the costs and delays associated with any regulatory intervention that could otherwise occur under s. 50 of the TPA. The ACCC (sub. DR334, p. 3) noted the potential for extensive delays in the spectrum allocation process if it had to assess the results of auctions under s. 50.[7] Moreover, if the ACCC determined that a bidder had breached s. 50 and was able to prove a legal case, the auction may need to be held again, which would add further to costs and delays.

Effects of competition limits

The Commission examined the results of spectrum auctions and classified them according to the type of competition limits imposed. There are two types of limits: those applying to incumbents only; and those applying to all bidders. The former have generally applied to the major telecommunications carriers (that is, Telstra, Optus and/or Vodafone Australia) but, in one auction, limits applied only to Telstra. A single auction may include spectrum lots with both types of limits and lots with no limits.

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[7] The ACCC noted that it may be difficult to identify an individual acquisition that resulted in a substantial lessening of competition.

Incumbents-only limits applied to specified lots in the 800/1800 MHz, 3.4 GHz and 28/31 GHz auctions (table 6.1). The 800/1800 MHz auction saw the entry of Hutchison Telephone, AAPT Wireless, Catapult Communications and OzPhone. In the 3.4 GHz auction, competition limits imposed on Telstra caused it to withdraw from the auction. The auction resulted in the entry of two new players into the telecommunications industry.

Any advantages that incumbents may have when bidding at auctions are difficult to detect. However, some insights may be gained from examining the proportion of the spectrum offered at auction that was won by incumbents, and whether they paid more on average than their competitors. In auctions where all-bidder limits applied to certain lots, the proportion of spectrum acquired by incumbents varied considerably. They won most of the spectrum in the 800/1800 MHz and 2 GHz auctions, whereas other bidders purchased the majority of available spectrum in the 1.8 GHz auction held in 2000. In terms of the prices paid, incumbents do not appear to have systematically paid more for spectrum than other bidders. For example, in the 1.8 and 2 GHz auctions, incumbents paid less, on a normalised price basis (that is, price per MHz and head of population), than other bidders.

Even for those lots where no competition limits applied, bidders other than the incumbents were able to acquire bandwidth. For instance, new entrants purchased most of the spectrum on offer in the 500 MHz auction and about half of the spectrum upon which no limits applied in the 800/1800 MHz and 27 GHz auctions.

Finally, competition limits are not always binding. For example, combined limits were imposed in the 800/1800 MHz and 1.8 GHz auctions (table 6.1), but two of the three incumbents did not reach their limits. This meant that sufficient spectrum was available to allow entry by two new players, even though the limits were set in anticipation of only one new player emerging.

Assessment of the limit provisions

Competition limits appear to have some advantages. In particular, *ex ante* limits are clear and may add certainty to the auction process. Compared to the *ex post* application of s. 50 of the TPA, they also might result in a more timely allocation of licences.

While noting these possible benefits, the Commission has identified significant problems with competition limits.

A supplementary layer of regulation, in the form of competition limits, is not required to address the competitive structure of new or future markets. Section 50 of the TPA makes no distinction between existing and future markets. In seeking to define a market under the TPA, the ACCC attempts to establish actual or potential sources of substitutes for the new product or service in question. The interpretation of 'a lessening in competition' is not limited to an actual reduction in the number of competitors in a given market. It also can be interpreted as fewer firms in a new market compared with an alternative market structure. The ACCC (1999) has prepared a set of guidelines to assist interpretation of s. 50, noting that a lessening in competition can include preventing or hindering competition.

To determine whether competition limits should be applied, the ACCC and/or DCITA must anticipate the likely uses of the spectrum and the likely market structure in the absence of limits. However, in practice, it is extremely difficult to predict accurately which services and/or technologies will be successful among the available alternatives. Government agencies generally are not well placed to make such forward-looking assessments, given their limited access to commercial information about emerging technologies and consumer preferences for new services.

Because of their discretionary nature, competition limits need not be consistent with s. 50 of the TPA. For instance, limits may be used to impose pre-conceived market structures. While this approach may encourage entry and appears pro-competitive, it also could introduce significant market distortions. Government attempts to 'engineer' market structures are prone to failure. Economies of scale dictate that some markets will tend to be populated by only a few firms. This need not be a policy concern, provided barriers to entry are low or absent. If the Government sought to increase competitors in such cases by applying competition limits, this could result in unsustainable competition and lead to a costly rationalisation of the industry.

Moreover, the existence of secondary markets in licences undermines the effectiveness of competition limits. For example, Telstra was prevented by bidding limits from purchasing certain spectrum lots in the 3.4 GHz auction in 2000 (table 6.1), but it subsequently purchased some of that spectrum in the secondary market. To the extent that competition limits are applied inconsistently with s. 50 of the TPA, parties subject to the limits may acquire the same spectrum from secondary markets after the auction. The ACCC (sub. 282, p. 4) proposed that competition limits also should apply in the secondary market, but it gave little reason for doing so, given that these transactions are already covered by the TPA (see chapter 7).

The competition limits also suffer from a number of procedural deficiencies. Sections 60 and 106 of the RC Act lack transparency. At present, Ministerial directions issued under these provisions are non-disallowable instruments. This means that, while they must be published in the Gazette, there is no requirement to table them in Parliament or to publish the regulatory impact statements (RISs) relating to competition limits.[8] In practice, DCITA puts the Minister's decisions and RISs on its web site. However, most of the RISs that are available exclude important information, such as comprehensive definitions of the relevant markets.

The process for determining competition limits may deny procedural fairness to the parties who would be adversely affected by the imposition of limits. Under ss 60 and 106 of the RC Act, the Minister determines whether bidding limits apply based on the advice of DCITA and the ACCC, but affected parties have no formal avenue to appeal the recommendations of these government agencies. In contrast, the onus is on the ACCC to prove allegations of breaches of s. 50 of the TPA in court.

The Government introduced the competition limit provisions in 1997 when it deregulated the telecommunications sector.[9] Since then, the number of licensed telecommunications carriers has increased. The number of mobile phone operators increased from three in 1997 to four in 2002. The PC (2001f) found that the mobile services market exhibits characteristics of an effectively competitive market. These developments have eroded the need for competition limits.

The Commission is not convinced that there are compelling arguments for having specific competition rules for radiocommunications. The TPA currently provides general protection against anti-competitive practices. The RC Act specifies that s. 50 of the TPA applies to licences (see chapter 3). The ACA reminds prospective bidders of this in its pre-auction documentation. Knowing that the TPA could be invoked should be sufficient warning to guide prospective purchasers of licences.

The perceived disadvantages of relying solely on s. 50 could be addressed by providing auction participants with broad guidelines about what is likely to be a permissible acquisition. The ACCC could incorporate information on how the acquisition of radiocommunications licences would be assessed under s. 50 of the TPA into its merger guidelines. This would be useful to prospective purchasers deciding how much spectrum to acquire. It also would aid the transition to reliance on the TPA.

At best, the competition limits imposed under ss 60 and 106 of the RC Act duplicate the operation of s. 50 of the TPA. At worst, they may be used to engineer industry outcomes that exceed the reach of s. 50.

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8 The preparation of a RIS is mandatory for all proposed new or amended regulation, including primary and subordinate legislation such as disallowable and non-disallowable instruments (ORR 1998). DCITA prepares RISs for competition limits. These identify the objective(s) of the proposed limits, options considered, consultations and the option recommended to the Minister.

9 The *Telecommunications Act 1997* removed legislative barriers to entry to telecommunications.

FINDING 6.6

Competition limits imposed under sections 60 and 106 of the Radiocommunications Act 1992 *are unnecessary, potentially distortionary and procedurally deficient.*

The Commission's preferred position is that the competition limit provisions be deleted from the RC Act. However, if the Government decides to retain them, the Commission strongly recommends that the provisions be amended to address a number of deficiencies.

The RC Act should be amended to make the application of competition limits consistent with s. 50 of the TPA. That is, the limits should only be imposed to prevent a substantial lessening of competition in a substantial market. This would retain the benefits of *ex ante* application and align competition regulation between primary and secondary markets.

To maintain consistency with its responsibilities under s. 50, the ACCC should be responsible for competition limits without the involvement of the Minister. The ACCC should issue a determination when it decides to apply *ex ante* limits. This determination should be a disallowable instrument. This would make the publication of RISs mandatory and therefore improve the transparency of decision making. The ACCC should ensure that the RISs contain all relevant information. Similarly, if the Minister is to retain the power to impose limits, the determination should also be a disallowable instrument.

As noted above, there is no mechanism for reviewing or appealing the competition limits. Unlike s. 50 of the TPA, there is no onus on the ACCC or the Minister to prove the case for imposing limits. To rectify this shortcoming, a formal consultation or review process should be introduced.

One option is to formalise the existing consultation process. The ACCC could publish draft limits together with its supporting reasons. It would give interested parties sufficient opportunity to submit their views. After taking these views into account, the ACCC would finalise its position. This option is unlikely to create significant delays. However, the ACCC would still make the final decision with no provision for appeals to an independent arbiter.

The Commission considers that a better option is to institute a formal review process which allows an affected party to seek an independent review of an ACCC decision on competition limits. The Australian Competition Tribunal, which already hears appeals on the merits of some ACCC decisions, would be well placed to hear appeals on competition limit determinations.

Review mechanisms increase accountability and may reduce regulatory error. However, they may also slow regulatory decisions and increase compliance burdens and administrative costs (PC 2001f). The Commission recognises that a review mechanism could encourage 'gaming' by incumbents. For example, they could challenge all limits, even where they do not expect to win, in order to delay new entrants. However, this is not a sufficient reason for disregarding good administrative practice. If the ACCC is to be given responsibility for imposing competition limits, it is appropriate that its decisions be subject to review.

Several mechanisms can be used to discourage gaming and consequent delays.

- Clear criteria for imposing limits can reduce the scope for disagreement. The Commission recommends that competition limits be applied consistently with s. 50 of the TPA, to address 'substantial lessening of competition in a substantial market'.
- A requirement for significant upfront deposits from appellants can discourage frivolous or mischievous appeals. These deposits could be subject to forfeiture if an appeal were found to be without merit.
- Appeal processes can be run in parallel with the technical specification of lots and the design of the auction framework.
- Indicative time limits can be placed on the duration of appeals. Binding time limits are also possible, but arbitrary time limits run the risk of compromising the quality of decision making (PC 2001f).

RECOMMENDATION 6.3

Competition limits should not apply to the primary issue of radiocommunications licences. Therefore:

- ***the competition limit provisions in sections 60 and 106 of the*** **Radiocommunications Act 1992** ***should be repealed; and***
- ***the Australian Competition and Consumer Commission should amend its merger guidelines to address the assessment of the acquisition of radiocommunications licences under section 50 of the*** **Trade Practices Act 1974.**

In the event that the Government decides to retain the competition limit provisions, the **Radiocommunications Act 1992** ***should be amended to specify that:***

- ***competition limits be applied consistently with section 50 of the*** **Trade Practices Act 1974*****;***

- ***determinations imposing competition limits be issued by the Australian Competition and Consumer Commission;***
- ***determinations imposing competition limits be disallowable instruments for the purposes of section 46A of the* Acts Interpretation Act 1901*; and***
- ***determinations be subject to appeal to the Australian Competition Tribunal.***

6.3 Security of tenure

The security of licence tenure is determined by: the nominal licence term; renewal arrangements; the possibility of spectrum resumption; and compensation arrangements. These differ substantially between apparatus and spectrum licences.

Apparatus licences

Some inquiry participants expressed concern about the term of apparatus licences (currently one to five years renewable) and wanted improved security of tenure.

Participants' views about licence terms

Austar United Communications (sub. 32, p. 2) argued strongly for greater security and 2KY Broadcasters (sub. 10, p. 10) said assigning apparatus licences on an indefinite basis would be desirable.

According to some inquiry participants, the life of the investment generally exceeds the nominal licence term. The Electricity Supply Association of Australia (sub. 279, p. 4) argued that licence terms should match the period during which manufacturers of communications equipment support their products. The Bureau of Emergency Services Telecommunications (sub. 11, p. 2) noted that major capital investments in its sphere of operations typically occur every seven to ten years.

Short-term licences may pose problems for prospective investors in raising debt or equity finance for their projects. Financial intermediaries may be reluctant to make long-term loans to projects with little security of tenure. Mismatches between licence terms and investment periods may prevent operators from opening or expanding their businesses. For example, Bramex (trans., p. 332) claimed that some prospective investors withdrew after being informed about the short terms for apparatus licences.

It was claimed that short-term licences diminish incentives to invest in and maintain equipment as the licence term nears expiry. Telstra noted problems with fixed-term licences:

> Because investments in the industry are long-lived and highly specific, there are significant sunk costs associated with the deployment of infrastructure to supply services using spectrum. Accordingly, it is necessary to ensure that there is adequate incentive for appropriate investment decisions. (Telstra, sub. 63, p. 13)

Licence terms, renewal and re-allocation

Apparatus licences can be issued for terms up to five years, with fees paid upfront or by annual installment (ACA 2001d). Terms shorter than one year may be appropriate for special events, such as outside broadcasts. Terms greater than one year allow licensees to select a term closer to the life of their investment. For longer licences, licensees can avoid the risk of subsequent increases in annual fees by paying their fee for the full term upfront.

Most apparatus licences have terms of one-year or less (table 6.2). The ACA (sub. 9, p. 23) said this was the licensees' decision. This may indicate that few licensees want longer term licences. The majority of five-year licences are held by broadcasters, amateurs and government organisations (RCC 2002).

Table 6.2 **Terms of assigned apparatus licences, June 2001[a]**

Term	*Years*	*< 1*	*1*	*2*	*3*	*4*	*5*
Share of total	%	2.1	91.2	2.2	0.7	1.1	2.7

[a] Assigned licences are issued where individual frequency assignment is required.

Source: ACA (sub. 9, p. 23).

The nominal term of apparatus licences may not be important if there is a strong presumption of renewal. The ACA's practice has been to renew apparatus licences in most cases. If it refuses a renewal, it must give its reasons to the licensee upon request. Under s. 130 of the RC Act, the ACA must not renew licences that are affected by a spectrum re-allocation declaration and would expire after the end of the re-allocation period. Advance notice of non-renewal is given if licences are to be cancelled or not renewed.[10] Prior to spectrum re-allocations, the RC Act protects the rights of incumbents for a minimum of two years. In practice, the period of warning may be substantially longer (ACA, sub. 9, p. 23).

[10] Affected licensees typically are given advance warning in the form of published international planning decisions, specific advisory notices printed on licences, and through statutory public consultation on proposed future uses of the spectrum (RCC 2002).

The re-allocation process has a longer formal notice period for incumbents than the band re-planning process. Under the latter, the ACA can prepare and vary band plans with a minimum of one month's notice, although in practice, the ACA has given significantly longer notice of re-planning (ACA, sub. DR340, p. 9).

Short-term licences help to ensure that (the usually technically prescriptive) apparatus licences will be returned to the ACA for re-allocation to other uses and/or users. Short term licences provide the ACA with greater regulatory flexibility. The ACA could use the 'embargo' method of band clearing, that is, letting licences expire in the nominated band and not issuing new ones. A band could be cleared relatively quickly if all licences in that band had one-year terms. Short-term licences and compulsory resumption powers are methods for clearing bands and addressing any 'hold-out' problems (box 6.1). Short terms may also be a way of addressing potential competition problems that arise during licence terms.[11]

Box 6.1 **The hold-out problem**

The hold-out problem arises where some incumbents impede the efficient re-allocation of a resource by refusing to sell or exchange their rights to that resource. The classic hold-out problem is when a few landowners refuse to sell their properties to make way for the construction of major public infrastructure such as an airport or highway.

In the case of spectrum, the hold-out problem could arise during a band clearance. While the majority of incumbents in a band nominated for clearance may have re-located to other bands or sold their licences, a small group may demand excessively high prices for their licences. This may slow or prevent the full clearance of the band and block the introduction of new uses and technologies.

The hold-out problem also occurs when apparatus licensees are motivated by non-commercial considerations. Government or non-profit organisations, for example, may not sell their licences despite being offered high prices.

Source: Network Economics Consulting Group (sub. 73).

There is some tension between apparatus licensees' desire to have investment security and the ACA's need to have flexibility to re-allocate spectrum. Spectrum re-allocation or re-planning is necessary when a given part of the spectrum has been allocated using apparatus licences, the prescribed use and configuration of which are inconsistent with a new, higher value use. This process is typically triggered by the development of new services and technologies which require access to occupied spectrum. Under current arrangements, the ACA attempts to balance the rights of incumbents to use spectrum against the needs of new users to access spectrum.

[11] In addition to the TPA, limits on the life of spectrum access rights have been identified as a means of countering competition problems over the longer term (HORSCOTCI 1991).

Proposals for improving tenure

The Commission identified several proposals that seek to strengthen the security of tenure of apparatus licensees, including:

- increasing the maximum nominal term;
- assigning licences a statutory right to a term extension;
- providing licences with a statutory presumption of renewal;
- increasing the period of notice for spectrum re-allocation; or
- assigning compensation rights.

Some inquiry participants argued that increasing the term of apparatus licences to ten years would reduce uncertainty. The Radiocommunications Review (DCITA 2001a) recommended that the maximum duration of apparatus licences be extended to at least ten years. In response to this recommendation, the Radiocommunications Consultative Council (RCC) Working Group was unable to agree on an appropriate licence term, after considering both five and ten year terms (RCC 2002). Some inquiry participants argued that apparatus licences should have the same duration as spectrum licences (fifteen years). This could result in some administrative efficiencies for the ACA and, if licensees were able to retain the option of paying their licence fees upfront, greater certainty for them.

Another approach could be to give apparatus licences a statutory right of renewal for an additional fixed period. According to the Federation of Australian Commercial Television Stations (FACTS), an assured right of renewal after the first licence period expires could provide further certainty — for example, an initial five-year term plus a five-year extension (ACA 2000b).

However, the nominal term of a licence is largely irrelevant so long as licences are subject to spectrum re-allocation and spectrum re-planning. Regardless of whether the maximum term is five, ten or fifteen years, the effective tenure of apparatus licences ultimately is determined by renewal conditions and the period of notice of spectrum re-allocation (a minimum of two years) or re-planning (a minimum of one month).

Given that apparatus licences currently have a *de facto* positive presumption of renewal and most licences are renewed, the RC Act could be amended to provide a statutory presumption. The ACA (sub. 9, p. 23) indicated that it would have no difficulty if the Act were amended in this way. This was also supported by many inquiry participants, including AEEMA (sub. DR320, p. 3), Ericsson Australia (sub. DR325, p. 3), FACTS (sub. DR338, p. 15) and FuturePace Solutions (sub. DR314, p. 23).

The Commission sees merit in making explicit the positive presumption of renewal which exists in practice. Certainty for licensees would be enhanced if the RC Act specified that licences generally would be renewed, where licensees have satisfactorily complied with their licence conditions and no spectrum re-allocation declaration or re-planning affects the licences. This also would assist licensees in securing financial backing for their investments. The amendment would allow the ACA to renew licences affected by a spectrum re-allocation, so long as their terms expired before the end of the re-allocation period.

There is a view within the industry that the minimum period of notice for spectrum re-allocation is too short. The RCC Working Group recommended that the RC Act be amended to include a statutory minimum period of notice for band clearance of three years, irrespective of whether the band is subject to apparatus or spectrum licensing (RCC 2002). FACTS (sub. DR338, p. 15) argued that a notice period of at least five years is needed to allow adequate planning by incumbent users affected by spectrum re-allocation.

While security of tenure could be improved by increasing the formal period of notice that is given to apparatus licensees under spectrum re-allocations, the Commission considers that affected licensees already receive substantial informal notice in addition to the minimum two years' formal notice before their licences are cancelled or not renewed. Increasing the minimum re-allocation period could restrict the ability of the Commonwealth Government and the ACA to undertake beneficial spectrum re-allocations.

FINDING 6.7

The effective tenure of apparatus licensees is determined by renewal conditions and the possibility of spectrum re-allocation or re-planning. Increasing the maximum nominal term of apparatus licences would not affect this.

RECOMMENDATION 6.4

Section 130 of the **Radiocommunications Act 1992** ***should be amended to specify that apparatus licences generally will be renewed unless:***

- ***licensees have failed to comply satisfactorily with their licence conditions; or***
- ***renewal on the same conditions would be inconsistent with the Australian Radiofrequency Spectrum Plan, frequency band plans, or spectrum re-allocation declarations.***

Compensation

Another means of strengthening tenure would be to extend compensation rights in the event of spectrum re-allocation or re-planning. The Australian Broadcasting Corporation (ABC, sub. 21, p. 3) argued for minimum ten-year terms for apparatus licences, as well as for compensation for spectrum resumption and re-allocation. Similarly, FACTS (sub. 28, p. 4) said licensees should be compensated if their licences are cancelled.

Compensation rights may reduce uncertainty and strengthen incentives to invest. If compensation were payable, it may serve as a discipline on the ACA to conduct a thorough assessment of the benefits and costs of any spectrum re-allocation. However, the requirement to pay compensation would increase the cost to the Government of re-allocating spectrum and could delay or prevent the re-allocation of spectrum to higher value uses.

The circumstances under which the Government is required to pay compensation for altering property rights are contentious. Under s. 51 of the Constitution, the Commonwealth Government can compulsorily acquire property on ‘just terms’ (that is, with just compensation) from any State or person and for any purpose within the Parliament’s powers. The question, therefore, is whether an apparatus licence is considered to be ‘property’ for the purposes of compensation.

Apparatus licences lack some of the characteristics of property rights. In particular, they have short terms, are not permanent, and are issued on the condition of no compensation for cancellation (s. 308 of the RC Act). They are priced to reflect these characteristics. Apparatus licences are more in the nature of short-term ‘permits’ giving access to a public resource, than full ownership rights. The ACA retains the power to renew or not renew licences. Given this, a decision not to renew a licence cannot be construed as an act of expropriation. The grounds for compensation are weak given the current specification of apparatus licences. Moreover, compensation may not be needed if a sufficient period of notice is provided to licensees affected by spectrum re-allocations or re-planning.

FINDING 6.8

Apparatus licences are short-term permits to access a public resource that may need to be cancelled periodically, or not renewed, to make way for higher value uses. Therefore, it is not appropriate to provide compensation to apparatus licensees whose licences are cancelled or not renewed.

If the ACA wishes to clear a band in less than two years, affected apparatus licensees could be provided with financial inducements to vacate the band sooner.

This would be appropriate only if a significant net benefit accrued from introducing new users more quickly. New users should also have the option of paying incumbents to vacate the spectrum if they wish to have earlier access to it.

Spectrum licences

The RC Act was amended in 1997 to increase the maximum term of spectrum licences from ten to fifteen years.[12] Virtually all spectrum licensees with ten-year terms accepted the opportunity to extend to fifteen years, by paying an additional 50 per cent of the original purchase price, with adjustments for inflation and the Goods and Services Tax (ACA, sub. DR340, p. 1).

While this change was intended to provide greater certainty for licensees, some inquiry participants argued for even longer terms. Optus (sub. 17, p. 22) supported longer terms and pointed to the twenty-year 3G licences sold in the UK. Similarly, Vodafone Australia (sub. DR326, p. 6) said spectrum licences for mobile networks should have a minimum term of fifteen years (and probably twenty years).

The Commission favours the introduction of perpetual spectrum licences as a medium-term objective. Unlike apparatus licences, there is no need to resume spectrum licences to give effect to a change in use. Perpetual rights for spectrum licences should create greater certainty and promote trade in secondary markets. The proposed move to perpetual spectrum licences is discussed in chapter 12.

The first spectrum licences were issued in 1997 and some of these licences are due to expire in 2007. Many inquiry participants were concerned about what will occur when spectrum licences near expiry, especially the process for re-issuing licences and the timing of this process. The RC Act allows for spectrum licences to be re-assigned by market-based methods within the two years prior to licence expiry or re-issued to the same licensee on public interest grounds (ss 78–84).

The Commission examined three processes for re-issuing spectrum licences:

- attaching rights of renewal to licences;
- market-based re-assignment of licences; and
- re-issuing licences on ‘public interest’ grounds.

[12] *Radiocommunications Amendment Act 1997* (No. 41).

Rights of renewal

Some inquiry participants suggested attaching a presumption of renewal or a ‘right of first refusal’ to spectrum licences. Austar United Communications (sub. 32, p. 2) strongly supported a renewal option, whereby the licence holder is given the first right of refusal. Such renewal rights would reduce uncertainty for incumbents in developing and implementing their investment plans. These rights also may reduce the incentive to run down infrastructure as the expiry date approaches and encourage licence trading in secondary markets.

However, assigning rights of first refusal has drawbacks. Such rights would override market-based assignment and pricing of licences. If incumbents decided to exercise their right to renew, other parties would be precluded from bidding for the licences and licence fees would not be market-based. There is a risk that rights of first refusal would not see licences assigned to their highest value uses.

An alternative would be to give spectrum licensees a ‘right of last reply’. This right would apply when licences are assigned through market-based procedures such as auctions. Incumbents would have the option — at the conclusion of the auction — to match or surpass the highest bid submitted by other parties during the auction and thereby win the licence. While the right of last reply can allow for market-based assignment and pricing, it nevertheless extends an advantage to incumbents over potential entrants — an advantage that was not incorporated into their initial bids, but which has considerable commercial value.

The Commission does not support attaching rights of first refusal or last reply to spectrum licences because, upon licence expiry, such rights give an advantage to incumbents which may impede spectrum licences from flowing to their best uses and/or users.

Market-based assignment

Section 81 of the RC Act allows the ACA to re-assign spectrum licences using market-based procedures. Where the number of parties that are interested in purchasing licences exceeds the number of licences on offer, this generally constitutes the pre-conditions for using market-based methods such as auctions.

The RC Act does not indicate the extent to which s. 81 (market-based assignment) and s. 82 (re-issue in the public interest) should be invoked. However, based on the general thrust of the 1992 reforms, it is logical to assume that most if not all spectrum licences would be re-assigned via market-based methods. Given the drawbacks of using administrative assignment methods when there is strong demand for licences and the relative immaturity of secondary markets (see chapter 7), the Commission considers that market-based assignment should be the principal means of re-issuing spectrum licences. Periodic re-auctioning simulates the re-allocative function that would otherwise be performed by well developed secondary markets.

Re-auctioning licences

The re-auctioning of licences raises the question of whether incumbents have an advantage over potential new entrants in bidding for the licences. Incumbents, having held and used the licences for substantial periods, would have acquired detailed information on their licences' profit-generating capacity and be able to place a more accurate value on the licences.

Incumbents also may be prepared to pay larger amounts for the licences than other bidders at auction because they expect to make higher profits. Because incumbents have already made substantial investments in fixed assets during the first licence term, their expected costs over the second term are likely to be lower than those of newcomers to the industry who need to invest in infrastructure:

> The fixed cost of setting up a network (say of antennae and relays) is very large. In contrast, a substantial part of the incumbents' fixed costs are already sunk, since they can use parts of their already existing facilities. (Jehiel and Moldovanu 2000, p. 3)

Similarly, the Network Economics Consulting Group (sub. 73, p. 10) argued that there are significant sunk costs associated with deploying infrastructure to supply services using spectrum. If investments are sunk, then the licensee cannot recover the value of these assets if its business fails. Knowing that the incumbent has a cost advantage, potential entrants could be discouraged from bidding for licences at auction.

To some extent, the perceived advantages of incumbents may be offset by potential entrants having access to more efficient technologies and by existing regulatory safeguards against anti-competitive conduct. Information advantages arising from incumbency can be reduced if potential entrants undertake comprehensive due diligence. Often, potential bidders are already established in the radiocommunications sector and are able to draw on their own experience to assess the value of licences.

While potential entrants face significant fixed costs, this is not a unique characteristic of the radiocommunications sector. Fixed costs are often large in other industries that require networks such as electricity transmission, gas pipelines, postal services and railways. Moreover, fixed costs are not necessarily sunk costs. Many assets have alternative uses and can be sold in second-hand markets.

Potential entrants can reduce their costs by adopting newer technologies, sharing infrastructure with other operators, and/or offering different levels of service delivery compared with those of incumbents. These strategies may increase their expected profits and therefore lead them to bid higher amounts for licences at auction. In this respect, the 'telecommunications boom' at the close of the 1990s may have led some new entrants to pay too much for spectrum in Australia and overseas (see chapter 8).

Although incumbents have some inherent advantages over potential entrants, efficient allocation will generally be achieved through auctioning spectrum to the parties who value it the most. It is not inefficient if an incumbent is able to outbid potential entrants on the strength of its sunk costs.

Timing of auctions

The timing of auctions will influence the investment behaviour of incumbents and the participation of new bidders. Sections 78–79 of the RC Act suggest that decisions on the re-issue of spectrum licences will not be taken until the final two years before licence expiry. Many inquiry participants were concerned that this time-frame weakens the incentives of incumbents to maintain their infrastructure and may cause a reduction in service quality. The ACA (sub. DR324, p. 7) said this arrangement could be a disincentive to investment in the mid-to-later years of the licence period. Similarly, Ericsson Australia stated:

> Given that the uncertainties cannot be resolved until near the end of the licence period, and given the time necessary to achieve an appropriate return on investments in infrastructure to operate in the spectrum, it is unlikely that a licensee would have the incentive to invest in infrastructure beyond the initial rollout period. (Ericsson Australia, sub. DR325, p. 5).

Incentives to invest typically would be affected where the incumbent wishes to provide services beyond the fifteen-year term, but faces uncertainty about licence retention. In this case, incentives to invest will depend on the incumbent's expectation of winning the licence at auction the second time around. If the incumbent expects to outbid the opposition, it is more likely to continue investing in its equipment and network. However, if the incumbent assumes a 'worst case' scenario where the licence is lost and no alternative licence is obtained, it will plan its investment over the fifteen-year period and no further.

In the Commission's view, current provisions in the RC Act regarding the timing of licence re-issue create uncertainty and do not provide sufficient time for incumbents to plan investment over the latter part of the licence term. Some inquiry participants suggested that re-issue should take place closer to the mid-term of licences. Telstra (sub. DR323, p. 6) stated that the process for re-issuing or re-assigning spectrum licences should be put in train at least five years before the expiry date and preferably around the mid-term of licences. Similarly, Unwired Australia (sub. DR319, p. 4) argued that re-auctioning should occur at least five to seven years before licence expiry.

The interests of potential entrants also need to be considered. Spectrum licences that are re-auctioned relatively early in their terms could discourage new entrants from bidding. If auctions were held five or seven years prior to expiry, this may not attract sufficient interest from potential entrants as it may be difficult to predict the likely use of a licence in its next term, particularly given the rapidly changing nature of the communications sector. Auctions should be timed so as to promote competitive neutrality between incumbents and potential entrants.

The Commission considers the current period too short. Market-based spectrum licence re-assignments should be completed three years before the licence term expires. To inform the public about the licences on offer, the ACA should publish details of the licences sufficiently in advance of their scheduled re-assignment. These timing arrangements would be possible to implement with the spectrum licences currently on issue.

These arrangements would reduce investment uncertainty. If the incumbent were successful in retaining its licence, it would have incentives to invest in the final years of the first term and beyond. If unsuccessful, the incumbent could plan its investment and maintenance over the last three years of the licence term — if it planned to exit the industry, it could run down its assets or sell them to the new licensee. The new licensee could pay the incumbent to maintain the associated assets and infrastructure until the licence expired. Even so, it is difficult to design a re-assignment process for fixed term spectrum licences to ensure that incumbents do not run down their infrastructure at the end of their licence term. This problem will be resolved if perpetual spectrum licences are introduced (see chapter 12).

FINDING 6.9

Re-assignment of spectrum licences within the two-year period before licence expiry does not provide sufficient certainty for incumbents to plan investment and maintenance over the latter part of their licence terms. This could result in a run down of assets and diminish the level and quality of services provided to customers.

RECOMMENDATION 6.5

The* Radiocommunications Act 1992 *should be amended so that the Australian Communications Authority is required to complete the market-based re-assignment of spectrum licences three years before they are due to expire.

Re-issue in the public interest

Section 82 of the RC Act contains two public interest tests under which spectrum licences may be re-issued to the same person. Under the first test, the Minister may make a determination specifying a class of services for which re-issuing licences to the same persons would be in the public interest. Under the second test, the ACA may re-issue a licence to the same person if it is satisfied that special circumstances exist which are in the public interest. Neither of these provisions has yet been applied, as no spectrum licences have expired or are near expiry.

Problems with the public interest tests

Provisions for public interest tests give rise to a number of problems.

First, it is not clear what problem the tests are meant to address. The general view seems to be that the tests can help to avoid the potential disruption to services that might result if the incumbents were unsuccessful in competing for their licence(s) at auction. The Commission does not consider this to be a compelling argument.

As mentioned above, incumbents are likely to have considerable advantages over potential new entrants in bidding for licences. A new entrant would have to possess a compelling new service or significant cost savings to displace the cost advantages of the incumbents.

Even if new entrants were to displace incumbents, in many cases, services could be maintained despite changes in licensees and operators. For example, electricity suppliers and mobile phone companies trade clients without affecting service delivery, while television and radio stations change owners without stopping transmission. If valued by customers, continuity of service becomes an asset that incumbents can sell to new entrants.

Second — and most fundamentally — the RC Act does not define ‘public interest’. This leaves scope for discretion in its application. It could be interpreted in a variety of ways and used to support a range of objectives. This was recognised by a number of inquiry participants. The New South Wales Government, for example, noted that:

> 'Special circumstances' and 'public interest' are open terms that could be used to cover almost anything. The use of those terms is simply to provide the opportunity for re-issue, but without definition, they are no more than a guideline. (NSW Government, sub. 27, p. 15)

The 'public interest' is a term often used in legislation, yet it is rarely defined. The Commission considers that there is a strong public interest in the efficient allocation of resources, and that this is best achieved through market-based mechanisms. However, without specific guidance in the RC Act, other interpretations may be possible. The provisions could be used simply to prolong the incumbency of established firms, despite strong demand for those licences from more efficient operators or users with higher value applications. It may also lead to increased lobbying activity by incumbents and potential entrants. This could result in arbitrary and inconsistent outcomes.

Third, the special circumstances under which the ACA test might be invoked are not explained under the RC Act. The RCC Working Group has indicated that the ACA's powers under s. 82(1b) may be restricted (RCC 2002). Any 'special circumstances' would need to be unique and apply only to a particular licensee at a particular time. Under this interpretation, the ACA could not, for instance, authorise the re-issue of spectrum licences to all or several licensees in a given band.

Fourth, the Ministerial public interest test may limit the 'service flexibility' of spectrum licences and thus reduce their tradeability. This is because the Minister must specify a class of service for which the re-issue of licences would be in the public interest. Licensees may feel obliged to continue providing the specified service, especially if they thought this might increase their chances of renewal. This could stifle the take-up of new, higher value uses or technologies.

Furthermore, spectrum licences are flexible and tradeable. In order to ensure that re-issued licences are used for the class of services determined to be in the public interest, the ACA may have to attach conditions to the licence on re-issue.[13] However, this would be contrary to the principles of flexible spectrum licensing and lead to the inefficient use of spectrum.

The requirement to specify a whole class of services for which re-issue of licences would be in the 'public interest' is also questionable. The RC Act gives no guidance on how a class of services should be defined, nor on why it might be in the public interest to re-issue all licences in that class.

13 In the absence of such conditions, licensees could change their use of spectrum or sell their licences on the secondary market.

If the Minister determines a class of service for which it would be in the public interest to re-issue licences, the ACA may then re-issue the licences. However, it is unclear what discretion the ACA has in this process. It would seem inappropriate for the ACA to 'second guess' the Minister by applying a 'public interest' test to each licence. Its role would seem to be limited to deciding whether a licence belongs to the class of service in the Minister's determination, and then to consider any variation of conditions.

Lastly, there are concerns about transparency. The two tests differ in the respective obligations they place on the Minister and the ACA to disclose information. The Ministerial test is a disallowable instrument, so RISs must be tabled or otherwise published. This gives some transparency to the specification of the class of services. However, there is no requirement for the ACA to publish the conditions under which licences are subsequently re-issued, nor why some might be re-issued and some not. Under the ACA 'special circumstances' test, the ACA is not required to disclose its reasons for re-issuing licences. In addition, the ACA is not required to reveal the fees applying to licences re-issued under either test.

FINDING 6.10

The 'public interest' tests create scope for arbitrary and inconsistent outcomes. The Australian Communications Authority's 'special circumstances' test lacks transparency.

Interpreting the public interest

Given the problems outlined above and the advantages of market-based re-assignment, there is a strong case for abolishing s. 82 in its entirety. However, the Commission notes that existing licences were sold with some expectation that one of these two tests might later apply. Accordingly, the Commission recommends that the tests be grandfathered; that is, they should apply only to spectrum licences issued before a specified date. For spectrum licences issued after this date, market-based assignment should be the only mechanism for licence re-issue.

If s. 82 is grandfathered, the public interest tests may still be invoked for existing spectrum licences. This raises the vexed issue of how to interpret the 'public interest'. One approach is to devise a 'public interest' test specifically for s. 82. There are various examples of public interest tests and related hybrids, such as tests of public benefit, national interest or national significance in existing legislation. Examples can be found in the *Telecommunications Act 1997* (box 6.2), the TPA, and the Competition Principles Agreement (1995). Typically, such tests comprise a list of key criteria which the relevant decision-maker must take into consideration.

The RCC Working Group (RCC 2002) developed a position on the construction of the Ministerial public interest test. Their suggested criteria, which are largely derived from the national significance test in the *Telecommunications Act 1997* (box 6.2), were:

- the nature of the services operated under the spectrum licences;
- the number of customers using the services operated under the spectrum licences;
- the geographic reach of the facilities operated under the spectrum licences;
- the importance of the facilities operated, under the spectrum licences, to the national economy; and
- such other matters as the Minister considers relevant.

Box 6.2 **The *Telecommunications Act 1997* national significance test**

The Act gives carriers powers to install and maintain facilities on others land. To constrain this power, they must first obtain a facility installation permit, which requires (among other things) that they convince the ACA that the telecommunications network to which the facility relates is of 'national significance' (Schedule 3, s. 27(1)(a)). In determining 'national significance' the ACA must have regard to the following:

(a) the geographical reach of the network;

(b) the number of customers connected, or likely to be connected, to the network;

(c) the importance of the network to the national economy;

(d) such other matters (if any) as the ACA considers relevant (Schedule 3, s. 27(3)).

Source: *Telecommunications Act 1997*.

Several inquiry participants (who are represented on the RCC) expressed their support for this (or similar) approaches. Telstra, for example, supported the RCC Working Group's criteria, but suggested the test be conducted by the ACA rather than the Minister (sub. DR323, pp. 7–8).

The Commission has a number of concerns about the public interest test proposed by the RCC Working Group, whether it is administered by the Minister or the ACA.

It is doubtful whether the criteria drawn from the *Telecommunications Act 1997* are appropriate measures of the 'public interest'. The Telecommunications Act criteria apply to obtaining a permit to install a telecommunications facility and are measures of 'national *significance*', not national or public *interest*. They do not relate well to the re-issue of spectrum licences.

The criteria also are poor proxies for the value of declared services to customers or the economy. The criterion on the importance of the facilities of the declared service to the economy relates to capital input rather than the volume or value of output. Although the number of customers served is an output-based measure, it does not indicate the value that consumers and businesses place on that service, or the potential for alternative providers to supply that service.

The most significant problem with the RCC Working Group's test is that, by focusing on the characteristics of services and facilities currently in operation, it does not give any explicit consideration to the possibility of new, alternative services or providers. Even if the spectrum is being put to its best use, there may be potential entrants who could provide the same services more efficiently than the incumbents. Failure to ask questions about the best uses or users is likely to bias the results of the public interest test towards incumbents and the *status quo*. This could impede the flow of resources to their best uses.

Even if the RCC Working Group's test were amended to enable a 'forward looking' assessment of current and potential uses based on improved criteria, it would still put the Minister or ACA in the undesirable position of having to pick winners regarding service providers and/or technologies. The Government and its agencies are not well placed to choose which products or services will be commercially successful. Assigning spectrum by administrative means, using public interest criteria, is unlikely to replicate market-based mechanisms, which generally ensure that spectrum is assigned to its highest value uses.

In the absence of any specific definition, the 'public interest' should be interpreted according to the objects of the RC Act. Thus, licence re-issue to the same person would be in the 'public interest' if it furthered the achievement of those objects. The Commission recommended clarifying the objects of the RC Act by recognising the efficient use of spectrum as the primary object (see chapter 5). Re-issue to the same person would therefore need to promote the efficient use of spectrum to further the objects of the RC Act (s.3[a]). If the 'public interest' were to be interpreted in this way, re-issue to the same licensee should be compared with other possible outcomes. This would best be achieved through competitive processes.

The Commission has suggested retaining as subordinate objects two other clauses, one relating to promoting Australia's interests in the international arena, the other to providing access to spectrum for public and community users. Neither clause is helpful in defining the public's interest in re-issuing licences to incumbents. It is difficult to see how re-issue of spectrum licences to incumbents could promote Australia's interests in the international arena. This is a function of the ACA, not individual licence holders.

With respect to the access for public and community users clause, the Commission notes that no public or community users currently hold spectrum licences. If they did, it could be argued that re-issue to them would be in the 'public interest'. But if the tests are grandfathered this situation will not arise. This leaves open the possibility of using this clause to define the 'public interest' in re-issuing licences to existing commercial licensees. However, such an interpretation of the test would in all probability result in the licence not being re-issued, on the grounds that this would damage the interests of non-commercial users. This clause would therefore seem to be irrelevant to the definition of the public interest tests.

Conclusion

The Commission considers that there is little justification for invoking s. 82 of the RC Act for current licences. Virtually all spectrum licences on issue were competitively assigned by auction to commercial operators. This aligns with the RC Act's primary objective of efficient allocation. It would be inconsistent with this objective to re-issue these licences to the same operators without going through a competitive allocation process. Given this inconsistency and the existence of other instruments to pursue social objectives, the Commission does not envisage any class of service or special circumstances where the application of s. 82 would be warranted.

FINDING 6.11

The 'public interest' is served by spectrum licences flowing to where they are most valued. This is best facilitated by market-based re-assignment.

Amending s. 82

In the event that the Minister or ACA decides to invoke s. 82, the Commission considers that a number of changes are necessary to improve the operation of these provisions.

Before the Minister can make a determination under s. 82, the ACA should analyse the issues relating to the class of service in question and consult with interested parties. Given the possibility that the use of s. 82 may have the effect of foreclosing entry, the RC Act should be amended to require the ACA to hold a public inquiry.[14] This would give interested parties, such as alternative spectrum users and consumers, an opportunity to put forward their views. Otherwise, there is a risk that the re-issue process may be captured by the incumbents. The inquiry should be

[14] The ACA can hold public inquiries under ss 255–261D of the RC Act.

completed in the twelve months before the licences would otherwise be re-assigned by market-based means.

If such an inquiry were to be held, the ACA would interpret the 'public interest' with respect to the objects of the RC Act. To prevent the inquiry degenerating into a 'beauty contest' (see appendix D), the ACA would apply a cost-benefit approach. It would focus on why the 'public interest' would not be best served by the competitive re-assignment of spectrum licences. The ACA, after assessing the evidence, would make a recommendation to the Minister. If, based on the results of the inquiry, the Minister made a determination, the ACA would then decide whether the service provided by an individual spectrum licensee belonged to the class of service specified in the determination.

To limit the application of the public interest tests to current spectrum licences, it will be necessary to amend the RC Act to allow the tests to be used once only. Further, the Commission recommends that the term of re-issued licences should be reduced to a maximum of five years. This is in recognition of the likelihood that circumstances will change quickly, making the original 'public interest' justification no longer valid. For example, as further spectrum licences are issued, competing suppliers may be able to provide the same or similar services.

The pricing of spectrum licences re-issued under s. 82 is also an issue. The RC Act is silent on the price to be charged to incumbents for re-issued licences. The Commission considers that the ACA should price the licence using a market-value proxy method such as shadow pricing (see chapter 8). This is important because re-issue to the same licensee has an opportunity cost, measured by the value that an alternative user would have placed on the spectrum. If it is not possible to use a market value proxy method, then a formula-based approach should be used to estimate the market value. The ACA should be required to disclose the prices paid for re-issued licences, to ensure transparency and accountability.

If the ACA decides to re-issue a licence in special circumstances that are in the 'public interest', it should be required to disclose both its reasons for re-issuing the licence and the price paid for it.

RECOMMENDATION 6.6

The 'public interest' tests in section 82 of the* Radiocommunications Act 1992 *should be amended to:

- ***restrict the scope for their use to spectrum licences issued before a date to be set by the Government; and***
- ***allow licences to be re-issued once only and for a maximum term of five years.***

The amendments should also direct the Australian Communications Authority to:

- ***hold a public inquiry before the Minister makes any determination under section 82(3) that must:***
  - ***demonstrate why it would not be in the 'public interest' to use market-based assignment for the re-issue of licences;***
  - ***apply a cost-benefit approach when considering licence re-issue to the same person; and***
  - ***be completed within the twelve months before the scheduled market-based assignment of the potentially affected spectrum licences;***
- ***use shadow pricing, where feasible, to price spectrum licences re-issued under section 82;***
- ***publish the prices paid for spectrum licences re-issued under section 82(1)(a); and***
- ***publish its reasons for re-issuing spectrum licences under section 82(1)(b) and the prices paid for those licences.***

6.4 Managing encumbered spectrum

Under the RC Act, spectrum licences can be issued in encumbered spectrum via conversion and spectrum re-allocation. Another approach would be to sell 'encumbered' spectrum licences.

Conversion

The conversion process seeks to reconfigure apparatus licences as spectrum licences without necessarily involving a change in ownership. The RC Act sets out a detailed process for conversion (ss 36–44 and 52–59). The process begins with the Minister designating bands for spectrum licensing under s. 36. If the designated spectrum is encumbered, the ACA must prepare a conversion plan setting out the procedures and timetable for issuing spectrum licences to replace existing apparatus licences.

In converting licences, the ACA must replace apparatus licences with spectrum licences which authorise, as far as practicable, the operation of a device to at least the same extent authorised under the apparatus licences they replace (s. 53). To date, the conversion process has been applied to the 500-MHz band and the multipoint distribution station (MDS) band. In total, a relatively small number of apparatus licences have been converted to spectrum licences, and only around 106 MHz of spectrum has been subject to conversion (see chapter 11).

The Commission considers that conversion is an important way to extend spectrum licensing into encumbered bands. The process should only be undertaken when the benefits clearly exceed the costs. The limited use of conversion stems from a number of problems that need to be addressed.

Conversion has proved to be a technically detailed and complex process. It involves defining the spectrum space used by devices authorised under apparatus licensing, so that the ACA can issue spectrum licences. Market Dynamics (sub. 33, pp. 36–37) outlined the process as follows:

- a common interference model is established to calculate the geographic area covered by the emissions of the device;
- each device is considered, using the model to determine the geographic outer boundary of coverage;
- the boundaries of the new spectrum licences must be drawn so they do not overlap and must be acceptable to the licensees involved;
- the same process is undertaken to model the bandwidth occupancy of the device; and
- apparatus licensees are offered spectrum licences at a price reflecting their market value.

This technical complexity combined with the requirement to provide apparatus licensees with the opportunity to comment on draft spectrum licences, and the possibility that many licensees occupy the designated band, mean that the conversion process can be time-consuming and administratively costly.

Conversion is easier to achieve in some situations than in others. The ACA (sub. 9, p. 25) noted that conversion is useful where a small number of apparatus licences have discrete spectrum parcels (all of which cover large geographic areas), but conversion can encounter problems even in these cases. The conversion of apparatus licences in the MDS band has been simpler because the licences were area-based, which assisted in defining the geographic areas of the new spectrum licences.

Legislative impediments also hamper conversion. The RC Act requires that all incumbents in a band designated for spectrum licensing must be offered the right to convert from apparatus licensing. However, this has hampered the conversion process in the case of overlapping apparatus licences (that is, where licences covering small areas overlap with licences covering larger areas). These situations create legal complexities because spectrum licences assign exclusive spectrum space and are not designed to overlap.[15] Consequently, the licensees cannot always be offered spectrum licences of similar utility to their existing apparatus licences.

To address this problem, the ACA (sub. 9, p. 25) suggested that the RC Act be amended to allow the Minister to designate a band for spectrum licensing while allowing certain apparatus licences in the band to remain. Such an amendment to the RC Act would facilitate the conversion of apparatus licences in bands where licences overlap. This change would enable the conversion of Australia-wide apparatus licences, such as those operating in the 900-MHz band covering mobile phone systems.

There are informal ways to overcome the difficulties of converting overlapping licences. For example, apparatus licensees whose operations will be encompassed by a larger converted licence could surrender their licences to the ACA and negotiate private agreements with the new spectrum licensee who would act as a private band manager (see chapter 7). For this approach to work, the parties must be willing to enter into such arrangements.

The RC Act requires that spectrum licences are offered to all the apparatus licensees in the bands and areas designated for conversion. Given that licensees often are authorised to operate on different frequencies and in different areas, this requirement may result in the creation of many spectrum licences covering small geographic areas. The ACA noted:

> Where many 'small' apparatus licences are on issue, most of those licensees are likely to be offered licences of minimal size. In practice, such licences would probably offer little utility or benefit beyond the apparatus licences they replace, and would have a … negative impact on the utility of surrounding spectrum licences. (ACA, sub. 9, p. 25)

For an apparatus licensee who operates on different frequencies in contiguous geographic areas, it would be more efficient to issue one spectrum licence covering those areas on the same frequency, rather than a number of spectrum licences each covering a small area and a different frequency. The conversion process would be improved if it permitted the ACA to negotiate with apparatus licensees so it could offer spectrum licences covering larger, contiguous areas for a given frequency range. There appear to be good grounds for amending the RC Act to allow the ACA to offer, where practicable, spectrum licences for the same frequency range across contiguous geographic areas.

[15] The ACA (trans., pp. 581–582) noted that there may be some cases where spectrum licences need not confer an exclusive right to spectrum space. For example, two satellites in different geostationary orbits could transmit and receive in the same spectrum space without causing interference to each other's signals.

Where conversion of all apparatus licences in the designated spectrum would result in a large number of spectrum licences of minimal size, the administrative costs of conversion may erode the potential efficiency benefits. Amending the conversion process, as recommended by the Commission, will provide the ACA with improved operational flexibility so that it need not convert apparatus licences where this would create spectrum licences of little utility at considerable administrative cost.

The Commission considers that wide area apparatus licences should be converted where it is cost effective to do so. Wide area apparatus licences are held by a range of users, including telecommunication carriers, broadcasters and the Department of Defence. The ACA (sub. DR340, p. 5) agreed that most wide area apparatus licences could be converted to spectrum licences, and saw no particular barriers to converting Department of Defence licences.

Apart from the technical and legal complexities noted above, the pricing of converted licences also raised concerns among some inquiry participants (see chapter 8).

FINDING 6.12

The conversion process has been hampered by technical complexities and legislative impediments.

RECOMMENDATION 6.7

The conversion process in the* Radiocommunications Act 1992 *should be amended to allow the Australian Communications Authority to:

- ***convert a designated band to spectrum licences while allowing for certain apparatus licences to remain in that band; and***
- ***offer, where practicable, a spectrum licence for the same frequency range in cases where an apparatus licensee operates on different frequencies in contiguous geographic areas.***

RECOMMENDATION 6.8

Where it is cost-effective to do so, the Australian Communications Authority should convert wide area apparatus licences into spectrum licences.

Spectrum re-allocation

The spectrum re-allocation process (ss 153A–153P) was introduced as part of the 1997 amendments to the RC Act [16], primarily to overcome the problems of the conversion process. Under spectrum re-allocation, incumbent apparatus licensees are given a minimum period of two years to vacate the declared band so new spectrum licensees have unencumbered access to that spectrum. There have been seven sets of spectrum re-allocations covering 738 MHz of spectrum (see chapter 11).

Some inquiry participants were concerned about aspects of spectrum re-allocation, such as the length of notice and the absence of compensation. The Commission considers that, in practice, sufficient warning of an impending spectrum re-allocation is provided (section 6.3). The ACA (pers. comm., 1 February 2002) indicated that no apparatus licences have been cancelled as a result of spectrum re-allocations, because it endeavours to provide licensees with sufficient notice to find alternative bands, and it clears bands by not issuing licences beyond the re-allocation date.

Moreover, the ACA assists apparatus licensees affected by spectrum re-allocation by providing advice on alternative delivery options. Although the options may be constrained by individual service characteristics, the potential range of adjustment strategies includes:

- re-locating to another band (box 6.3);
- diverting traffic to other parts of an operator's network;
- replacing the current service with a cable solution;
- buying a spectrum licence that covers the affected service; and
- leasing capacity from another operator.

Spectrum re-allocation is a detailed and time consuming process. This stems in part from the consultation requirements and the role of the Minister. The ACA must consult with apparatus licensees likely to be affected by the proposed re-allocation before making a recommendation to the Minister. The Minister then considers the ACA's recommendation and may make a spectrum re-allocation declaration under s. 153B of the RC Act. There is potential to streamline these consultation arrangements, saving time and resources for the ACA and industry (see chapter 11).

[16] *Radiocommunications Amendment Act 1997* (No. 41).

Box 6.3 Re-location of fixed link services

Re-location is an option for apparatus licensees affected by a spectrum re-allocation. It involves the affected licensees moving to another suitable band. The affected service, the spectrum available in the alternative band and the costs of relocating must be considered to determine whether this option is viable. In the case of fixed link services, re-location usually has been to higher frequency bands.

Re-location options generally are limited to those bands supporting similar services, unless the affected operators wish to upgrade their service. The cost of re-locating can vary greatly. In some cases where the equipment is 'frequency agile', most of the existing infrastructure can be re-used. In other cases, the cost of re-locating to higher frequencies requires significant additional investment in infrastructure such as new antennas, towers and repeater stations.

Fixed link services in the 1.8-gigahertz (GHz) band were required to re-locate. This band accommodated around 1380 two-way fixed link services. Virtually all the fixed links operating in city areas were to be cleared. The Australian Communications Authority found that many fixed links in these areas had short paths, so there was scope to re-locate them to bands above 10 GHz. However, for links with longer paths, cost-effective options were limited to the 6/7.5 and 8 GHz bands which already had high rates of occupancy.

Source: ACA (2000c).

Spectrum re-allocation is an important instrument for introducing spectrum licences into bands previously under apparatus licensing. It also may avoid temporary hold-out situations where incumbents would not otherwise relinquish their licences until term expiry. The main benefits of spectrum re-allocation include greater efficiency through the issue of spectrum licences (which are more flexible and tradeable than apparatus licences) and the introduction of new services and technologies.

While the use of spectrum re-allocation requires central planning, once spectrum licences are issued into those bands, the need for further planning would fall away.

FINDING 6.13

Given the characteristics of apparatus licences and to avoid the risk of hold-out, it is appropriate to retain the spectrum re-allocation process to facilitate the clearing of bands for the introduction of spectrum licences and new services and technologies.

Encumbered spectrum licences

As spectrum licences incorporate the right to authorise third-party use, spectrum licensees are free to negotiate lease agreements with incumbent apparatus licensees that wish to remain in the band following re-allocation. FuturePace Solutions stated:

> Under the present Act, a space (a spectrum licence) could be defined for management by a single private spectrum administrator who would operate solely through third party authorisation. Or, certain apparatus licensed channels could be privately managed. (FuturePace Solutions, sub. 18, p. 24)

In some cases, spectrum licensees have allowed some incumbents to remain after spectrum re-allocation. For example, some apparatus licensees in the 1.8 GHz spectrum licensed band were able to reach agreement with spectrum licensees to remain in the band for a period after re-allocation (ACA, sub. DR324, p. 7).

However, new spectrum licensees have tended to prefer the spectrum re-allocation process to clear the band of incumbents. Telstra (sub. DR323, p. 10) and Vodafone Australia (sub. DR326, p. 9) favoured the sale of unencumbered spectrum. There has been limited leasing of bandwidth under spectrum licences (see chapter 7). This suggests that most spectrum licensees are primarily interested in providing their own communications services, rather than managing the spectrum use of others.

An alternative approach would be to sell spectrum licences with apparatus licences attached as encumbrances. Market Dynamics (sub. 33, p. 39) noted that spectrum licences can be regarded as a management right or a set of management responsibilities that is devolved from the ACA to another party. Under this approach, the spectrum licences would be sold with existing users and devices in place. This is similar to selling management rights over encumbered spectrum, as occurred in New Zealand (see appendix C).

An important issue in implementing such an approach is how to transfer the responsibility for managing incumbent apparatus licensees from the ACA to the new managers. The apparatus licensees that choose to remain in the band would become tenants and pay fees to the spectrum licensees. These fees would be negotiated between the parties. As a result, there would be a transfer of revenue and costs from the ACA to the spectrum licensees.

This approach has a number of advantages compared with conversion or spectrum re-allocation. Importantly, apparatus licensees could be accommodated as tenants under spectrum licences, thereby avoiding the problem of overlapping licences encountered by the conversion process. In addition, the management approach is unlikely to involve the same cost and disruption associated with spectrum re-allocation as incumbents are not compelled to vacate the band. The ability to form private agreements may lead to greater flexibility in spectrum use (for example, negotiating longer tenure). This approach would facilitate the wider deployment of spectrum licences.

Inquiry participants raised concerns about selling encumbered spectrum licences and the transfer of management responsibilities from the ACA to band managers. Telstra (sub. DR323, p. 10) stated that such a transfer would carry with it a risk of exploitation by a speculative landlord. The ACA (sub. DR340, p. 4) argued that incumbent apparatus licensees are likely to want protection against unilateral clearance of the spectrum by the manager, inappropriate rent levels, and anti-competitive conduct by the manager. Incumbents also would want clarification of their rights to sublet spectrum. Vodafone Australia (sub. DR326, p. 9) was concerned that spectrum licensees may not have the requisite skill and interest levels to manage other spectrum users.

The Commission acknowledges these concerns, but notes that they are not unique to spectrum management — such contractual arrangements already exist in many other markets. The ability of band managers to raise rents would be constrained if ‘management rights’ were sold to several competing band managers, and by the residual role of the ACA. Tenants would also have recourse to the TPA which provides protection against a range of anti-competitive practices. Even so, the rights and responsibilities of tenants and managers should be clarified before such an approach can be implemented.

The sale of encumbered spectrum licences raises some transitional questions. In the first instance, apparatus licensees could be transferred as tenants to the band manager on broadly similar terms to those they currently have under the RC Act. For example, band managers might be required to give two years notice to tenants to quit and tenants be given the option of locking in fees for the term of their current licences. At the end of this transitional period, the tenant and band manager would be free to negotiate new conditions regarding the term and renewal of the lease.

Another issue is the expiry of the band manager’s spectrum licence (although this would not be an issue with perpetual licences). Tenants may wish for greater certainty about renewing their lease beyond the expiry of the spectrum licence. Under the Commission’s recommendations, existing spectrum licences would be auctioned three years before expiry. This gives tenants three years to negotiate a new lease with the purchaser of the spectrum licence or to make alternative arrangements — more notice than the two years currently required for a re-allocation. The ACA could explore the opportunities for selling encumbered spectrum licences and identify bands suitable for such an approach.

RECOMMENDATION 6.9

The* Radiocommunications Act 1992 *should be amended to allow the sale of encumbered spectrum licences. The Australian Communications Authority should develop the necessary arrangements and identify suitable bands for its implementation.

6.5 Conclusion

The Commission supports the retention of the current licence types in the RC Act. The main risk with the ACA's single licence proposal is that it could weaken progress towards market-based spectrum allocation, which began with the introduction of the RC Act.

Although apparatus licensing has been the predominant approach to regulating the use of the spectrum, the Commission sees benefits from an expanded role for spectrum licensing. Spectrum licences are well suited for wide area applications and private band management. Unlike apparatus licences, which are re-assigned primarily by administrative means, the flexible and tradeable nature of spectrum licences encourages voluntary re-assignment through secondary markets.

Despite the advantages of spectrum licensing, its deployment has been slow and confined to a small number of bands. The further deployment of spectrum licensing could be facilitated by some changes. The time taken to deploy licences in encumbered and unencumbered spectrum would be reduced by streamlining current administrative processes. The conversion process could be improved to enable most wide area apparatus licences to be converted. Spectrum licences also could be issued administratively in unencumbered spectrum where there is only one prospective buyer.

Renewal arrangements for apparatus and spectrum licences have created some uncertainty among licensees, which in turn may diminish incentives to invest in and maintain infrastructure. The security of tenure of incumbent licensees needs to be balanced against the possibility that spectrum could be re-allocated to more beneficial uses. Security of tenure for apparatus licensees would be enhanced by amending the RC Act to include a statutory presumption of renewal. For spectrum licensees, investment incentives would be improved by holding auctions three years before licences are due to expire.

The application of competition limits to the primary issue of apparatus or spectrum licences is not necessary given the protection provided by the TPA. Because of their discretionary nature, competition limits are not necessarily consistent with s. 50 of the TPA. While this approach may encourage entry and appears pro-competitive, it risks introducing significant market distortions. The competition limit provisions also suffer from a number of procedural deficiencies.

7 Secondary markets

Until the 1990s, all radiocommunications licences in Australia were re-assigned administratively. Trading in apparatus licences only occurred indirectly as a result of business acquisitions and mergers. A key element of the 1992 reforms was the introduction of spectrum licences. These new licences were designed to be tradeable on secondary markets with minimal intervention from the spectrum manager. Further reforms in 1995 also allowed trading in apparatus licences.

This chapter examines the recent experience with spectrum markets in Australia. The chapter outlines the trading and leasing provisions in the *Radiocommunications Act 1992* (RC Act). It then discusses the allocative role of secondary markets and describes several mechanisms for spectrum trading and leasing. After examining trading and leasing activity in spectrum markets, the chapter identifies influences on the operation of spectrum markets.

7.1 Trading and leasing provisions

The RC Act allows for spectrum and apparatus licences to be traded.[1] The trading provisions for spectrum licences are set out in ss 85–88 of the RC Act. They enable a spectrum licensee to assign part or all of the licence to another party, provided the licensee complies with any Australian Communications Authority (ACA) determination regarding such assignments. At present, a determination sets out the trading rules for spectrum licences.[2] Under this determination, licensees can only trade a part of a licence that is a whole standard trading unit (STU) or a multiple of STUs (box 7.1).

Where a spectrum licence is traded, the parties must notify the ACA so that licence details in the public register can be amended. The ACA has powers to vary the licence conditions, issue new licences and/or cancel existing licences. Any licence that has been varied must comply with the general conditions in the RC Act.

[1] Secondary trading is not applicable to class licences given the nature of this licence type. Individual users are not issued class licences, so exchange between users cannot occur.

[2] The Radiocommunications (Trading Rules for Spectrum Licences) Determination 1998.

Box 7.1 Standard trading unit (STU)

STUs are the basic building blocks from which useable spectrum space can be built. The Spectrum Management Agency, the predecessor to the Australian Communications Authority (ACA), made STUs finite, indivisible and able to be combined with their neighbours into large spectrum spaces with more utility. Conversely, large spectrum spaces can be disaggregated in terms of STUs, allowing trading in spectrum space (Hayne 1997).

The STU is the smallest unit of spectrum space for which the ACA will issue a spectrum licence or register trading. STUs are defined in terms of radiofrequency bandwidth and geographic area. The frequency bandwidth of STUs may vary in size, depending on the spectrum band in which the licensee operates (that is, higher frequency bands tend to have larger frequency bandwidths of STUs), but the geographic areas of STUs are constant for all bands (ACA 1998b).

Sources: Hayne (1997); ACA (1998b and 1998e).

Sections 131AA–131ACA of the RC Act enable the transfer of apparatus licences. The licensee must apply to the ACA for approval to transfer a licence to another party. The ACA can make determinations to prevent the transfer of particular types of apparatus licence or to specify the circumstances in which a transfer is not allowed.[3] The ACA must have regard to the same provisions that apply to the primary issue of licences, and it has the power to vary licence conditions upon transfer.

The RC Act allows spectrum and apparatus licensees to authorise other individuals or organisations to operate devices under their licences (ss 68 and 114). Apparatus licensees must keep a written record of third party authorisations. The ACA can make rules and determinations regarding third party use of spectrum and apparatus licences.

7.2 Role of secondary markets

Secondary markets help to promote efficient allocation and use of spectrum. They offer opportunities for licence holders to trade licences when demand and supply conditions change. As a result of changes in technology, business strategy and/or market share, some licensees may hold spectrum that they no longer need. They can on-sell or sub-let their surplus spectrum to licensees who desire access to that spectrum. Secondary markets also allow the emergence of intermediaries that may trade in spectrum or lease it to third parties.

3 The Radiocommunications (Transfer of Apparatus Licences) Determination 2000.

Secondary markets already play an important allocative role in many sectors of the economy, for example in property, motor vehicles, computer equipment, industrial machinery, commodities and financial securities (such as bonds, notes and shares).[4] The key function of these markets is to re-allocate resources between different users and/or uses.

Some inquiry participants saw a significant role for secondary markets to allocate rights to use spectrum. Vodafone Australia stated:

> Where companies acquire more or less spectrum than they require due to uncertain demand for services, secondary trading should lead to the efficient subsequent allocation of spectrum. (Vodafone Australia, sub. 23, p. 6)

Similarly, the Australian Broadcasting Corporation (ABC) (sub. 21, p. 23) noted that the current role performed by secondary trading is to provide liquidity and a second chance to use a licence if it remains unused.

Secondary markets can help correct inefficient allocations made in the primary issue of licences. If licences were not issued efficiently because market-based assignment was not used, trading in secondary markets allows licences to be subsequently assigned to those who value them most highly. Even when primary assignment occurs via auctions, secondary trading may allow licensees to achieve their desired aggregations of spectrum. Optus (sub. 17, p. 24) noted that secondary trading can be beneficial in consolidating spectrum into contiguous holdings. Trading also may generate price information which can be used as a guide in setting the prices of new licences in the primary market. Secondary markets, therefore, are an important complement to the primary issue of licences.

Secondary markets also facilitate the efficient re-allocation of spectrum in times of rapid technological and market change. Spectrum users may wish to trade licences as consumer preferences for new services displace older services. The secondary market helps to transfer spectrum rights to where they are most valued by the market. The party that values the spectrum most highly will be prepared to pay the highest price to obtain it, which ensures efficient allocation. In this way, the price paid for spectrum will more closely match its opportunity cost; that is, the value of the best alternative forgone (see chapter 4).

The speed at which spectrum re-assignment takes place via secondary markets depends on transaction costs. If transaction costs are significant, they impede the transfer of spectrum between parties. Transaction costs and other influences on secondary markets are examined in section 7.5.

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4 In the United States, there are active markets in second-hand communications equipment such as carrier-grade phone exchanges (Biddlecombe 2002).

Unlike apparatus licences, spectrum licences were designed to be traded. Licensees can amalgamate or subdivide licences to suit their changing needs. An entity may purchase a spectrum licence, or part of one, on the secondary market, to form a contiguous block of spectrum (that is, a wider frequency bandwidth) that may allow the user to operate more efficiently by reducing or eliminating 'guard' bands. Spectrum licences can also be combined to cover larger geographic areas. Conversely, users can on-sell or lease parts of their spectrum licences that they no longer require. Secondary trade in spectrum licences allows the market to determine its preferred aggregations of spectrum and to adapt to changing circumstances.

Trading in spectrum is a recent development. Secondary markets exist in Australia, New Zealand and Canada. Spectrum management agencies in the United States and the United Kingdom are considering the introduction of secondary trading (see appendix C).

Further development of spectrum markets in Australia will influence the extent of planning and re-assignment undertaken by the ACA. The ability to trade spectrum licences, which are reasonably flexible with respect to changes in use and technology, gives market participants a greater role in determining the assignment and use of frequencies. Licence re-assignment via secondary trading is likely to diminish the need for detailed central planning and lessen the use of administrative re-allocation.

FINDING 7.1

Secondary markets can improve the allocation of rights to use spectrum.

7.3 Trading and leasing mechanisms

Trading in spectrum can occur by negotiation or through exchange mechanisms. Spectrum users also have the option of leasing bandwidth from band managers.

Negotiated trades

Buyers and sellers may negotiate the trade of licences directly or via a broker. The parties can bargain over price, but cannot renegotiate licence conditions without recourse to the ACA. Trade generally occurs when each party expects to benefit from the transaction. Most known trades have resulted from bilateral or brokered negotiations.

The key function of brokers is to bring buyers and sellers together. Potential traders engage brokers to seek out the other side of the trade. In return, brokers receive commissions and fees for facilitating trades and providing market information. The Australian Electrical and Electronic Manufacturers' Association (AEEMA, sub. 36, p. 15) claimed that brokers in spectrum have not emerged as expected. In spectrum licensing, for example, there are few active brokers. In the Commission's view, accredited assigners would appear to be well placed to play a brokering role, given their knowledge of the industry. At present, there are around 40 persons who are accredited to undertake frequency assignment work for apparatus licensing and/or device registrations (ACA, sub. 9, p. 10, see chapter 11).

Spectrum exchanges

Exchanges can be a useful means for bringing buyers and sellers into closer contact. They can lower search costs and expedite transactions compared with bilateral or brokered negotiations. Exchanges also generate price information which may reduce the potential for 'buyer or seller remorse' which can arise from bilateral transactions.[5] There is a variety of exchanges operating in other areas of the economy, the stock exchange being the most prominent example. On-line exchanges have also been established for trading wired bandwidth capacity which in many ways is analogous to radiofrequency spectrum (box 7.2).

The tradeability of spectrum licences has attracted some commercial interest in setting up spectrum exchanges. Macquarie Bank established an on-line exchange called 'Spectrum Desk' in March 2001 which has hosted one auction so far.[6] According to Macquarie Bank (2001b), Spectrum Desk was the world's first on-line exchange for spectrum rights. It enables buyer and seller auctions, and is based on a set of market rules and information flows between anonymous participants. Macquarie Bank argued that Spectrum Desk would assist the development of secondary trading through a range of market and transaction efficiencies. Although most trades still occur by private negotiation, spectrum exchanges may play a greater role as secondary trading gathers momentum.

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5 That is, the lack of price information in bilateral trades means one or both parties may feel they could have achieved a better deal using other means.

6 In May 2001, 100 kilohertz (kHz) of spectrum in the 500-megahertz (MHz) band covering the Newcastle metropolitan area and surrounding regions was auctioned via Spectrum Desk.

Box 7.2 **Bandwidth exchanges**

Bandwidth exchanges have emerged to provide a marketplace for multilateral trading of bandwidth capacity. These exchanges have developed as an alternative to traditional bilateral negotiations. Examples include Arbinet, Asia Pacific Exchange Band-X, InterXion and RateXchange.

RateXchange, for instance, is a trading platform that allows market participants to buy, sell and/or deliver fibre optic bandwidth capacity globally. It handles trade in broadband services in the United States and Europe, and across the Atlantic and Pacific oceans. Buyers and sellers enter the trading system through the RateXchange web site. The trading system facilitates price discovery because buyers and sellers can review capacity posting prices on the system. Capacity can be supplied in as little as one or two days.

Source: RateXchange, www.ratexchange.com (accessed 9 January 2002).

Band managers

Some Government organisations, such as the Department of Defence and the Australian Broadcasting Authority, already manage parts of the spectrum (see chapters 2 and 10). The concept of the band manager also extends to private sector entities who lease frequencies to third parties on a commercial basis.

Spectrum and apparatus licences, via their leasing provisions, allow for the possibility of private band managers. Economies of scale in management may be achieved by amalgamating spectrum licences (across bandwidth and/or geographic areas) or holding portfolios of apparatus licences. Band managers would face incentives to increase the use of spectrum in order to maximise their profits. Some private band managers are currently operating in the land mobile bands and the 3.4 gigahertz (GHz) band (section 7.4).

In New Zealand, the *Radiocommunications Act 1989* introduced management rights and tradeable licences, allowing for the emergence of band managers (box 7.3). The management rights allow public and private entities to determine the use of bandwidth. The manager issues tradeable licences to spectrum users (who could be the manager or someone else) and is responsible for the emissions generated within the band. The rights allow flexibility of spectrum use, subject only to interference constraints (see appendix C).

> **Box 7.3 Management rights in New Zealand**
>
> Eighty-one management rights were current at October 2001. The New Zealand Government retains ownership of 18 of these, including those covering the public broadcasting spectrum (radio and television). Private sector band managers in the remaining 63 bands are free to issue licences according to their own policies. Spectrum users under management rights are operating cellular mobile, multipoint distribution system and local multipoint distribution system services.
>
> The creation and sale of private sector management rights in New Zealand has not been as extensive as originally contemplated. The New Zealand Ministry of Economic Development (2000) states that there are two reasons. First, potential managers have been uncertain about how some spectrum will be treated for international planning purposes and about which standards or systems will apply to spectrum used commercially. Second, the Ministry has been concerned about the adequacy of competition safeguards under the Act.
>
> *Sources*: New Zealand Ministry of Economic Development (2000 and 2001b).

7.4 Extent of market activity

According to many inquiry participants, secondary trading in spectrum and apparatus licences is limited and the market has developed slowly. McInnes Pynt Solicitors (sub. 16, p. 2), for example, observed that there is only limited secondary demand for spectrum.

Trading activity

The level of trading activity in a given market usually is measured by the volume of transactions relative to the market's size. The turnover rate of spectrum and apparatus licences could be measured in several ways, including:

- the number of licences traded as a proportion of the stock of licences on issue;
- the amount of spectrum (measured in hertz or STUs) traded relative to the total amount of spectrum currently licensed; and
- the value of licences traded relative to the total value of the licensed spectrum.

Turnover rates based on the amount of spectrum and market value would give the most accurate indications of trading activity. However, such data are not currently available. There also would be significant practical and conceptual difficulties in attempting to compile these data. While it is feasible to derive a turnover rate based on STUs traded for spectrum licences, this would be a time consuming exercise.

Compiling a similar measure for apparatus licences would be quite complex as the licences would need to be redefined in terms of STUs (see chapter 6). Information on the market value of spectrum and apparatus licences is not available on a financial year basis which means value-based turnover rates cannot be derived.

The Commission has calculated turnover rates for spectrum and apparatus licences based on licence numbers. Such turnover rates may not correlate closely with the amount or value of spectrum traded and therefore, only serve as crude indicators of secondary trading. Turnover in the stock of spectrum licences was estimated at around 8 per cent in 2000-01 (table 7.1). This rate includes the small numbers of subdivisions and amalgamations that have taken place since 1996-97.

Table 7.1 **Trading in spectrum licences**

Year	*Licences traded* [a]	*Turnover rate* [b]
	no.	%
1998-99	50	13.8
1999-2000	22	5.4
2000-01	47	7.7
2001-02 [c]	51	8.4

[a] Includes subdivisions and amalgamations. [b] The turnover rate is measured as the number of licences traded relative to the stock of licences on issue. [c] July 2001 to May 2002 inclusive.

Source: ACA, pers. comm. 19 October 2001, 1 February 2002, 11 February 2002 and 18 June 2002.

Trading in spectrum licences has occurred in a number of bands, including the 500-MHz, 800-MHz, 2.3-GHz and 3.4-GHz bands. For example, Television and Radio Broadcasting Services Australia recently sold its spectrum licences in the 2.3 GHz band to Austar (FuturePace Solutions, sub. 18, p. 28), while Telstra purchased spectrum in the 3.4-GHz band through the secondary market (Telstra, sub. 63, p. 9).

Some trading in apparatus licences has also taken place, although it is proportionately much less than for spectrum licences. It is estimated that only about 2 per cent of apparatus licences on issue were transferred in 2000-01.[7] There have been trades in land mobile radio licences and quasi-broadcasting licences such as those for open narrowcasting services (ACA, sub. 9, p. 26). Trading in apparatus licences is often indirect, occurring when businesses are sold with licences attached.

7 Estimate based on the number of apparatus licences for which the name of the licensee changed during 2000-01. This is likely to overstate the number of licences traded for several reasons. First, the name on a licence might have changed after personnel movements within a company. Second, a company may have been acquired by another entity. Third, a company might have changed its name or updated its licence details. The results therefore should be interpreted with caution (ACA, pers. comm., 30 November 2001 and 8 February 2002).

The turnover rates estimated for spectrum and apparatus licences probably overstate the extent of trading between independent entities, because many transfers have been among related parties — from a parent company to a subsidiary or vice versa. They often involve no change in effective ownership. If related party transfers were removed, the recorded level of trading in both spectrum and apparatus licences would be lower.

Whether the level of trading in radiocommunications licences is considered high or low depends on the point of reference. Trading in spectrum and apparatus licences is many times lower than bond trading in the capital market and share trading on the Australian Stock Exchange. But to some extent this would be expected since spectrum cannot be used without the use of equipment, meaning that entry to and exit from spectrum markets are not costless. The magnitude of trading in spectrum and apparatus licences is similar to annual turnover rates in the residential property market.[8] The existence of any trade at all makes Australia unusual. Most countries do not allow trading in radiocommunications licences (see appendix C).

Leasing activity

The extent of spectrum leasing could be gauged by comparing the number of leasing agreements to the stock of licences on issue, or measuring the amount of spectrum leased relative to the total amount of spectrum licensed. Lack of information prevents either of these measures being used.[9] Again, measuring spectrum in terms of STUs is problematic for apparatus licences.

Several inquiry participants provided examples of commercial leasing arrangements under spectrum licensing. The ACA (sub. DR324, p. 7) noted that spectrum licences in the 500-MHz band were leased for communications services required for the Sydney 2000 Olympic Games. Telstra (sub. DR323, p. 9) said it has executed a number of leasing arrangements in portions of spectrum licences for which it has no immediate need. Unwired Australia (sub. DR319, p. 4) has leased out part of its spectrum in Sydney and Melbourne for a monthly fee.

Although comprehensive data on third party authorisations are not available, the ACA (sub. DR333, p. 4) noted that authorisations under apparatus licences are common. The ACA is aware of reasonably extensive leasing arrangements,

8 The turnover rate in the residential property market (that is, the number of established dwellings sold as a proportion of the total stock of dwellings) was estimated at 5 per cent in 2000-01 (REI 2001; ABS 2001). The commercial property market would be a more appropriate comparator, but data were not available to compute turnover rates.

9 There are no complete statistics on spectrum leasing activity. The RC Act does not require spectrum or apparatus licensees to register third party authorisations with the ACA.

particularly in the land mobile bands where some licensees have acquired licences and developed infrastructure for the purpose of leasing capacity to third parties. Leasing arrangements also operate, albeit to a lesser extent, in the fixed link bands and typically involve a licensee leasing surplus capacity to third parties (ACA, sub. DR324, pp. 7–8).

FINDING 7.2

The turnover rate for spectrum licences is around four times that for apparatus licences and similar to that of the residential property market. Some commercial leasing arrangements exist within both spectrum and apparatus licensing.

7.5 Influences on secondary markets

Some inquiry participants claimed that the potential for secondary trading is limited in their sector. The ABC (sub. 21, p. 23), for example, argued that the broadcasting industry only obtains licences for the spectrum it needs and, therefore, the scope for secondary trading is limited.

However, some inquiry participants pointed to opportunities for mutually beneficial transactions. Optus (sub. 17, p. 24) said that potential gains existed from secondary trading in the 1800-MHz band, but no trades had taken place yet. Optus and other participants pointed to possible impediments to secondary markets, such as licence tenure and taxation arrangements.

The level of activity in secondary markets appears to be subject to a number of influences including: the primary market; substitution possibilities; non-commercial users; licence conditions including terms; transaction costs; and the availability of market information.

Primary market

Prospective spectrum users are able to purchase spectrum licences at auction or from secondary markets. The issue of spectrum licences has been slower than indicated in the Spectrum Management Agency's initial plans (see chapter 11). Spectrum licences are more suitable than apparatus licences for trading, so their limited availability has constrained secondary trading. The issue of spectrum licences would be accelerated by:

- streamlining the processes for deploying licences;
- issuing spectrum licences for fallow spectrum; and

- converting area based apparatus licences into spectrum licences.

Where apparatus licences offering similar coverage are available from the ACA at known prices, the demand for licences in secondary markets will be discouraged. The ACA (sub. 9, p. 27) noted that alternative apparatus licences may be available on primary issue. However, opportunities to obtain substitute licences are constrained by the availability of vacant spectrum and sites. While licences may be available in bands that are not fully occupied or in regional and remote areas, there appears to be less scope for obtaining substitute licences from the ACA where demand for spectrum is strong, such as in the VHF and UHF bands, and in metropolitan areas.

Competitive neutrality concerns have arisen over apparatus licence fees set by the ACA and the rental fees that could be charged by private band managers. Market Dynamics claimed that the level of apparatus fees has reduced the incentive for spectrum licensees to lease surplus spectrum:

> It's not efficient for a spectrum licensee to sublet their spectrum space at the moment, because the ACA will undercut the fees they [licensees] could reasonably charge and make a return on the investment. (Market Dynamics, trans., p. 117)

As band managers will incur costs from managing tenants, to remain viable they would need to set the rental at a level that recovers these costs as well as making some profit. If the annual rental significantly exceeds the annual apparatus fee charged by the ACA, potential spectrum users who have a choice may prefer to obtain an apparatus licence rather than rent spectrum from band managers.

There is some evidence of underpricing of apparatus licences (see chapter 8). However, this may reflect inadequate information on the market values of particular frequencies. In addition to spectrum, band managers may supply a range of facilities and services (such as sites and infrastructure) that are not provided by the ACA. In these cases, the fees charged by band managers are likely to be higher than apparatus licence fees applying to equivalent spectrum. Competitive neutrality principles are not a concern where apparatus licence fees are determined by market-based methods.

Substitution possibilities

The level of secondary trading also depends on the possibilities for substitution between different frequencies. The natural properties of the spectrum, planning arrangements, and available technologies and equipment may constrain the degree of substitution.

The propagation characteristics of the relevant spectrum mean that different bands of frequencies are suited to particular types of use (see chapter 2). This has implications for substitution possibilities. For example, a long-distance radio operator may not be able to move into a higher band and still provide the same long-distance communications service. For such services, trading is likely to be confined to particular bands. The heterogeneous nature of the spectrum has led to the creation of multiple markets.

Even where frequencies are substitutable, trade in licences from different bands may be restricted because moving between frequencies often involves modifying or purchasing new equipment. To transmit signals over the same distance, fixed link services operating at higher frequencies may require more infrastructure (such as diversity antennae and repeaters) than fixed links in lower bands. That said, technological innovation that results in greater availability and reduced cost of 'frequency agile' equipment may increase the substitutability between bands in the future.

The planning process allocates bands to particular uses. This also affects the extent of secondary trading. For example, the Minister may designate parts of the spectrum for broadcasting purposes (s. 31 of the RC Act, see chapter 3). Several participants noted that spectrum currently used by broadcasters could be used readily for other purposes. The Network Economics Consulting Group (sub. 73, p. 15) said the 700-MHz and 2.5-GHz bands currently allocated for television broadcasting could be used for cellular mobile services. The ACA (sub. 9, p. 4) said there is no technical reason why broadcasting spectrum cannot be used for other purposes.

However, lifting International Telecommunications Union and ACA planning constraints would not immediately lead to a broader, deeper marketplace for spectrum. Equipment availability constrains opportunities in the short term, although the possibilities for substitution would increase in the longer term.

FINDING 7.3

The level of trading in spectrum and apparatus licences indicates a restricted range of substitution possibilities created by the natural properties of the spectrum, planning arrangements and equipment availability.

Non-commercial users

Many government organisations use the spectrum. They hold around 31 per cent of assigned apparatus licences (table 7.2). The ACA (trans., p. 162) noted that government organisations do not appear to be interested in secondary trading. Community groups, which generally are non-profit entities, hold about 6 per cent of assigned apparatus licences and no spectrum licences. They too appear to have limited interest in trading or leasing spectrum.

Table 7.2 **Assigned apparatus licences, by client type, November 2001[a]**

Client type	*Licences* [b]	*Share of total*
	no.	%
Companies	64 146	60.9
Community groups	6 419	6.1
Individuals	2 026	1.9
Private total	**72 591**	**68.9**
Commonwealth Government	7 829	7.4
State government	21 090	20.0
Local government	3 805	3.6
Government total	**32 724**	**31.1**
Total	**105 315**	**100.0**

[a] Assigned licences are issued where individual frequency assignment is required. [b] These are approximate figures. They do not include licences that have a set fee (that is, licences for broadcasting services, PABX cordless telephone services and private CTS). The number of licences does not necessarily equate to the amount or value of spectrum held.

Source: ACA, pers. comm. 17 December 2001 and 8 February 2002.

It has been argued that government departments and agencies, as well as non-profit private entities, have less incentive to engage in licence trading because they are not motivated by profit maximisation. Nevertheless, these entities face budgetary pressures which require them to economise on the use of all inputs. If licences are priced appropriately, these organisations would be encouraged to use spectrum efficiently, including divesting themselves of surplus or under-utilised licences.[10]

Licence conditions

The specification of licences is critical to the functioning of secondary markets. If licences are poorly specified and lack certain key characteristics (see chapter 4), there is little incentive for spectrum users to trade.

Spectrum and apparatus licences have different specifications which affect their tradeability (see chapter 6). Apparatus licences are short term permits generally for

10 Although government organisations do not currently hold any spectrum licences, they may hold some in the future. As spectrum licences are considered to be intangible assets, they would be included in balance sheets and the capital-use charge would therefore apply to them. The capital-use charge (which is levied on the asset base of government departments and agencies) is intended to encourage efficient asset management, providing an incentive to dispose of under-utilised or surplus assets.

a specific use. The RC Act was amended in 1995 to enable the transfer of apparatus licences,[11] but some conditions still hamper the exchange of these licences. The ACA (sub. 9, p. 27) noted that the nature of apparatus licences makes them less amenable to being traded on secondary markets.

Apparatus licences are generally based on the operation of certain equipment in specific locations. Although apparatus licences are clearly defined, they often are narrowly and specifically defined which means that they have little value to anyone but the initial user. Prospective buyers have to either take over the existing equipment or replace it with equivalent equipment. Purchasers wanting to use alternative equipment would have to approach the ACA for a variation to the licence conditions, or for a new licence.

Moreover, unlike spectrum licences, apparatus licences cannot be divided or combined in either frequency or geographic dimensions, which further reduces the scope for their secondary trading. Vodafone Australia (sub. 23, p. 12) argued that spectrum licences are more amenable to trading because they have fewer restrictions than those of apparatus licences.

The security of tenure influences the potential for trading too, because the nominal licence term, renewal arrangements and the possibility of spectrum re-allocation or re-planning affect their marketability. Most apparatus licences have one-year nominal terms. The Commission has recommended that a statutory presumption of renewal be applied to apparatus licences (see chapter 6). While this should enhance security of tenure and the scope for trading, tenure is ultimately determined by the ACA's powers to resume licences to change spectrum use. Spectrum licences, which have up to 15-year terms and compensation rights, are more suitable for secondary trading. The introduction of perpetual spectrum licences would create further impetus for trading (see chapter 12).

FINDING 7.4

The technology and site specific nature of many apparatus licences reduces the opportunities for trade in these licences.

Transaction costs

Transaction costs are always important in trading decisions. Trading would only take place when the benefits are expected to outweigh these costs. When transaction costs are high, trading is less likely to occur. Transaction costs in secondary markets include search costs, the cost of due diligence, legal costs, brokerage, stamp duties

11 *Communications and the Arts Legislation Amendment Act 1995*.

and other taxes. Many inquiry participants raised the issue of government duties and taxes applying to transactions in spectrum assets.

Stamp duty

States and Territories levy stamp duties on a range of transactions, including the transfer of unlisted marketable securities, statutory licences, property and leases. Stamp duty is an *ad valorem* tax which normally applies to the higher of the value of the asset or the consideration paid. In each jurisdiction, the duty is progressive.

Stamp duties on radiocommunications licences (which are treated as statutory licences under State legislation) differ across jurisdictions. Victoria does not levy stamp duty on the sale of spectrum licences, but the effective duty is 5.4 per cent in New South Wales and the Australian Capital Territory (table 7.3). The stamp duty on statutory licences generally aligns with the duty on transfers of real property and can be nine times the duty applying to unlisted marketable securities.

Table 7.3 **Stamp duty on selected assets, States and Territories, 2001**

Jurisdiction	*Unlisted securities*	*Statutory licences*[a]	*Real property*[a]
	%	%	%
New South Wales	0.6	5.4	5.4
Victoria	0.6	0.0	5.5
Queensland	0.6	3.7	3.7
South Australia	0.6	4.9	4.9
Western Australia	0.6	4.8	4.8
Tasmania	0.6	4.0	4.0
Australian Capital Territory	0.6	5.4	5.4
Northern Territory	0.6	5.4	5.4

[a] Effective stamp duty calculated on the basis of a $10 million transfer.

Sources: Office of State Revenue NSW, *Transfer of Land or Business,* www.osr.nsw.gov.au/taxes/duty_how.htm; South Australia Treasury, *Stamp Duty on Transfer of Real Property,* www.treasury.sa.gov.au/revenuesa/stamps/sdreal.html; ACT Revenue Office, *Duty on the Purchase of Property,* www.revenue.act.gov.au/property.html; Territory Revenue Management, *Stamp Duty Rates,* www.nt.gov.au/ntt/revenue/ratestam.html; Tasmania State Revenue Office, *Duties Act 2001,* www.treasury.tas.gov.au/tax; WA State Revenue Department, *Stamp Duty Rates March 2000,* www.wa.gov.au/srd; Queensland Office of State Revenue, *Stamp duty rates*, www.osr.qld.gov.au/brochure/sd-rates.pdf; Treasury Victoria, http://www.sro.vic.gov.au/taxes_stampduty.htm (accessed December 2001 to February 2002).

Some studies have found that stamp duties, as an instrument of taxation, perform poorly in terms of efficiency, equity and simplicity (Gabbitas and Eldridge 1998; Anderson 1999). Because stamp duties add to transaction costs, they weaken incentives to trade in radiocommunications licences as well as other dutiable transactions.

Stamp duties may cause spectrum users to re-consider or postpone trades despite the potential for efficiency benefits. McInnes Pynt Solicitors (sub. 16, p. 3) and Optus (sub. 17, p. 24) claimed that stamp duties impede secondary trading in spectrum licences. Similarly, Telstra said stamp duty:

> … is currently the major inhibitor to the highly desirable rationalisation of the present 1800 MHz spectrum licence lot holdings. (Telstra, sub. DR323, p. 9)

In *A New Tax System*, the Commonwealth Government proposed the abolition of various stamp duties as part of broader tax reforms (Costello 1998). In April 1999, the Heads of Governments signed an intergovernmental agreement[12] which provided for the transfer of all goods and services tax (GST) revenue to the States and Territories (States) and established a timetable for abolishing a range of State taxes and stamp duties. As a result of Parliamentary negotiations over the GST, the intergovernmental agreement was modified in June 1999. The revised timetable indicated that stamp duties on listed marketable securities would be removed from 1 July 2001 and the need for retaining a number of other stamp duties[13] would be reviewed by the Ministerial Council by 2005. The Commission considers that stamp duties are a disincentive to secondary trading in spectrum licences.

FINDING 7.5

Given that stamp duties contribute to transaction costs, they may slow the transfer of radiocommunications licences and therefore, of spectrum, to more efficient users and/or uses.

Income tax

Some telecommunications carriers contended that potentially large capital gains tax liabilities discourage the swapping[14] of spectrum licences to create contiguous holdings of spectrum. Vodafone Australia stated:

> The prices paid for spectrum in the 2000 auction were much higher than those paid for spectrum in the 1998 auction. Consequently, it’s likely that the Australian Taxation Office will determine that the current market value of any 1998 spectrum is higher than its original purchase price. If a carrier chooses to swap spectrum obtained in the 1998 auction for another piece of spectrum from either the ‘98 or 2000 auction, that carrier

[12] Intergovernmental Agreement on the Reform of Commonwealth-State Financial Relations.

[13] Including stamp duties on: unlisted marketable securities; non-residential conveyances; statutory licences; leases; mortgages, debentures, bonds and other loan securities; credit, installment purchase and rental arrangements; cheques; bills of exchange; and promissory notes.

[14] Transactions in which licences are exchanged between two parties, but no money or other property is exchanged.

> will be deemed to have sold its piece of spectrum for its current market value and will therefore have a capital gain. (Vodafone Australia, trans., pp. 54–55)

As a result of recent business tax reforms, such tax events are now covered by the uniform capital allowance system[15] rather than the capital gains tax provisions.

Under Division 40 of the *Income Tax Assessment Act 1997*, expenditure incurred to acquire a spectrum licence may be written off over the period of the licence, providing the licence is used to generate assessable income. When a licence is disposed of or swapped, a balancing adjustment needs to be calculated. The balancing adjustment is the difference between the 'termination value' of the licence (that is, the market value at the time of the disposal or swap) and its adjustable value. If the termination value exceeds the adjustable value, then the difference (a positive balancing adjustment) is regarded as assessable income for tax purposes. Conversely, where the termination value is less than the adjustable value, this would result in a deduction.

Movements in the value of spectrum licences since the first personal communications services (PCS) auction in 1998 could create a significant positive balancing adjustment if a carrier swaps a licence purchased at the 1998 auction for one purchased by another carrier at the 2000 auction.

The termination value of licences is crucial to determining any tax liability. Under the self-assessment system, parties involved in licence swaps estimate the value of the licences for tax purposes and their tax returns may be subject to review by the Australian Taxation Office (ATO). The parties and the ATO could reach different valuations of the licences, especially in the absence of an active secondary market. The ATO may seek advice from the Australian Valuation Office on the valuation of spectrum licences. Various methods could be used to estimate licence values (for example, shadow pricing).

Inquiry participants proposed solutions along two lines. First, Vodafone Australia (sub. 23, pp. 12–13) argued that there are grounds for roll-over relief when spectrum licences are exchanged for no monetary or other consideration. Second, some carriers have suggested that they be allowed to negotiate swaps during an interim period after an auction without incurring tax liabilities (AEEMA, trans., p. 191). This would require changes to the auction rules. The adoption of combinatorial auctions may reduce the need for swapping licences because bidders can achieve their preferred aggregations of spectrum (see chapter 8). However, such

15 The uniform capital allowance system applied from 1 July 2001. It consolidated, on a consistent basis, most of the different capital allowances in the pre-existing law (Division 40 of the *Income Tax Assessment Act 1997).*

changes would not resolve the possible tax liabilities created by swapping licences between two separate auctions, as occurred with the PCS auctions in 1998 and 2000.

The Commission is not convinced that the circumstances surrounding these auctions warrant special treatment for the participants. Firms in all industries are subject to the same tax rules and may similarly incur a tax liability when asset prices of traded goods moves against them. Moreover, the firms who participated in those auctions did so in the full knowledge that subsequent resale of licences would be assessed for income tax purposes. There is also the prospect that the general downturn in telecommunications markets over the last two years would mean that the assessed market values of the licences concerned would be substantially lower now than they might have been even a year ago.

Market information

Potential buyers and sellers of licences require a range of information for secondary markets to operate efficiently.

Public register

Section 143 of the RC Act requires the ACA to maintain a public register of radiocommunications licences. It is possible to extract register details on who holds licences, technical aspects of licences and transmitter site details. Full copies of spectrum licences are also available.

While the register plays an important role in interference management (see chapter 9), it also has the potential to facilitate secondary trade in licences and to improve the use of spectrum. As Market Dynamics noted, the provision of market information is critical to the functioning of secondary markets:

> The market really won't function properly until there is information in the marketplace that's readily accessible to all-comers in the radiocommunications industry about the spatial representation of licences — who owns what, where and so on. (Market Dynamics, trans., p. 114)

Incumbents, potential entrants and brokers could, for example, access the register to identify unoccupied or under-used frequencies for the delivery of new communications services. Businesses could examine the register to identify frequencies that may support profitable opportunities, whereas non-commercial organisations could identify alternative frequencies that may lead to efficiencies in their operations.

The public register is a valuable tool which helps bring buyers and sellers of licences together. Because the register identifies the owners of licences, prospective purchasers or their brokers are able to contact owners to ascertain whether their licences are on the market. As a result, the register reduces search costs and the time to complete transactions.

The ACA recently introduced a new, graphics-based register of spectrum licences on its web site. This register provides a diagrammatic presentation of licence information, showing licence numbers and market areas for all spectrum licences issued via auction or conversion. Further details on these licences can be obtained via links to the existing public register. The graphics-based register is a significant enhancement to the public register system.

FINDING 7.6

The public register of radiocommunications licences is an important tool which facilitates secondary trading by reducing search costs and transaction times.

Trading information

The ACA receives information on licence transfers, but the RC Act does not require parties to report prices paid for licences acquired via secondary transactions. The ACA does not disseminate data on the number of licences traded or the prices paid for them. The issue is whether such information should be provided to the ACA for the purpose of public dissemination.

This type of information is usually available in other markets, including property, motor vehicle, electricity and securities markets. For example, the Australian Stock Exchange provides price and volume data for trades in listed securities. In property markets, most prices and the volume of transactions are collected and published by real estate institutes and the general press.

Some market-based mechanisms already require the disclosure of licence trades or provide trading information. Listed public companies are required to disclose any information that may affect their share prices, such as significant transactions in radiocommunications licences. Prospective buyers and sellers of licences can engage the services of specialist brokers to obtain information about market activity and going prices. Spectrum exchanges may be another source of trading information.

The public dissemination of trading data generally improves the operation of markets. It allows prospective buyers and sellers to identify price levels and movements as well as demand and supply trends in the market. Importantly, it enables buyers or sellers to obtain an indication of the current market value of licences, which helps to formulate bids and offers. Trading information would allow interested parties to monitor the market and track the development of secondary trading.

The prices of traded licences also may assist the ACA in determining what prices to charge for some new or converted licences in the primary market. The Radiocommunications Consultative Council (RCC) Working Group stated:

> The ACA's intention is that licence fees should reflect market values. That said, at the present time and for most bands and applications, there is little data for establishing true market values. (RCC 2002, p. 10)

The ACA (sub. DR324, p. 8) noted that it does not generally have access to information on prices paid for licences in the secondary market.

There are concerns, however, that public reporting of licence prices could breach commercial confidentiality between transacting parties because thin trading may allow the parties to be identified. Some parties may wish to keep the financial details of transactions private for competitive reasons; for instance, price disclosure may reveal a company's cost advantage to its rivals. Unwired Australia (sub. DR319, p. 5) claimed there are ways that parties could disguise the true price in a spectrum transaction, thereby reducing the usefulness of mandatory reporting.

The Commission supports the reporting to the ACA of prices paid for traded licences on a confidential basis and the appropriate publication of price information. This would achieve the benefits noted above and the compliance costs would be minimal. It is important that the ACA protects the confidentiality of transacting parties when publishing price data. If licence prices were to be publicly disclosed on a band and geographic basis, current levels of trading may not be sufficient to preserve the anonymity of transacting parties. This could be addressed, for example, by publishing average prices only when a threshold number of trades have been completed.

FINDING 7.7

Price information on traded licences would help the Australian Communications Authority to determine the prices to charge for some new or converted licences in the primary market. The publication of trading information, such as volumes traded and prices paid, will improve the functioning of secondary markets.

RECOMMENDATION 7.1

The* Radiocommunications Act 1992 *should be amended so that:

- ***purchasers of traded licences are required to notify the Australian Communications Authority of the prices paid for licences; and***
- ***the Australian Communications Authority publish on a regular basis the volumes of licences traded and the prices paid for traded licences in an aggregated form to preserve the confidentiality of transacting parties.***

7.6 Competition issues

Secondary markets may pose risks to competition if trading results in a concentration of licences in the hands of one or a few parties.

Hoarding is the accumulation of more licences (and spectrum) than the buyer intends to use. The opportunity cost of leaving spectrum fallow generally discourages hoarding. It is important to distinguish between two types of hoarding behaviour. First, some parties may hoard licences purchased from secondary markets as an exclusionary tactic to block the entry of competitors. The accumulation of licences in a few hands also may create market power which could be used to restrict output and raise prices above competitive levels. Second, some hoarding may be for speculative gain. Speculators can perform a useful function because they provide an alternative source of licences for potential entrants and assist the process of price discovery.

Mergers and acquisitions

The main regulatory protection against anti-competitive practices, such as exclusionary hoarding, is s. 50 of the *Trade Practices Act 1974* (TPA).[16] Several major spectrum users noted that the TPA covers secondary trading in licences (Vodafone Australia, sub. 23, p. 12; Telstra, sub. 63, p. 10). The Commission concurs with the Australian Competition and Consumer Commission (ACCC) view that the TPA has an important and continuing role to play in ensuring that secondary trading does not result in anti-competitive outcomes (ACCC, sub. 282, p. 4).

[16] The RC Act (ss 68A, 71A, 106A and 114A) requires apparatus and spectrum licences to be treated as acquisitions of assets for the purposes of s. 50 of the TPA (see chapter 3).

The RC Act allows for the imposition of competition limits on the primary assignment of spectrum and apparatus licences (see chapter 6). The ACCC (sub. 282, p. 4) argued that there may be merit in extending competition limits to secondary trading to pursue pro-competitive outcomes. However, it gave no detail on how this might work in practice nor why it was necessary given s. 50 of the TPA. The suggestion appears to target situations where parties may try to circumvent competition limits set at the time of primary assignment by subsequently purchasing licences on the secondary market.

Extending competition limits to secondary markets could result in inappropriate regulation, especially when market conditions are changing rapidly. This possibility arises because the competition analysis underlying any limits imposed on the primary issue of licences may no longer be relevant if market conditions alter substantially. In such circumstances, the application of competition limits to secondary transactions could place unwarranted restrictions on nominated enterprises.

As argued in chapter 6, the competition limits imposed on the primary issue of licences are discretionary and should be either repealed or made consistent with s. 50 of the TPA. The Commission can see even less reason for introducing competition limits for the secondary market. The main reason they might be retained for the primary market would be that if they were consistent with s. 50 of the TPA, they might create more certainty in the auction process. This does not apply to the secondary market. The Commission considers that general, rather than industry specific, competition regulation will better promote the efficient allocation of resources in both the primary and secondary markets for spectrum.

‘Use it or lose it’ provisions

It has been suggested that the inclusion of ‘use it or lose it’ provisions in the RC Act and in licence conditions could provide additional protection against hoarding of spectrum. NTL Australia proposed:

> … the introduction of an anti-hoarding ‘use it or lose it’ licence condition. This would ensure that spectrum is available for new entrants and prevent existing industry participants from ‘tying up’ spectrum without any economic benefits. (NTL Australia, sub. 22, p. 3)

The ABC (sub. 21, p. 21), 2KY Broadcasters (sub. 10, p. 11), Electronic Frontiers Australia (sub. DR318, p. 2) and Mobile Communication Systems (sub. DR350, p. 1) also supported ‘use it or lose it’ provisions.

Application of ‘use it or lose it’ provisions to radiocommunications licences has been limited. Such provisions were imposed on low power open narrowcasting licences by Ministerial direction, in response to concerns that licences were being held without the licensees providing radio services. The ACA imposed similar provisions on satellite licences that were auctioned in 2001.

‘Use it or lose it’ provisions are crude instruments for encouraging the efficient use of spectrum and have several drawbacks. They can be used to prevent a powerful incumbent from parking spectrum for the purposes of restricting supply and pushing up the prices of end services. But they may fail to distinguish this reason for not using spectrum from other legitimate reasons. In some cases, spectrum may lie temporarily fallow while the licensee is planning the roll out of infrastructure. They may also deny the useful role that speculators can have in markets.

‘Use it or lose it’ provisions also create the risk of encouraging firms to roll out infrastructure prematurely. If market conditions do not warrant the roll out, the firm may be exposed to unnecessary financial risk. This would be an inefficient use of resources.

Applying such conditions would also present significant operational difficulties. There are definitional questions as to what constitutes reasonable or adequate use of a frequency, what roll-out period should apply, and whether these parameters should differ between uses or bands. ‘Use it or lose it’ conditions could prevent a firm from purchasing additional capacity to accommodate expected future growth. To implement and enforce these provisions, the ACA would need to somehow define and monitor spectrum use. As the ACA pointed out, these conditions have practical difficulties in a technology-neutral environment where licensees are free to use the spectrum for whatever service they choose. For this reason, the use of such provisions has been confined to narrowly defined circumstances (ACA, sub. 9, p. 24).

Any wider application of such provisions will lead to further complexity and costs, creating definitional problems and adding substantially to the administrative costs of the ACA. The Commission considers that the TPA provides general protection against exclusionary hoarding, removing the need for ‘use it or lose it’ provisions. The potential for hoarding would also be minimised by the appropriate pricing of licences; that is, prices based on opportunity cost.

FINDING 7.8

‘Use it or lose it’ provisions generally are not warranted as supplementary conditions in radiocommunications licences because of the protection afforded by the Trade Practices Act 1974*.*

7.7 Conclusion

Secondary markets have the potential to play a much greater role in allocating spectrum among different users and/or uses in Australia than they currently do. However, to some extent, the natural properties of the spectrum and planning arrangements constrain trading possibilities.

Apparatus licences are less amenable to trading because they are technology and site specific. In particular, the trading of apparatus licences does not lead to changes in the use of given frequencies.

Trading in spectrum licences holds more promise as a means of facilitating market-based changes in the assignment and use of spectrum. This is already evidenced in the turnover rates in spectrum licences, which are proportionately much higher than those for apparatus licences.

However, secondary markets in spectrum are not yet well developed. They could be encouraged in a number of ways. Applying a statutory presumption of renewal to apparatus licences should enhance their tradeability. Further deployment of spectrum licences would add greater depth to secondary markets. The introduction of perpetual spectrum licences would enhance secondary markets by giving licensees the flexibility to hold licences for long enough to make a return on their investments (see chapter 12). Recent improvements to the public register and the publication of trading information also will assist the functioning of these markets.

8 Charging for spectrum

In chapter 4, the Commission outlined the following guiding principles for the efficient pricing of spectrum:

- spectrum users should be charged the direct administrative costs associated with managing their use of spectrum;
- spectrum users, as a group, should be charged for the indirect costs associated with spectrum management;
- when spectrum is scarce, efficient spectrum use requires a charge in excess of the cost of management; and
- the charge for scarce spectrum should be based on the opportunity cost of spectrum, that is, on the value of the best alternative use forgone (which, in competitive markets, will be the market price).

This chapter reviews Australia's current spectrum pricing framework in the light of these principles.

8.1 Introduction

Australia employs a combination of administrative pricing and market-based pricing to charge users for access to spectrum. Following a long period of administrative pricing (see chapter 3), the implementation of the *Radiocommunications Act 1992* (RC Act) encouraged increased use of market mechanisms — mostly in the form of spectrum auctions — to assign spectrum to competing users. However, the bulk of spectrum continues to be priced administratively, albeit in a way that is intended to promote the efficient use of spectrum.

For efficiency reasons, the Commission favours market-based pricing of spectrum (see chapter 4). While efficient spectrum prices would theoretically emerge from the interplay of buyers and sellers in competitive secondary markets, these markets are still relatively immature (see chapter 7). It is therefore important that auctions achieve efficient allocation and pricing of licences.

When auctions are not feasible, administrative pricing which seeks to generate incentives similar to those created by a fully functioning market is appropriate. These prices should be as close as possible to the market value of spectrum.

The three licence types have different pricing mechanisms. Charges applying to apparatus licences are determined mainly administratively, but can be market-based on occasion. Spectrum licences attract both administrative and market-based charges, while class licences attract no charges. The next section of this chapter examines market-based pricing of spectrum, in terms of its underlying rationale and implementation. Section 8.3 examines administrative pricing.

8.2 Market-based pricing

Section 39(5) of the RC Act allows the Australian Communications Authority (ACA) to use auctions, tenders, pre-determined prices and negotiated prices for the sale of spectrum licences. Section 106(1) of the RC Act allows the ACA to determine a market-based system for the allocation of apparatus licences.[1] Virtually all market-based allocations of spectrum and apparatus licences to date have taken place at auction.[2] Given the prevalence of this mechanism, this section concentrates on the use of auctions as a market-based method for allocating and pricing spectrum. Alternative pricing methods are discussed in chapter 11 and appendix D.

Spectrum auctions worldwide

The idea that radiofrequency spectrum could be auctioned emerged in the United States (US) in 1958, when Ronald Coase suggested to the US Congress that the Federal Communications Commission (FCC) should allow the market-based allocation of spectrum property rights. Until then, the US had used comparative hearings (‘beauty contests’)[3] to allocate spectrum. In 1981, hearings were replaced with lotteries which assigned licences randomly among applicants. In 1993, the US Congress passed legislation giving the FCC authority to auction licences (McMillan 1994; Sutherland 1998).

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[1] The specific term used in the Act is ‘price-based allocation’. However, to avoid confusion with allocation based on administrative prices, the term ‘market-based’ is used instead in this chapter.

[2] Except when the sale of spectrum licences resulted from the conversion of apparatus licences, in which case the price was negotiated.

[3] A beauty contest, or comparative hearing, assigns licences based on multiple criteria, one of which may be price (Chan et al. 2002).

The first spectrum auctions were conducted in New Zealand in 1989. The New Zealand Government adopted second-price (Vickrey) auctions[4] to allocate spectrum for radio, television and mobile telephones. Because no minimum bids were required, this auction design produced unforeseen results, with large gaps between the two highest bids. As a result, prices paid were often negligible (even equal to zero in one case) (McMillan 1994). These early auctions broke new ground and resulted in auction rules and designs being refined to avoid repeating early disappointments (Coutts 2000, 2001).

The next phase, termed the 'consolidation phase' by Coutts, began in 1994 with the first spectrum auctions in the US — the personal communication services (PCS) auctions. These auctions were run using a new auction design, the simultaneous ascending auction, designed for the FCC by a team of mathematical economists and game theorists (Milgrom 2000). This format was considered an advance on traditional sequential auctions[5] because:

- it allows bidders to react to prices across multiple licences; and
- bidders have the capacity to switch between licence aggregations until the auction closes (Cramton 1997).

Unlike one-shot, sealed-bid auctions ('tenders'), simultaneous ascending auctions usually take place over multiple rounds, which means that bidders have the opportunity to react to information revealed in previous rounds. The FCC held several PCS auctions between 1994 and 1997, using the simultaneous ascending format. They successfully allocated thousands of licences, each granting exclusive rights to parts of the radiofrequency spectrum in a particular geographic area.

The third phase of spectrum auctions is what Coutts terms the 'maturation' phase:

> … with auctions now being accepted as a legitimate and effective means to allocate spectrum for high demand sectors and the mobile communications industry in particular. (Coutts 2001, p. 13)

Auctions of third generation (3G) spectrum world wide belong to this phase. Very high prices have been paid in the United Kingdom (UK) and Germany for spectrum considered crucial to the 3G business plans of telecommunications firms (see appendix C).

[4] Under this design, bidders submit closed bids for the good. The bidder with the highest bid wins the good, but pays a price equal to the second-highest bid (Chan et al. 2002).

[5] Sequential auctions allow bidding on only one item at a time. An example is the 'English' auction, also known as 'open outcry' or 'oral' auction (Chan et al. 2002).

Spectrum auctions in Australia

The first auction of licences under the RC Act by the Spectrum Management Agency (SMA) occurred in 1994 (table 8.1). Nonetheless, there had been previous auctions of spectrum in Australia. In 1991 and 1992, Optus and Vodafone acquired telecommunications carrier licences through a combination of 'beauty contest' and tender. These licences were valid for 25 years and included public mobile telecommunications service (PMTS) class B apparatus licences that gave carriers access to spectrum in the 900-megahertz (MHz) band.[6]

In the early 1990s, the Australian Broadcasting Authority (ABA) auctioned a number of radio station licences giving access to spectrum. It also conducted a major spectrum auction of two satellite pay television licences in 1993. Because these were broadcasting licences, they were accompanied by licences giving access to the necessary spectrum (see chapter 10). The auction was a first-price, sealed-bid auction and did not preclude multiple bids by a single bidder, or require financial security deposits. As a result, some bidders used a strategy of defaulting on their winning bid, secure in also holding the next-highest bid. This resulted in cascading bids, with the prices ultimately paid for the licences representing less than half of the original winning bids (McMillan 1994; Veljanovski 1999). That auction might still have resulted in the licences being allocated to the firms that valued them the highest, and so have been allocatively efficient. However, the auction design had several flaws. First, it was not able to allocate the licences quickly and transparently, which meant transaction efficiency was reduced. Second, it was dynamically inefficient because it delayed by almost a year the introduction of the new technology which the licences supported. Third, it effectively relied on the secondary market, not on the auction itself, to achieve an efficient allocation.[7]

The first auction of spectrum under the RC Act was for the allocation of multipoint distribution system (MDS) apparatus licences by open outcry in 1994-95. That auction avoided some of the design pitfalls of the pay television auction and raised $101 million.

The first Australian spectrum licence auction using the simultaneous ascending format was the 1997 auction of lots in the 500-MHz band (table 8.1). This was also the first auction anywhere in the world to allocate licences that were ostensibly technology and use neutral.

[6] These apparatus licences were annual, but it was understood that they would be renewed for the duration of the carrier licences.

[7] Following successive defaults by bidders with the standing highest bids, licences were eventually allocated to firms who immediately sold them on.

This is where Australia's version of the 'breaking new ground' phase ended. The consolidation that followed comprised a series of auctions of highly valued mobile phone spectrum in Australia — known as the PCS auctions. The first major PCS auction took place in 1998, and the second in 2000. Box 8.1 provides a brief overview of the 1998 auction. Overall, the PCS auctions raised $1.7 billion for the Commonwealth Government (table 8.1), including proceeds from the subsequent auctioning of unsold lots.

Australian auctions are now in their 'maturation phase', comprising the 2000 PCS auction and the so-called 3G auction for frequencies in the 2-GHz band. The latter, which is the most recent auction of spectrum licences conducted by the ACA, raised almost $1.2 billion (table 8.1 and box 8.2).

Auctions as a spectrum allocation mechanism

Auctions can be an efficient way of allocating an asset where no conventional or ongoing market exists for that asset. By forcing bidders to reveal information about their valuation of the resource, auctions usually are able to allocate the resource to the bidder who values it the most.[8] The usual result is an efficient allocation of the resource — that is, one that maximises social welfare in the downstream market. Exceptions arise when, for example, bids contain an element of rent seeking, as in the case of an incumbent monopoly striving to preserve its market dominance.

Auctions are less subjective and more transparent than alternative assignment mechanisms such as administrative allocation based on firm characteristics ('beauty contests') or lotteries (see appendix D). Beauty contests, in particular, provide an opportunity for bias towards incumbent firms with established track records, which stifles innovation and competition. Similarly, if beauty contests are biased towards new but untested technologies, they could disadvantage proven technologies.

[8] There are some circumstances in which an auction is not able to allocate a good to the bidder who values it most (Chan et al. 2002).

Table 8.1 **Overview of spectrum auctions in Australia**

Auction	*Licence type*	*No. of licences/lots*	*Date*	*Rounds*	*Bidders*
Multipoint distribution station (MDS) (2.3 GHz)[a]	5 yr apparatus	471 licences	1994 and 1995	na	20
500 MHz[b]	10 yr spectrum	834 lots	3 Feb–24 Mar 1997	63	13
PCS (800 MHz and 1.8 GHz)[c]	15 yr spectrum	230 lots	20 Apr–25 May 1998	89	9
Second PCS (unsold lots) (800 MHz and 1.8 GHz)	15 yr spectrum	18 lots	15 Sep 1998	na	5
Broadband wireless access (28/31 GHz)[d]	15 yr spectrum	29 lots	1–8 Feb 1999	37	5
Third PCS (unsold lot) (800 MHz)	15 yr spectrum	1 lot	29 Apr 1999	na	1
800 MHz TLMS[e]	5 yr apparatus	2 lots	30 Apr 1999	na	2
PCS 2000 (1.8 GHz)[f]	15 yr spectrum	60 lots	24 Jan–5 Mar 2000	138	7
3.4 GHz[g]	15 yr spectrum	482 lots	3–24 Oct 2000	53	8
Broadband wireless access (27 GHz)[h]	15 yr spectrum	126 lots	28 Nov 2000	3	2
800 MHz residual PCS[i]	13 yr spectrum	2 lots	22 Feb 2001	na	na
3G mobiles (2.1 GHz)[j]	15-yr spectrum	58 lots	15–22 Mar 2001	19	7
Space licences[k]	5 yr apparatus	2 licences	30 Oct 2001	..	1
Low power open narrowcasting licences[l]	5 yr apparatus	19 licences; 25 licences	December 2001; March 2002	..	na

a Licences in the B band (2302–2400 MHz) were converted to 15 year spectrum licences in 2000. Licences in the A band (2076–2110 MHz) will terminate in 2002 and the spectrum will be re-planned. **b** First simultaneous ascending spectrum auction in Australia. First auction of a spectrum licence in the world. Parts of the band were sold encumbered. **c** Parts of the spectrum were encumbered. Competition limits were in force, regarding the maximum bandwidth available to a single bidder and the identity of bidders for some lots. **d** AAPT won all 29 licences, covering the whole of Australia. Competition limits prevented Optus and Telstra from bidding. **e** Lots only in Melbourne. Motorola won both. **f** Lots only available in capital cities. Winning bidders were Hutchison, OneTel, Telstra, and Vodafone. Competition limits applied to all bidders.

(Continued on next page.)

Table 8.1 (continued)

Auction	*Auction type*	*Amount raised*	*($/MHz) /pop (mean)*	*Annualised figure*[m]	*Typical service*
		$m	$	$	
Multipoint distribution station (MDS) (2.3 GHz)[a]	Open outcry	101.0	na	na	Pay television
500 MHz[b]	Simultaneous ascending	1.0	0.05	0.0062	Land mobile and point-to-point
PCS (800 MHz and 1.8 GHz)[c]	Simultaneous ascending	347.4	0.11	0.0113	Land mobile and mobile phones
Second PCS (unsold lots) (800 MHz and 1.8 GHz)	Open outcry	30.6	0.10	0.0105	As above
Broadband wireless access (28/31 GHz)[d]	Simultaneous ascending	66.2	0.0008	0.0001	Fixed wireless
Third PCS (unsold lot) (800 MHz)	Open outcry	0.02	0.02	0.0016	
800 MHz TLMS[e]	Open outcry	0.05	na	na	Trunked land mobile
PCS 2000 (1.8 GHz)[f]	Simultaneous ascending	1 327.7	1.26	0.1295	Mobile phones
3.4 GHz[g]	Simultaneous ascending	114.8	0.04	0.0040	Wireless local loop
Broadband wireless access (27 GHz)[h]	Simultaneous ascending	37.6	0.002	0.0003	Fixed wireless
800 MHz residual PCS[i]	Open outcry	na	na	na	Mobile phones
3G mobiles (2.1 GHz)[j]	Simultaneous ascending	1 169.0	0.61	0.0627	Mobile phones
Space licences[k]	Simultaneous ascending	1	na	na	Broadcasting
Low power open narrowcasting licences[l]	Open outcry	0.009; 0.0125	..	na	Niche radio
Total		**3 196.4**			

[g] Subject to competition limits applying to all bidders and, in some cases, to Telstra only. Telstra withdrew from the auction. Lots were unpaired. [h] Two winning bidders: Agility Networks (owned by Optus) and Shin Satellite Co. [i] All lots allocated to the only bidder, Telstra. The licence term was timed to coincide with that of the previously allocated 800 MHz licences and therefore was equivalent to about 13 years. [j] Winners were Telstra, Vodafone, Optus, Hutchison, 3G Investments (Qualcomm) and CKW Wireless (ArrayComm). Some paired and some unpaired lots. Competition limits were in force, applying to all bidders. [k] Competition limit of one licence per bidder. Only Foxtel entered the auction, so the ACA sold one licence to this firm at the reserve price. [l] Subject to a 'use it or lose it' condition. Licences were allocated at their reserve price. [m] Discount rate is 6 per cent per annum, equal to the average daily yield on 10-year Treasury bond rates between 1997 and 2001. **na** : not available; **..** : not applicable.

Source: Commission estimates based on ACA data and information.

Box 8.1 **The 1998 Personal Communication Services (PCS) auction**

Following the successful 1995 auction of United States spectrum for PCS, the Australian Communications Authority conducted the first Australian PCS auction in 1998, in the 800-megahertz (MHz) and 1800-MHz bands. The winning bidders were to receive spectrum licences covering lots with characteristics thought to be suitable for mobile phones and data transfer systems. 227 lots were auctioned, located in 21 geographic areas classified as metropolitan, regional or outback. Each lot was given a rating based on population coverage and bandwidth.

Nine bidders registered for the auction, including the three incumbent mobile phone carriers: Telstra, Vodafone and Optus. International companies were represented, either as bidders or in partnership with Australian companies. The auction was subject to competition limits, in that no bidder could bid for more than 15 MHz in the 1.8-gigahertz (GHz) band in one region. Further, Telstra, Optus and Vodafone were not allowed to bid in the first two frequency ranges of the 800-MHz band.

When the auction concluded, after 89 rounds and seven weeks, in excess of $347 million was collected in winning bids. One registered bidder did not bid at all, while another withdrew without securing any lot. Telstra won more than half of the lots on offer, with the rest accruing to six other bidders. Nineteen lots, mainly in the capital cities, remained unsold (later sold in other PCS auctions). Thirty-eight lots were sold at the reserve price.

Metropolitan areas generated more than 93 per cent of the auction revenue in both bands, with Sydney alone accounting for nearly 50 per cent of total revenue. Lot prices received ranged from $0.69 per MHz and head of population in Sydney to $0.05 in Albury (for 15 years). Prices received varied across bands and geographic areas, based on several factors affecting the value of the spectrum, for instance, spectrum location, nature of the terrain and the possibility of aggregation. While demand for lots exceeded supply in the 800-MHz band, the reverse seems to have been true in the 1.8-GHz band, which possesses less attractive propagation characteristics than the 800-MHz band.

A significant feature of this auction was the opportunity to disguise bids, allowed by the simultaneous auctioning of two bands. Bidders with an interest in one band only were able to conceal it by bidding in the other band for a while (to maintain their overall eligibility). This strategic demand reduction strategy (through bid ‘shading’) might have contributed to higher than expected prices being paid for other, less valuable lots.

By the time the auction ended, most bidders appeared to have been able to construct their preferred aggregation of lots. Most bidders were prepared to pay a premium to secure adjacent lots.

Sources: Coutts (1999); Sutherland (1998); Chan et al. (2002).

Box 8.2 **The third generation (3G) auction**

The first auction of spectrum to be used for 3G mobile phone services took place in the United Kingdom (UK) in March–April 2000. It was followed closely by 3G auctions in the Netherlands, Germany and other European countries.

The Australian auction of spectrum in the 2-gigahertz (GHz) band, suitable for 3G services, took place on 15–22 March 2001. That auction offered 58 lots of spectrum — some paired and some unpaired — covering the whole of Australia, capital cities, regional cities and regional areas. The number of lots did not pre-determine the number of winning bidders, because bidders could win any combination of lots. However, competition limits in place for that auction meant that no bidder could acquire more than 25 per cent of the available spectrum in any metropolitan area or more than 50 per cent in any regional area.

When the auction concluded after 19 rounds, 48 of the 58 lots on offer had been sold. Telstra had spent the most on licences, with 26 per cent of the total bid revenue of $1168 million. Among the five other successful bidders, existing mobile phone companies spent the largest amounts. Prices received per megahertz and head of population ranged from $0.86 in regional Tasmania to $0.12 in Adelaide (for 15 years). The average price received was approximately 6 per cent of equivalent prices in the UK and German auctions (see appendix C). In Coutts' analysis, international price variations for 3G spectrum are the product of a number of influences: business climate for telecommunications; perceived strategic value of the market; regulatory factors; technology considerations and alternatives to spectrum.

FuturePace and Optus said the reserve prices set by the Australian Communications Authority (ACA) dampened competition in the 3G auction. FuturePace argued that simultaneous ascending auction rules penalised bidders who did not bid actively enough in a round or who withdrew from lots. In FuturePace's analysis, bidders were cautious in their bids so as to avoid such penalties, thus leading to the small number of rounds and only about half the lots selling above the reserve.

According to the ACA, the 3G auction exemplified the technology-neutral nature of spectrum licences. Two of the winning bidders, Qualcomm and Arraycomm (both United States companies with links to equipment vendors) do not intend to use the spectrum to roll out the dominant 3G technology (wideband code division multiple access [CDMA]). Instead, Qualcomm plans to use CDMA 2000 while Arraycomm intends providing portable wireless data services. The simultaneous operation of quite different technologies in the same part of the spectrum is a feature of Australian spectrum licences and would not have been possible (or indeed allowed) in many other countries.

The six spectrum licences issued in the 3G auction are due to run between October 2002 (following band clearance) and October 2017.

Sources: FuturePace (2001); Coutts (2001); ACA (2001c); Optus, sub. 17; ACA, sub. DR333.

Not all auction formats are well adapted to the assignment of spectrum licences. Traditional auction formats, such as the English open outcry auction, are sequential. This means that, when several lots are being auctioned, one must be sold before bidding opens on the next lot. Bidders must therefore bid on a lot, not knowing if they are likely to win others. This has disadvantages in situations when there are benefits from combining several lots. These benefits — known as 'synergies' — mean that the joint value of owning two adjacent lots (geographically or spectrally) is greater than the sum of the two lots held individually. Synergies arise from enabling mobile phone roaming, economies of scale (fewer but more powerful base stations) and greater spectrum efficiency ('guard bands' are minimised). Such complementarities between spectrum lots have been identified as a factor behind the bidding in some US and Australian auctions (Ausubel et al. 1997; Moreton and Spiller 1998; Sutherland 1998; Chan et al. 2002).

Simultaneous ascending auctions, which were first introduced in the US in 1994 and now are common around the world (including in Australia), are now the preferred method for assigning many lots of spectrum quickly and efficiently. One advantage is that they allow any synergies to be identified and exploited. During the auction, the behaviour of bidders reveals information about whether they consider some lots to be complements or substitutes. Bidders can build this information into their strategies, resulting in more efficient aggregations of lots at the end of the auction (Chan et al. 2002).

While auctions have the potential to allocate spectrum efficiently, their use can have disadvantages. First, auctions generate revenue for the Government, so their design and conditions may be geared towards maximising revenue rather than achieving efficiency. Governments, as the sole supplier of spectrum in most cases, can create artificial scarcity, by restricting the amount of spectrum available at auction. Such a strategy would create competitive tension in auctions and thus increase revenue. But it may be inefficient because some spectrum would remain unused or allocated to its existing uses, and thus produce potentially lower benefits for the community.

Government-induced scarcity has been noted by Hazlett (2001, p. 132) in US spectrum auctions. It has also been apparent in some recent European spectrum auctions, where governments have legislated a particular type of equipment for a band (for example, universal mobile telecommunication services [UMTS]). Carriers must have the designated spectrum to be able to deploy the particular equipment, which accentuates the scarcity of the spectrum (Coutts 2001). Australian spectrum auctions have been characterised by a much lower degree of technical specification, which has reduced the potential for creating artificial scarcity (see chapter 9).

Even if auctions do not favour revenue maximisation over efficiency, they can have undesirable effects. An often cited problem with some types of auction is the so-called ‘winner’s curse’, where the winning bid in an auction is higher than the lot’s real value to the winning bidder (Chan et al. 2002). This arises in auctions when the value to each bidder of the lot on offer is not fixed in advance. In such cases, information revealed during the auction has the capacity to alter bidders’ valuations. If the auction design does not allow bid information to be shared (as is the case in a sealed-bid, one-shot auction), a naive bidder may win the auction only to realise that its rivals’ consensus on the value of the lot is lower than its own and it has paid too much. This is more likely in the case of first-price, sealed-bid auctions (tenders), because bidders do not have the option of revising their bids based on the bids of their competitors. More experienced bidders account for this effect and reduce their bids accordingly (Chan et al. 2002).

Generally, the more information that is available about the value of an auction lot, the less is the risk of a winner’s curse outcome. Information allows bidders to form an accurate idea of the consensus value of the lot. Simultaneous ascending auctions are an effective way of combating the winner’s curse, because they are multi-round and open (that is, non-sealed). They usually generate ample information on the value of the lots (individually and as parts of aggregations) and on the strategies of rival bidders. However, some inquiry participants argued that some past winning bidders paid too much for spectrum in Australian auctions (Market Dynamics, sub. 33, pp. 28–29; Bramex, trans., p. 327). It is not clear whether any overpayments resulted from the auction design or from flaws in the business models of the bidders.

Impact of auction prices on industry business cases and consumer prices

The UMTS Forum (1998) has asserted that the large sums of money paid by winning bidders in recent spectrum auctions have negatively affected bidders’ profitability, capacity to roll out infrastructure and prices to consumers. Some inquiry participants argued that the collapse of the telecommunications company OneTel was partly attributable to the price it paid for spectrum (Spectrum Engineering Australia, sub. 30, p. 7; Market Dynamics, sub. 33, p. 13).

Prices paid at auction — whether high or low — are determined by the bidders. They should be consistent with the profitable operation of the bidder’s business, given the anticipated demand for their services and the level of competition in the industry. Theoretically, bidders with perfect information should never pay ‘too much’ for spectrum.

In practice, bidders purchase spectrum to provide services in markets that are subject to risk and uncertainty. This is especially true of an embryonic market, such as that for 3G services. It may be argued that the prices paid at 3G auctions in the

UK and Germany were based on expectations of above-normal profits, made possible by the scarcity of 3G spectrum (and thus of mobile telephony services relying on that spectrum). Given that information about future demand for 3G services is imperfect and profits are highly speculative, a firm could belatedly realise that its licence is overvalued, once additional information comes to light. This, however, is not attributable to the use of auctions.

Moreover, it is also possible that what appears as overbidding in relation to local (domestic) markets is part of a rational corporate strategy to maximise overall (international) profit or future profit. In Coutts' assessment, the following factors drove some recent bidding strategies:

- the global aspirations of some telecommunications companies, such as Vodafone and Hutchison, which led them to expand world market coverage for strategic reasons; and
- the perceived need to stake a claim in future growth markets such as data transfer and 3G (Coutts 2001).

In such scenarios, the value of a licence is based on factors other than purely domestic and/or contemporaneous ones. This makes it difficult to determine if overvaluation or overbidding have occurred.

Overbidding is a matter of judgement. Coutts (2001) reported that in some European countries, share markets penalised companies that did not bid for a 3G spectrum licence and rewarded the winning bidders, even when external observers considered the prices paid to be too high. Under this scenario, it may be possible for concerns about share market perceptions to compel a company to acquire a spectrum licence that the company's executives think overpriced. Not to do so would expose the company to the risk of share sell-offs and/or takeover. There is also anecdotal evidence that executives occasionally have exceeded shareholder valuations when bidding for licences. This demonstrates that shareholders and executives can value spectrum licences differently.

Even if some firms can be assumed to have overestimated licence values, sometimes to the point of failing, it is not clear that auctions are to blame. The factors discussed above — uncertainty, business expectations, capital market imperfections — stem from phenomena largely outside the regulatory sphere. Just as some firms will fail after purchasing their assets in an ongoing market, some will fail after purchasing their assets at auction. In many cases, spectrum may not even be the most significant infrastructure cost that a firm faces. It is the nature of markets to penalise inefficient firms and to release their inputs for use by more efficient firms.

Some inquiry participants argued that high spectrum prices paid by telecommunications firms would translate into high prices for downstream consumers (Optus, sub. 17; Vodafone Australia, sub. 23; Bramex, sub. 64). As fixed, largely sunk costs, however, spectrum auction bids should not influence the price charged to consumers by a profit-maximising firm. In a competitive market, that price will be a function of the firm's marginal cost, which is dependant on variable costs alone (those costs that vary with output).

It may be possible, on a few occasions, for prices paid at auction to affect variable costs, and for consumers to face higher prices as a result. This may occur, for example, when the amount bid means that the winning bidder has a budget constraint and cannot spend as much as planned on infrastructure roll-out. In this case, opting for a smaller network may translate into higher variable costs and thus higher prices (in an imperfectly competitive market). High prices paid in some European auctions (for example, the UK and Germany — see appendix C) mean that in some cases, spectrum costs may exceed the industry norm of 15 per cent of typical network infrastructure costs (Coutts 2001).

That said, high auction prices can also benefit consumers if, as suggested by two successful bidders in the UK 3G auction, they provide firms with incentives to roll out new services more quickly than they otherwise might have (Cave 2002, p. 119).

Performance of Australian spectrum auctions

Following five years of spectrum licence auctions in Australia, it is possible to make a preliminary assessment of their performance. That performance can be assessed from several perspectives, of which the most important are allocative efficiency, valuation of spectrum, competition and revenue.

Allocative efficiency

Australian spectrum auctions appear to have allocated spectrum to the firms that valued it most. Prices paid in some auctions far exceeded forecasts. This suggests that alternative allocation methods (such as administrative allocation) would have lacked sufficient information to identify those firms most able to use the spectrum productively.

Apart from identifying high-value users, allocative efficiency also requires winning bidders to be able to benefit from synergies between lots by constructing their preferred spectrum aggregations. This is particularly true if the secondary market for spectrum does not allow firms to adjust their initial allocation of spectrum.

While simultaneous ascending auctions are a clear advance on other auction formats in this context, they cannot guarantee efficient aggregations. This creates the possibility of an ‘exposure’ problem for bidders. That is, given the necessity of bidding on each lot separately, bidders might pay more for lots forming part of an incomplete aggregation than those lots are worth to them individually. According to some inquiry participants, bidders in some Australian auctions have been affected by exposure (Vodafone Australia, trans., p. 56; Centre for Telecommunications Information Networking, trans., p. 478). Market Dynamics argued that this had occurred in some Australian spectrum auctions:

> … the data from a number of auctions in Australia shows evidence of the sort of sub-optimal allocation that might be predicted by theory, evidence of a failure of the process to completely solve an efficient allocation. (Market Dynamics, sub. 33, p. 28)

This type of outcome has the potential to allocate goods inefficiently, as bidders fail to complete those lot aggregations yielding the highest cumulative valuation (Chan et al. 2002).

Combinatorial auctions (package auctions), on the other hand, are a theoretical auction design that avoids the exposure problem by allowing bidding on an ‘all or nothing’ basis (Chan et al. 2002). If a firm is not able to win any of its preferred lot combinations, then it incurs no cost. Given the theoretical advantages of this design, the FCC has scheduled its first combinatorial auction for 14 January 2003, in the upper 700-MHz band (FCC 2002a).

The ACA indicated that it is monitoring the development of combinatorial auctions and is consulting with its clients. However, the ACA does not currently favour combinatorial designs because of their complexity (sub. DR324, p. 11; trans., p. 173). One inquiry participant suggested that potential bidders, having invested in tools to manage simultaneous ascending auctions, would not be interested in moving to combinatorial auctions (FuturePace Solutions, trans., p. 254). However, another inquiry participant suggested the ACA may wish to avoid committing resources to the assessment and adoption of new auction designs (Centre for Telecommunications Information Networking, trans., p. 480).

There is empirical evidence of positive population synergies at work in two of the Australian spectrum auctions: the 1998 PCS and the 2000 PCS auctions (Sutherland 1998; Chan et al. 2002). If synergies were thought to be sufficiently strong in future auctions — and hence the exposure problem of sufficient concern — then a combinatorial design could result in more efficient lot aggregations than can be achieved under a simultaneous ascending auction format. The Commission considers that the ACA should re-assess the potential costs and benefits of combinatorial auctions in the light of results from the forthcoming US auction. This assessment could take the form of an ACA working paper on the applicability of combinatorial auctions to Australia, accompanied by a call for comment from interested parties.

RECOMMENDATION 8.1

The Australian Communications Authority should re-assess the advantages of combinatorial auctions over simultaneous ascending auctions in the light of forthcoming overseas evidence. If combinatorial auctions prove a workable and effective way of reducing significant exposure, the Authority should, following consultation, consider this format for future spectrum auctions where strong synergies between lots exist.

Valuing spectrum

Auctions have been instrumental in revealing the value that firms place on some parts of the spectrum in Australia. This is desirable from an efficiency perspective, because it allows economic decisions to be based on opportunity costs rather than on administrative formulae. This applies not only to decisions about how much spectrum to use, and in what band, but also about whether to use spectrum at all for communications purposes (when alternatives are available).

However, as the range of prices achieved in Australia and overseas demonstrates, auction results need to be interpreted with caution, as they can be strongly influenced by speculative bubbles, technological constraints and regulatory frameworks.

Moreover, several inquiry participants argued that the prices generated in some Australian auctions have indicated the limited amount of spectrum released by the ACA, rather than the true opportunity cost of the spectrum (Market Dynamics, trans., p. 110; Optus, sub. 17, p. 13; Vodafone Australia, sub. 23, p. 11, see chapter 11). Market Dynamics (trans., p. 129) argued that uncertainty about the true value of spectrum is creating distortions in resource allocation, by not allowing the various information delivery modes (such as radio and fibre optic cable) to be properly costed and compared.

Spectrum licences are relatively technology neutral in Australia and are not bound by the spectrum plan (see chapters 6 and 9). This may help to lessen artificial price differentials. As long as technological standards are not locked in, firms may be able to use other segments of the spectrum as substitutes for that being auctioned. For instance, 3G services can be provided using spectrum at 1.8 GHz or 2 GHz. Similarly, spectrum at 27 GHz and at 28/31 GHz is equally suited to fixed wireless services using high frequencies. Thus, any Government attempt to increase spectrum revenue through market segmentation is likely to prove less successful than in other countries, as licensees can substitute one band for another.

Encouraging competition

Auctions appear to have achieved the goal of promoting greater competition in the Australian telecommunications market. Some auctions were subject to competition limits and spectrum caps, specifically designed to encourage the entry of new firms and to moderate the power of incumbents. Outwardly at least, these measures appear to have achieved their objective (see chapter 6). Optus suggested that, in the 3G auction for example, competition limits successfully balanced the interests of new entrants and those of incumbents (Optus, sub. 17, p. 11).

However, it is not clear that the competition limits have been necessary to promote entry of new firms. In some cases, the technology neutral nature of the licences on offer may have played a greater role in encouraging new entrants. The ACA said that technology neutrality and small spectrum lot sizes, rather than competition limits, allowed entry by Arraycomm (ACA, trans., p. 176). More generally, the application of s. 50 of the *Trade Practices Act 1974* (TPA), should be sufficient to ensure that competition in the telecommunications industry is not reduced by the auction process. For this reason, the Commission recommends, in chapter 6, that those parts of the RC Act that impose limits be repealed or, at a minimum, be made consistent with s. 50 of the TPA.

Raising revenue

The success of Australian spectrum auctions in raising revenue is apparent from the $3 billion plus raised since 1994 (table 8.1). Two particular auctions stand out: the PCS 2000 auction (41 per cent of the overall revenue) and the 3G auction (37 per cent). Whether such a level of revenue raising can be maintained is uncertain. Following the ‘dot.com’ crash of 2001, demand for spectrum appears to have weakened worldwide, at least in the short term. In Australia, the proposed auction of two space licences by the ACA was cancelled in 2001 because of a lack of bidders. (One of the two licences was subsequently sold at the reserve price to the only interested party.)

On the supply side, the Commission’s recommendations that more spectrum licences be issued (including over encumbered spectrum) would mean an increase in the availability of such licences in the short to medium term, which may also affect revenue from auctions (see chapter 6).

FINDING 8.1

Spectrum auctions appear to have met the objectives assigned to them by the Government: efficient allocation of spectrum; accurate pricing of the resource; increased competition; and revenue raising.

8.3 Administrative pricing

The ACA's predecessor, the SMA, introduced the current system of administrative charges in 1995, following a public inquiry into the apparatus licence system in 1993 (SMA 1993). Similar charges were subsequently adopted for spectrum licences (SMA 1995a). According to the ACA (sub. 9, p. 18), the 1995 system of administrative charges drew on the following HORSCOTCI recommendations:

> The cost recovery component of annual charges for spectrum access be levied in such a way that the actual costs incurred by the spectrum manager on behalf of individual users are identified and recovered from individual users;
>
> To further assist in developing a transparent charging structure, the taxation component contained in the charges should be clearly identified; and
>
> A suitable means of recovering economic rent be formulated. (HORSCOTCI 1991, pp. xix–xx)

Charges implemented in 1995 by the SMA were part cost recovery and part tax on the economic rent associated with the use of spectrum. The objectives of cost recovery charges were consistent with the government's policy of charging for services provided at a client's request, to create efficiency gains by eliminating frivolous demand and to promote the development of service providers in the private sector (SMA 1993, p. 14). The charges imposed were designed to recover SMA direct costs and 'ongoing' (indirect) costs (for example, policy development). It was intended that the charges would promote equity among users (who would pay for the costs they imposed), and greater transparency (because interested parties would easily understand the licence fees) (SMA 1995b, p. 13).

The tax component of SMA fees was intended to provide 'a direct monetary return, via government, … intended to compensate the community where a user is benefiting from access to scarce spectrum' (SMA 1993, p. 15). A feature of the tax, therefore, was that it was proportional to the scarcity of the spectrum.

Until recently, ACA charges on apparatus licensees were structured in the same way as those devised by the SMA. They consisted of:

- an administrative component to recover direct costs;

- a notional indirect cost recovery component — the Spectrum Maintenance Component (SMC); and
- a notional tax component — the Spectrum Access Tax (SAT).

The ACA said:

> … the practice of disaggregating apparatus licence fees into a notional cost recovery component and a notional tax on the use of spectrum, has caused some confusion amongst clients. (ACA, sub. 9, p. 19)

This practice of disaggregation was discontinued at the end of 2001. The ACA also noted that both the RC Act and the *Australian Communications Authority Act 1997* (ACA Act) emphasized equity and efficiency in fee setting, over the recovery of spectrum management costs (ACA, sub. DR333, p. 4; pers. comm., 14 May 2002).

Apparatus licensees are now subject to two groups of charges:

- administrative charges (formerly the administrative component); and
- an annual transmitter or receiver licence tax (formerly a combination of SMC and SAT).

The RC Act also allows two administrative charges on spectrum licensees: an auction entry fee (s. 60[2]) and a spectrum access charge (s. 60[3g]). Spectrum access charges are applied once only, at the time of conversion from an apparatus licence to a spectrum licence, when the spectrum licence commences. The ACA also collects an annual tax on spectrum licence holders, under the *Radiocommunications (Spectrum Licence Tax) Act 1997*. This tax is smaller than the tax on apparatus licences, because the rental element of a spectrum licence is already captured by the auction price. The spectrum licence tax was originally meant to be the equivalent of the SMC, that is, the contribution of spectrum licensees to the ACA's indirect costs (ACA 1998e). However, the ACA recently indicated that, while the tax is still collected, it is no longer intended for this purpose (ACA, pers. comm., 13 May 2002).

Table 8.2 shows the amount of revenue collected by the ACA in spectrum fees. The nature and underlying rationale of some of these charges are examined in more detail below.

Administrative charges

Administrative charges are imposed to recover the direct costs to the ACA of a particular licensing transaction. Depending on the status of the licence, there are charges for: issuing a licence; renewing a licence; or processing a licence fee instalment. These charges are imposed under s. 53 of the ACA Act, which enables the ACA to make determinations about ‘charges relating to the ACA’s costs’.[9]

Table 8.2 **ACA radiocommunications revenue and expenditure**

	Revenue and expenditure			
Charge		*1999-2000*		*2000-01*
		$m		$m
Administrative component		5.9		5.1
Notional Spectrum Maintenance Component[a]	24.3		38.2	
Notional Spectrum Access Tax	62.4		74.9	
Annual transmitter or receiver tax:		86.7		113.1
Apparatus licence fees		**92.6**		**118.2**
Auction revenue (15 year)[b]		**1327.9**		**1325.7**
Spectrum access charge (15 year)		32.1		39.0
Spectrum licence tax (annual)		0.1		0.2
Spectrum licence fees		**32.2**		**39.2**
Total ACA expenses[c]		**50.1**		**59.6**
Of which:				
(ACA radiocommunications expenses)[a]	37.4		43.0	

a Includes Australia’s radiocommunications contribution to the International Telecommunications Union (ITU). **b** Includes upfront payment for 15 year spectrum licences, auction entry fees and withdrawal penalties. The annualised equivalent of auction revenue would be approximately $136 million per year (assuming a 6 per cent discount rate). **c** Includes costs incurred by the ACA for the regulation of telecommunications.

Data sources: ACA, pers. comms, 6 and 8 February 2002.

The direct costs underlying administrative charges are calculated using an activity-based costing method and are reviewed by the ACA at least every two years (PC 2001a). At least some of these charges are on a downward trend. For example, the administrative charge for the renewal of apparatus licences decreased from $20 to $7.70 between 1997 and 2001. FuturePace Solutions (sub. 59, p. 2) said the ‘the ACA have recently reduced their own costs for data entry from $40 to less than $2 per registration’. The ACA indicated it has made efficiency gains from improved data entry and money collection systems, such as B-Pay and Locked Bag payments (ACA, pers. comm., 22 January 2002). The introduction of web-based systems may have also contributed to reduced costs, and hence charges (ACA, trans., p. 180).

9 The Radiocommunications (Charges) Determination 2001.

Annual transmitter or receiver licence tax

This tax is set by determination of the ACA under the *Radiocommunications (Receiver Licence Tax) Act 1983* and the *Radiocommunications (Transmitter Licence Tax) Act 1983*. This charge is imposed whenever access to the spectrum resource is granted, either to transmit or receive signals. Although it is not made explicit in the legislation, this tax has two objectives:

- to recover the ACA's indirect costs in managing the spectrum (the function previously assigned to the SMC); and
- to 'encourage efficiency in the use of the spectrum and provide a return to government for the use of a scarce and valuable community resource' (the function previously assigned to the SAT) (ACA 2001d, p. 2).

Indirect costs are incurred on behalf of spectrum users generally and for activities that are not attributable to any particular licensees, such as international coordination, International Telecommunications Union (ITU) membership, domestic planning, interference investigation and policy development (PC 2001a). These costs are four to seven times greater than the direct costs of managing apparatus licences (table 8.2).

Until it was discontinued, the SMC provided a transparent way of identifying the proportion of apparatus licence fees which was meant to cover indirect costs. The SMC was set at 39.78 per cent of the SAT for all licensees. This was because it was regarded as too difficult to calculate the benefits to individual licensees from activities undertaken on behalf of all spectrum users. The use of the SAT as a basis for calculating the SMC was intended to achieve an equitable distribution of indirect costs, in that the agency's resources tended to be directed at higher demand spectrum and geographic locations (SMA 1995b, p. 13).

The other function of the annual licence tax is to charge for part of the benefit that spectrum users derive from the private use of a community resource (a 'rent'). As a result, Australia is one of only a few countries where the collection of licence fees (excluding auction revenue) exceeds cost recovery (see appendix C). The combination of the tax and the administrative component amounted to more than double the ACA's radiocommunications operating expenses in 1999-2000 and 2000-01 (table 8.2).

For each assigned apparatus licence, the annual tax is calculated according to a formula introduced by the SMA in 1995 (box 8.3).

Box 8.3 Calculation of annual transmitter and receiver licence tax

The basic formula for the calculation of the tax:

$$\textbf{Tax} = K \times (S_i, G_i) \times B_i \times A_i$$

where K = scaling constant allowing the overall level of fees to be set and adjusted (for CPI movements for example). The current value of K equals approximately 0.18.

$$\left.\begin{array}{l}\text{Si = spectrum location of licence}\\ \text{Gi = geographic location of licence}\end{array}\right\}\text{(Si, Gi) = location weight}$$

Bi = bandwidth of licence (in kilohertz [kHz], measured as the mid-point of several possible ranges)

Ai = area of coverage of licence (based on the power of the transmission, with a value of 1 [local] or 0.1 [sub-local]).

The (Si, Gi) weights (29 in total) are based on the density of spectrum use at various spectrum and geographic locations. They are calculated as the total bandwidth used by existing assignments in each spectrum/geographic location as a proportion of the bandwidth available. They are a proxy, therefore, for congestion in a particular band and location. For example, the largest weight is 10, for Australia-wide licences in the 70–960-megahertz (MHz) band. The lowest weight is 0.004, for licences in low population density areas in the band above 31.3 gigahertz (GHz). Weights may be updated as the density of spectrum use changes.

As an example, the value of the tax for a fixed earth licence in the high density region and spectrum range 70–960 MHz, using a channel with a bandwidth between 36 and 200 kHz, is given by:

$$0.18 \times 4.902 \times 118^{*} \times 1 = \$103.48$$

* Midpoint of 36–200 kHz.

For some services, such as land mobile systems, a loading coefficient equal to 74 is applied to the formula result, to account for the particularly high demand for the frequencies used. For other services, such as fixed links, a discount factor of 0.44 is applied to reflect the more intensive use of the spectrum they allow.

The formula does not apply to broadcasting licences, multipoint distribution station licences, some space licences or public mobile telecommunications services class B licences.

For a non-assigned apparatus licence, the tax is calculated using the formula, but the tax applying to the total volume of spectrum used is then divided by the number of individual licensees covered by that licence. (A non-assigned licence is issued when use of the spectrum does not require an individual frequency to be assigned to a particular user, or when the frequency is selected from a pre-determined suite (for example, an amateur radio licence.)

Sources: ACA (2001d); ACA (2002b); ACA, pers. comm., 30 January 2002.

Appropriateness of administrative spectrum charges

As explained above, administrative charges serve two broad purposes. First, they recover direct and indirect regulatory costs. Second, they tax the benefit derived by the licensee from the use of a valuable community resource. These two functions are discussed in more detail below.

Cost recovery

Most inquiry participants agreed with the practice of recovering from spectrum users the direct costs they create for the ACA (for example, Bramex, sub. 64, p. 3; Bureau of Meteorology, sub. 5, p. 7). The Commission previously has noted that recovery of direct and indirect costs by a regulatory agency is often justified on equity and allocative efficiency grounds (PC 2001a). However, charging should be cost-effective and consistent with the agency's policy objectives. This means, for instance, that charging should not encourage unlicensed spectrum use.

The requirement that charging be cost-effective is particularly important when recovering indirect costs. While apportioning direct costs (for example, of licence renewal) is generally straightforward, apportioning indirect costs among individual users, by definition, is not. Several accounting techniques exist to apportion indirect costs, but they can be difficult or costly to implement (PC 2001a). Yet, to have incentives that lead to allocative efficiency, users should face the full cost they impose on an agency (as long as these costs are incurred efficiently).

As mentioned earlier, the spectrum licence tax applying to spectrum licensees is no longer regarded as a cost recovery charge by the ACA. This raises the question of what purpose the tax serves, given that spectrum licensees have already paid an auction bid or a conversion price to acquire the spectrum. The Commission considers that the ACA should clarify the purpose of this tax. If the amount of the tax (based on bandwidth and population coverage) is related to the value of spectrum, then the tax is redundant and should be abandoned. If, on the other hand, the tax is still a notional cost recovery fee, it should be presented as such to licensees, in the interests of transparency and accountability.

RECOMMENDATION 8.2

The Australian Communications Authority should clarify the purpose of the spectrum licence tax. If the tax is intended to reflect the value of the spectrum denied, it should be discontinued. If the tax is intended — even notionally — for the cost recovery of indirect costs, its purpose should be made clear to spectrum licensees.

Apparatus licence fees give rise to a similar issue. While no longer identified through the SMC, the ACA continues to recover indirect costs in practice. Unlike the SMC, however, the cost recovery component is no longer obvious to spectrum users. The ACA indicated that abandoning the SMC construct was consistent with the Government's intention to use price setting as a means of promoting spectrum management objectives (ACA, pers. comm., 14 May 2002).

The Commission considers that recovery of regulatory costs should be transparent for efficient management of spectrum. Without it, users are unable to identify what portion of their spectrum licence fees constitutes cost recovery. As a result, they may over-consume regulatory services. For example, they may not take sufficient precautions to avoid interference, because the costs of interference investigation is not made explicit in the charges they face.

The Commission agrees that the SMC suffered from a major weakness, inherent in any uniform cost recovery levy. Uniform levies lead to indirect cross-subsidisation of some users by others because they apply an equal rate to all users, even though they do not create the same costs for the regulator. For example, it is likely that holders of space licences place a greater burden on the international co-ordination functions of the ACA than do fixed links users.[10]

In general, indirect costs incurred by the ACA on behalf of different categories of user are likely to differ not only according to the quantity of spectrum each category uses, but also according to how it uses the spectrum. The Commission considers that levies should be implemented carefully, because they create potential for cross-subsidisation and thus distort resource allocations. However, in some cases, levies may be justified. In these cases, in the interests of transparency and accountability, the indirect costs associated with different categories of users should be made explicit (PC 2001a).

When levies are unavoidable because some costs cannot be allocated directly to individual users, regulatory agencies should distinguish among different groups of users, based on the costs they create for the agency. Different levy rates could then apply to each group of users, based on a specific, relevant cost driver (PC 2001a).

The Commission considers that flexible levies have potential efficiency advantages. Whether this potential can be realised depends on the cost-effectiveness of devoting resources to designing and implementing better targeted levies. If the administrative costs are high, then they may exceed any allocative efficiency benefits resulting from lower cross-subsidies. However, around 90 per cent of the ACA's

[10] Higher administrative costs associated with space licences are recovered partly through higher direct charges (ACA, sub. DR333, p. 5).

radiocommunications management costs are presently unassigned to individual users (table 8.2).[11] This suggests that scope exists for a cost-effective, more precise apportioning of the ACA's indirect costs, for example, through the extended use of activity-based costing. Guidelines for the design of appropriate indirect cost recovery arrangements are provided in PC (2001a).

FINDING 8.2

Recovery of the direct and indirect costs of spectrum management is appropriate, as long as it is administratively efficient, consistent with radiocommunications policy objectives and minimises cross-subsidies between groups of users.

RECOMMENDATION 8.3

The Australian Communications Authority should examine the cost effectiveness and policy consistency of introducing a new system for recovering indirect costs of spectrum management, using a suite of levies designed to recover the costs imposed by different categories of users.

There is also potential for cross-subsidisation between spectrum users covered by class licences and other licence holders. Class licences attract no fees, but their management still creates costs for the ACA. Recovery of these costs is included in spectrum taxes, which implies a financial transfer from other licensees towards class licence users. At present, this transfer is trivial, given the negligible costs of class licensed spectrum management. In future, the magnitude of this transfer could increase significantly, if new technologies in the class licensed bands spread quickly (for example, wireless local area networks, see chapter 2).

Class licences are analogous to 'public parks', where anybody may operate radio equipment that meets certain requirements (see chapter 6). Once a park exists, the marginal cost of granting entry to one more user is zero or close to zero. Therefore it is unlikely to be efficient to charge for access, especially when it is not cost effective to individually license users (see chapter 9). However, it would be inefficient also to charge other spectrum users for the cost of managing class licences. As part of the ACA's review of its cost recovery arrangements, alternative means of funding the management of class licences should be investigated. Solutions could range from imposing levies on products operating under class licences to taxpayer funding, depending on their relative cost-effectiveness and efficiency (PC 2001a).

[11] The percentage of costs assigned directly is calculated as the ratio of the administrative component to the ACA radiocommunications expenses in table 8.2.

Taxation

The economic rent component of the annual tax is calculated on the basis of spectrum 'denial'. Spectrum used and spectrum denied are not the same because protection against interference requires the existence of 'guard bands' (see chapter 9). However, if no-one but the licensee is interested in using that segment of spectrum, then there is no spectrum denial and the resource is not scarce in that range of frequencies. Where no scarcity exists, the opportunity cost of the spectrum is zero and it is not efficient to recover more than the administrative costs (direct and indirect) of managing the resource (see chapter 4). This requires that charges for indirect cost recovery should be identified separately from any tax component of spectrum fees (as recommended above).

Efficient pricing requires that a licence for spectrum that is uncontested (following calls for expressions of interest by the ACA) should not be charged more than is required to recover costs fully, even if the licensee intends a high-value use for the resource.[12] In such circumstances, it is not desirable to base charges on alternative considerations, such as a 'fair return for the community' or Government revenue raising.

RECOMMENDATION 8.4

To achieve efficient outcomes, spectrum charges should be based on opportunity cost, that is, on the value of the best forgone alternative use of that spectrum. If no such alternative exists, charges should not exceed full cost recovery. Charges should not be aimed at raising government revenue or providing a return to the community.

Where there is spectrum scarcity — that is, where two or more users are competing to use the same frequency — opportunity costs exist and charges in excess of administrative costs are warranted (see chapter 4). The question arises, however, of how those charges should be calculated in order to promote efficiency.

The formula used by the ACA to calculate the annual apparatus licence tax (box 8.3) belongs to the general category of 'incentive fee formulae' (also known as administrative incentive pricing). Such formulae attempt to calculate fees that are reflective of the economic value of the spectrum (Youssef, Kalman and Benzoni 1995). In the ACA formula, that value is assumed to vary according to:

- the bandwidth used by the device;
- the level of spectrum congestion;

[12] This was also suggested by the Radiocommunications Review (DCITA 1998).

- the area of coverage;
- the spectrum location of the frequency; and
- the type of service supplied.

Such a formula is termed ‘incentive’ because it attempts to simulate market prices for spectrum. This aims to encourage licensees to use spectrum more sparingly, to move to less congested bands and to hand back spectrum they do not need. Market prices are based on spectrum scarcity which, in the formula, is proxied by the weights for spectrum location and geographic location (Si and Gi in box 8.3). Incentive formulae are now used in many countries (see appendix C). They are regarded as an advance on strict cost recovery in terms of the efficient use of spectrum (ERC 1999).

However, this approach to spectrum pricing suffers from a number of shortcomings:

> The problem with these formulas is that efficient spectrum management requires the determination of price, equal to the marginal willingness to pay for every assignment. There is no reason for these prices to be the same for each assignment, nor for the correct price to vary according to the proposed fee schedules. (Youssef, Kalman and Benzoni 1995, p. 93)

Some of the features of the formula presented in box 8.3 illustrate the difficulty of setting efficient administrative prices.

First, once a formula is set, it is largely inflexible. While spectrum congestion in different areas and bands can change rapidly over time, very few congestion weights (that is, combinations of spectrum and geographic location) have been adjusted since their introduction in 1995.

Second, each band of spectrum used for weighting purposes (‘weighting bands’) covers a large number of Spectrum Plan bands. For example, the 70–960-MHz weighting band contains Spectrum Plan bands dedicated to defence, broadcasting, mobile services, and fixed services. Because of the diversity of uses and charging mechanisms, spectrum congestion and scarcity vary markedly within weighting bands, sometimes in the space of a few MHz or kilometres. The Bureau of Transport and Communications Economics (BTCE 1990, p. 146) estimated that the degree of congestion at the lower end of the VHF band in Sydney ranged from under 10 per cent in aeronautical frequencies to above 50 per cent in fixed/mobile bands, reaching 100 per cent in broadcasting bands. Fees charged per MHz showed similar variation. Such anomalies flow from prescribed spectrum uses and different approaches to pricing. They almost certainly continue to exist in apparatus licensed bands. The removal of these anomalies would require either a less prescriptive Spectrum Plan, or the spectrum licensing of those bands. Otherwise, the intensity with which contiguous Spectrum Plan bands are used will continue to vary considerably.

It would be advantageous, at a minimum, for formula weights to take the very heterogeneous nature of congestion into account. At present, the weighting bands used by the ACA for charging purposes are much larger than those defined in the Spectrum Plan. This can lead to spectrum users receiving inefficient price signals. If, for example, a user deliberately sought a licence to occupy an uncongested portion of an otherwise congested band (in a given geographic area), then he or she would pay the same tax as other users competing for congested segments of that band. The current formula cannot distinguish between users of scarce and non-scarce spectrum within the broad weighting bands and geographic areas. Thus, spectrum congestion and spectrum fees are not equal across contiguous bands which have otherwise similar technical characteristics.

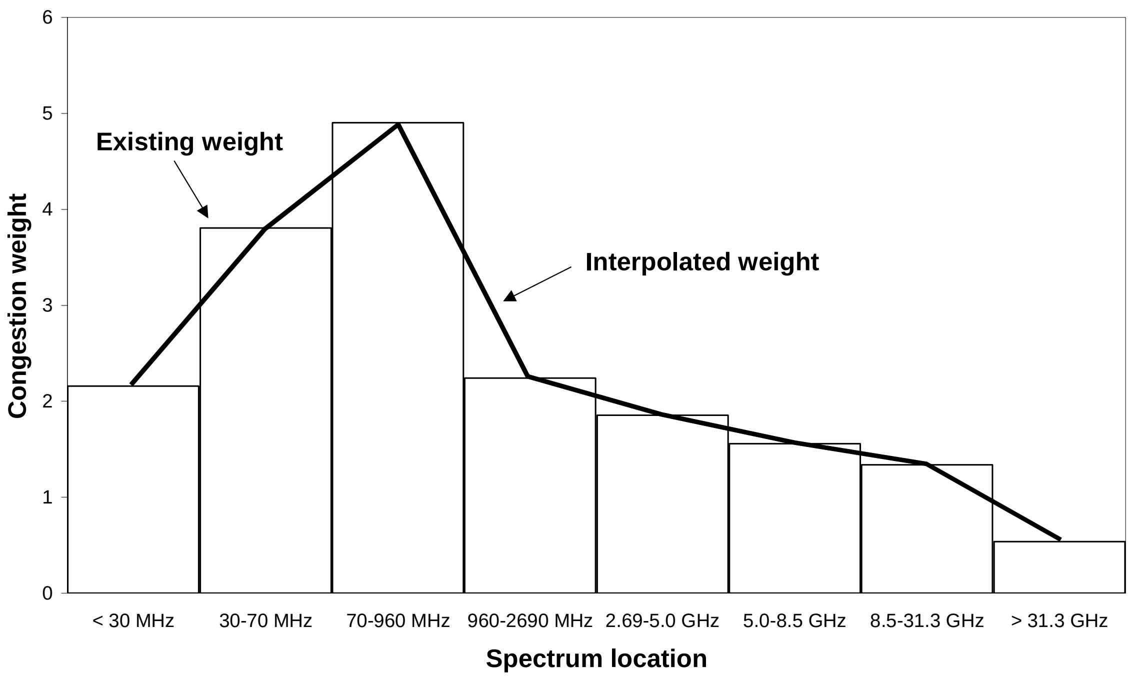
Another consequence of the formula used by the ACA is that fees vary discretely rather than continuously — a result of the weights and bandwidth ranges used to calculate the annual tax. Thus, fees can vary significantly within a few MHz of spectrum location and bandwidth use. The 'lumpiness' of fees calculated in this way can lead to inefficient use of spectrum if licensees face incentives to change their spectrum use purely to avoid 'edge effects'.

The ACA acknowledged that continuous pricing with respect to bandwidth use is a desirable, long-term objective (ACA, sub. DR324, p. 10). Regarding the lumpiness of fees with respect to spectrum location, it argued that edge effects are justified by the artificial constraints international and domestic planning put on spectrum uses (ACA, sub. DR324, p. 10). However, if this argument were taken to its logical conclusion, such effects should exist between each of the Spectrum Plan bands and not just between the broader weighting bands.

Moreover, the concept of opportunity cost suggests that the price of spectrum should be dictated by its value in the best alternative use forgone (see chapter 4). Given that most bands can support multiple uses — even under spectrum planning — there is no *a priori* reason why two contiguous bands should not have very similar charges applied to them, if they are able to sustain similar services.

The spectrum weights adopted by the ACA tend to follow an inverted U shape. This seems to indicate that — on average — congestion increases at first and then decreases as one moves up the spectrum (figure 8.1). It would be desirable for fees to reflect more accurately this congestion profile. This could be achieved, for each frequency assignment or each Spectrum Plan band, by calculating a specific weight based on the interpolation of the existing weights (figure 8.1). Such a modification would avoid large disparities in fees between neighbouring licences, and would generate incentives for a more efficient use of spectrum.

Figure 8.1 **Interpolation of spectrum location weights**[a, b]



a Using spectrum weights for assignments in high density geographic areas as examples. **b** Assumes a constant level of congestion at both ends of the spectrum.

Data sources: ACA (2001d); Productivity Commission estimates.

A final issue regarding the apparatus fee formula is the transparency and accountability of the 'K' constant and the adjustment factors (box 8.3). The K constant converts the various formula elements (weights, power, bandwidth) into actual fees. It also incorporates movements in the consumer price index (CPI) into the fees (ACA 2001d). Adjustments factors modify the K constant so as to improve the flexibility of fees applying to different classes of service.

There are two specific problems with the use of the K constant. First, neither the value of K nor those of the adjustment factors are communicated to licensees. A licensee would need to make supplementary inquiries to determine how the fee tables published by the ACA are obtained from the fee formula. This goes against the transparency and accountability principles of good public administration.

Second, the basis for setting the value of the K constant is unclear. Its initial value of 0.152 was set so as to ensure the total apparatus licence fee did not change significantly when the formula was introduced in 1995. Since then, the K constant has risen by around 18 per cent, in line with the CPI over the same period.

Nonetheless, the existence of the K constant (in addition to the explicit weights in the formula) gives the Government the ability to manipulate fees without licensees being aware of the reasons behind the changes. This could create incentives for revenue raising by the Government, and could mean that apparatus licence fees exceed the opportunity cost or the administrative cost of the spectrum used.

Several inquiry participants expressed reservations about the adequacy of the formula. Bramex (sub. 64, p. 3) questioned the apparent arbitrariness of the formula. Market Dynamics (sub. 33, p. 23) doubted the appropriateness of the geographic weights, because they refer to the location of a device, not to its transmission reach. FuturePace Solutions (sub. DR314, p. 26) argued that fees should be based on the occupied bandwidth of a transmitter, not on the channel width.

The final report of the Radiocommunications Review recommended that:

> The ACA continues to consult widely on the way charges are developed in order to create a more robust charging model that will assist all sectors of the industry. (DCITA 2001, p. 35)

The ACA acknowledged that:

> … in the interests of simplicity and accessibility to spectrum users, the fee formula incorporates some compromises and a degree of crudeness in the manner in which different factors are measured and charged. That said, we are unaware of any more robust models around the world. Most spectrum administrations around the globe have fees based on cost recovery alone and very few appear to have fee models designed to encourage efficient use of spectrum. (ACA, sub. 9, p. 18)

FINDING 8.3

It is difficult to design an administrative pricing framework that replicates market prices closely. The apparatus licence charging model in use by the Australian Communications Authority has some deficiencies.

The Commission considers that a model with the following characteristics would improve the efficiency and transparency of administrative pricing:

- a separate framework for cost recovery of indirect costs;
- fees that increase continuously with the amount of bandwidth used. This could be achieved by re-defining the bandwidth variable (Bi in box 8.3) as that actually used by the device, rather than the mid-point of the relevant bandwidth range;
- fees that vary continuously with the spectrum location of the device, rather than remain constant within a spectrum location range (Si in box 8.3). This could be achieved by interpolating the existing weights, thus providing a smooth transition between weights rather than ‘step’ changes;

- removal of the distinction between K and the two adjustment factors. Each of the three current categories of service should have its own fee scaling constant, the value of which should be made explicit in ACA publications; and
- explicit indexation of overall fees on movements in the CPI. Any non-CPI related change in fees should be justified by the ACA.

RECOMMENDATION 8.5

The Australian Communications Authority should implement a more transparent and flexible model for calculating the apparatus licence tax. In particular, it should ensure that all the elements required for the calculation of fees are given to licensees, and that, as far as possible, fees vary in a continuous — rather than discrete — fashion.

Shadow pricing

The K constant and the adjustment factors apply equally to all apparatus licence fees. They cannot be adjusted in response to new information about market values, such as that revealed at auction. This can lead to price distortions between comparable licences that are formula priced and market priced.

Market Dynamics argued that apparatus licences are usually underpriced relative to spectrum licences (trans., p. 109). As evidence, it calculated the value of the spectrum denied by an apparatus licensed wide area device operating in the 3.4-GHz band near Newcastle. Using the annualised auction prices achieved in the 3.4 GHz auction of spectrum licences as a benchmark, and its own propagation modelling software to calculate spectrum denial, it estimated the value of the spectrum used greatly exceeded the current apparatus licence fee for the operation of that device (sub. 33, pp. 22–24).

Under-valuation of apparatus licences relative to comparable spectrum licences does not appear to occur in all cases. Coutts (1999) found that the aggregate revenue raised by the 1998 PCS auction was only 75 per cent of the present value[13] of the total apparatus (GSM) licence fees which would be required to gain access to the same amount of spectrum nationally over 15 years. He attributed the 25 per cent ‘discount’ in the value of the spectrum licence to an adjustment for risk and uncertainty over 15 years, and to no presumption of renewal for that type of licence.

Shadow pricing is one way of avoiding distortions between administrative prices and market prices. Strictly speaking, shadow pricing means calculating the price

[13] Calculated over fifteen years using a discount rate of 7 per cent.

that would prevail in a perfectly competitive market. By definition, that price would equal the opportunity cost of spectrum, that is, its value in the best alternative use forgone. More generally, shadow pricing means setting administrative prices by reference to any relevant market information.

The ACA indicated that it shadow prices apparatus licence fees against the following:

- alternative (non-wireless) service delivery mechanisms;
- auction outcomes; and
- trading in secondary markets. (ACA, sub. 9, p. 19)

However, the ACA stressed the difficulty in using market values to price apparatus licences:

> The ACA has discovered that there is little reliable information available about spectrum values and that market prices are volatile … Because of this it has been very difficult for the ACA to justifiably vary licence fees even where it has market information at a particular point in time. (ACA, sub. DR333, p. 5)

Similarly, the ACA (trans., p. 178) indicated it has found 'more problems than answers' in its attempts to shadow price spectrum against alternative technologies such as fibre optic cable. These problems arise because the economics of different delivery platforms vary considerably based on geography and other characteristics. Thus, pricing spectrum use in rural areas based on the cost of alternative technologies (say, fibre optic cable) could result in very high prices being charged for spectrum. This would be inefficient where spectrum is not scarce, because it would unnecessarily preclude socially desirable uses of spectrum.

The pricing approach adopted by the Radiocommunications Agency (RA) in the UK includes a form of shadow price (box 8.4). The RA's stated pricing philosophy is that, for spectrum to be allocated efficiently, its price must be equated with its marginal value in its next best use (including the same use by a different user). This is equivalent to the opportunity cost of spectrum in a perfectly competitive market and is therefore efficient. The RA calculates the marginal value of spectrum by reference to the least-cost available alternative to having access to the spectrum under review. This alternative can be radio-based or not (for example, fibre optic cable can be substituted for fixed links).

Box 8.4 Administrative pricing of spectrum in the United Kingdom

Administrative pricing of spectrum in the United Kingdom (UK) was first introduced as part of the Wireless Telegraphy Act 1998, following a 1996 study by consultants National Economic Research Associates and Smith System Engineering (RA 1996). The technique developed for the Radiocommunications Agency (RA) is used where the spectrum is congested and spectrum users are able to use alternative technologies. It is not used where there is no excess demand, where spectrum use cannot change (regardless of price), where policy impediments to charging exist or where it is not feasible to administer spectrum pricing.

The rationale underlying the RA pricing methodology is that profit-maximising firms will use spectrum as long as their marginal revenue exceeds their marginal cost. In a competitive spectrum market, marginal cost (the price of spectrum) will measure the true opportunity cost of spectrum. That cost can be regarded as the highest cost from forgone savings of those excluded from the spectrum which is being priced. The spectrum regulator's task, therefore, is to discover that opportunity cost by examining the difference between the cost of using the spectrum in question and the cost of the least expensive practicable alternative to the existing assignment. That alternative may be another service, frequency band, technology or medium, such as fibre optic cable.

Based on this premise, the UK method may be summarised as follows.

- *Define alternatives to the current assignment*. For example, in the case of private business radio used by taxi firms, couriers and so on, alternatives are the use of narrowband technology, a move to trunked systems, more efficient sharing and re-use, and the move to a different frequency band.
- *Cost the alternatives over the lifetime of the equipment*. The additional cost of the cheapest alternative (in the example above, this was a move to trunked systems) compared with current radio costs provides a measure of the marginal value of the spectrum for the service.
- *Derive licence fees from the marginal value of spectrum on the basis of pre-selected parameters*. In the example of private business radio, these proposed parameters are bandwidth, coverage area and the degree of sharing as indicated by the number of mobiles as a proxy for traffic generated.
- *Apply 'modifiers'*. These numerical factors take account of various spectrum management factors, such as competition, choice and diversity, quality of service and spectrum use constraints.

Implementation of administrative pricing in the UK was staggered, starting with the most congested sectors of the spectrum. For all sectors, a four year transitional period was allowed, during which fees were progressively adjusted. Fees were initially capped at 50 per cent of the full opportunity cost of spectrum. The recent Cave Review (Cave 2002) recommended the lifting of that cap.

Sources: RA (1996, 1999, 2001c); Green (1999); Cave (2002).

The RA methodology does not seem entirely satisfactory from an efficiency standpoint. Spectrum use is dictated through planning and cannot be altered. The RA therefore calculates the least-cost alternative available to the next-best user providing the same type of service. For example, while it recognises that spectrum currently used for fixed links services would achieve a much higher value if used for mobile phones, its pricing of that spectrum only considers the extra cost incurred by another fixed link operator when deprived of it (RA 1996, p. 28). Given the high value of the best alternative use (mobile phones), this cost is not a measure of the opportunity cost of spectrum.

In Australia, spectrum licences offer the possibility of changing the use of any part of the spectrum, including that used for fixed links. This means that all alternative uses should be considered when pricing spectrum, not just those which are allowed under the Spectrum Plan.

A possible example of shadow pricing against auction prices is the one-off increase in May 2001 of the annual apparatus licence fees charged for GSM spectrum in the 900-MHz band (the PMTS class B licences). Optus and Vodafone purchased carrier licences in 1991 and 1992 for a period of 25 years. With the licences purchased through a combination of beauty contest and tender, the cost of annual licence fees for the spectrum accompanying the licences can be expected to have been factored into the firms' tender price.

However, following a determination from the Minister for Communications, fees for these licences were increased by 150 per cent in 2001. This increase brought annual fees approximately in line with (annualised) prices received from the auctioning of spectrum in the PCS 2000 and the 3G auctions (table 8.3).

Several inquiry participants argued the fee increases imposed on 900 MHz licensees were unwarranted, given that they were not foreshadowed in the initial licence contract and not explained by the Commonwealth Government at the time of the increase (Optus, sub. 17; Vodafone Australia, sub. 23; Bramex, sub. 64). They attributed the decision to increase the fees to a Government revenue-raising objective and to the Government's presumption that spectrum prices achieved during the speculative telecommunications 'bubble' of 2000 were indicative of a long-term trend.

In general, re-balancing annual apparatus licence fees to reflect market values is justified on efficiency grounds. Different prices for comparable spectrum, depending on whether they are charged administratively or at auction, will create distortions.

Table 8.3 **Increase in PMTS class B (GSM 900) annual apparatus licence fees**

Year	*Notional fee*[a]	*Actual fee*[b]	*Actual fee + surcharge*[c]	*Auction results*[d]
	$'000/MHz	$'000/MHz	$'000/MHz	$'000/MHz
1992	700.0	140.0	140.0	..
1993	708.4	283.4	283.4	..
1994	721.9	433.2	433.2	..
1995	734.1	595.5	595.5	..
1996	787.1	787.1	1 277.2	..
1997	789.5	789.5	1 279.5	..
1998	789.5	789.5	1 279.5	580.7[e]
1999	824.5	824.5	824.5	..
2000	824.5	824.5	824.5	2278.5[f]
2001	2139.9	2139.9	2 139.9	2787.5[g]

[a] Does not take into account the 'phasing in' period, from 1992–1995. [b] Allows for fee remissions during the 1992–95 'phasing in' period. [c] A 'GSM surcharge' of $12 246 667 per carrier for three years coincided with the assignment of extra spectrum to each of the three carriers. [d] Annualised amounts based on a 6 per cent discount rate. [e] Based on the average cost of coverage of all capital cities in the first PCS auction (800-MHz band only). [f] Based on the average cost of coverage of all capital cities in the PCS 2000 auction. [g] Based on results of national and regional lots in the auction of 2.1 GHz (3G) spectrum (assumes 20 MHz across Australia). **..** Not applicable.

Source: Commission estimates based on ACA data and ACA pers. comm., 21 December 2001.

However, two caveats to this principle are necessary. The first concerns sovereign risk. In 1991 and 1992, the companies that tendered for the PMTS licences could not have foreseen that fees would more than double in 2001. Had they been able to predict that increase, they might have applied a risk discount to their tender price and/or modified their investment strategy. An unexpected fee increase during the term of a licence is likely to render previous investment decisions inefficient and create uncertainty in the minds of spectrum users about the value of holding licences in the future. This is a classic example of the 'hold-up' problem (see chapter 6). To address this problem, the terms of the licence should include the conditions under which fees can be increased (if at all). This would ensure that sufficient information is available for market pricing to be efficient.

A second caveat is that re-balancing based on shadow prices must ascertain that auction and other market prices are realistic. Raising annual fees based on the results of a single auction at the height of a speculative episode would result in over-pricing and inefficiency. Further, it could lead to volatility in fees and uncertainty.

The difficulty of deciding when to shadow price and when not to is exemplified by the debate regarding conversion prices for multipoint distribution systems (MDS) licences (box 8.5).

Box 8.5 **Conversion of MDS spectrum licences**

In 1994-95, the Spectrum Management Agency auctioned apparatus licences suitable for multipoint distribution systems. In addition to the amount bid at auction, these licences also attracted annual licence fees. In 2000, the Australian Communications Authority (ACA) converted some of the licences in the MDS B band (2302–2400 megahertz) to spectrum licences. In establishing a price for conversion, the ACA took the view that the 'resource rent' element of these licences had already been paid for in the original auction. Therefore, conversion prices were based on the net present value of the revenue stream from annual fees over 15 years.

Following conversion, one set of spectrum licences was purported to have been traded in the secondary market at a price well in excess of the conversion price. Similarly, auction prices obtained in the same year for spectrum licences in a comparable band (3.4 gigahertz) were well above those charged by the ACA for conversion.

Some inquiry participants concluded from the alleged price differentials that regulators are typically unable to decide administratively the commercial value of the spectrum, and that auctions and auction results are always the best option for pricing licences. In reply, the ACA noted that the secondary trade mentioned above involved additional assets as well as the spectrum licences and that the licences have subsequently been revalued at zero by the purchaser.

Sources: Market Dynamics (sub. 33); FuturePace Solutions (sub. 18); ACA (subs DR324 and DR333).

The two caveats above suggest that shadow pricing should not lead to uncertainty among licensees. Shadow pricing should be transparent, and any arrangements for its application should be stated clearly in the terms of the licence.

RECOMMENDATION 8.6

Shadow pricing of apparatus licences is a suitable technique for avoiding distortions between different types of licence, but it should be undertaken in a transparent and predictable manner that incorporates necessary adjustments to make comparisons meaningful.

The opportunity for shadow pricing differs between apparatus licences that are priced according to the formula and those that are priced 'off formula'. At present, the ACA has little latitude to incorporate market value information into apparatus licence fees that are governed by the formula. Market Dynamics criticised this situation:

> … the failing, in my view, is that we … have not reflected [in the] licence fee formula what we've learnt about spectrum values. (Market Dynamics, trans., p. 109)

While the ACA attempts to reflect high demand for some types of licence through the use of an adjustment factor (box 8.3), there is no indication that the value of the factor is based on shadow pricing. The ACA should consider incorporating shadow pricing information in the formula. If shadow prices are based on auction results, the ACA would need to ascertain that these results are an accurate measure of the long-term value of spectrum, not the product of a speculative boom or a similarly short-lived event. The ACA would also need to account for the different characteristics of formula-priced and auction-priced licences. The former are invariably apparatus licences, while the latter usually are spectrum licences, so that direct comparisons are difficult. This suggests that any shadow prices should be adjusted prior to being applied.

The need for a formula is likely to decline over time as the deployment of spectrum licensing proceeds. Where apparatus licences are converted to spectrum licences, the price initially would be negotiated between the incumbent and the ACA, giving the latter the opportunity to incorporate any relevant shadow pricing information. Further, the Commission recommends, in chapter 6, that spectrum licences generally should be re-assigned by market-based means three years before their term expires. This means that market forces should eventually be able to influence the price of licences directly.

8.4 Conclusion

The price charged for spectrum is a crucial determinant of its efficient use. If users face the true opportunity cost of spectrum, then they are automatically encouraged to economise on its use and to allocate it to its most valuable purpose. If rights to use spectrum were traded in an ongoing market like most other commodities, then the interaction of supply and demand would generate prices based on opportunity costs. Efficient use of spectrum would follow.

Where spectrum markets are relatively weak or absent, the spectrum regulator faces the task of simulating the operation of that market. The SMA/ACA has done so by using auctions and incentive-based administrative pricing. Auctions appear to have successfully allocated the right to use spectrum to its most efficient uses and users, in a transparent manner. The same cannot be said of administrative pricing. While the current formulaic approach is better than an administrative cost recovery approach, its flexibility and transparency could be improved. In their current form, administrative prices have the potential to distort the allocation of spectrum. As the volume of privately owned and traded spectrum increases over time, the need for administrative pricing will diminish, thus moderating any distortions. Administrative prices, however, will continue to play an important role during the transition period. It is important, therefore, that the basis for their calculation is improved.

9 Managing interference

The primary rationale for government intervention in the market for spectrum is to address interference, in order to facilitate the efficient use of spectrum (see chapter 4). This is fundamental to the Australian Communication Authority's (ACA's) planning and licensing activities. This chapter examines several other ACA activities undertaken to manage interference, including the technical specification of spectrum licensing, mandating technical standards and maintaining a register of radiocommunications licences and devices.

9.1 Spectrum licensing

Spectrum licences are designed to grant licensees flexibility in their use of spectrum. However, the potential to cause interference to other spectrum users must still be managed. This is done through two mechanisms: the specification of licence core conditions; and the device registration process.

Core conditions

Core conditions are the technical parameters used to define the boundaries of spectrum licences. The core conditions require that any interference created by the licensee should fall within acceptable limits, when measured at the geographic and spectrum boundaries of the licence. Put simply, they require the spill-over power of licensee transmissions (measured at the licence's boundary) to be below a specified amount.

Spectrum licences are often described as being technology and use neutral (see chapter 11). However, the core conditions, along with the configuration of spectrum lots for sale, influence how spectrum licences are used.

The core conditions do this in two ways. First, a licensee cannot do anything that would breach their core conditions. Second, and less obvious, the conditions set the 'background noise level' that adjacent licensees must expect at the boundary. Different core conditions will limit what adjacent licensees can do with their spectrum.

Similarly, the configuration of lots for sale can influence the likely use. For example, the majority of lots in the 2 gigahertz (GHz) spectrum licence allocation were configured in paired bands to facilitate IMT-2000 telecommunications services:

> Since this spectrum is being re-allocated primarily to promote competition in the telecommunications market and facilitate the provision of IMT-2000 services (the so-called third generation services), it is being configured in a way which facilitates telecommunications use. (ACA 2000d, p. 2)

In theory, truly neutral core conditions would specify that a licensee's signals must be undetectable at the boundary. In such a case, licensees could employ the spectrum for any use, using any technology, knowing that there would be no interference at all from adjacent licensees. A very sensitive receiver could set up 'next door' to a powerful transmitter and expect zero interference. However, this neutrality (even if possible, given the difficulty of estimating signal propagation) would come at a significant cost. It would require wide buffer zones at licence boundaries in order to ensure zero emissions. This would severely restrict the technical efficiency of spectrum use.

To improve technical efficiency, core conditions assume a 'likely use'. If it is assumed that everyone has the same broad use (for example, mobile telephony) a common level of tolerable interference can be determined. With the likely use in mind, the core conditions set an *acceptable* (not zero) level of interference at the boundary.

The adoption of likely uses is evident in the names of Australia's various tranches of spectrum licensing. Spectrum Engineering Australia stated:

> Despite the 'purist concept' of 'unspecified purpose', technical constraints are placed on the licences based on that expected use. We then proceed to have the 'PCS [Personal Communications System] Auction' or the 'LMDS [local multipoint distribution system] Auction', in clear contravention of the spectrum licensing ideal. (sub. 30, p. 8)

The improvement in spectrum efficiency from assuming a likely use comes at the cost of technical neutrality. This can reduce the efficiency of spectrum over time. Although there is still a degree of neutrality — a licensee does not have to follow the assumed use — any other use is unlikely to be as spectrum efficient, and the licensee must bear the additional costs of designing a system that is consistent with the core conditions. Licensees are also able to negotiate changes to core conditions with adjacent licensees, although there is little evidence of this occurring to date. The ACA recognised the trade-off between the *technical* efficiency possible when a specific likely use is assumed, and the potential for dynamic *economic* efficiency from technology neutral licences:

> In an ideal world you want something which is completely transparent to the assumed use, so it can be used for fixed service or a mobile service or radio navigation service, without naming a whole bunch of things. Our difficulty has been coming up with the set of conditions which allow that, but at the same time don't unnecessarily harm the most likely users of the spectrum. We have had examples where that's been alleged as being the result of the technical frameworks. So we've had people come to us and say, 'You might have made them technologically neutral, but it's at the cost of the useability of the spectrum.' (ACA, trans., p. 599)

Some inquiry participants argued that the ACA had stepped beyond 'likely use' to bias conditions in favour of particular technologies. FuturePace Solutions raised the 3G spectrum licences as an example:

> FuturePace has identified a problem with the most recent 3G technical framework. … it was both biased and partially defined assuming WCDMA [wide band code division multiple access] as a likely use. (sub. DR342, p. 7)

This is a serious concern. The technical efficiency arguments for assuming a likely *use* are compelling, but the more narrowly licences are defined, the less flexible, and less marketable, they become.

In its draft report, the Commission requested further information on the implications of adopting generic boundary conditions for spectrum licences. By 'generic' conditions, the Commission intended a standard set of technology neutral conditions that would apply to all spectrum licences, unless there was good reason to vary from them. As is currently the case, licensees could then negotiate to change conditions. This approach would have the advantage of assuming a broad category of likely use (allowing 'non zero' emission limits), but avoid the major problem of biasing conditions in favour of particular technologies.

The Commission received little direct evidence on standardising boundary conditions. However, several inquiry participants did note that assuming a likely use constrained potential licensees' choices. For example, FuturePace Solutions stated:

> FuturePace continues to argue against a likely use as a base for the development of spectrum licensing frameworks. We believe it is both possible and essential to design frameworks without an in-built likely use. Any bias that industry deems necessary should come as a commercial decision by industry after an underlying technology-neutral framework has been first provided by government. We believe that licensees are entitled to maximum flexibility and certainty and with certainty enhanced by a minimum of negotiation. Flexible, technology-neutral licence conditions are essential to maximise utility and hence, the value of spectrum licences. (FuturePace Solutions, trans., p. 543)
>
> Any bias towards one service type means that additional spectrum space will usually be required to operate other services. This creates inequities in the isolation demanded by the access conditions for different types of services. Therefore, biased access conditions

> lead to inefficient use of spectrum for certain equipment. (FuturePace Solutions, sub. DR314, p. 37)

The Commission considers that setting spectrum licence conditions will involve some pragmatic notion of 'likely use'. However, such conditions should not needlessly constrain potential licensees' choice of technology. The Commission strongly supports licence conditions that are as technologically neutral as possible. This allows market forces the greatest say in the allocation and re-allocation of spectrum to changing uses over time, contributing to efficient outcomes over time. It reinforces the flexible nature of spectrum licences and reduces the need for recourse to the ACA to change licence conditions to cater for changes in technology or consumer preferences. These characteristics also make spectrum licences more amenable to trade on the secondary market and better suited to being granted as perpetual rights.

If there are benefits for spectrum users from a particular set of boundary conditions, market forces could lead to those conditions being negotiated among licensees, once a starting point for negotiations was set by 'generic' likely use conditions. *Ex ante* negotiation between potential licensees and the ACA on likely use and technology would be replaced by *ex post* negotiation among actual licensees. The relative costs and benefits associated with each approach (including flexibility, certainty, speed, and transaction costs) are difficult to quantify.

The ACA has indicated its intention to conduct a workshop on various aspects of spectrum licensing, including the specification of core conditions and configuring spectrum lots for sale (ACA, trans., p. 600). The Commission encourages this workshop to consider the following issues:

- the appropriate balance between the short-term technical efficiencies of technical specificity against the long-term allocative efficiency benefits of technology (and use) neutral licences (particularly in the context of continuous or ongoing spectrum licences);
- the scope for adopting standard boundary conditions for spectrum licences and the relative transaction costs of *ex ante* negotiation between all potential licensees and the ACA on likely use, and *ex post* negotiation among actual licensees; and
- the adequacy of arrangements for licensees to negotiate changes to licence boundary conditions.

Device registration

Rather than attempting to police the level of interference created by spectrum licensees' devices at the licence boundary, the spectrum licensing model developed by the Spectrum Management Agency (SMA) manages interference by requiring the registration of all devices before they can be operated under a spectrum licence (RC Act, s. 69).[1] A device will not be registered until its transmission characteristics have been modelled to establish a 'device boundary' (that is, the estimated extent of its transmission). Provided that the device boundary of a proposed device falls wholly within the geographic and frequency boundaries of the licence, the device is deemed not to cause unacceptable interference and will be registered. The device boundary approach was regarded as providing a more feasible interference management framework, in an environment in which licences could be aggregated or broken up in unpredictable fashion.

Some inquiry participants argued that, although spectrum *licences* should be registered, there is no benefit in registering individual *devices* because spectrum licensees are responsible for managing interference within the parameters of their licence (for example, Spectrum Engineering Australia, sub. 30, pp. 15–16).

Other inquiry participants supported the device registration system (for example, FuturePace Solutions, sub. 18, pp. 12–13). Although interference within a spectrum licence is the responsibility of the licensee, there may be interference between a spectrum licensee and other spectrum users. Information on the devices being operated under the spectrum licence would assist in the management of such interference. Unwired Australia, for example, stated:

> Unwired recognises the need to have information about the devices that are radiating, in a public register. There is public benefit in that … (trans., p. 452)

The Commission sought inquiry participants' views on whether the current list of device registration details was appropriate, but did not receive much comment. Those that did respond supported retaining the current list of details:

> Telstra would not support any relaxation of present conditions … Such information is necessary in various ways to ensure maximum efficiency in spectrum management by licensees and regulators. (Telstra, sub. DR323, p. 10)

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[1] Some devices can be declared exempt, although the types of devices that are exempt vary between spectrum licences issued under different auctions. Mobile telephone handsets and mobile transmitters, for example, that only transmit at sea and communicate only with mobile receivers at sea were exempt for the 800-megahertz (MHz) band and 1.8 GHz-band auctions (ACA 1998e). Similarly, mobile transmitters and fixed indoor transmitters were exempt for the 28/31 GHz-band auction (ACA 1998f).

> … the present list of technical details for spectrum licensing were carefully selected by an industry based consultation process in 1995-96 to create an efficient balance between the data necessary for reasonably accurate coordination to manage interference and the cost of gathering and recording that data. (FuturePace Solutions, sub. DR314, p. 13)

The Commission considers that device registration forms an important element of the technical framework for managing interference from spectrum licences. Removing the requirement for device registration would reduce the level of certainty many in the industry consider necessary. The feedback the Commission received from inquiry participants suggested that the current list of details required for device registration does not impose a significant burden on spectrum licensees. Further, the list was agreed following industry consultation.

FINDING 9.1

Registration of devices to be operated under spectrum licences is an important element of the interference management framework. Inquiry participants supported the current list of details required for device registration.

Interference impact certificates

Under s. 145 of the *Radiocommunications Act 1992* (RC Act), the ACA may require that a device, before registration, be certified by an accredited person as not causing unacceptable interference. The ACA (1998c, p. 6) has stated that, in practice, certification 'is usually necessary for registration of a transmitter'.[2]

The ACA makes determinations under s. 145 that set out the procedures that licensees must follow to ensure that their systems satisfy the core conditions of the licence. These procedures require the calculation of a 'device boundary' for each device (ACA 2000d, p. 5). An accredited person must certify that a device complies with the ACA's device boundary construct (through an interference impact certificate) before the device will be registered.

Inquiry participants were divided over the usefulness of the ACA's device boundary construct and the requirement for an interference impact certificate to demonstrate compliance with the device boundary. FuturePace Solutions, for example, supported the ACA's device boundary construct:

2 It is possible to register a device without an interference impact certificate. The ACA normally registers a device without the certificate if the licensee can show that all licensees who may be affected by the operation of the device have agreed that the device may be operated or satisfy the ACA that it will maintain sufficient internal guard space to manage interference by the device.

> There are a number of techniques used throughout the world that seek to emulate the operation of the device boundary, however, no other method offers more flexibility, certainty or equity. (FuturePace Solutions, sub. 34, appendix A)

And:

> FuturePace Solutions sees the [interference impact certificate] as certifying the integrity of our national centralised database. … In the case of spectrum licensing it provides a certified basis for managing interference across the frequency boundary and determining options for the operation of receivers across the area boundaries. … Removal of the [interference impact certificate] requirement would undermine the legal integrity of the database upon which the liability associated with spectrum licensing is going to be distributed. (FuturePace Solutions, trans., p. 543)

Telstra also supported the current regime requiring interference impact certificates:

> We think that the current technical framework is essential to enable full maximum utility of the spectrum to be derived by all spectrum licensees and that includes enabling your spectral and geographic neighbours to maximise the utility as well as yourself and we certainly believe that the current structure and the current elements of the technical framework are very crucial. (Telstra, trans., p. 512)

By contrast, other inquiry participants questioned the usefulness of the ACA's device boundary construct. For example, Spectrum Engineering Australia argued that the entire approach was flawed:

> By any reasonable engineering assessment, however, the device boundary construct is a technical farce. It achieves no practical purpose except to meet the requirements of the ill-conceived legislation. (Spectrum Engineering Australia, sub. 30, p. 6)

And:

> Despite it being a mandatory requirement, device registration does not ensure (or even seek to ensure) that unacceptable interference will not be caused by the operation of the transmitter. (Spectrum Engineering Australia, sub. 30, p. 16)

On the one hand, the ACA, and many inquiry participants, wanted assurance that proposed devices will not cause unacceptable interference before they are registered. On the other hand, some inquiry participants argued that the requirement to certify compliance with the ACA's device boundary construct is redundant, because they have undertaken their own planning to ensure that the devices will not cause interference. These inquiry participants argued that, in effect, they had to do the planning twice — once to plan for their own purposes and once to meet the interference impact certificate requirements. Unwired Australia and Market Dynamics stated:

> Why, we ask, is it necessary for us — after having planned all these devices, got it right from our business point of view — to have to go to an accredited person and get this

interference impact certificate to certify that the device complies with a demonstrably flawed procedure? (trans., p. 454)

The Commission considers that there are two options for reforming the system:

- the ACA could remove the requirement for interference impact certificates for device registration; or
- the ACA could retain the requirement for interference impact certificates that certify compliance with licence core conditions for device registration, but remove the requirement that devices must comply with the ACA device boundary construct as set out in determinations made under s. 145 of the RC Act.

The first of these options was suggested by some inquiry participants, such as Unwired Australia:

> We believe that the ACA should simply register the devices that we ask to be registered because we've already done the radio planning. We know they're going to be okay. We don't need to have interference impact certificates to tell us that they comply with a procedure that does nothing to certify that they really are going to be okay in a radio engineering sense. (Unwired Australia, trans., p. 454)

Removing the requirement for interference impact certificates may not provide the assurance many in the industry consider necessary for the successful operation of radiocommunications equipment. FuturePace Solutions argued:

> … use of the device boundary in spectrum licensing provides an optimal balance between operational flexibility and certainty for managing in-band interference. (sub. DR314, p. 13)

The ACA suggested that even if interference impact certificates were not required 'up front', it would still expect licensees to be able to produce a certificate in the event of an interference dispute (ACA, sub. DR324, pp. 8-9). Such an approach would not address the concerns of those opposed to the process of certifying compliance with the device boundary construct, as they would still be required to produce a certificate in the case of a dispute.

The second option, of retaining certification of compliance with core conditions, but removing the requirement that devices comply with ACA device boundaries, represents a compromise between the current system and the option of abolishing certification. Evidence presented to the Commission suggests that some inquiry participants considered the ACA's device boundary construct to be a useful means of ensuring compliance with spectrum licence core conditions. However, it may not be the only means of doing so. If licensees can demonstrate that they meet licence core conditions using other methodologies, they should be able to do so. This would reduce the burden on spectrum licensees that have chosen to use a different set of engineering rules to manage their spectrum than those suggested by the ACA. FuturePace Solutions was sceptical that other methodologies existed:

> We also questioned whether, in proposing that it be abandoned, the proposer had devised a new method and could demonstrate that it further improved on those benefits. (sub. DR314, p. 13)

The Commission does not consider that alternative methodologies should be ruled out. Spectrum licensees choosing to use different methodology to that endorsed by the ACA could be subject to audit by the ACA and liable for the costs of rectification and/or damages if found to be causing interference to other spectrum users. Those choosing to use the ACA's device boundary construct would be deemed to comply with their licence conditions. This approach is consistent with other performance-based certification systems that emphasise the desired outcome (meeting licence core conditions), rather than prescribing the process of achieving that outcome.

The Commission considers that requiring an accredited person to certify compliance with the licence core conditions is justified in order to provide a degree of certainty to all spectrum users and to maintain the integrity of the register. Allowing certification according to either the ACA's device boundary construct, or some other methodology, will increase the flexibility of spectrum licensees to manage their spectrum holdings and decrease the costs of complying with the certification requirements.

RECOMMENDATION 9.1

Spectrum licensees should be required to certify compliance with core conditions when registering devices. However, the requirement that devices comply with the device boundary as set out in the relevant determinations under section 145 of the **Radiocommunications Act 1992** ***should not be mandatory.***

9.2 Maintaining registers

The ACA maintains a register of detailed information about individual licences and the devices operated under each licence (box 9.1). It automatically places apparatus and class licences on the register (such licences are, in effect, permits to use a particular device). Spectrum licences are also registered along with details on the devices licensees intend to operate.

The register is available for public inspection, unless the ACA is satisfied that it would not be in the national interest for certain information to be available to the public (for example, for defence or security reasons). That part of the register is known as the 'classified register'.

Box 9.1 Contents of the register of radiocommunications licences

For each *apparatus* or *spectrum licence,* the register contains the following information:

- the licensee's name and postal address;
- the date of issue and expiry of the licence;
- any other details that the Australian Communications Authority (ACA) determines, in writing, about:
  - the conditions of apparatus or spectrum licences;
  - authorisations by licensees for other people to operate radiocommunications devices;
  - radiocommunications devices that are operated under the licences;
- a note that an apparatus licence is affected by a spectrum re-allocation declaration, if that is the case; and
- any other details about the licences that the ACA thinks necessary or convenient for the purposes of the *Radiocommunications Act 1992*.

The ACA may refuse to include details of a transmitter proposed to be operated under a spectrum licence if it is satisfied that the operation of the transmitter would cause an unacceptable level of interference to the operation of other radiocommunications devices under that licence or any other licence. Operation of a transmitter without registration may breach a licence condition.

For class licences, the register contains such details as the ACA determines in writing.

Source: *Radiocommunications Act 1992*, ss 144, 147 and 149.

The explanatory memorandum to the RC Act stated that the purpose of the register is to 'establish support mechanisms designed to minimise the chance of interference':

> All high powered transmitters will need to be registered and, prior to registration, licensees will need to satisfy the SMA [Spectrum Management Agency] that their operation will not cause interference to other services. By having access to the data base, users will themselves be able to assess the impact of technical changes on other services. (Explanatory memorandum, p. 44)

The register aids the efficient allocation of apparatus licences by frequency assigners. Without a register of current licences, it is not possible to identify 'unused' spectrum. A register of licences also provides certainty of title for secondary trading (much like the central registry of land titles) (see chapter 7).

ACA power to refuse registration

As discussed above, the ACA uses the registration process to manage the risk that spectrum licensees may create interference for other spectrum users. However, there does not appear to be good reason for the ACA to refuse registration of a device. The original proposal by the Bureau of Transport and Communications Economics was that the regulatory agency should *register* devices, but that the agency did not need to *approve* devices (BTCE 1990).

The ACA, however, did not consider that its power to refuse registration was inappropriate. It argued that:

> … removal of the ACA's power would prevent it from being able to prevent potential problems if, at the time of registration, an obvious risk of unacceptable interference is detected. (sub. DR324, p. 7)

The Commission accepts that this is not currently a major issue. The ACA stated that 'all spectrum licensed devices and nearly all apparatus licensed devices are automatically registered' (ACA, sub. DR324, p. 7). However, the Commission considers that safeguards such as the accreditation of frequency assigners and the ACA's general powers to set spectrum licence core conditions and to require certification of compliance are sufficient to manage interference. The only exception is possible interference with devices on the classified register. Accredited assigners (like all others outside the ACA) do not have access to this register, and so cannot be expected to account for it in their assignments.

As a matter of principle, having devolved responsibility to accredited assigners and spectrum licensees, the ACA should not second-guess their professional opinions. Of course, if an 'obvious risk of unacceptable interference' is identified, the ACA should bring this to the attention of the person wishing to register a device. That person may then either withdraw the registration or accept responsibility for the costs of any subsequent interference.

RECOMMENDATION 9.2

The Australian Communications Authority should not be able to refuse registration of a device where an accredited person certifies that the device will not cause unacceptable interference, except in cases of possible interference with devices on the classified register.

9.3 Standards

The ACA, under the RC Act, has established a broad standards framework encompassing radiocommunications equipment, the electromagnetic compatibility (EMC) of electronic and other electrical devices, and electromagnetic radiation (EMR) exposure. As well as these mandatory standards, the ACA also refers to standards when setting class and apparatus licence conditions, and the methods to be used to calculate device boundaries for spectrum licences (section 9.1). The incorporation of these otherwise voluntary standards into legal instruments (such as licence conditions) gives them mandatory force.

The ACA has a memorandum of understanding with Standards Australia, under which Standards Australia has primary responsibility for developing radiocommunications standards, which may then be given mandatory force by adoption by the ACA. The Australian Communications Industry Forum (ACIF), which is accredited by Standards Australia to produce Australian Standards, also has developed some radiocommunications standards.

Electromagnetic radiation standards

EMR standards regulate human exposure to electromagnetic radiation. Mandatory EMR standards were first introduced in 1999 (box 9.2). Although the impact of electromagnetic radiation on humans can be characterised as a form of ‘interference’, there appears to be a significant ‘social’, rather than ‘technical’ aspect to the introduction of EMR standards. The ACA stated:

> EMR regulation is a unique regulatory issue for the ACA for two reasons. Firstly, it is a more politically volatile issue than spectrum or interference management. Instances in recent history in which government and science are perceived to have failed in their protection of the public (for example, in relation to smoking or asbestos) have created some mistrust in the community, making it vital that public perceptions of risk be considered alongside the technical issues associated with the regulations. Secondly, the standards provisions under the Act were originally drafted to regulate transmitters in terms of their ability to interfere with each other — device to device — rather than to regulate human exposure to a transmitter. (ACA, sub. 9, pp. 16–17)

Inquiry participants made little comment on EMR standards. The ACA considered existing arrangements to be effective but anticipated changes in the near future, including the adoption of an internationally agreed method of measuring exposure (ACA 2001n).

Box 9.2 **Electromagnetic radiation standards**

In 1999, the Australian Communications Authority (ACA) introduced regulatory arrangements to limit human exposure to electromagnetic radiation (EMR) emitted from radiocommunications transmitters. The mandatory standard originally applied to certain cellular mobile and cordless phones and certain cellular mobile base stations. The ACA extended the scope of the standard on 1 June 2000 to include all cellular mobile telecommunications handsets and base stations, cordless phones and satellite phones operating between 800 megahertz (MHz) and 2.5 gigahertz (GHz). In time, all radiocommunications devices will be included in the scope of the regulations.

A new emissions standard was approved by the Australian Radiation Protection and Nuclear Safety Agency in May 2002. This standard, which brought Australia into line with international standards, raised the allowable level of mobile phone radiation emissions and changed the way emissions were measured. This standard is currently being considered by the ACA for adoption.

Source: ARPANSA (2002).

The EMR standards appear to adopt a 'precautionary principle' approach — that is, minimising the possibility of future 'serious' or 'irreversible' harm in situations where there is scientific uncertainty about the impacts of certain activities.[3] For example, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and the CSIRO agreed that there is no scientific proof that low level exposure to mobile phone radiation causes health problems (Age, 28 May 2002, p. 4), but drew opposite policy conclusions. ARPANSA raised emission limits (to match international standards), while the CSIRO opposed the new standard. In a submission to a Senate inquiry into electromagnetic radiation, the CSIRO stated:

> It is not possible at present to conclude that exposure to radiofrequency radiation, even at levels below national guidelines, is without potential adverse health effects. (CSIRO 2001, p. 1)

The application of the precautionary principle inevitably raises difficult questions. As stated by Harding and Fisher (1999):

> How much evidence of potential harm is needed before precautionary measures are put in place? What level of precaution is necessary? What precautionary measures are appropriate? What type of 'threats' require precautionary measures? What is the relationship between the precautionary principle and risk assessment? What is the role of science in applying the precautionary principle? How should social and economic needs be factored into decisions on precaution? (Harding and Fisher 1999, p. v)

3 The precautionary principle has gained prominence since the United Nations Conference on Environment and Development (in Rio de Janeiro in 1992) and is widely cited in health and environmental areas.

The Commission is not in a position to comment on the appropriate level of EMR standards. But the degree of uncertainty inherent in the precautionary principle emphasises the importance of regulatory processes that subject proposed EMR standards to rigorous scrutiny. The remainder of this section focuses on the role of technical standards in managing interference. The broad principles about the need for consultation, performance-based standards and international harmonisation apply equally to EMR standards.

Technical standards

Radiocommunications standards are important tools for managing interference. They aim to provide consistent, predictable performance from radiocommunications equipment. This approach minimises the costs of interference investigation and resolution by controlling equipment at the source of supply rather than attempting to police emission levels when equipment is in operation. The explanatory memorandum to the RC Act stated:

> Provision for the setting of technical standards for equipment is an important tool for achieving efficiency in spectrum use and minimising interference. With the proliferation, on the one hand, of communications services that depend on spectrum and, on the other, with electric and electronic equipment which affects and can in turn be affected by radiocommunications transmitters, there is increasing need to provide mechanisms to ensure compatibility. (Explanatory memorandum, p. 47)

Compliance with radiocommunications standards

Compliance with RC Act standards is based largely on self-assessment by suppliers or accredited assessors, subject to audit by the ACA. In 2000-01, the ACA audited 586 equipment manufacturers or suppliers (out of 5430 firms registered with the ACA). No serious breaches were found, but 20 per cent of folders audited did not comply with requirements. The ACA regarded this as a relatively high level of compliance (ACA 2001c, pp. 18–19).

The ACA has stated that it was an international pioneer in this shift towards self-assessment (described by the ACA as self-regulation):

> The ACA is considered a world leader in standards and compliance regulation. As one of the first to introduce ‘light touch’ self-regulation for radiofrequency standards and compliance, the ACA arrangements are a model of open, transparent and cost effective standards and compliance development. (ACA, sub. 9, pp. 13–14)

The ACA identified some costs but also several advantages for suppliers and consumers from its approach:

The costs to manufacturers and importers subject to standards include testing, maintenance of compliance records and labelling. Compared to a product approval process, the costs are minimal. (ACA, sub. 9, p. 14)

For suppliers, the main advantage of this self-regulatory approach is that products gain faster access to markets. Suppliers welcome this in increasingly competitive markets where products have short product life cycles. Consumers also benefit when suppliers pass on cost-savings and from faster access to new technologies. (ACA, sub. 9, p. 16)

Voluntary versus mandatory standards

Standards may be either voluntary or mandatory. Voluntary standards are more flexible than mandatory requirements, but the outcomes are less certain. Where the risks posed by sub-standard equipment are high, voluntary codes may not provide sufficient re-assurance to those likely to be affected. Voluntary, industry-developed standards also may fail to take all views adequately into account. The public consultation generally required when the Government mandates standards (for example, as part of the Commonwealth Government's regulation impact statement process) is likely to canvass a broader range of views. The ACA also stated that mandatory standards are a necessary precondition for Australia's participation in international mutual recognition arrangements:

… voluntary compliance could not provide the confidence or certainty for the Government to participate in bilateral and multilateral mutual recognition arrangements.[4] (ACA, sub. 9, p. 16)

Mandatory standards also have potential disadvantages. They can restrict competition, deny consumer choice, and create significant barriers to innovation and technological development. In some cases, incumbent suppliers can influence mandatory standards to deter potential competitors. Market Dynamics argued that, '… in an area of rapid technological change you can see that standards may act as a brake on innovation.(trans., p. 109)'.

Mandatory standards can also increase regulatory and compliance costs. In a recent review, the Department of Communications, Information Technology and the Arts (DCITA) stated:

As in most technical regulatory areas, the making of radiocommunications standards carries the two fold risk of over-regulation causing unnecessarily high compliance costs or under-regulation which can endanger lives or businesses. (DCITA 2001a, p. 58)

[4] From 1 November 2001, Australia and New Zealand are to adopt the same suite of EMC standards and similar compliance labelling requirements. Australia also has EMC mutual recognition agreements with the European Union, Switzerland and the Asia Pacific Economic Cooperation [APEC] economies.

The DCITA review concluded that mandatory standards should be introduced only where a ‘significantly important objective of the regulation cannot be achieved in any other way’ (DCITA 2001a, p. 58).

Few inquiry participants commented on mandatory standards. The ACA stated that technical standards are applied only where necessary to manage interference:

> Radiocommunications standards are developed under the [Radiocommunications] Act to support class and apparatus licensing by setting performance criteria to manage interference. … In accordance with light touch regulation the standards are only mandated by exception for services such as land mobile radio and cordless telecommunications, when this is established as the most efficient way of managing interference. (ACA, sub. 9, p. 15)

Some general principles apply to all mandatory standards. Where they are justified, the Commission strongly supports the adoption of performance standards (which mandate desired outcomes) rather than prescriptive standards (which mandate how outcomes are to be achieved). It also supports alignment with internationally agreed standards where possible. Unique Australian standards should be adopted only where the benefits of addressing exceptional Australian requirements outweigh the additional compliance costs and potential barriers to competition (ORR 1998).

The Commission considers that mandatory technical standards are justified where they provide a cost effective means of managing interference. The self-assessment system under the RC Act has reduced the costs of complying with mandatory standards, making it more likely that the benefits of mandatory standards outweigh their costs. However, the benefits and costs of standards will differ on a case-by-case basis; for example, spectrum licensees should be free to manage interference within their own licences, so long as this does not breach their boundary conditions (section 9.1). In addition, the need for particular standards may change over time. This variability places a great deal of importance on the rigour of the process for determining mandatory standards, the way in which they are drafted and mechanisms for their review.

Mandatory standards are subject to the Commonwealth Government’s regulation impact statement process. In 2000-01, the Office of Regulation Review reported that the ACA had prepared adequate regulation impact statements for 90 per cent of required decisions. This provides some assurance that regulatory proposals have been subject to appropriate scrutiny and incorporate appropriate review mechanisms.[5]

5 The ACA prepared and supplied nineteen of the twenty-one regulation impact statements required in 2000-01. The Office of Regulation Review assessed all of these as adequate, resulting in a compliance rate of 90 per cent at the decision making stage (PC 2001e, p. 24).

9.4 Investigations

Despite the best efforts of spectrum planners, the use of technical standards and mandatory device registration, two types of interference may arise. ‘Unlawful’ interference arises as a result of non-compliance with the interference management regime. ‘Lawful’ (or inadvertent) interference arises despite technical compliance (box 9.3).

Box 9.3 **Unlawful and lawful interference**

Unlawful interference occurs because the planning and licensing regimes have not been followed.

Lawful interference can occur even where there has been full compliance with the spectrum management regime. Spectrum planning is not an exact science — a number of unpredictable factors, such as atmospheric conditions and malfunctioning devices, mean that the actual propagation of a radiocommunications signal may not match that calculated by a spectrum planner. The Australian Communications Authority reported, for example, that one of its ‘more unusual’ investigations involved interference with a very high frequency (VHF) and ultra-high frequency (UHF) emergency communications network in North Queensland from a high frequency (HF) broadcasting service situated in Victoria (ACA 2000a, p. 64).

Civil remedies

Many licensees have strong commercial and operational incentives to co-ordinate the planning of services to minimise interference and to resolve interference disputes rapidly and co-operatively. Anecdotal evidence, for example, suggests that the technical personnel of spectrum licensees often negotiate mutually acceptable resolutions to interference disputes.

In addition to co-operative approaches to resolving interference disputes, the RC Act gives spectrum licensees an explicit civil remedy for unlawful interference (s. 50). Spectrum licensees may apply to the Federal Court if they suffer interference caused by a person operating a radiocommunications device not in accordance with a licence. The court has wide powers to address the interference, including issuing orders to stop the interference and granting damages.

Other licensees, such as holders of apparatus licences, do not have a statutory right to take civil action, although they may have access to common law remedies. There does not appear to be any reason to deny other licensees a clear statutory right to take civil action to recover damages for harm caused by others’ unlawful activities.

However, the Commission is not aware of any civil actions brought to date. The ACA was unaware of any civil actions being launched, although there have been situations where interference has occurred and parties have negotiated solutions (ACA, pers. comm., 7 February 2002). Similarly, although civil actions have been available to spectrum users in New Zealand since 1992, no actions have been taken; spectrum users prefer to rely on investigation by the government agency (Ministry of Economic Development, pers. comm., 25 January 2002).

DCITA (1998, p. 26) argued that the lack of civil actions could be due to conservative licence conditions that ensure that disputes do not arise, or because disputants would rather settle the matter directly with the ACA. More recently, DCITA (2001a, p. 21) reported that industry participants considered that civil action was unsuited to technical fields and was highly expensive. Civil actions would be used only as a last resort after negotiation and conciliation had failed.

Civil actions may also require more proof than is available in many cases of interference. Some interference issues are extremely complex and difficult to resolve (box 9.3). In addition, individuals do not have the powers of investigation available to the Government, or access to the classified register of radiocommunications licences.

The Commission considers that civil actions are highly unlikely to be a practical means of settling interference disputes, except in cases of gross unlawful activity that causes significant damage to licensees. The ACA will have a significant ongoing role in managing interference disputes.

FINDING 9.2

As civil actions are unlikely to provide a practical means of settling most interference disputes, the Australian Communications Authority will continue to have a role in managing these disputes.

Role of the Australian Communications Authority

There are limits to the ability of co-operative action and the courts to resolve interference disputes. Many interference complaints have characteristics that justify government involvement, such as information failures, ‘free rider’ problems[6] and high transaction costs. In addition, it may not be clear before an investigation whether interference is from lawful or unlawful transmissions, and whether or not civil remedies may apply.

6 ‘Free rider’ problems arise where one person derives a benefit at no cost from a good or service being provided at a cost to someone else.

It may also be argued that licensees receive an implied guarantee from the ACA that they will not experience undue interference if they operate in accordance with the terms of a licence.[7] Where a licensee, complying with all licence conditions, experiences interference, they expect the ACA to investigate and resolve the complaint. For example, Unwired Australia and Market Dynamics stated:

> We're only responsible for what happens inside our tent. We're not responsible for what happens outside our tent or our relationship with other tent-holders, and so the ACA has the power, the authority; it has the statutory tools to deal with it, and I think we would be looking to the ACA's technical resources to solve the interference problem. (trans., p. 451)

The ACA appears to acknowledge this responsibility by bearing the costs of remedying interference caused by 'system failure' such as inappropriate allocations, although this occurs only on 'rare occasions' (see below).

The ACA does not guarantee to resolve interference problems. Its role is largely investigative, but it may provide directions or advice. For example, the ACA stated that, as far as possible, it encourages consumers to resolve their own radio and broadcasting reception problems (ACA, pers. comm., 7 February 2002). The ACA also limits its role in managing interference in spectrum licences. All spectrum licences require licensees to manage interference within their own licences (ACA, sub. 9, p. 12). In addition, neighbouring spectrum licensees are free to negotiate changes to the boundary conditions between their licences.

The requirement for spectrum licensees to manage interference within their own licences makes it possible for spectrum licensees to set up as private 'band managers', providing radiocommunications services to third parties. Band managers, as spectrum licensees, would be responsible for managing interference among the services they offer. In economic terms, band managers would 'internalise' the interference externality that previously existed between separate apparatus licensees. The ACA would continue to manage interference between individual band managers and other licensees, in much the same way it manages interference between existing spectrum licensees and other licensees.

The RC Act also provides for the establishment of a conciliation service and grants the ACA the power to issue directions to persons to prevent disputed conduct from causing interference. Neither of these mechanisms have been used to date. The ACA has reported that it is in the process of using the conciliation service for the first time, to resolve a dispute between parties unable to reach a negotiated solution.

7 This implied guarantee may be subject to limitations such as secondary uses not being protected from interference from primary uses (see chapter 2).

If conciliation is not successful, then the ACA may need to use its directive powers (ACA, pers. comm., 7 February 2002).

The conciliation and directions sections of the RC Act are most relevant to spectrum licensees, who are encouraged to resolve issues among themselves. As discussed in chapter 6, spectrum licences are relatively recent and do not make up a large proportion of licensed spectrum. If, as the Commission recommends, the amount of spectrum issued under spectrum licences increases significantly, then the conciliation service and the ACA's directive powers may become more important in resolving disputes. The volume of complaints may increase as less technically expert users take on responsibility for managing their own interference, although this will be tempered by the device registration and certification requirements.

ACA compliance and enforcement

The ACA undertakes a significant amount of interference investigation and dispute resolution. The ACA typically deals with inadvertent interference through negotiation and compromise. In 2000-01, it investigated 781 complaints of interference to radiocommunications services, along with 1758 neighbourhood interference problems with domestic broadcast reception. Of these, 1482 domestic interference problems were deemed to be beyond the control of the complainant and were investigated at no charge (ACA 2001c, p. 23).

For breaches of the Act, the ACA has a three-phase compliance and enforcement strategy: warnings; penalties in lieu of prosecutions; and prosecutions. The ACA is not constrained to follow all three phases; it may move directly to penalties or prosecutions if warranted.

In 2000-01, the ACA issued twelve penalties in lieu of prosecution. Three are under consideration by the ACA for withdrawal, seven were paid (total penalties of $6270) and two went to prosecution. In addition, prosecution proceedings (without penalties being issued) were instigated against six other parties for a total of twenty-two offences. The Courts ordered $5250 in penalties for seven offences, two prosecutions were withdrawn and thirteen prosecutions are awaiting determination (ACA 2001c, p. 23).

Funding interference investigations

Under current arrangements, most ACA interference investigations are financed out of radiocommunications licence fees, according to its arrangements for recovering indirect costs (see chapter 8). Funding of remedial action is determined on a case-by-case basis, depending on whether the complainant or a third party is responsible for the interference. The following are some exceptions.

- Where the ACA has been contracted to be on stand-by for a particular event (for example, the Olympics) or to provide a particular service (for example, tracking safety distress beacons for the Australian Maritime Safety Authority), there are direct cost recovery charges. The ACA did not regard this as typical interference investigation.
- Where 'lawful' interference results from a 'system failure' (for example, an inappropriate allocation), the ACA or the accredited assigner who made the assignment may be responsible for paying the costs of the investigation and remedying the situation. The ACA stated that this occurs very rarely (ACA, pers. comm., 7 February 2002).
- Where individuals complain about interference with the domestic reception of broadcast services, the ACA;
  - provides free information (a self-help guide);
  - encourages consumers to use commercial television repair services; and
  - investigates if consumers insist, with a charge of $88 (currently) but no guarantee of being able to resolve the problem. This fee may be refunded if the problem is caused by a factor out of the control of the complainant.

The costs of managing interference are part of the regulatory costs of spectrum management. The Commission has previously argued that recovery of such costs may be justified on equity and allocative efficiency grounds, provided it accords with the Commission's recommended cost recovery guidelines (PC 2001a). Where interference is found to arise from the unintended consequences of lawful transmissions, it is appropriate to recover the costs of investigation from the broad group of spectrum users according to the cost recovery arrangements for indirect costs (see chapter 8). Charging individual complainants would be inequitable and could discourage legitimate complaints.

The ACA noted that it currently recovers the cost of all interference investigation according to the cost recovery arrangements for indirect costs (sub. DR324, p. 8). This is appropriate for interference arising from lawful transmissions. However, where interference is found to arise from unlawful transmissions, there is a strong case for recovering the costs of investigation from the person making the unlawful transmissions. The ACA agreed with this approach (sub. DR324, p. 8). This places an additional incentive on spectrum users to ensure they are operating lawfully. It also removes an unnecessary cost from lawful spectrum users, who would otherwise fund these investigations through increased indirect charges. Cost recovery of investigations should be distinguished from financial penalties for breaching licence conditions, which are a form of punishment and not necessarily related to the costs of investigation.

RECOMMENDATION 9.3

In the case of 'lawful' interference, the Australian Communications Authority should continue to recover the costs of interference investigation according to the cost recovery arrangements for indirect costs.

In the case of 'unlawful' interference, the Australian Communications Authority should endeavour to recover the reasonable costs of interference investigations from the person making the unlawful transmissions.

Guidelines for dispute resolution

When an interference problem arises, there is a need to resolve the problem in a way that produces the best outcome for the community, is cost-effective and upholds the rights of those involved (DCITA 1998, p. 24). The first step is to distinguish between investigating and preventing unlawful interference, and settling disputes between lawful users suffering from inadvertent interference. Lawful uses clearly take precedence over unlawful uses, a position which should be reinforced by the cost recovery arrangements (see above).

There are no general guidelines regarding the ACA's response to lawful interference, although FuturePace Solutions noted that an ACA guideline for managing interference was developed in consultation with industry for the 3.4 GHz spectrum licences (sub. DR314, p. 19). The guideline largely relied on the common law principle of first-in-time, but also provided for the use of more economically efficient solutions where possible. The ACA stated that under its general approach, 'safety-of-life services are given highest priority' and that otherwise, 'a general principle is that first-in-time services take precedence' (ACA, pers. comm., 7 February 2002).

Establishing principles that would apply to dispute resolution would provide greater certainty for users and assist parties to resolve disputes among themselves. Alternative approaches are possible. The common law principle of 'first-in-time', gives established licensees precedence over later licensees. This principle is simple, predictable and easily applied. On the other hand, granting priority to earlier uses may impede new uses that offer greater social benefits. DCITA (1998, p. 28) identified alternatives to the first-in-time rule, including: the relative costs to each party of reducing interference; relevant risks, including potential loss of life or impact on safety services; and conformity with international use of spectrum and/or planned future use of spectrum.

The Commission considers that consistent dispute resolution guidelines governing all interference disputes could provide valuable assistance to licensees and the ACA. The Commission prefers guidelines that emphasise economic efficiency rather than arbitrary first-in-time rules, but recognises that such guidelines may be difficult to design and implement.

RECOMMENDATION 9.4

The Commission recommends that the Australian Communications Authority, in consultation with industry, develop and publish dispute resolution guidelines setting out the principles to be applied in interference disputes.

10 Managing spectrum for non-commercial and broadcasting services

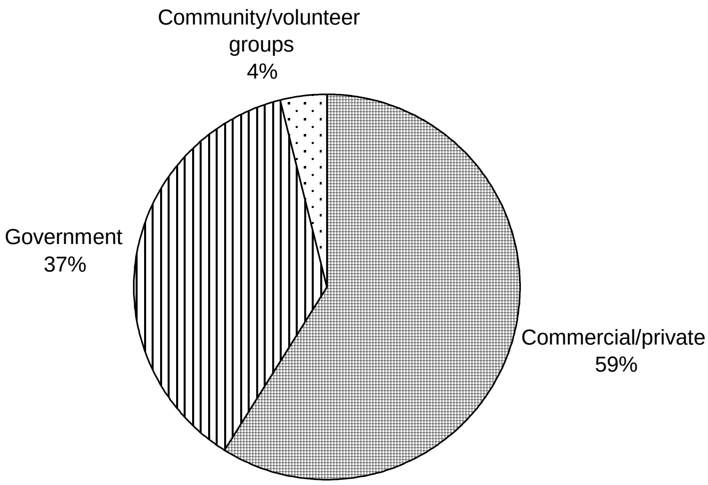
The previous chapters outlined the importance of developing an efficient system for spectrum access and appropriate licensing and charging regimes. However, a large number of spectrum users are treated differently from other spectrum users under current arrangements. Some users, such as the Department of Defence (Defence) and free-to-air broadcasters, are reserved spectrum in the Australian Radiofrequency Spectrum Plan (the Spectrum Plan). Other users are not subject to charges (for example, volunteer emergency service providers and public and community broadcasters) or pay charges that are not related to the amount of spectrum they use (for example, amateur radio operators and commercial free-to-air broadcasters). In addition, some users (such as those conducting scientific research or predicting weather patterns) argue that they too should be treated differently because their work has public benefits and is non-commercial.

The effect of these differences may be to undermine the development of an effective market for spectrum. This chapter briefly describes the spectrum management arrangements used for these special cases. It examines the rationales for managing spectrum for these purposes differently, along with the implications of these differences for the efficiency of spectrum use. This chapter identifies alternative ways in which the government could manage these spectrum users, while still encouraging a robust market for the rights to use spectrum.

10.1 Current arrangements

Non-commercial users of spectrum (including government, community and volunteer groups) currently comprise 41 per cent of all frequency assignments (figure 10.1). Given their significance, any attempt to establish a market for spectrum must take into account these users, the ways in which spectrum is managed for them, and the effects of this management approach on spectrum efficiency. The following section provides a brief summary of current spectrum management arrangements for these users. A more detailed description is contained in appendix E.

Figure 10.1 **Frequency assignments, by type of user, March 2001**



Data source: ACA (unpublished).

Some radiofrequency spectrum in Australia is set aside for particular purposes, in line with international agreements. For example, Australia has international obligations as a signatory to specific treaties governing international uses of spectrum for aviation and maritime safety-of-life services. Similarly, some spectrum is set aside for meteorological services, satellite services and for amateurs. But while certain frequencies are set aside for these purposes, the *users* of those frequencies are not granted any special status. They must be authorised to use spectrum by the Australian Communications Authority (ACA) and pay licence fees. By contrast, the users discussed below are subject to different spectrum management arrangements.

Defence and national security

Defence, which is a relatively large user of spectrum in Australia (see chapter 2), has exclusive use of some spectrum (known as the 'defence bands'). Further, Defence and other national security personnel (such as those working for the Australian Secret Intelligence Service and the Australian Security Intelligence Organisation) are exempt from provisions of the *Radiocommunications Act 1992* (RC Act), which means they can use spectrum without obtaining a licence from the

ACA.[1] However, most spectrum use for national security purposes is licensed by the ACA. Where necessary, the details of these licences are maintained on a classified register which is not made available to the public (see chapter 9).

Defence pays licence fees for apparatus licences, calculated on the same basis as other apparatus licences. Defence pays around $8.4 million each year for spectrum reserved in the defence bands. It pays a further $979 000 for spectrum it uses outside the defence bands and $245 000 for classified assignments (Department of Defence, pers. comm., December 2001).

Broadcasting

Section 31 of the RC Act allows the Minister to designate spectrum to be used primarily for broadcasting (the ‘broadcasting services bands’). Responsibility for planning and licensing these bands is delegated to the Australian Broadcasting Authority (ABA). Broadcasting licences, most of which carry the entitlement to spectrum, regulate the number of broadcasters, their behaviour and the content of broadcasts. Ownership of these licences can be transferred as a complete package, but it is not possible under the current regulations to transfer access to the spectrum separately from the licence to broadcast.

Under the *Broadcasting Services Act 1992* (BS Act), new commercial radio and television licences are awarded to the highest bidder at auction.[2] In addition, commercial television and radio broadcasters pay annual licence fees based on a percentage of their gross earnings from the broadcast of ‘advertisements or other matter’. According to the ABA (1999, p. 11), these licence fees are ‘a tax for the use of a scarce public resource and for the benefits of operating in closed markets created by legislative restrictions’. Non-commercial broadcasters (such as the national and community broadcasters) do not pay any fees for the spectrum they use in the broadcasting services bands.

Broadcasters also have licences from the ACA for the use of non-broadcasting parts of the spectrum (for example, for microwave or satellite links). They pay for these on the same basis as other spectrum users.

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1 While their personnel are exempt from the provisions of the RC Act, agencies such as Defence are not. Defence argued this ambiguity renders some of its uses of the spectrum illegal and recommended changing the legislation. Neither the ACA nor the Department of Communications, Information Technology and the Arts considered that any legislative changes are necessary (Department of Defence, sub. DR329, p. 3).

2 Television licences have been auctioned in the past, but amendments to the BS Act in 1998 prohibit the allocation of any new commercial television broadcasting licences before 2007.

Exemptions and concessions from fees and charges

Currently, 350 bodies — including rural fire fighting services, State emergency services, surf life-saving clubs and St John's Ambulance services — are eligible for exemption from apparatus licence fees. Another fifteen bodies, such as the Royal Flying Doctor Service, are entitled to concessions. The legislation enabling the ACA to grant exemptions and concessions, and the criteria for qualification are described in box 10.1.

Fee exemptions and concessions totalled around $6.1 million in 2000-01. Exemptions and concessions from the spectrum access tax accounted for 90 per cent ($5.5 million), while exemptions from cost recovery charges (that is, the administrative charge) comprised the remaining 10 per cent ($600 000) (ACA, pers. comm., 9 November 2002).

Box 10.1 **Exemptions and Concessions**

The *Radiocommunications (Taxes Collection) Act 1983*, the *Radiocommunications (Receiver Licence Tax) Act 1983* and the *Radiocommunications (Spectrum Licence Tax) Act 1997* enable the ACA to exempt specific classes of person from the obligation to pay charges, or enable the ACA to set these charges at different levels for different persons.

The Radiocommunications (Charges) Determination 2000 and regulation 5 of the Radiocommunications Taxes Collection Regulations allow exemptions from apparatus licence fees, including the spectrum access tax and the administrative component.

Regulation 5 exempts bodies whose principal purpose is to provide:

- diplomatic and consular services;
- surf life-saving and remote area ambulance services; and
- emergency services or services for the safeguarding of human life (for example, rural fire fighting, search and rescue, and coastguard services) where the body is staffed principally by volunteers and is exempt from paying income tax.

The ACA also grants concessions and discounts to some licensees. Licence fee concessions (exemption from 71 per cent of the annual licence tax) apply to:

- the Royal Flying Doctor Service; and
- open narrowcasting television services for community and educational non-profit purposes.

10.2 Reasons for special treatment

For a number of reasons, some spectrum users are treated differently and others argue that they should be. These reasons, which seem to vary from fulfilling other government objectives to historic accident, are discussed in this section. Section 10.3 discusses the effects of different treatment of spectrum users on the efficiency of spectrum management.

Some differences appear to be for historical reasons. Defence and free-to-air broadcasters, for example, have long histories of using spectrum to provide their services. This may help to explain why spectrum is reserved for defence and broadcasting purposes and why the licence fees paid by free-to-air broadcasters are not related to spectrum use. The radio and television licence fees legislation was introduced in 1964, long before charging for spectrum based on its opportunity cost (that is, on the value of the best alternative forgone) became an issue. It is symptomatic of the special status that is given to broadcasting that charges for broadcasting spectrum were not changed when the Spectrum Management Agency (SMA) introduced fees based on spectrum denial for all other spectrum users.

Some users are treated differently because the Commonwealth Government is trying to achieve certain objectives. A common argument for special treatment is that a service is a public good or in the public interest, and is unlikely to be provided to a sufficient extent by the private market. However, this principle is not applied consistently. Defence requires spectrum to fulfil its duties (spectrum being essential in many cases), so spectrum is reserved for its use. Nevertheless, Defence must pay for the spectrum it uses. Similarly, Bureau of Meteorology services include some public good characteristics, but it pays for the apparatus licences it uses, just as it pays normal prices for all other inputs it uses.

As discussed in chapter 5, it is difficult to define the ‘pubic interest’. However, it is generally accepted that there is a public interest in providing safety-of-life services. The Commonwealth Government has chosen to support those safety-of-life organisations staffed principally by volunteers, by granting them exemptions or concessions from radiocommunications licence fees.

Public interest concerns are also used to explain why spectrum in the broadcasting services bands should be managed differently from the rest of the spectrum. Many in the broadcasting industry argued that broadcasters fulfil government social objectives and that spectrum planning should address these objectives, including the ABA (sub. DR321), Federation of Australian Commercial Television Stations (FACTS, sub. DR338), the Australian Broadcasting Corporation (ABC, sub. 21) and 2KY Broadcasters (sub. 10).

The licence fee exemptions granted to national and community free-to-air broadcasters using spectrum in the broadcasting services bands are ostensibly justified as being in the public interest. However, the national broadcasters — the ABC and the Special Broadcasting Service (SBS) — are required to pay for spectrum used outside the broadcasting services bands.

Amateur users of the spectrum are treated differently from other users. In line with international agreements, amateurs have access to a variety of spectrum bands (see appendix E). Their licence fees are not related to the amount of spectrum they use. The Department of Communications, Information Technology and the Arts (DCITA) argued in its final report of the radiocommunications review that the amateur licence fee would be higher if calculated on the same basis as fees for other non-assigned spectrum users (DCITA 2001a, p. 60).

10.3 Effects on the efficiency of spectrum use

Whatever the reason, treating some users differently from others creates distortions and inefficiencies in spectrum use. Charging fees that do not reflect the opportunity cost of the spectrum, and granting fee exemptions or concessions, reduces users' incentives to use spectrum efficiently. The ACA recognised this issue:

> … it is possible that fee exemptions and concessions that the ACA has in place could lead to some inefficiency in spectrum use. (ACA, sub. 9, p. 29)

Similarly, reserving bands for particular users makes it difficult for newer, potentially higher valued users to gain access without incurring the administration and transaction costs of lobbying the ACA to change plans. Incumbent users may have reduced incentives to use the spectrum efficiently if there is no credible threat of it being made available to others.

The overall effects of these inefficiencies may be an artificial scarcity of spectrum in some bands and unnecessary congestion in others, while bands capable of similar use are underutilised. These problems are likely to affect how many services are provided and/or the types of service that are provided.

The Commission argued in its draft report that spectrum in the broadcasting services bands was not managed as efficiently as it might otherwise have been, resulting in fewer services. The ABA disagreed with this analysis:

> ABA planning is efficient and in areas of high demand the spectrum is planned to saturation. The overall number of services reflects tradeoffs between the number and coverage area of services and the costs to service providers … (ABA, sub. DR321, p. 3)

Similarly, FACTS argued that, '… the ABA has been effective in maximising the availability of broadcasting licence opportunities within the available spectrum' (FACTS, sub. DR338, p. 21).

Both the ABA and FACTS are referring to the technical efficiency of the planning process (although this may also be questioned, as discussed below), rather than the economic efficiency of spectrum use. Under existing planning and licensing arrangements, the ABA issues broadcasters with sufficient spectrum (via apparatus licences) to maximise coverage within the licence area. However, the amount of spectrum broadcasters actually need has not been tested in a market where broadcasters pay for the spectrum they use. In some cases, it may be more economically efficient to provide services using a variety of delivery mechanisms, such as cable and satellite, not just terrestrial broadcasting. Moreover, parts of the broadcasting bands have not been used because available spectrum did not cover an entire licence area, or allocation has been delayed because of ABA concerns about possible undesirable consequences on the industry (ABA 1999b). For example, some FM radio broadcasting licences proposed for Sydney and Melbourne in 1999 will not be auctioned until 2004.

The Commission also questions claims that the ABA's technical planning processes are efficient. Concerns about reception quality led the ABA to determine the number of services of a particular technical quality that can be made available in a given area. The Commission has previously argued that this does not account for technology changes that improve the ability of televisions and radio to receive broadcasting signals (PC 2000). A similar argument was raised in a review of spectrum management arrangements in the United Kingdom (UK):

> … plans are based on certain technical assumptions, for example on the capability of TVs and radios to receive broadcasts. Since the plans were originally formulated there has been a significant improvement in the quality of reception equipment. This could make it possible for broadcasters to fulfil their universal coverage requirements using less spectrum. (Cave 2002, p. 176)

The ABA conceded that the level of interference protection may not be appropriate:

> The ABA is … proposing to commence a review of the level of interference for radio this year and this could potentially result in more spectrum available for use in areas. (ABA, sub. DR321, p. 4)

Even if the interference protection levels were lowered, the ABA would still determine the number of services that can be accommodated. An alternative approach would be to let service providers decide the quality of service they wish to provide. The interests of consumers are likely to be better met by competition among broadcasters to serve them, than by a regulatory process that attempts to anticipate the market's needs and engineer the structure of the broadcasting industry. According to the Australian National Audit Office, the ABA gives:

> … limited consideration to the level of audience interest in the provision of new services, which it finds is a difficult matter to assess. … Accordingly, all spectrum is not always identified for allocation to the fullest extent possible. (ANAO 2001, p. 46)

The Commission argued in its broadcasting report that current arrangements for digital television broadcasting will lead to inefficient spectrum use, if the Commonwealth Government continues to restrict access to broadcasting spectrum in order to fulfil other social objectives (PC 2000). The Commonwealth Government is currently reviewing several aspects of the digital television legislation (box 10.2), including restrictions on the content of datacasting services and the process for allocating datacasting licences (DCITA 2001b).

Some participants argued that reserving spectrum for particular uses is a barrier to more general use of the spectrum. Hydro Tasmania uses some spectrum in the defence bands (with the permission of Defence), for example, but the agreement requires that Hydro Tasmania cause no interference with defence users. Further, Hydro Tasmania receives no protection from interference caused by defence users. According to Hydro Tasmania (sub. 24), this arrangement creates uncertainty, which undermines investment.

The ABC (sub. 21) argued that reserving bands for amateur radio operators may be inappropriate if the costs of doing so (in terms of other services that could be provided) outweigh the social value or economic contribution of amateur operators.

Exemptions and concessions from spectrum charges, and prices that do not reflect opportunity cost, may result in cross-subsidies between users, particularly where an agency must fully recover its costs. DCITA argued that amateur operators are being cross-subsidised by other spectrum users (DCITA 2001a). Fee exemptions or concessions also reduce the transparency of the real costs associated with providing services, even where those services are in the public interest.

As well as affecting the efficiency of spectrum use, licence fee concessions and exemptions can affect the ACA. Exemptions from fees include the administrative charges levied by the ACA to recover the administrative costs of issuing licences and assigning frequencies:

> Experience would indicate that exemption from such charges can have the effect of encouraging eligible bodies to obtain licences even where the benefit given by the licence is less than the cost of undertaking frequency co-ordination. (ACA, sub. 9, p. 30)

Box 10.2 **Digital television**

The *Broadcasting Services Amendment (Digital Television and Datacasting) Act 2000* introduced provisions for digital broadcasting in Australia. The significant elements were that:

- broadcasters must transmit a standard definition television signal at all times and at least 20 hours a week of high definition digital broadcasts;
- the Australian Broadcasting Corporation and the Special Broadcasting Service can multichannel certain kinds of programs;
- broadcasters may transmit enhanced programming that complements the main simulcast program; and
- datacasters are restricted from broadcasting matter that would be equivalent to a television news, drama, sports, documentary, lifestyle or entertainment program, or a commercial radio program.

Digital television transmissions commenced on 1 January 2001. Anecdotal evidence suggests that few Australians are watching digital television. According to the ABA, 12 000 set top boxes had been sold to February 2002, which may reflect their relatively high cost (reported to be around $700). Others have argued that limited digital programming has affected take-up.

The Australian Communications Authority was to auction datacasting licences in May 2001. It received seven initial applications, only four of which were later confirmed. The auction was cancelled in May 2001 when another applicant withdrew, leaving only three bidders. The Commonwealth Government was concerned about the lack of competition and how this would affect the services provided and the return it could expect from the sale of the licences.

Sources: *Broadcasting Services Amendment (Digital Television and Datacasting) Act 2000*; ABC (2001); Alston (2001); ABA (trans., p. 423).

10.4 Policy options

The previous section highlights the problems created when spectrum users face diminished incentives to operate efficiently. Spectrum is likely to be set aside for at least some uses (such as international maritime and aeronautical services and satellites) because the international nature of these services requires planning on a worldwide scale (see appendix E). Some of the problems identified in this chapter may be addressed (at least in part) if users of ‘reserved’ spectrum faced stronger incentives for efficient spectrum use.

Managing spectrum in the defence bands

Maintaining national security means that it is likely that Defence should always have exclusive use of some spectrum. But as mentioned earlier, Defence holds apparatus licences for all its spectrum holdings and pays licence fees that are calculated on the same basis as commercial users. This provides some incentive for efficient spectrum use.

Defence may be exposed to further incentives under anticipated changes to footnotes AUS 1 and AUS 11 of the Spectrum Plan, which are used to reserve spectrum for defence purposes. Under certain circumstances, Defence may have to share 'defence' spectrum, albeit on an *ad hoc* basis.

Elsewhere in the report, the Commission has recommended the ACA should convert wide area apparatus licences into spectrum licences (see chapter 6). For Defence this would have the beneficial effect of encouraging more efficient use of defence spectrum. Defence would manage its spectrum use and could sublet spectrum to others. It would have the incentive to become an active band manager.

Managing spectrum in the broadcasting services bands

According to the ACA, there is scope to rationalise the amount of spectrum set aside in the broadcasting services bands, once the conversion from analogue television broadcasting to digital television broadcasting is complete (ACA, sub. 9). In its broadcasting report (PC 2000), the Commission argued that the Commonwealth Government's digital policy was undermining the take-up of digital services and therefore the release of spectrum. The Commission recommended changes to the legislation to overcome this problem. Current spectrum management arrangements also impede attempts to use spectrum in the broadcasting services bands efficiently.

Commercial broadcasters using spectrum in the broadcasting services bands have a reduced incentive to use the spectrum efficiently, because:

- they receive automatic access to spectrum in the broadcasting services bands; and
- they pay fees that do not relate to the amount, or opportunity cost, of the spectrum they use.

In its draft report, the Commission recommended repealing s. 31(1b) of the RC Act, thereby transferring responsibility for planning spectrum in the broadcasting services bands from the ABA to the ACA. There are strong reasons for this change.

First, technological change, especially convergence, means alternative uses for the broadcasting services bands are becoming increasingly important. Second, there is a degree of overlap between the functions of the ABA and the ACA. Not all broadcasters use spectrum in the broadcasting services bands to deliver their signals. Some broadcasters receive a content-related licence from the ABA, but are licensed by the ACA to use spectrum outside the broadcasting services bands. In addition, most broadcasters relying on the broadcasting services bands also hold licences from the ACA for non-broadcasting spectrum. Placing all spectrum under the one system would remove these overlaps. The ACA would apply the same planning rules for all spectrum users, which should provide scope for improving the efficiency of spectrum use. Combining the planning activities of the ACA and the ABA under one structure could also generate administrative efficiencies.

The Commission considers, however, that there are drawbacks from requiring one body to pursue multiple and sometimes conflicting objectives. Many of the spectrum planning and licensing problems discussed above result from the ABA attempting to use technical planning processes to achieve social and cultural objectives. The Commission considers that such objectives are better pursued independently from the allocation of spectrum. The ABA is well suited to manage those aspects of broadcasting that relate to regulating content, enforcing codes of practice, controlling ownership and deciding the number of national and community broadcasting licences to be made available.

A similar separation of regulatory functions has been advocated in the UK, even though the government recently announced plans to combine broadcasting content and carriage functions. An independent review of spectrum management found:

> … it would be desirable for the Government to separate entirely its broadcasting policy from the management of spectrum used for broadcasting. The Government would then set coverage and content requirements for public service broadcasters who would then obtain access to as many separate communications platforms as were necessary to meet these targets. (Cave 2002, p. 178)

The Commission, in its broadcasting report, recommended formally separating licences providing access to spectrum (currently apparatus licences) from licences to provide broadcasting services (‘broadcasting licences’). This would have several benefits.

First, splitting the current broadcasting licence into a licence to operate a broadcasting business and a separate licence to use spectrum would create the pre-conditions for more efficient use of spectrum.

Second, content provision could be separated from signal carriage. This would further encourage the development of carriage operators that can provide access to broadcast spectrum for multiple content providers (similar to a cable operator providing carrier services for multiple channels).

Third, it would improve planning and regulatory efficiency. The ABA has been criticised for allowing excessive concerns about the quality of program content to limit the spectrum made available in licence area plans (PC 2000). The Commission considers that concerns about the nature of content are better addressed more directly. Splitting access to the spectrum resource from the broadcasting licence would encourage a clearer alignment of regulatory instruments and government objectives.

Fourth, it would allow for technological convergence (see chapter 2). The ABA already issues commercial broadcasting licences that do not include access to spectrum (BS Act, s. 40). These licensees in effect pay fees for spectrum they do not use, and they must also pay for whatever delivery mechanism they do use (such as the Internet or spectrum outside the broadcasting services bands).

Fifth, it would create consistency with other spectrum planning. Spectrum in the broadcasting services bands would be planned in the same way as the rest of the spectrum. The fees charged by the ACA for use of spectrum in the broadcasting services bands would reflect the opportunity cost of spectrum. This would provide broadcasters with an incentive to evaluate their use of spectrum and explore other means of providing their services. This may involve using more spectrally efficient technologies or another delivery mechanism entirely.

Participants' comments

A number of inquiry participants supported the Commission's recommendation to separate licences to broadcast from licences to access spectrum and to transfer responsibility for planning the broadcasting services bands to the ACA.

> Ericsson supports … transferring responsibility for planning and licensing the broadcasting services bands of the spectrum to the ACA and that licence fees and access to spectrum be based on the opportunity cost of spectrum used. Such provisions are necessary in an environment of convergence to prevent distortions of technology usage in investment decisions. (Ericsson Australia, sub. DR325, p. 6)

> The Commission's recommendation … to transfer spectrum planning and licensing of broadcast service bands to the ACA from the ABA is welcomed. (Electronic Frontiers Australia, sub. DR318, p. 4)

> Vodafone supports the … recommendation that responsibility for the broadcasting services spectrum bands should be transferred to the ACA and be managed under the [RC Act]. … differing regulatory treatment of broadcasters and telecommunications companies create the potential for inconsistent policy outcomes and market distortions at a time of increasing convergence of technologies. Spectrum users should not be able

to gain a competitive advantage due to differing regulatory environments. (Vodafone Australia, sub. DR326, p. 10)

Defence strongly supports this recommendation. (Defence, sub. DR329, p. 6)

However, the ABA (sub. DR321), FACTS (sub. DR338), the Federation of Australian Radio Broadcasters (FARB, sub. DR339) and SBS (sub. DR344) expressed concerns with the Commission’s draft recommendation. Their concerns focussed on three main issues:

- that transferring responsibility for planning spectrum to the ACA would restrict the ability of the ABA and broadcasters to fulfil the social and cultural objects of the BS Act, especially those relating to the content of the services;
- that separating content from carriage would give broadcasters the incentive to trade away spectrum, making it less likely that they would meet their coverage obligations; and
- that basing licence fees on the opportunity cost of spectrum used may increase the total fees paid by broadcasters, which may affect incentives to increase (or maintain) coverage levels. The ABA (sub. 31, p. 14) was particularly concerned that an increase in fees may affect Government initiatives to extend television coverage in regional areas and black spots.

The Commission considers that these concerns are misplaced.

The Commission does not question the importance of the social and cultural objectives of broadcasting (including the content and coverage of services). What it has consistently argued is that they should be pursued independently of the technical planning and licensing of spectrum in the broadcasting services bands. The Commission agrees that these and other non-economic objectives, such as those contained in the Competition Principles Agreement 1995, are important, but it does not consider that the changes recommended to management of the broadcasting services bands will undermine their fulfilment.

Under the Commission’s proposals the ABA would retain responsibility for issuing broadcasting licences, which would include any conditions concerning content or coverage of broadcasting services. Existing and potential broadcasters would be subject to these conditions, regardless of the platform used to deliver the service. The ABA could revoke the licence of any broadcaster that fails to fulfil the licence conditions.

It is unclear what effect replacing licence fees based on gross earnings with fees based on spectrum use would have on the amount of fees paid by broadcasters, especially if the Government removes the restriction on the number of broadcasters (as recommended by the Commission in its broadcasting report). To minimise disruption to broadcasters, the Commission recommended in its report on broadcasting that fees be converted on a revenue neutral basis in the first instance, with adjustments made as required in subsequent years to equate fees with the opportunity cost of spectrum (PC 2000).

National and community broadcasters are currently exempt from paying licence fees. There are two ways of ensuring sufficient spectrum is available for these broadcasters:

- the acquisition of spectrum for these services could be explicitly funded in the form of a community service obligation payment; or
- spectrum could be reserved for these services.

The major advantage of the explicit funding approach is that it makes apparent the opportunity cost of national and community broadcasters' spectrum use. This is consistent with the Commission's approach to concession and exemption holders (see below). However, given the Government's commitment to national and community broadcasting services (that is, it is likely to purchase the spectrum regardless of the cost) it may be administratively simpler to reserve spectrum for these services. In its report on broadcasting, the Commission recommended that, if the current approach to reserving spectrum is retained, the ACA should estimate and publish the value of the spectrum reserved for national and community broadcasters. Awareness of true costs is necessary for accountability and the effective assessment of socially beneficial investments.

The basis for levying fees need not affect government initiatives to extend television coverage in regional areas and black spots. Assistance provided in the form of rebates on fees could continue regardless of how fees are determined. It may affect the amount of the rebate provided, but the Commission has previously recommended that the licence fee conversion occur on a revenue neutral basis.

The Commission reaffirms the conclusion reached in the draft report — that transferring responsibility for planning the broadcasting services bands to the ACA, to be managed under the RC Act, and separating the licence to broadcast from the licence to access spectrum, would provide opportunities to improve the efficiency of use of this spectrum. In an increasingly convergent environment, spectrum should be recognised as merely one input into the broadcasting production process and priced accordingly. This is consistent with the conclusions and recommendations of the Commission's broadcasting report, which still awaits a formal response from the Government.

A longer term objective would be to extend the use of spectrum licences in the broadcasting services bands. These licences are divisible and transferable, which would give broadcasters an incentive to review the amount of spectrum they hold, as well as encourage more efficient use of it. In addition, spectrum licences are not bound by the Spectrum Plan, which would allow broadcasters to use spectrum for non-broadcasting purposes. Alternatively, non-broadcasting users could bid for spectrum in competition with broadcasters.

RECOMMENDATION 10.1

The Commission recommends that:

- ***section 31(1b) of the*** **Radiocommunications Act 1992** ***should be repealed, transferring responsibility for the broadcasting services bands of the spectrum to the Australian Communications Authority, to be managed under the provisions of the Act;***
- ***licences granting access to spectrum should be separated from content-related licences that grant permission to broadcast;***
- ***licence fees for existing commercial broadcasters should be converted to fees that reflect the opportunity cost of spectrum used;***
- ***the value of broadcasting services bands reserved for non-commercial broadcasting services should be estimated and reported publicly; and***
- ***the Australian Broadcasting Authority should retain responsibility for issuing licences to broadcast and for determining the number of national and community broadcasting licences in a licence area. It also should retain responsibility for regulating content, enforcing codes of practice and monitoring ownership.***

Managing exemptions and concessions

The criteria for exemptions and concessions from fees and charges were described in box 10.1. There are three problems with the current arrangements:

- spectrum users face no incentive to rationalise demand or manage spectrum holdings efficiently;
- the real costs of providing the services are not apparent; and
- exemption and concession holders are cross-subsidised by other spectrum users, under ACA cost recovery arrangements.

There are two possible approaches to resolving these problems. Both options ensure that targeted spectrum users would be no worse off than they are under current arrangements.

The Commission's preferred approach is to discontinue concessions and exemptions and fund eligible users directly. These users would then be subject to the same incentives as other spectrum users to manage spectrum efficiently. It also would highlight the real cost of providing these services and remove cross-subsidies. Many inquiry participants agreed (for example, ACA, DR324; Ericsson Australia, DR325; FARB, DR339; Market Dynamics, trans., p. 115). The ACA stated that:

> … we would support more publicly visible support, such as a system of grants. We also note that, unlike the current system of exemptions and concessions, a system of grants would serve to encourage more efficient use of spectrum over time. (ACA, sub. DR324, p. 11)

Under this approach, targeted spectrum users could choose to purchase communication services rather than purchasing spectrum and radio equipment. For example, Telstra indicated a willingness to provide communication services for emergency service providers:

> Their primary function is provision of their particular emergency service. They're not experts in the communications business. So the presumption that they need their own spectrum … is open to a great deal of question. In fact, it may well be in the community's interest and to a greater benefit if those communication services were able to be leveraged off other communications resources. (Telstra, trans., p. 298)

A carrier, such as Telstra, can take advantage of existing fixed link and/or cellular sites to provide communications for emergency service providers. The marginal cost of using these existing sites is likely to be small compared with the costs of each service provider in each state establishing and maintaining its own network. Moreover, Telstra already provides some mobile radiocommunications for service providers in some jurisdictions on a contractual basis.

A possible disadvantage with an explicit funding approach is that it may be more administratively complex than a system of concessions and exemptions. The explicit funding approach requires establishing a mechanism for distributing funds to those organisations eligible for assistance. However, in this instance it is unlikely that the costs of establishing a separate funding mechanism would be prohibitive, because exemptions and concessions are currently limited to 365 organisations. Further, it would require a relatively small amount of funding ($6.1 million compared with total licence fee revenue of $118.2 million) (ACA, pers. comm., 9 November 2001).

Explicit budget funding increases the transparency of concessions and exemptions. Such transparency may prompt questions about the level of assistance received by some groups. Such scrutiny is avoided when assistance is hidden in the form of exemptions and concessions. However, awareness of the true costs of spectrum use is necessary for an effective market in spectrum. It is also important for the assessment of socially beneficial investments (see chapter 4).

It is appropriate to review the level of assistance paid to particular groups over time. Assistance may be adjusted to reflect, among other things, improvements in the efficiency of spectrum use. At least in the first instance, users should be funded to the full value of their current spectrum use. Over time, the level of budget funding would be subject to normal budget disciplines.

As a matter of principle, the Commission considers that explicit budget funding is the most appropriate means of supporting the communication needs of targeted spectrum users. The Commission recognises that beneficiaries of the current arrangements may be concerned about this approach, but does not consider that this warrants retention of the current system of non-transparent concessions and exemptions. The Commission is required to take an economy-wide view, and considers that the benefits to the community as a whole of more efficient spectrum use are likely to outweigh the costs to any specific group of users. Some targeted spectrum users (such as government agencies) are budget funded and there is no evidence to suggest that they have suffered materially as a result.

RECOMMENDATION 10.2

A system of explicit budgetary support should replace the current system of granting exemptions and concessions from spectrum charges to targeted spectrum users. These users should be funded to the full value of their current spectrum use, that is, the value of licence fees and the cost recovery charges levied by the Australian Communications Authority.

The Commission recognises that replacing the current system of exemptions and concessions will not occur immediately. In the meantime, or if administrative costs make the Commission’s preferred approach impractical, the ACA should continue exemptions and concessions with two changes to current arrangements. First, concessions and exemptions should be limited to the tax component of the charges. Users should pay at least the direct cost recovery charges to create a minimal incentive to manage their spectrum use, and to remove the cross-subsidies paid by other spectrum users. Second, to improve transparency, the ACA should estimate and publish the value of the concessions and exemptions, by the broad categories of recipients. This is consistent with the approach adopted for non-commercial broadcasters in the broadcasting report.

Targeting assistance

A number of inquiry participants argued that the criteria for determining eligibility for exemptions and concessions should be widened. The Australia Telescope National Facility (ATNF) CSIRO (sub. 13) and the Bureau of Meteorology (sub. 5) argued for exemptions or concessions from licence fees because they produce information that has some attributes of a public good. Moreover, the information that they produce can have safety-of-life implications. Similarly, the Department of Transport and Regional Services (sub. 62) argued that maritime service providers should be exempt from fees because safety-of-life issues are involved.

The Bureau of Meteorology (sub. 5) and the New South Wales Government (sub. 27) suggested extending the eligibility criteria to include public service providers, which would include Defence, police departments, education departments (including schools) and health departments (including hospitals).

DCITA argued in the final report of the Radiocommunications Review that exemptions should not be extended to include public sector agencies:

> The licence fee structure should provide similar incentives for efficient use to State or Territory governments as to other users. … The Review considered that from the viewpoint of efficient spectrum management and effective community use of the spectrum resource there was not a strong case to extend the range of exemptions. (DCITA 2001a, pp. 32–3)

The Commission supports DCITA's position. First, State, Territory and Commonwealth government agencies are required to purchase all other inputs at full cost. Spectrum should not be considered any differently from other inputs into the production process. Second, government users account for over one third of frequency assignments (figure 10.1). Extending the range of users eligible for government assistance to include government agencies would seriously undermine efforts to manage the spectrum efficiently.

Similarly, the Commission does not consider that maritime and aeronautical spectrum users should be eligible for government assistance to meet the costs of spectrum access. While the Commission accepts that there are safety-of-life issues associated with these services, commercial operators are using the spectrum to engage in for-profit activities in most instances. Again, the Commission does not believe that spectrum should be considered any differently from other inputs into the production process.

A further issue is whether some groups meet the current eligibility requirements for government assistance. The Australian National 4WD Radio Network (sub. 7), for example, argued that it should be eligible for government assistance, on the grounds that it is a volunteer based organisation providing safety-of-life services. As long as the practice of subsidising some groups over others continues, there will be problems with deciding where such boundaries are drawn. The ACA was established and resourced to manage the spectrum, not to decide who merits financial assistance from public funds. It is important, therefore, for it to be provided with clear guidelines for granting government assistance to targeted users.

The Commission reaffirms its position that a system of explicit budgetary support should replace the current system of granting exemptions and concessions from spectrum charges. However, in either case, government assistance should be closely targeted and the criteria for receiving exemptions and concessions from fees and charges (or explicit budgetary support) should be reviewed periodically. This process would ensure that organisations receiving government assistance are subject to public scrutiny on a regular basis. It also promotes transparency and is consistent with good public policy.

RECOMMENDATION 10.3

The criteria for eligibility for government assistance to meet the costs of spectrum access should be reviewed periodically.

Ensuring continued access for non-commercial users

Many non-commercial users (both government and non-government) were concerned about ensuring future access to spectrum. They were concerned that they will be unable to compete with commercial users:

> … there is a degree of nervousness amongst non-commercial spectrum users, both in Australia and internationally, that market-based reforms to spectrum management, such as the auctioning of spectrum, could have serious implications for emergency and safety-of-life services. (Australian Maritime Safety Authority, sub. 4, p. 2)

> … as the use of spectrum throughout Australia by the civil community increases, it is becoming progressively more difficult to satisfy military requirements. (Defence, sub. 25, p. 11)

> As a non-commercial public good organisation, the Bureau would be unable to compete at public auction for spectrum. One potential danger is that the auction process could easily swamp the usually smaller but fundamentally important public interest players. The highest value to society for spectrum does not necessarily equate to the bidder with the most financial resources. (Bureau of Meteorology, sub. 5, p. 7)

In practice, the market-based reforms to date have had little effect on non-commercial users. The ACA (sub. 9, p. 28) stated that few public or community users have had to move when bands were cleared for spectrum licences.

The pressure from commercial users must also be kept in perspective. The results of spectrum auctions must be interpreted carefully. There is some evidence that the amounts paid for spectrum in recent years have overstated the typical long-term value of spectrum (see chapter 8). Further, all spectrum is not substitutable, so prices paid in one part of the spectrum may not be indicative of the value of spectrum in other parts. The ACA (trans., p. 167) argued that there is little evidence of a shortage of spectrum for public or community service use.

Even if the demand from commercial users grows substantially, the RC Act includes measures designed to ensure non-commercial users have access to the spectrum, reflecting the desire of the Commonwealth Government to accommodate non-commercial spectrum users. For example:

- frequency band plans may provide for parts of the spectrum to be reserved for public and community services (s. 32);
- marketing plans issued by the ACA may specify how much spectrum to be allocated via spectrum licences should be reserved for public or community services (s. 39); and
- the ACA also may determine the spectrum access charges applied to spectrum licences issued to public and community services (s. 294).

Further, the ACA has the authority to buy spectrum licences on the open market (RC Act, s. 89) or resume them compulsorily (RC Act, s. 91). Similarly, the Government could fund non-commercial users to purchase spectrum. As discussed above, this would improve the efficiency with which spectrum is used and promote transparency and accountability.

The Commission considers that these measures are sufficient to ensure continued access to spectrum for public and community services. The Commission does not believe it is necessary to introduce other measures (such as incorporating social objectives into auction design), which may undermine efforts to establish an effective and efficient market for spectrum (Chan et al. 2002).

Other issues

The issues discussed above largely relate to planning and charging for spectrum used for non-commercial and broadcasting purposes. In addition, inquiry participants raised the following issues that relate to specific spectrum users.

Restrictions on amateur radio operators

The Commission received a large number of submissions from the international yachting community requesting that the regulations governing amateur radio in Australia be changed to allow the use of new technologies, such as WinLink 2000. WinLink, a digital radio communications system, allows the transfer of email files and other information over amateur radio. The submissions' main argument was that these new technologies provide a valuable communications system which can be used to enhance the safety of those at sea and those travelling in remote areas.

Amateur radio operators in Australia are unable to use technologies such as WinLink because they are prohibited from connecting to the public switched telecommunications network in certain circumstances (Radiocommunications Licence Conditions (Amateur Licence) Determination No. 1 of 1997, s. 11). According to the ACA, the restriction, which applies to automated systems where there is little direct human control, is imposed to protect the amateur bands from use by unregistered and/or unqualified users. The ACA (sub. DR340) said it is required to take 'such measures as [it] judges necessary to verify the operational and technical qualifications of any person wishing to operate an amateur station', under article 25 of the International Telecommunications Union (ITU) Radio Regulations.

A number of inquiry participants argued that WinLink poses no serious threat to the integrity of the amateur bands. For example, all WinLink users are subject to a 30 day probation period, during which time their licence details are verified. Users unable to verify their licence are locked from the system (Steve Waterman, sub. DR307). Moreover, WinLink currently operates in 12 countries around the world including the United States, Canada, France, Germany, South Africa and New Zealand. This suggests that there are ways to allow the operation of new technologies, such as WinLink, while still protecting the amateur bands from unauthorised traffic.

Section 5 of the amateur licence determination restricts Australian amateurs from transferring third party traffic to amateurs in other countries, except where Australia has an agreement. Australia currently has agreements with only five countries: the United States, Canada, the Solomon Islands, Israel and Honduras (ACA 2001b). This restriction should not prohibit the use of WinLink, because traffic from Australia is directed to the server in the United States, with whom Australia has an agreement (R.D. MacDonnell, sub. DR337). This restriction may apply to other systems based in countries with whom Australia does not have a treaty.

It is unclear whether WinLink (or a similar system) would be regarded as a network unit under the *Telecommunications Act 1997* and therefore be required to either:

- obtain a carrier licence, pay carrier licence fees ($10 000 a year) and contribute to funding the universal service obligation; or
- obtain a nominated carrier declaration in relation to the WinLink system, requiring a once-off payment of $3411.10 to the ACA.[3]

The ACA argued they do not have sufficient information about WinLink to make a judgement (ACA, sub. DR340). The application of the *Telecommunications Act 1997* is beyond the terms of reference for this inquiry.

The majority of submissions received by the Commission regarding this issue came from international amateurs. However, the evidence presented in a number of submissions indicated that both the operators of the WinLink system and Australian amateurs have approached the ACA in the past regarding the introduction of this system in Australia (Anthony Van Vugt, sub. 14; R.D. MacDonnell, sub. DR337; Steve Waterman, sub. DR341).

Given the apparently innocuous operation of WinLink in other countries and the potential benefits, it appears that it should be possible to amend the amateur licence determination to allow the use of technologies such as WinLink in Australia without breaching ITU Radio Regulations. The Commission agrees with the ACA that Australian amateurs as a whole should be consulted before a change is made. The Commission considers that consultations should include a broader cross-section of Australian amateurs than those represented by the Wireless Institute of Australia (whose membership accounts for only one third of all Australian amateur radio operators). The onus should be on demonstrating why the restrictions (particularly those imposed under s. 11 of the amateur licence determination) should be maintained, rather than why they should be removed.

FINDING 10.1

Changes to the Radiocommunications Licence Conditions (Amateur Licence) Determination No. 1 of 1997 to allow the use of technologies such as WinLink 2000 would not appear to undermine the integrity of the amateur bands or Australia's obligations under international agreements.

Radioastronomy 'sensitive sites'

Radioastronomy is a 'passive' service because radio telescopes receive transmissions (radio signals from space) but do not transmit any signals. As such,

[3] To obtain a nominated carrier declaration the owner of a network unit must arrange for a carrier to accept carrier-related responsibilities and become the 'nominated carrier' in relation to the network unit (*Telecommunications Act 1997*, Division 4, Part 3).

radioastronomy does not cause interference to other spectrum users. However, it is extremely susceptible to interference from others because it uses very sensitive equipment to detect very faint signals.

The primary use frequencies allocated to radioastronomy are protected from interference by ‘earth receive’ licences held by the ATNF. The ATNF is also permitted to use spectrum outside the allocated bands, provided no interference is caused to the primary users. These bands are specified in footnote AUS 87 to the Spectrum Plan.[4]

The ATNF argued that footnote AUS 87 is not effective in managing the interference with radioastronomers in these secondary use bands. The ATNF suggested that it would be more effective to designate major radioastronomy facilities as ‘radio sensitive zones’. Under this proposal, it would be mandatory to notify radio telescope facilities that another user has applied for a transmitter licence wholly or partially within the zone. This would allow the ATNF to find a technical solution that overcomes any interference with radioastronomers.

The Commission did not receive any submissions arguing against this proposal. It does not appear that notifying radio telescope facilities would impose significant costs on new users of spectrum in the secondary use bands. The ATNF did not suggest that other services be prohibited from using the spectrum. Further, the ATNF would be responsible for finding a solution to interference (ATNF CSIRO, sub. 13). Therefore, the Commission considers that the benefits of designating radioastronomy facilities as ‘radio sensitive sites’ outweigh the costs to potential spectrum users.

RECOMMENDATION 10.4

Radioastronomy facilities should be designated as ‘radio sensitive sites’ under the Australian Radiofrequency Spectrum Plan. These facilities must be notified that another user has applied for a transmitter licence wholly or partially within the bands specified in footnote AUS 87.

4 AUS 87 states that radioastronomy facilities operated by the CSIRO at the Paul Wild Observatory Narrabri, the Parkes Observatory, the Mopra Observatory Coonabarabran and the Canberra Deep Space Communication Complex conduct passive observations in the frequency bands 1250–1780 MHz, 2200–2550 MHz, 4350–6700 MHz and 8000–9200 MHz using receivers that are highly sensitive to interference (ACA 2002a, p. 150).

10.5 Conclusion

In the past, the Commonwealth Government has varied the rules and regulations governing some users' access to the radiofrequency spectrum, as a means of fulfilling social and cultural objectives not directly related to spectrum management. The changes often resulted in preferential access for some users, and/or charges that do not reflect the opportunity cost of the spectrum they use. In all cases, these changes dulled the incentive for these users to manage their spectrum efficiently and undermined the establishment of an effective market for spectrum.

As demand for spectrum increases, it is important that it be used efficiently and effectively. This is not possible if large numbers of spectrum users are subject to a different set of rules and regulations. The Government can fulfil its objectives without undermining the efficiency with which spectrum is managed. To the maximum extent possible, all spectrum users should be subject to the same conditions to ensure spectrum is managed efficiently. Any assistance provided by the Government should be funded explicitly via budget allocations. In addition to improving the efficiency of spectrum use, this would also improve the transparency and accountability of support arrangements.

11 Operations of the Australian Communications Authority

The Commission's terms of reference require it to assess the effectiveness of the Australian Communications Authority (ACA) in implementing the reforms introduced by the *Radiocommunications Act 1992* (RC Act). This chapter examines the operations of the ACA in this context. The ACA's functions and objectives are set out in section 11.1. Sections 11.2 and 11.3 discuss the ACA's public consultation arrangements and the delegation of administrative functions. Sections 11.4 and 11.5 examine the effectiveness of the ACA in implementing the major reforms of the RC Act — spectrum licensing and spectrum auctions. The final section summarises the overall effectiveness of the ACA.

11.1 Australian Communications Authority functions and objectives

One of the key radiocommunications regulation reforms in the 1990s was the creation of an independent regulator, the Spectrum Management Agency (SMA). The SMA became the ACA with the introduction of the *Australian Communications Authority Act 1997* (ACA Act). The ACA Act lists the spectrum management functions of the ACA as:

- to manage the radiofrequency spectrum in accordance with the *Radiocommunications Act 1992*;
- to advise and assist the radiocommunications community;
- to report to and advise the Minister in relation to the radiocommunications community;
- to manage Australia's input into the setting of international standards…; and …
- to make available information … educational programs … and advice to the public. (ACA Act, s.7)

In some of its operations, the ACA does not act alone. Under the RC Act and the ACA Act, the Minister for Communications, the Department of Communications, Information Technology and the Arts (DCITA) and the Australian Competition and Consumer Commission (ACCC) have responsibilities in certain areas of spectrum regulation. The Minister must approve spectrum re-allocations, spectrum licence auction procedures and competition limits for auctions, with advice from the ACA, DCITA and the ACCC (see chapter 6). These Ministerial approval procedures slow the spectrum licence process and may no longer be necessary now the ACA's credentials have been established and spectrum licence management processes have been accepted (see chapter 12).

In accordance with the ACA Act and the objectives of the RC Act (see chapter 5), the ACA has identified four key objectives for spectrum regulation:

- A regulatory approach that promotes benefits to end-users and contributes to an efficient and competitive Australian communications industry.
- Efficiency in the planning, allocation and use of national resources such as radiofrequency spectrum.
- Reduction in the costs of regulation and of the ACA's services.
- The fostering of industry self-regulation in a way which addresses public and national interest considerations without imposing undue financial and administrative burdens on industry. (ACA 2001c, p. 11)

Based on these objectives, the ACA has developed a range of key performance indicators (KPIs) in each of the activity areas of radiocommunications planning, licensing and allocation. These cover a variety of issues, from client satisfaction with ACA services and compliance with technical standards, to the extent and timing of spectrum licence auctions. Some KPIs are relevant to this inquiry's examination of the ACA and spectrum management reform (box 11.1).

Some of the ACA's KPIs are quantifiable — for example, the number of frequency assignments registered by accredited agents or the proportion of auctions completed within six months of a Ministerial determination. Others are qualitative or subjective and can be difficult to assess. Even so, the ACA reviews them annually and conducts client satisfaction surveys for some aspects of its regulatory performance (sections 11.2 to 11.5). General principles of good public administration, such as efficiency, consistency, transparency and accountability, are also relevant to examining the ACA's performance (see chapter 1).

11.2 Australian Communications Authority consultation arrangements

Given the significant changes in spectrum regulation and management in recent years, establishing effective consultation mechanisms has been vital. The ACA consults with industry, government, the community and other spectrum users across

Box 11.1 **Selected key performance indicators for spectrum regulation**

Key Performance Indicators (KPIs) for spectrum policy and planning include:

- conformity between the Australian Radiofrequency Spectrum Plan and international treaty regulations, while also meeting the needs of ACA clients;
- prompt notice to incumbent users to vacate spectrum for re-allocation; and
- appropriate technical standards and adequate industry awareness and compliance.

KPIs for licensing and monitoring include:

- effectiveness of accredited persons in conforming with ACA requirements;
- electronic processing of licence applications and renewals; and
- contestability between the ACA and externally accredited frequency assigners, as measured by the ratio of frequency assignments conducted by each.

KPIs for price-based allocation of spectrum include:

- allocating spectrum according to the Forward Program of auctions;
- the extent of spectrum managed through spectrum licensing and allocated through auction processes; and
- timing spectrum allocations to facilitate new technology relative to other countries.

Source: ACA 2001c, pp. 12–25.

a range of spectrum-related matters. Some ACA consultation arrangements are required by the RC Act — for example, for draft spectrum plans (s. 33), making standards (s. 163) or making declarations (s. 191). Other procedures are not a legal requirement, but are undertaken to meet the KPIs which the ACA has set for itself to promote good practice in public administration (section 11.1).

The ACA has established a number of advisory and consultative groups for specific purposes, primarily under s. 51 of the ACA Act. Formal radiocommunications consultation groups currently include:

- the International Radiocommunications Advisory Committee (IRAC) and the Australian Radiocommunications Study Groups (ARSGs), set up for International Telecommunications Union (ITU) consultations (box 11.2);
- the Radiocommunications Consultative Council (RCC);
- the Communications Technical Regulation Advisory Committee;
- the Emergency Services Advisory Committee;
- the Law Enforcement Advisory Committee; and

- temporary working groups and sub-committees established under these various councils and committees to examine particular issues.

Box 11.2 **International Radiocommunications Advisory Committee**

The International Radiocommunications Advisory Committee (IRAC) was formed in 1994 to promote consultation on international issues between the Australian Communications Authority (ACA), Australian industry and other interested parties.

IRAC members include the chairs of the seven Australian Radiocommunications Study Groups (ARSGs) and representatives from the Australian Electrical and Electronic Manufacturers Association; Airservices Australia; the Bureau of Meteorology; CSIRO; the Department of Communications, Information Technology and the Arts; the Department of Defence; the Department of Industry, Science and Resources; the Department of Transport and Regional Services; and the Wireless Institute of Australia. It is chaired by the ACA. The ACA retains responsibility for overall policy direction.

The ACA formally reconstituted the IRAC in 1997 (under s. 51, ACA Act). IRAC's functions were reformed again in April 2001. Currently, its role is to:

- provide advice to the ACA on matters of interest and policy significance to Australia;
- review finalised briefs for treaty-level conferences;
- set processes for subordinate committees; and
- advise on the composition of delegations and strategies for promoting Australian proposals for conferences.

Sources: ACA 2001q; ACA 2001c, p. 16.

The ACA also participates in the Australian Communications Industry Forum (ACIF), which is an industry body responsible for self-regulation of industry codes and standards. The ACIF oversees several reference panels and working committees and 'consults widely with industry and the community' (ACA 2001c, p. 179).

Consultation for the International Telecommunications Union

The ACA is responsible for managing Australia's input into the ITU-R World Radiocommunications Conferences and various specialist study groups.[1] The ACA is under no statutory obligation to consult industry on its position, but it has established a comprehensive, formal consultation network, consisting of the IRAC and seven subordinate ARSGs (box 11.2). These groups advise the ACA on Australia's position in ITU-R negotiations and develop input documents for discussion by the ITU-R study groups. The ACA retains final control over these

[1] The ACA also represents Australia in regional fora such as the Asia-Pacific Telecommunity.

processes and approves all documents developed by the IRAC and ARSGs before they are submitted to the ITU-R.

Many inquiry participants were supportive of the ACA's consultation arrangements for international spectrum planning (for example, Ericsson Australia, sub DR325, p. 1; Department of Defence, sub. 25, p. 19; ABC, sub. 21, p. 11; WIA sub. 15, p. 5; FACTS, DR338, p. 24). However, some participants had concerns with IRAC and the ARSGs. The Federation of Australian Commercial Television Stations (FACTS) wanted to ensure the ACA was 'provided with adequate resources to … remain committed to its international and national consultative role' (FACTS, DR338, p. 6). The Wireless Institute of Australia (WIA) suggested the ACA should provide 'financial support' to assist volunteer delegates to attend IRAC meetings (sub 15, p. 5).

Within IRAC, the Australian Broadcasting Corporation and the Department of Defence were concerned about the promotion of commercial interests which 'do not necessarily coincide' with the national position negotiated prior to the ITU (ABC, sub. 21, p. 11; Department of Defence, sub. 25, p. 12). On the other hand, Vodafone Australia said its global perspective should be given greater emphasis in IRAC consultations:

> … reforms should be made to the rules on company representation to reflect the global nature of the industries using radiospectrum. … Such constraints on representation are likely to lead to poorer decision-making in the long run. (Vodafone Australia, sub. 23, p. 9)

These conflicting viewpoints demonstrate the difficulty of accommodating all interests within a single 'national position', as is required for effective Australian participation in the ITU-R (box 11.2). The ACA encourages all interested parties to participate in the IRAC and ARSGs (ACA 2001c, p. 16). The ACA also emphasised that:

> … differences between Australian participants must be resolved within Australia, not at the international ITU meetings. The Chairpersons and the ACA should work to ensure consistency in the Australian contributions to each Study Group. The ACA has responsibility for the overall policy directions in ITU matters. (ACA 2001f, p. 15)

Given the range of interests of IRAC members, differences of opinion among them are probably inevitable. The current process strives to provide an appropriate balance. The IRAC and ARSGs are advisory bodies only. The strong role of the ACA — as chair of IRAC and as final author of Australia's policy position in the ITU-R — is important.

Consultation for spectrum planning

Section 33 of the RC Act requires the ACA to consult interested parties on the preparation of the Australian Radiofrequency Spectrum Plan and the frequency band plans. It is mandatory that draft spectrum plans be made available to the public and interested parties for comment, with at least one month for consideration.

The ACA fulfills these requirements through notification in the *Gazette* (as specified in s. 33), publication on its own website and through its primary consultative forum, the RCC. The RCC was established by a determination of the SMA in 1993 to provide advice on spectrum policy, planning and procedures. Its members include representatives of Government, industry, consumer and employee groups, and it is chaired by the ACA.

The RCC may establish working groups (sub-committees) to examine specialist topics. For example, an RCC working group was established to review apparatus licence tenure (2002), in response to the Government's Radiocommunications Review (DCITA 2001a). This required industry-wide consultation (in addition to that undertaken during the previous three years by DCITA) and a public report on licence tenure and renewal arrangements (see chapter 1).

The ACA also makes spectrum planning information available to the wider public, primarily through the Internet. In the interests of transparency, the ACA publishes planning information beyond its statutory requirements, releasing discussion papers, guidelines and summaries of the various responses from interested parties:

> … we would regard the open and transparent process as exposing ourselves to public consultation processes. That's really the best way of getting a handle on that. If we're going to make technical judgments, which the industry disagrees with, they'll certainly let us know. (ACA, trans., p. 155)

One of the ACA's KPIs for spectrum policy and planning includes 'the extent to which the interests of stakeholders are taken into account when providing access to radiofrequency spectrum' (ACA 2001c, p. 12). This KPI is assessed by the ACA through a survey of RCC members. A separate KPI measures customer satisfaction with planning activities (including related consultation) through a survey of ACA clients. The results of this survey are confidential (ACA 2001c, p. 12).

ACA consultations for the Spectrum Plan are difficult to separate from its consultations for ITU preparations (discussed above), as both are part of the same ongoing spectrum planning process. Inquiry participants were generally supportive of the total consultation procedure for spectrum planning purposes.

Consultation for spectrum re-allocation and licensing

Before reaching a decision regarding spectrum re-allocation, the Minister may take advice from the ACA, DCITA and the ACCC (see chapter 6). Also, s. 153G of the RC Act requires the ACA to consult parties affected by re-allocation before making its recommendation to the Minister. ACA consultation for re-allocations includes:

- the quantity and location of spectrum to be allocated;
- the timing of the allocation;
- spectrum allocation mechanisms;
- the licence period; and
- transition and other re-allocation issues.

In addition, potential bidders and interested parties have the opportunity to discuss forthcoming auctions directly with the ACCC, the Minister, and DCITA. A good example of the chronology of these consultations is the auctioning of spectrum licences in the 2-GHz band (the 3G auction) (table 11.1).

Table 11.1 **Chronology of the 3G auction consultation process**

Date	*Stage*
12 May 1999	First meeting of RCC Working Group on Planning for IMT-2000
24 December 1999	Release of 3G Mobile Telecommunications Working Group report
12 May 2000	Release of ACA 3G working paper and invitation to comment
26 June 2000	ACA release of summary of 3G submissions
20 July 2000	ACA release of draft spectrum re-allocation declarations for public comment
25 July 2000	First meeting of the Technical Liaison Group
9–17 August 2000	Release of five discussion papers by the Technical Liaison Group
25 August 2000	ACA release of summary of submissions on draft spectrum re-allocation declarations
1–19 September 2000	ACA release of revised Technical Liaison Group discussion papers
27 September 2000	ACA release of packaging options paper
19 October 2000	Minister sign-off on re-allocation declarations
2 November 2000	ACA proposal of lot packaging
15–22 March 2001	Auction of 3G spectrum licences
12 October 2002	Licences due to take effect

Source: ACA (2001r).

As the chronology for the 3G auction shows, these consultation requirements take time. If the ACA modifies its recommendation to the Minister as a result of its consultations, it is obliged under the RC Act to consult the affected parties again.

Inquiry participants said the legal process leading to the issue of a spectrum licence is 'very consultation intensive' (ACA, trans., p. 171) and 'quite extensive' (Ericsson Australia, trans., p. 500). Spectrum licences require far more consultation than is necessary for the issue of an apparatus licence (Vodafone Australia, trans., p. 539) (see chapter 6). Telstra described the consultation process for re-allocations and subsequent spectrum licensing as taking several years:

> The ACA and the department, if they're contemplating a re-allocation, will put out the draft re-allocation declaration for consultation by the industry and they put it up on their Web site and that consultation usually will take at least a year. Then after that they usually then go out on consultation again for something of the order of another year on the proposed draft conditions attaching to a licence. (Telstra, trans., p. 316)

The ACA has attempted to reduce the number of rounds of consultations by preparing a number of re-allocation options for review. Interested parties are consulted on these options which are then put forward to the Minister. This removes the need for a second (or even third) round of consultation if the ACA or Minister amend a recommendation from the initial form presented by the ACA.

In response to ACA concerns about the administrative burden of consultation for re-allocations, the Radiocommunications Review recommended that:

> … consideration be given to minor legislative amendments to streamline processes where minor changes are made to a re-allocation declaration following public consultation. (DCITA 2001a, p. 20)

The Commission endorses this recommendation. The respective roles of the ACA and the Minister in the re-allocation process are discussed further in chapter 12.

FINDING 11.1

The administrative efficiency of the Australian Communications Authority would be improved if minor changes made to a spectrum re-allocation declaration following public consultation did not require further consultation.

Other ACA consultation arrangements

In addition to the legislative requirements discussed above, the RC Act requires the ACA to publish proposals in the *Gazette* and to invite comment from interested parties for draft conversion and marketing plans for spectrum licences (s. 40); variations and revocations of class licences (s. 136); making or amending new technical standards (s. 163); and proposals for declarations (s. 191).

In the case of creating or amending standards, most consultation is done by Standards Australia as part of the functions delegated to it by the ACA (section 11.3). However, the ACA also consults widely on more significant standards issues. For example, during its review of electromagnetic compatibility (EMC) standards in 2000-01, the ACA asked 5500 manufacturers, importers, industry associations and 'test houses' to comment on the proposed amendments, convened an EMC Review Task Group and considered 88 submissions from the public (ACA 2001c, p. 19). Similarly, for the implementation of the electromagnetic radiation (EMR) standards, the ACA consulted directly with the Australian Broadcasting Authority, Federation of Australian Radio Broadcasters, the WIA and others and is conducting an online trial of self-assessment materials (ACA 2001c, p. 20).

As noted above, the ACA operates a series of specialist committees (in addition to the RCC) for radiocommunications consultations, such as the Emergency Services Advisory Committee and the Law Enforcement Advisory Committee. These are enabled (but not required) by s. 51 of the ACA Act and are chaired by the ACA. As their names suggest, the membership of these two committees consists of emergency services and law enforcement agencies, as well as telecommunications companies and others with an interest in these areas (ACA 2001c, p. 180).

The Consumer Consultative Forum is a mandatory consultation requirement for the ACA (s. 52, ACA Act). It meets biannually to consider mainly telecommunications issues. The ACA is also a member of the Inter-Government Spectrum Harmonisation Committee, established to promote harmonisation of frequencies and platforms between State Government police and emergency services (ACA, sub. 9, p. 29).

Effectiveness of ACA consultation arrangements

Most inquiry participants supported the ACA's formal consultation arrangements and said they work well (for example, NSW Government, sub. 27, p. 8; Ericsson Australia, sub. DR325, p. 6; Bramex, trans., p. 323).

However, FuturePace Solutions said there is poor coordination between the committees and between ACA and DCITA reviews (DCITA also consults industry on radiocommunications policy from time to time). FuturePace Solutions noted that related reviews and processes can run simultaneously, and become time-consuming for businesses with an interest in more than one area of spectrum management (trans., pp. 254–5). The Centre for Telecommunications Information Networking (trans., p. 480) said all consultation should be more transparent, so as to 'avoid the potential for capture' by 'self-interested' parties.

The Australian Electrical and Electronic Manufacturers Association (AEEMA) said that formal committees are an effective means of consulting industry and other groups, but ‘they are not a substitute for wider consultation or information sharing’ with the public (sub. 36, p. 4). The ACA (sub. 9, p. 9) acknowledged that of the ‘approximately 90 000 separate persons, government bodies and businesses’ holding spectrum or apparatus licences, only a small proportion are represented by industry and consumer bodies on the formal committees. As noted above, the ACA makes available to the public large amounts of planning and other material through its website and general publications.

The ACA is conscientious in consulting widely through committees, reviews, workshops, publications, advertisements and the Internet. One exception appears to be in setting reserve prices for spectrum licence auctions, where one inquiry participant argued that consultation and transparency have been insufficient (AEEMA, sub. 36; section 11.5).

ACA consultation has been important in bedding down the market-based reforms introduced under the RC Act and associated regulation. Any further consultation would need to be balanced against resource constraints, the potential for further time delays in regulatory processes and the potential to compromise the perception of the ACA as an independent regulator. Where it has discretion under its Acts, the ACA’s current consultation processes appear to be adequate.

FINDING 11.2

The Australian Communications Authority’s public consultation procedures generally give adequate opportunity for interested parties to have their views taken into account in a balanced manner.

11.3 Delegation and accreditation arrangements

The RC Act allows the ACA to delegate standards development, frequency assignment, compliance testing and qualifications examinations to selected bodies. This is a significant departure from pre-RC Act arrangements, under which the spectrum manager (the then Department of Communications) was responsible for administering all regulations directly (see chapter 3). Although the extent of delegation is not a meaningful measure of an agency’s performance, the ACA’s willingness to delegate is consistent with its objectives of reducing the costs of regulation and of encouraging industry self-regulation (section 11.1).

Delegation and accreditation of technical standards

Standards Australia is accredited by the ACA to develop technical standards for radiocommunications, in consultation with industry. It does not have authority to make these standards compulsory (see chapter 9). While generally supportive of this arrangement, inquiry participants point to some risk with the delegation of standards development. FACTS argued:

> Industry self-regulation leads to … the potential for particular commercial interests to unduly influence outcomes which are not directly related to the standard. … The ACA needs to maintain an active role in these different industry groups to ensure that standards accord with the objectives of the Act. (FACTS, sub. 28, p. 18)

These risks are reduced by:

- legal requirements for consultation with all interested parties before standards are finalised (under s. 163 of the RC Act);
- the ACA's discretion to declare mandatory standards (for example, the EMC and EMR standards); and
- the compulsory regulation impact statement process for introducing new subordinate legislation (see chapters 3 and 9).

Accreditation for frequency assignments

The RC Act allows the ACA to accredit approved agents to issue frequency assignment certificates under apparatus licensing and interference impact certificates under spectrum licensing. These certify that operation of a device will not cause unacceptable interference. There are over 41 accredited agents (ACA, sub. 9, p. 10), up from 33 in June 1999 and 17 in 1997 (ACA 2001c, p. 22).

The ACA has set itself a KPI for 'the level of contestability' between the ACA and accredited assigners, as measured by the ratio of assignments conducted by accredited assigners relative to the ACA (box 11.1). In the four years since the accreditation scheme was introduced, the quantity of frequency assignment work done outside the ACA has increased steadily. In total:

> The number of frequency assignments undertaken by external frequency assigners grew from 8393 in 1999-2000 to 17 581 in 2000-01, an increase of 109 per cent. Of the 28 037 assignments conducted during the year, external assigners undertook 63 per cent. (ACA 2001c, p. 23)

The ACA plans to improve the efficiency of the accredited assignment system by introducing 'on-line, automated processing of Frequency Assignment Certificates, submitted by accredited persons' in 2002 (ACA, sub. 9, p. 10). This will extend the

ACA's current facilities for electronic lodgment of licence applications.[2] This process is in line with the ACA's objective of improving administrative efficiency; its KPI for the electronic processing of applications (section 11.1); and the Commonwealth Government's 'Government Online' strategy (ACA 2001c, p. 22).

Some inquiry participants criticised elements of the scheme. For example, the Australia Telescope National Facility was concerned that accreditation had led to sensitive sites being overlooked (ATNF CSIRO, sub. 13, p. 4, see chapter 10).

Other inquiry participants (including the ACA) suggested that delegation of frequency assignment should extend to licensing itself, to further reduce the cost of regulation to users. For example, Hydro Tasmania explained that it had:

> … concerns over the way we have to deal with both the ACA and the engineering organisation we engage to do our spectrum planning, whereas we should be able to go through the one conduit to get our spectrum allocated. (Hydro Tasmania, trans., p. 340)

The ACA stated that it has no in-principle objections to delegating licensing functions. However, it emphasized that licensing has associated responsibilities which may be difficult to delegate, such as interference management and maintaining the public register of licences, which includes a classified section for defence and related uses (ACA, sub. 9, pp. 10–11). There will always be a need for the ACA to maintain a national register of spectrum licences (see chapter 9). In practice, this means the ACA must authorise the final approval and registration for each licence.

Competitive neutrality in frequency assignments

FuturePace Solutions said it was concerned with competitive neutrality between the ACA and private assignment agents, and argued that 'the regulator should not participate directly in the industry it regulates' (that is, the frequency assignment industry) (sub. 34, p. 2; trans., p. 256).

In response, the ACA said it has 'been our objective to ensure complete competitive neutrality between ourselves and accredited assigners' (trans., p. 590) and that it was careful in its pricing decisions to avoid being 'seen to be acting anti-competitively' (trans., p. 153). It said it was not aware of any problems to date:

> … if we are doing things to the detriment of competitive neutrality, it's not having much effect because we have rapidly lost the market. I think nearly two-thirds of apparatus licences are now being handled by accredited assigners and not by the ACA, and it started from nothing about four years ago. (ACA, trans., p. 590)

2 The ACA accepts electronic payments (BPay) for licence renewals and has outsourced renewal processing (ACA 2001c, p. 22).

As discussed above, the ACA has identified contestability between itself and assignment providers as one of its KPIs (box 11.1). Given the large increase in assignments made by accredited agents over the four years to 2002, competitive neutrality for frequency assignments does not appear to be a significant problem. The ACA is aware that the Government's competitive neutrality policy applies to any assignment services it offers in competition with private providers (Commonwealth of Australia 1996).

FINDING 11.3

Frequency assignments made by accredited agents have increased significantly since their introduction in 1997. The Australian Communications Authority has applied competitive neutrality principles to the frequency assignment activities it still undertakes directly.

Delegation of operator assessments and certificates

Division 5 of the RC Act states that the ACA may require people operating transmitters under specified transmitter licence classes to hold formal qualifications. The ACA may conduct approved examinations or approve other agents or organisations to conduct them. The ACA can delegate the issue of operator's certificates, but not the power 'to make a final decision refusing to issue a certificate' (s. 122A[2] RC Act; ACA, sub. DR324, p. 12).[3]

External examiners conducted 98 per cent of the 6981 marine qualification examinations during 2000-01, with the ACA conducting the remainder. From 1 August 2002, the administration of marine radio operator's certificates will be delegated to the Australian Maritime College. The College will produce, distribute and mark examinations, produce the *Marine Radio Operators Handbook* for examination candidates and issue certificates for marine radio operators. The ACA will continue to undertake special examinations upon request (ACA 2002c, p. 1).

The ACA issued 271 Amateur Certificates in 2000-01 (ACA 2001c, p. 23). Most examinations for amateurs were conducted by the WIA. The ACA said the WIA provided:

> … a timely and responsive amateur radio operator examination system. The ACA conducts examinations only in special circumstances, usually where for medical reasons the candidate is unable to sit for a group examination. (ACA 2001c, p. 23)

[3] If the delegate decides not to issue a certificate, the delegate must refer the application to the ACA for a final decision. Section 122A was added to the RC Act by the *Radiocommunications Legislation Amendment Act 2000* (No. 34 of 2000).

The WIA argued that the ACA could devolve its remaining amateur operating certificate functions to the WIA:

> … the WIA currently administers examinations of prospective radio amateurs; the WIA would be well placed to extend this service to include the issue of certificates of competency and potentially even [amateurs' apparatus] licences. (WIA, sub. 15, p. 10)

The WIA noted that 'for this to work, a mechanism for cost recovery along with necessary changes to the legislation would have to occur' (sub. 15, p. 10). The Radiocommunications Review recommended 'the ACA and amateurs continue to explore areas of further devolution of the ACA's regulatory activities regarding amateurs' (DCITA 2001a, p. 61).

The Commission agrees with this recommendation. The ACA released a discussion paper and is undertaking consultations to examine options for the implementation of this recommendation. Pending the outcome of these consultations and any legal requirements under ITU or other agreements (for example, ITU minimum standards for amateurs, WIA, sub. 15, p 5), the ACA should delegate more of the administration of amateur radio operator certification to the WIA or other appropriate amateur organisations.

RECOMMENDATION 11.1

The Australian Communications Authority should delegate the conferring of amateur radio operator certificates.

11.4 Spectrum licences

The RC Act introduced the concept of the spectrum licence. The ACA (and its predecessor, the SMA) had the task of turning the theoretical construct into reality, by developing a system of licensing that reduced the risk of interference while maximising the benefits of flexible spectrum use.

Technological neutrality of spectrum licences

Spectrum licences, as implemented by the SMA, were based on the concept of 'standard trading units' of spectrum, which are defined in terms of geographic area, frequency, permissible out of band and out of area emissions, and time. These parameters make up the core conditions of the spectrum licence. Defined in this way, the spectrum licence assumes the characteristics of a 'property right' which can be bought and sold privately, as long as licensees continue to meet the core conditions (see chapter 6).

The technical framework adopted by the ACA, made up of core conditions and device boundaries, influences the type of services that can be accommodated within the licence (see chapter 9). In general, the technical framework is based on the likely use of the spectrum, established following ACA consultation with potential spectrum licensees. As discussed in chapter 9, those inquiry participants who commented on the 'likely use' approach unanimously argued that it undermines the original concept of a flexible spectrum property right (Spectrum Engineering Australia, sub. 30, p. 8; Whittle, sub. 276, p. 2; FuturePace Solutions, trans., p. 543).

However, neither the Bureau of Transport and Communications Economics (BTCE) nor the House of Representatives Standing Committee on Transport, Communications and Infrastructure (HORSCOTCI) reports envisaged spectrum licences as completely technology or use neutral. They anticipated that spectrum rights holders could vary use only among a set of uses permitted by the spectrum licence. The core conditions for spectrum licences specified in the RC Act, however, do not include any condition covering use of the spectrum. Some inquiry participants interpreted this as implying that spectrum licences are technology and use neutral — that is, that any use is permitted as long as it complies with the core conditions. The SMA discussion paper on the implementation of spectrum licences is more cautious, stating only that:

> Spectrum licensing is intended to promote flexibility of use, so care will be needed to formulate a technical framework for spectrum licensing that opens the possibility of different uses. The SMA proposes that in defining the technical framework for spectrum licences, the framework should minimise any bias towards particular service types. (SMA 1995a, p. 13)

The Commission considers that the spectrum licences introduced by the SMA in 1995 were more flexible than those originally envisaged in the BTCE report. However, the degree to which core conditions and device boundaries must assume 'likely use' is a technical issue which is difficult for the Commission to assess. On the one hand, the core conditions for the 3G auction, for example, were designed to allow different mobile telephony technologies and have not prevented some licensees from intending to use their licences for quite different data transfer services. In addition, other uses can be accommodated though the negotiation of changed boundary conditions with neighbours, or the use of a wide enough buffer to prevent a breach of core conditions (although this may be technically less efficient). On the other hand, each spectrum licence issue has been characterised by a different set of core conditions and device boundaries, indicating a lack of neutrality that limits substitution possibilities.

FINDING 11.4

Spectrum licensing provides greater flexibility of use than the concept originally envisaged, but it is more prescriptive than was potentially provided for in the Radiocommunications Act 1992*.*

Deployment of spectrum licences

One of the ACA's KPIs for the price-based allocation of spectrum is 'the extent of spectrum managed through spectrum licensing and allocated through auction processes' (box 11.1). This section examines the performance of the ACA in implementing spectrum licensing, the conversion of apparatus licences into spectrum licences, and the spectrum re-allocation process. The conduct of auctions is examined in section 11.5.

Market Dynamics claimed that the use of spectrum licensing has been relatively limited:

> Despite the advantages of spectrum licensing, the joy that licensees have for it, and the fact it has brought more than $2.5 billion to the Australian Federal Budget, the ACA (and other agencies, for the ACA does not act alone) deploys spectrum licensing sparingly. (Market Dynamics, sub. 33, p. 17)

There was a lengthy delay between the introduction of the RC Act and the issue of the first spectrum licences. While the RC Act came into effect in July 1993, and the SMA had expected to hold the first allocations in late 1995, the first spectrum licences were not issued until early 1997. The initial delay in issuing spectrum licences arose from difficulties in defining the technical framework of these licences. Since 1997, the number of spectrum licences has increased at a faster rate than the number of assigned apparatus licences (table 3.2), albeit from a much lower base. Relatively few spectrum licences have been issued to date, and they account for only a small part of the licensed spectrum (see chapters 2 and 6). However, they are now the licence of choice for high-value telecommunications applications.

The pace of spectrum licensing can be gauged by comparing the actual deployment with that initially contemplated. In the mid-1990s, the SMA assessed the technical suitability of bands for spectrum licensing based on six criteria (SMA 1995a). According to this analysis, bands were not considered to be appropriate or available for spectrum licensing if:

- the Minister had designated the bands as a broadcasting services band under s. 31 of the RC Act;
- spectrum was being used for services where there was a high degree of sharing;

- spectrum licensing would require both core conditions and frequency co-ordination that would result in only marginal increases in flexibility;
- there would be difficulty in implementing licensing because a large number of licences were operating using narrow bandwidths and with limited coverage;
- further disruption would not be acceptable in the short-term following recent re-planning; or
- bands were reserved for the general purposes of defence.

On this basis, the SMA examined the suitability of some 133 bands, ranging from 39–41 MHz to 2900–3100 MHz, along with the 27.5–29.5-GHz band. In total, this was equivalent to 5061 MHz of bandwidth. The SMA considered that 84 bands out of the total 133 bands examined in this frequency range were technically suitable for spectrum licensing (table 11.2). The suitable bands covered 4260 MHz of bandwidth, or about 84 per cent of the spectrum examined.

The SMA recommended a number of bands for priority conversion to spectrum licensing, including:

- 501–505/511–515 MHz;
- 2076–2111 MHz;
- 2300–2450 MHz; and
- 27.5–29.5 GHz.

Since early 1997, spectrum licences have been issued in all the designated priority bands. From a broader perspective, however, spectrum licensing has been applied only in 13 of the 84 bands initially assessed by the SMA as being suitable for this licensing approach (table 11.2), representing around 30 per cent of the spectrum covered by these bands. The deployment of spectrum licences in the 39–3100-MHz band, in particular, lags significantly behind the SMA's initial assessment. Some spectrum licences have also been issued outside the bands originally considered for spectrum licensing (for example, in the 3.4-GHz band).

The conversion process is a means of introducing spectrum licences in encumbered spectrum. There have been only two conversions. Five apparatus licences were converted in the 500-MHz band and 417 licences in the multipoint distribution station band (ACA, pers. comm., 1 February 2002). This amounts to 106 MHz of spectrum (table 11.3). The limited use of the conversion process stems from the problems discussed in chapter 6.

Table 11.2 Extent of deployment of spectrum licensing in the bands considered suitable by the SMA,[a] 1996–2001

Band range[b]	*Potentially suitable for spectrum licensing*[c]		*Spectrum licensing implemented*[d]	
	Bands	MHz[e]	Bands	MHz[e]
39–41 MHz	0	0	0	0
42–43 MHz	1	1	0	0
44–45 MHz	1	1	0	0
108–117.975 MHz to 136–137 MHz	3	29	0	0
148–149.9 MHz	1	2	0	0
328.6–335.4 MHz	1	7	0	0
399.9–400.05 MHz to 410–420 MHz	8	20	0	0
450–460 MHz to 470–476.4 MHz	3	26	0	0
477.4–501 MHz to 515–520 MHz	5	43	4	14
820–850 MHz to 890–915 MHz	3	95	2	40
928–942 MHz to 960–1215 MHz	3	287	0	0
1260–1300 MHz to 1350–1400 MHz	3	140	0	0
1427–1429 MHz to 1544–1545 MHz	9	118	0	0
1559–1610 MHz to 2300–2450 MHz	34	891	6	378
2500–2520 MHz to 2900–3100 MHz	8	600	0	0
27.5–29.5 GHz	1	2000	1	850
Total	**84**	**4260**	**13**	**1282**

[a] Other bands not considered in 1995 have since been spectrum licensed. [b] Bands as defined in SMA (1995a). [c] Based on the SMA (1995) assessment. [d] Includes converted licences in the 500 MHz and multipoint distribution station bands. [e] This measure does not account for the geographic dimension. That is, in some cases, spectrum licences may apply to the whole of Australia whereas, in other cases, they may apply only to capital cities or regional licence areas.

Sources: SMA (1995a); ACA, pers. comm., 1 February 2002; Commission estimates based on ACA (2002d).

There have been seven sets of spectrum re-allocation, covering a range of bands and about 738 MHz of spectrum (table 11.3). Given the difficulties the ACA encountered with the conversion process, it has placed greater reliance on spectrum re-allocation as the mechanism to clear bands so that spectrum licences may be issued.

In its forward program, the ACA (2002d) identifies potential bands for price-based allocation, which may provide further scope to introduce spectrum licensing in the near future. The spectrum identified ranges from the 400-MHz band to the 47-GHz band. The ACA expects that most of these bands either will be allocated within the next three years or a decision to allocate will be made within three years (where technology and demand issues are uncertain).

FINDING 11.5

The deployment of spectrum licences has proceeded more slowly and has been applied in far fewer bands than was envisaged in 1995.

Table 11.3 **Conversions and re-allocations**

Band	*Year*[a]	*Instrument*	*Frequency ranges*	*Bandwidth covered*
			MHz	MHz[b]
500 MHz	1996	Conversion and re-allocation	500.99375–504.99375, 510.99375–514.99375	8
800 MHz	1997 and 2000	Re-allocation	825–830, 830–835, 835–845, 870–875, 875–880, 880–890	40
1.8 GHz	1997	Re-allocation	1710–1755, 1805–1850	90
28/31 GHz	1998	Re-allocation	31000–31300	300
PCS	2000	Re-allocation	1755–1785, 1850–1880	60
3.4 GHz	2000	Re-allocation	3425–3442.5, 3475–3492.5, 3442.5–3475, 3542.5–3575	100
MDS	2000	Conversion	2302–2400	98
2 GHz	2000	Re-allocation	1900–1920, 1920–1980, 2110–2170	140
Total MHz subject to conversion				**106**
Total MHz subject to re-allocation				**738**

a The year in which the instrument was issued. **b** This measure does not account for the geographic dimension. That is, in some cases, the conversion (or re-allocation) process may apply to the whole of Australia whereas, in other cases, it may apply only to capital cities or regional areas.

Source: ACA, pers. comm., 1 February 2002.

11.5 Auctions

The RC Act gives the ACA some latitude in choosing a market-based allocation mechanism for apparatus and spectrum licences. It also gives the ACA the power to choose the way in which licensees pay for their licence. In practice, however, the ACA has invariably opted for auctions with upfront payments. Of all the alternatives, the Commission considers that this form of market-based allocation is the most appropriate. (A discussion of alternative allocation and payment mechanisms is provided in appendix D.) This section examines the ACA's implementation of auctions from two perspectives. First, it discusses the amount of spectrum auctioned and the timing of those allocations. Second, it examines the way in which auctions were implemented.

Decisions on when and how much to auction

One of the ACA's KPIs is the 'timing of spectrum allocations to facilitate new technology relative to other countries'. Another is 'the extent of spectrum managed through spectrum licensing and allocated through auction processes' (box 11.1). In the context of these indicators, this section aims to ascertain how effective the ACA has been in deciding the timing of auctions of spectrum licences and the quantity of spectrum that was offered for sale.

Under the RC Act, the process leading up to a spectrum licence auction can be initiated in one of two ways:

- by a Ministerial designation of an unencumbered band for spectrum licensing (s. 36);[4] or
- by a Ministerial declaration that encumbered spectrum should be re-allocated (s. 153B).

In both cases, the Minister's decision dictates how much spectrum is to be spectrum licensed, the characteristics of the spectrum lots on offer and the date of commencement of the spectrum licences. With regard to re-allocation declarations, the starting date must be no less than two years from the date of gazettal of the Ministerial decision.

As the chronology of the 3G auction shows, the consultation and spectrum packaging period leading up to an auction can be less than two years (table 11.1).[5] However, the sale of spectrum licences at auction has taken longer in other bands. Five years elapsed between the 1993 recommendation by the Australian Telecommunications Authority that the 1.8-GHz band be made available for the introduction of Personal Communication Services (PCS) in Australia, and the auctioning of that spectrum in 1998. That delay reaches seven years if the final release of 1.8 GHz spectrum (in the PCS 2000 auction) is included. This is the same period that was required, on average, for the auctioning of spectrum in the PCS bands in the United States (Hazlett 2001, p. 120).

Inquiry participants' views on the timing of spectrum auctions were divided. Market Dynamics argued that the rate at which spectrum auctions were held in Australia was too slow, compared to the United States (Market Dynamics, trans., p. 117).[6]

[4] When an encumbered band is designated for spectrum licensing under s. 36, apparatus licensees must be given the option of converting to spectrum licences (see chapter 6).

[5] However, the International Telecommunications Union designation of a band for 3G services took place in 1992.

[6] While the ACA ran 15 spectrum auctions between 1994 and 2002, the FCC conducted 82.

Another inquiry participant thought that, in general, that rate was appropriate, given the need for consultation prior to auction (CTIN, trans., p. 481).

In assessing the timing of its market-based allocations of spectrum, the ACA's view is that Australia is either at the forefront of allocations for new technologies or 'consistent' with similar allocations overseas. This seems borne out by a comparison of the allocation of spectrum for code division multiple access (CDMA), local multipoint distribution system (LMDS) and wireless local loop (WLL) technologies in Australia and overseas (table 11.4). The ACA states, further, that 'Australia has been one of the world leaders in allocating broadband spectrum above 20 GHz and datacasting spectrum' (ACA 2000a, p. 19).

Table 11.4 **Timing of selected spectrum allocations in Australia and internationally**

Technology	*Earlier than Australia*	*Australia*	*Later than Australia*
CDMA (800 MHz)	United States, South Korea	1998	China
LMDS (28/31 GHz)	United States, New Zealand	1999	Europe
WLL (3.4 GHz)	United Kingdom, Mexico	1997	United States, Canada, European Union
3G (2 GHz)	European Union, Japan, New Zealand	2001	United States[a]

[a] It is not known whether the United States will allocate spectrum for 3G technologies.

Sources: ACA annual reports, various issues; UMTS Forum (2001).

It should be noted that the timing of auctions will depend, in part, on the demand emanating from industry. In that respect, Optus said that the ACA was prepared, when approached, to auction more spectrum for LMDS services in the 27-GHz band (Optus, trans., pp. 37–38).

Given that spectrum auctions are normally preceded by the re-location of apparatus licences (see chapter 6), it is important that the ACA not overestimate the demand for unencumbered spectrum. To do so would mean that a band is cleared prematurely, with no or few new users requesting it. The ACA has indicated that it considers a range of factors when prioritising bands for auction, to ensure that the costs to the incumbents and the benefits to new potential users are taken into account (ACA 2001h). One inquiry participant agreed:

> … the ACA does quite a good job in terms of trying to establish whether there's a demand for spectrum before it goes on auction — because that's the key decision point. (Vodafone Australia, trans., p. 57)

Apart from their timing, the adequacy of spectrum allocations at auction also may be judged in terms of the quantity of spectrum released. As mentioned in section 11.4, only a small percentage of the total amount of spectrum originally considered suitable for spectrum licensing and price-based allocation has been licensed to date. This raised the question, in the minds of several inquiry participants, of whether the scarcity of spectrum for spectrum licensing was intentional, aiming to maximise auction revenue (Market Dynamics, trans., p. 110; Optus, sub. 17, p. 13; Vodafone Australia, sub. 23, p. 11). Market Dynamics stated:

> Spectrum for mobile telecommunications was released progressively to the market as a matter of policy, creating artificial scarcity in the low microwave area at auction points in 1998, especially in 2000 and then in 2001. (Market Dynamics, sub. 33, p. 13)

This comment refers primarily to the auctioning in two stages of spectrum suitable for PCS applications in the 1.8-GHz band (see chapter 8). The second major PCS auction, in 2000, generated considerably more revenue than the first in 1998 (table 8.1). The sale of 60 MHz of spectrum in Sydney, for example, yielded $0.76 million in 2000, while 90 MHz of spectrum in the same band sold for only $0.08 million in 1998.

The ACA denied that the progressive release of spectrum in the 1.8-GHz band was motivated by revenue-raising considerations:

> We agree that it might be argued that, because the PCS spectrum was sold over several auctions, there was an attempt to limit the supply. … This allocation was not undertaken, however, to maximise revenue and nor is there evidence to suggest that the staged release of the band led to this outcome. (ACA, sub. DR324, p. 10)

It also indicated, in a discussion paper published before the 2000 auction, that it did not release the entire amount of spectrum available in 1998 because incumbent fixed links operators made representations to that effect (ACA 2000e). Indeed, it is not clear that 1998 licensees themselves required more spectrum than was released: according to a summary of comments received by the ACA prior to the 2000 auction, potential bidders were divided over both its timing and its features (ACA 2000f).

Despite the contrasting views outlined above, Australia appears to have released about the same amount of spectrum for mobile telephony as released in other countries — 345 MHz in total, which is about the same as the European average (355 MHz) and significantly more than the United States average (210 MHz).[7]

FINDING 11.6

The timing and volume of spectrum released at auction by the Australian Communications Authority have been similar to or better than those implemented

[7] The first figure is a Commission estimate based on both spectrum and apparatus licensing. The last two figures are from Hazlett (2001, p. 119).

by comparable countries. Auctions do not appear to have delayed or hindered the introduction of new telecommunications technologies into Australia.

Auction implementation

Under the RC Act, the ACA has responsibility for determining an auction's design, rules and reserve prices. It is also responsible for managing the auction. These aspects of the ACA's role are examined below.

Auction design

Regulation impact statements prepared by the ACA before each spectrum auction provide an insight into the agency's reasons for choosing auctions over other allocation mechanisms, and for choosing simultaneous ascending auctions over other forms of auctions (box 11.3).

Box 11.3 **Reasons for choosing simultaneous ascending auctions**

In the regulation impact statement prepared for the auction of spectrum in the 27-GHz band, the Australian Communications Authority (ACA) stated that:

> In determining how licences are to be allocated the ACA has considered sale by auction (either 'English' or 'simultaneous'), sale by tender, and sale at pre-determined or negotiated price.
>
> Demand for spectrum licences is expected to exceed supply. This outcome favours allocation by tender or auction. Of these two, the ACA prefers auction.
>
> The benefits of conducting an auction to allocate spectrum licences are that it would be a quick and open process, it would establish a proper market value for the licences (for example, without bidders paying too much or too little), and it would ensure that the licences were allocated to the people who valued them most highly.
>
> The disadvantage of an auction over a tender is that bidders have more opportunity to collude during an auction where the identity of the other bidders is known.
>
> Where a large number of complementary and substitutable lots are on offer, the ACA prefers to conduct a simultaneous auction, rather than a conventional 'English' ('open outcry') auction. This type of auction offers far more scope for industry to acquire the combinations of spectrum they need to implement successful business plans. This is an important consideration in the 27-GHz band spectrum allocation where licences are to be offered in different areas and in different bandwidths.
>
> Although a simultaneous auction is relatively complex compared to tenders or open out cry auctions, prospective applicants would be familiar with the simultaneous auction format as a result of the ACA undertaking such auctions for the 500 MHz, 800 MHz, 1.8 GHz, 28 GHz and 31-GHz bands.

Source: ACA (2000g).

An examination of successive regulation impact statements suggests that the main reason for using simultaneous ascending auctions for multiple lots has remained the same since this design was first used in 1997. This format allows bidders to determine their own licence coverage (spectrally and geographically) in a context where lots can be complements or substitutes. In implementing this type of design in Australia, the ACA's predecessor, the SMA, was able to avail itself of technical and academic expertise generated by the PCS spectrum auctions in the United States since 1994. In particular, it benefited from the guidance of several auction theorists who had advised the Federal Communications Commission (FCC) and some bidders in these auctions (Hayne 1997).

The simultaneous ascending auction model, which the SMA adopted as a result of its consultants' advice, improved on that used in the United States PCS auctions. The Australian model allowed aggregations to take place spectrally as well as geographically (whereas only the latter was possible in United States auctions). Aggregation in two dimensions has been a trademark of Australian spectrum auctions since the first spectrum licence auction. It means that the market, rather than the regulator, is able to decide how many licences are allocated, what area they cover and how much bandwidth they comprise.[8] Countries such as Germany have since adopted this highly flexible model of spectrum allocation. In other countries, such as the UK, licence specifications are much more restrictive (Grant 2001).

Apart from simultaneous ascending auctions, the ACA has used English open outcry auctions on occasions (table 8.1). While, for reasons discussed in chapter 8, this auction format is not suitable for the sale of multiple items that may be interrelated, it is an appropriate choice when only few lots are offered for sale. For example, those left unsold following a simultaneous ascending auction. Then, the benefits of a quick and cheap auction outweigh the potential disadvantages of not facilitating efficient aggregations. The Commission considers that the use of English auctions by the ACA has been judicious in this respect.

According to the regulation impact statement for the second PCS auction, the ACA has rejected tenders for the price-based allocation of spectrum licences because of the possibility of a 'winner's curse' outcome (see chapter 8 and Chan et al. 2002) and its implications for the operation of a cost-effective service.

Most inquiry participants were satisfied with the choice of the simultaneous ascending format for most spectrum auctions. Vodafone Australia stated:

> The transaction costs … involved in [New Zealand spectrum auctions] were huge and they basically messed it up and I think in comparison that the Australian auction system

8 Subject to any competition limits and spectrum caps decided by the Minister.

> was predictable. It was understandable and worked really well. (Vodafone Australia, trans., p. 63)

However, as noted in chapter 8, Market Dynamics (sub. 33) argued strongly in favour of replacing simultaneous ascending auctions with combinatorial (package) auctions. In chapter 8, the Commission recommends that the ACA explore further the possibility of using combinatorial auctions to alleviate potential exposure problems.

The ACA should also consider the possibility of collusion between bidders when choosing an auction design. As documented by Klemperer (2002), ascending auctions are vulnerable to collusion amongst bidders. Collusive behaviour can be encouraged because ascending, multi-round auctions present ample opportunity for signalling to rivals and also for 'punishing' them (Chan et al. 2002). Several instances of signalling, in particular, have been reported in relation to recent European 3G auctions.

The Commission is not aware of any similar occurrence in Australian spectrum auctions. Indeed, these auctions appear to have successfully avoided the bidder signalling problem — through, in part, the rounding down of bids reported after each round, so as to prevent the use of a bid's final digits to communicate between bidders.[9] Nonetheless, if collusion is considered a strong risk in future auctions, the ACA should consider less susceptible designs such as sealed-bid or 'Anglo-Dutch' auctions (Klemperer 2002).

Auction rules

The conduct of any auction requires a certain number of rules and conditions, to ensure items are allocated quickly, efficiently and transparently. Some rules and conditions for simultaneous ascending auctions are identical to those applying to other auction formats. For example, reserve prices and minimum bid increments. Other rules were introduced specifically to deal with the particularities of simultaneous ascending formats. For example, activity rules are designed to discourage strategic bidding and to encourage active bidding (Chan et al. 2002).

With the exception of competition limits set by the Minister (see chapter 6), the ACA determines the rules and conditions of Australian simultaneous spectrum auctions. Summarised in box 11.4, these rules are similar to those introduced at the time of the first simultaneous ascending auctions in the United States in 1994 (McMillan 1994; Milgrom 2000).

[9] However, other methods, such as jump bidding and bid withdrawals, may have been used to communicate.

Box 11.4 **Simultaneous ascending auction rules and conditions**

- *Entry fee, eligibility payment and deed of financial security*: these are set by the ACA. The entry fee is fixed and non-refundable. The eligibility payment is proportional to the total lot rating covered by the bidders' eligibility (how much spectrum they hope to win). At the end of the auction, that payment is credited to the bidders' winning bids, net of any withdrawal penalties incurred during the auction (see *withdrawal penalties*). The deed of financial security represents a guarantee that a winning bidder will honour part or all of their bids.
- *Collusive bidding and associated persons*: bidders — whether they are associated or not — are forbidden from engaging in collusive bidding. Associated bidders are permitted to take part in the same auction, provided they do not collude and provided that their joint winnings do not breach the competition limits applying to the auction.
- *Activity rule*: applicants are required to meet a percentage of their eligibility when bidding in each round. This rule is designed to ensure active bidding throughout the auction. Unless they use a waiver (see *waiver*), bidders must bid on lots equivalent to at least a certain percentage of their eligibility. This percentage increases as the auction moves through its three stages (see *auction stages*). A bidder cannot bid in such a way that they exceed their maximum eligibility. If a bidder fails to meet their activity rule, then their total eligibility is reduced by the auctioneer. A bidder is regarded as active on a lot if they hold the current highest bid.
- *Auction stages*: the stages are the groups of rounds during the auction to which the same activity rule percentage applies. The number of rounds in each stage is not known in advance and is left to the discretion of the ACA.
- *Waiver*: this is an option not to bid but to retain current eligibility, even though the activity from current round bids is less than that necessary to maintain eligibility within the current activity rules.
- *Starting bids*: these are determined by the ACA and communicated to the bidders after they have entered the auction. They therefore act as a reserve price.
- *Minimum bids*: from one round to the next, the ACA sets the minimum bid increment over the previous highest bid. The ACA can decide, after consulting with bidders, to vary this increment during the auction, depending on the stage of the auction.
- *Withdrawal penalties*: a bidder can withdraw a highest bid on a lot. The second highest bid then becomes the current highest bid. If the lot ends up being sold at a price lower than the withdrawn bid, then the withdrawing bidder pays the difference.
- *Closing rule*: the auction is declared closed by the auctioneer when no new bid or waiver is received for any of the lots during a round. The auction manager can also bring the auction to a close on two rounds' notice.

Source: Compiled from various auction applicants' packages (see, for instance, ACA 1998e).

Most of the auction rules implemented by the SMA/ACA attracted no comment from inquiry participants. An ACA survey of bidders following the PCS 2000 auction (in the 1.8-GHz band), however, provides some insight into the operation of the auction rules. Bidders expressed a diverse range of opinions but generally were supportive of the rules in place and of their application by the ACA.

One auction rule, however, elicited numerous comments from this inquiry's participants. This rule concerns the setting of reserve prices ('starting bids') for lots being auctioned.

Reserve prices

In spectrum auctions, as in real estate auctions, reserve prices may be likened to a bid by the seller. Unlike in real estate auctions, however, the reserve price is usually made public prior to spectrum auctions, and therefore represents a *de facto* minimum bid. The good is sold only if the bid price is greater than or equal to the reserve price.

Reserve prices are commonly used to protect the seller against low priced final bids, such as could result from weak bidding or strategic demand reduction by the bidders. It can be shown, in certain auction environments, that the gap between the winning bidder's valuation of the good and the final price paid at auction is inversely proportional to the number of bidders. In other words, the more bidders, the closer the winning bid is to the winning bidder's willingness to pay. When only a few bidders enter the auction, the seller runs the risk that the willingness to pay of the second-highest bidder (hence the winning bid in a first-price auction) is below the cost of the good. To avoid this outcome, the seller wisely sets a reserve price (Chan et al. 2002).

Both auction theory and auction practice show that judiciously set reserve prices, beyond preventing a loss to the seller, can play an important part in ensuring the efficiency of an auction. Reserve prices that are too low — or non-existent — can encourage bidders to collude tacitly by bidding low, thus ending the auction quickly. This is particularly true when bidders are few, relative to the number of objects for sale. According to Klemperer (2002), this form of gaming was behind the very weak bidding recorded in the Swiss sale of 3G licences in 2000. In that auction, four bidders registered to bid on four licences, which resulted in per capita revenue being one-thirtieth of that recorded in the corresponding UK and German auctions. Collusion and strategic demand reduction mean that there is no guarantee that the licences are allocated to the most efficient users. Setting a high reserve price is one of the deterrents available to the seller in the presence of potential (or actual) collusion (Chan et al. 2002).

Reserve prices in spectrum auctions have been common internationally. They were used in all European 3G auctions, for example. However, they were used only sparingly in United States auctions until recently (McMillan 1994; Hazlett 2001). Reserve prices were set in all Australian spectrum auctions, because of the ACA's explicit goal of obtaining a 'fair return' for spectrum owned by the community (see chapter 4).

Some inquiry participants questioned the ACA's choice of reserve prices in its auctions (Optus, sub. 17, Vodafone Australia, sub. 23, AEEMA, sub. 36). For instance, AEEMA stated:

> Setting of reserve prices for spectrum does not appear to be established on any clear basis. The outcomes of auctions suggest that the reserve price has in fact determined to a large extent the price paid for the auctioned spectrum. (AEEMA, sub. 36, p. 12)

According to Optus, the setting of high reserve prices in some auctions was motivated by the desire to guarantee the Government a minimum amount of revenue (sub. 17). However, the ACA argued that:

> … if we were looking to maximise the revenue there would be far easier ways [than reserve prices] to do it; notably by constraining the supply, for instance at two GHz, instead of offering 60 MHz paired we could have increased the returns to the Commonwealth by offering only 40 MHz. (ACA, trans., p. 175)

Another inquiry participant suggested that Australian reserve prices compared favourably with those imposed overseas:

> I think reserve prices in the Australian case have worked quite well. In the Italian case they didn't, and that comes back to that revenue maximisation. When you start to get revenue maximisation there's a temptation to have larger reserve prices and, in the Italian case, the very high reserve price has really prevented the auction process from going through what I would call the natural stages of an auction. (CTIN, trans., p. 489)

Nonetheless, some inquiry participants argued that reserve prices had damaged the efficacy of the auction process in Australia, by lessening the amount of competitive bidding. Both Optus (sub. 17) and Vodafone Australia (sub. 23) referred to the number of lots sold at the reserve price or left unsold as evidence of this. They cited the 3G auction as an example of high reserve prices preventing the market value of spectrum from being revealed, thus detracting from the primary function of auctions. This is echoed by an industry analyst's view that high reserve prices brought that auction to a premature conclusion, for reasons related to maintaining activity levels and avoiding withdrawal penalties (FuturePace Solutions 2001).

The strength of competitive bidding at auction can be gauged in a number of ways. A number of indicators are shown in table 11.5, for all Australian simultaneous ascending auctions.

Table 11.5 **Indicators of competition in spectrum auctions**[a]

Auction	*Excess demand*[b]	*Number of winning bidders relative to registered bidders*	*Aggregate final prices relative to aggregate reserve prices*	*Percentage of lots sold at reserve prices*	*Percentage of lots unsold*
	%	*%*	*%*	*%*	*%*
500 MHz (1997)	150	92	214	17.3	19.3
First PCS (1998)	204	100	417	36.9	8.3
28/31 GHz (1999)	428	33	3 361[c]	82.8	0.0
PCS 2000 (2000)	311	67	1 301	0.0	0.0
3.4 GHz (2000)	262	75	189	36.7	4.6
27 GHz (2000)	101	100	50	50.0	48.4
3G (2001)	162	100	107	29.3	17.2

[a] Simultaneous ascending auctions only. [b] Proxied by the ratio of the total of initial bidder eligibility to total lot rating (McAfee and McMillan 1996). A lot's rating is based on its bandwidth and its population coverage, and can be regarded as a measure of the utility of the lot. Bidders, at the start of the auction, have to declare the total rating they hope to win — that is, their initial eligibility. Adding all the bidders' initial eligibilities together then gives an estimate of total demand, which can be compared to the total rating available (a proxy for the total population-weighted supply of spectrum). [c] While most lots sold at the reserve price in this auction, those in capital cities were hotly contested and sold well above their reserves.

Sources: ACA, pers. comm. 23 November 2001; Productivity Commission estimates based on ACA data.

Two important indicators are the percentage of lots left unsold or sold at reserve prices only. Two auctions stand out: in the 1999 28/31 GHz auction, 83 per cent of lots were sold at the reserve price and none were unsold; and in the 2000 27 GHz auction, 98 per cent of lots were either sold at the reserve price or unsold. The small percentage of 'above reserve price' lots notwithstanding, these two auctions differed considerably in terms of the revenue they collected. While aggregate final prices amounted to only 50 per cent of aggregate reserve prices in the 27 GHz auction, the equivalent figure was 3361 per cent in the 28/31 GHz auction. This dichotomy appears to be the result of very weak overall bidding in the former auction (where two bidders competed over only three rounds) and very selective active bidding (for capital cities) in the latter (where five bidders competed over 37 rounds).[10]

The degree of competition in the bidding also can be gauged from the percentage of winning bidders and the excess demand for spectrum. Both indicators point to the apparent weakening of demand for spectrum since 1999-2000. Indeed, in the 27 GHz auction, excess demand existed for only two of the lots on offer, which means that all other lots of interest to the bidders were sold at the reserve price (ACA, sub. DR324, p. 5).

[10] Telstra and Optus were prevented from bidding in the 28/31 GHz auction. AAPT won all lots on offer. All lots sold for the reserve price, except in mainland capital cities, where final prices ranged from 6 to 90 times the reserve price.

Even in the absence of excess demand, the high percentage of unsold lots in the 27 GHz auction is of some concern. It could be argued that, in the case of spectrum, the cost of producing that resource and bringing it to auction is zero or close to zero.[11]

While an auction can create costs for some parties, such as the cost of re-location for incumbent operators, these are not costs that should be recovered from the reserve price. As long as the social benefits flowing from the new service are greater than the costs to the incumbents, holding the auction is warranted.[12] Under these circumstances, it may be preferable, once the decision to re-allocate and go to auction has been taken, not to set such high reserve prices that the market does not clear. If some lots remain unsold, then they generate no benefits for the community and do not help offset the costs of re-location.

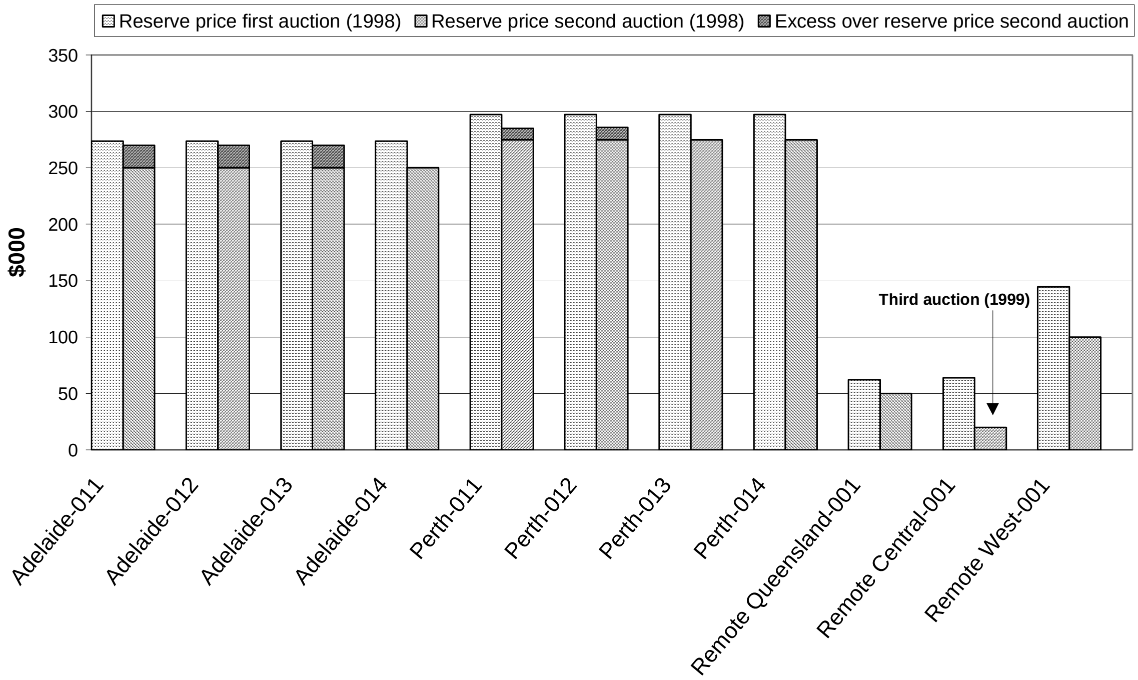
It is not clear whether high reserve prices may have caused lots to be unsold and thus prevented the deployment of new services in the 27-GHz band. The ACA indicated that the results of that auction stemmed largely from the 'inability of the Local Multipoint Distribution Technology … to gain a successful toehold in the market' (ACA, sub. DR324, p. 11). However, for a new technology to gain sufficient market share, it must be cost-effective. It could be argued that reserve prices which result in a large number of unsold lots could prevent a new service from achieving sufficient economies of scale, and hence from achieving satisfactory market penetration.

There is another reason why unsold lots do not necessarily indicate a lack of demand for spectrum and the services it provides. If reserve prices are high, bidders may refrain altogether from bidding on some lots, expecting to purchase them more cheaply in a subsequent auction of unsold lots (provided reserve prices are set lower). A price comparison of lots passed in during the first Australian PCS auction and sold at subsequent auctions suggests that such a strategy would have been rewarded with a 12 per cent 'discount' on the original cumulative reserve prices (figure 11.1). However, this expected benefit must be balanced against the cost of delaying the roll-out of infrastructure. It must also be weighed against the risk that a change in its competitive environment will make it more costly for a firm to purchase spectrum in a subsequent auction. As an example, a firm would have had to pay approximately 3.5 times more than the final prices shown in figure 11.1 to purchase the equivalent amount of PCS spectrum in Adelaide and Perth at the PCS 2000 auction.

[11] The cost of organising the auction should be recovered from auction entry fees.

[12] This would be true even if spectrum were left 'fallow' initially by its new user. If this were done in the expectation of introducing a new, high-value service at a latter stage, then the Net Present Value of those services could still exceed that of the services provided by the re-located user.

Figure 11.1 **Price comparisons for lots passed-in at the first PCS auction**[a]



[a] Passed-in lots exclude lots that were unsold because bids were withdrawn.

Data sources: ACA auction database; ACA pers. comm. 19 October 2001.

Ultimately, it is difficult to ascertain the appropriateness, or otherwise, of the reserve prices set by the ACA without a full knowledge of bidders' valuations and strategies. It is possible that reserve prices have, on occasions, weakened the bidding in Australian spectrum auctions and resulted in unsold lots. They may, as a result, have contributed to the community not gaining the full benefits of new technologies. However, setting high and credible market prices may also have ensured the efficient allocation of spectrum at auction, by discouraging gaming by bidders.

One way of ensuring that reserve prices do not limit opportunities to use spectrum in the future — and of allaying industry fears of revenue raising — is for the reserve price setting process to take place transparently. The ACA indicated that it relies on objective information (for example, comparable overseas or domestic spectrum prices) and outside financial expertise to set reserve prices (ACA, trans., p. 597). Yet, the ACA does not consult systematically with prospective licensees about these prices (ACA, trans., p. 597).

This contrasts with the consultation process undertaken by the FCC prior to United States spectrum auctions. In a recent call for comments from prospective bidders in an auction, the FCC wrote:

> If commenters believe that these minimum opening bids will result in substantial numbers of unsold licenses, or are not reasonable amounts, … they should explain why this is so, and comment on the desirability of an alternative approach. Commenters are advised to support their claims with valuation analyses and suggested reserve prices or minimum opening bid levels or formulas. (FCC 2002b, p. 7)

One inquiry participant expressed the view that the ACA should implement a similar level of consultation:

> Setting of the reserve should be a transparent process able to solicit industry and community views as well as demonstrating publicly the means by which the reserve has been set. (AEEMA, sub. 36, p. 12)

The Commission considers that it would be desirable for the ACA to present any relevant pricing information it has to bidders and consult with them systematically prior to the setting of reserve prices (though it would not be bound by their comments). This would give the regulator some insights into the range of bidder valuations and technical and commercial constraints, all of which would help it set an efficient reserve price.

RECOMMENDATION 11.2

The Australian Communications Authority should consult potential bidders prior to setting reserve prices in spectrum auctions. In particular, it should communicate to interested parties any relevant pricing information it proposes to use when setting reserve prices.

Auction management

The ACA appoints an auction manager, usually the head of the ACA's spectrum marketing team. The role of the auction manager is to enforce the rules and to keep the auction moving forward. To this end, the manager must decide when to move the auction from one stage to the next (box 11.4). The ACA's survey of bidders in the PCS 2000 auction indicates that generally they thought the auction had been managed judiciously.

The ACA's ability to manage simultaneous ascending auctions effectively is likely to have been enhanced by its adoption of electronic bidding. To this end, it developed its own Internet-based bidding software, which incorporated such design improvements over the FCC model as point-and-click functions and error detection routines (Hayne 1997). Electronic bidding — which has yet to be introduced in many countries — can increase the speed and the transparency of the auction process, thus promoting an efficient allocation of spectrum. It also serves to reduce the cost of running the auction.

FINDING 11.7

The design and implementation of spectrum auctions by the Australian Communications Authority have followed — and, in some cases, set — world's best practice.

11.6 Conclusion

This chapter has examined the effectiveness of the ACA (and of the SMA) in implementing the major reforms introduced by the RC Act in 1992 — keeping in mind that these reforms were also the responsibility of the Minister and DCITA.

The introduction of spectrum licences represents the most important reform entrusted to the ACA. This task was fraught with difficulty and uncertainty, given that the concept of a fully flexible and tradeable spectrum property right had not been tested anywhere in the world at the time. The solutions adopted by the ACA were innovative, but may have meant placing more restrictions on the licences than initially envisaged by the RC Act, or desired by licensees.

The need for technical solutions also led to delays in the introduction and issue of spectrum licences. The rate at which these licences have been issued since 1996 has possibly delayed the emergence of a secondary market.

According to some inquiry participants, the scarcity of spectrum licensed bands has perhaps been the product of the Commonwealth Government's revenue-raising objectives. The ACA appears, however, to have matched or bettered international rates of spectrum release. To do so, it has implemented an auction model that has emulated world's best practice. Auctions generally have been successful in assigning licences quickly, transparently and efficiently.

The introduction of the RC Act has meant that the ACA has delegated a number of functions that previously were the sole prerogative of the spectrum regulator. This process appears to have been largely successful, leading to the creation of a spectrum assignment and accreditation industry. There is scope for devolution to be taken further in a number of areas.

In most respects, the ACA has undertaken broad-based consultation, more than adequate to meet the requirements of the RC Act. This has given an effective voice to interested parties, and has enhanced Australia's reputation in international fora. However, greater consultation when setting reserve prices would bring some benefits.

In summary, the Commission considers that the ACA has done a commendable job in a challenging technical and commercial environment. It also notes that minor amendments to the RC Act would enable the ACA to progress its implementation of the 1992 reforms.

12 The way ahead

This chapter summarises the experience of the market reforms introduced by the *Radiocommunications Act 1992* (RC Act) and subsequent amendments. The key impacts on competition and economic efficiency of the RC Act are discussed, as required by a Competition Principles Agreement (CPA) review. It is evident that a strong foundation exists from which to move forward, so the chapter concentrates on further improvements that might be made to licensing and charging arrangements. Some issues, such as conditions for renewal of spectrum licences, require urgent action.

12.1 Experience to date

The market-based reforms introduced by the RC Act represented a significant shift in spectrum management in Australia. They put Australia in the vanguard of countries reforming the management of spectrum. In particular, the introduction of spectrum licences was ambitious.

But the introduction of spectrum licensing has been slower than anticipated. In part, this can be attributed to teething problems associated with the introduction of a radical new approach. Transforming the theoretical concept of spectrum licensing into practical regulatory instruments has been difficult.

Spectrum licences were intended to give freedom to use any radiocommunications technology for any purpose, as long as licensees did not create unacceptable levels of interference for others. This ‘open’ approach ran into difficulties in defining and enforcing licence conditions. Boundary conditions, intended to be technology and use neutral, were found to be impractical. The Spectrum Management Agency (SMA), and subsequently the Australian Communications Authority (ACA), have defined the boundaries in terms of an assumed use, such as mobile telephony. This has compromised the neutrality envisaged in the RC Act.

Problems with the conversion of apparatus licences to spectrum licences also caused delays. The RC Act requires that all apparatus licensees in a band designated for conversion be given a right of refusal on an equivalent spectrum licence. This has delayed conversion, and made it difficult where apparatus licences overlapped with each other. Negotiating prices for the new spectrum licences has also proved difficult.

The 1997 amendments to the RC Act introduced a mechanism for clearing incumbents from a spectrum band, facilitating re-allocation of the spectrum. This accelerated the issue of spectrum licences. But while re-allocation has proved valuable in clearing spectrum, it has been controversial, time consuming and has led to demands for compensation from those who have been given notice to quit. One irony is that, while re-allocation provides a means of introducing spectrum licensing, and hence market allocation and assignment, it invariably requires administrative planning to decide where re-allocation should take place.

Implementation of spectrum licensing has been slower than expected. Currently, only about 7 per cent of the spectrum is spectrum licensed. However, this includes virtually all of the spectrum devoted to high value mobile telecommunications.

While spectrum licensing has become more prescribed than first envisaged, apparatus licensing has become more market oriented. A 1995 amendment to the RC Act introduced tradeability in apparatus licences, which improved the prospects for efficiently allocating spectrum through secondary markets. But the technically prescribed nature of most apparatus licences effectively limits the extent to which trade can occur.

Although the RC Act has been in place for a relatively short period (major amendments were made as recently as 1997), radiocommunications is a rapidly evolving, high technology sector. The costs of an inappropriate regulatory structure could accumulate quickly. There is sufficient experience to gauge the strengths and weaknesses of the current system and to assess whether alternative approaches would improve outcomes.

12.2 Impacts on competition

The guiding principle of a CPA review is that legislation (including acts, enactments, ordinances and regulations) should not restrict competition unless it can be demonstrated that:

- the benefits of the restriction to the community as a whole outweigh the costs; and
- the objectives of the legislation can only be achieved by restricting competition.

Throughout this report, the Commission examines the legislative framework to assess if it is appropriate and whether it promotes efficient outcomes.

This involves a two-stage assessment. The first step is to assess whether regulatory intervention of any sort is required. The Commission's conclusion is that substantial market failures are present in radiocommunications and that some intervention is required. The main market failure derives from the open access nature of spectrum, which means that, in the absence of some form of government intervention, interference between users would create a major problem.

The second step is to consider whether the current framework is appropriate, and whether the benefits from restricting competition outweigh the costs. Most of this report informs this assessment, but four potentially anti-competitive features of the RC Act stand out:

- its technical and administrative prescription;
- its use of explicit competition limits in the conduct of auctions;
- the inclusion of public interest tests for the re-issue of spectrum licences to incumbents; and
- the special treatment given to some spectrum users.

Technical and administrative prescription

Despite the market-based reforms of 1992, the regulatory framework is still prescriptive. It includes the Australian Radiofrequency Spectrum Plan (the Spectrum Plan), frequency band plans, mandatory standards and licences with different technical conditions. By specifying how the spectrum may be used, the regulatory framework has the potential to influence competition and economic efficiency. There are good social and economic reasons for some prescription, but these should diminish as spectrum licensing is more widely deployed. Three examples illustrate the impacts of technical prescription: the Spectrum Plan, apparatus licences and spectrum licences.

The Australian Radiofrequency Spectrum Plan

The Spectrum Plan potentially restricts competition by defining the uses permitted in particular parts of the spectrum. This creates segmented markets and limits the potential for substitution between different parts of the spectrum. However, there are some good reasons for its retention. It summarises binding commitments Australia has made in international treaties (for example, for aviation and maritime use), and gives some guidance to spectrum users. Its effects on competition and economic efficiency will diminish as spectrum licences (which are not bound by the plan) become more widespread. If it is used more as a guide than a straitjacket, its adverse effects can be limited.

Apparatus licences

Most apparatus licences are tightly prescribed. Typically, they license the use of a particular device at a particular location in a particular way (by specifying conditions such as radiated power). This degree of technical prescription helps to assign a greater number of rights in the one spectrum space than would be possible with individual spectrum licences. But the downside is that these licences are inflexible and not conducive to changing uses and technologies. Apparatus licences account for the majority of spectrum use, and experience suggests that they may continue to play a role for some time to come. The challenge is to use the right licensing approach for the circumstances. Apparatus licensing should only be used where it is necessary to improve the technical efficiency with which a specific spectrum band can be used, or where spectrum licensing would be costly to implement for little gain in utility.

Spectrum licences

Spectrum licences offer the potential for much more flexible spectrum use. However, the practice of defining boundary conditions based on assumed uses tends to reduce flexibility. While assuming a likely use may maximise the technical efficiency of particular licences at a particular point in time, they can render the licences less suitable for other uses. This reduces their marketability and constrains secondary markets. This effect will be exacerbated if, as some participants claimed, the technical specifications go beyond an assumed use to bias licence conditions in favour of a particular technology (for example, a specific technology for providing mobile telephony). Furthermore, since different assumed uses have been used to configure each issue of spectrum licences, the potential for substitution between them is limited.

To date, technical constraints have not been a major problem and there is evidence of different technologies being planned for spectrum licences in the same band. But as further technological progress is made, the degree of prescription imposed on spectrum licences may compromise their flexibility to adapt to new uses. The ACA’s intention to hold a workshop on these issues later this year is welcomed. This workshop should focus on the appropriate balance between short-term technical efficiency and long-term allocative efficiency.

Competition limits

It is good regulatory practice to ensure that regulation addresses real, not perceived problems. The Commission doubts whether this is the case with the competition limits introduced in 1997. They have the potential to be used in ways that are not consistent with s. 50 of the *Trade Practices Act 1974* (TPA), which addresses the effects of mergers and acquisitions on competition.

The discretionary nature of the competition limits means that they may be used to engineer industry structures that appear pro-competitive, but subsequently may prove to be unsustainable. And to the extent that the limits are applied inconsistently with s. 50 of the TPA, they can be subverted in the secondary market.

Competition in telecommunications and related markets is an important objective, but artificially engineered outcomes are not the answer. The Commission is not convinced that there are compelling reasons in this case for having different rules for one industry, and recommends that these provisions be deleted from the RC Act. At the very least, the Commission strongly recommends that they be amended to make them consistent with s. 50 of the TPA.

The public interest tests

The Commission also questions the public interest tests in the RC Act, under which spectrum licences may be re-issued to incumbents. The ‘public interest’ is not defined in the RC Act, which gives scope for discretion and could result in the inefficient allocation of spectrum. It is not in the public interest to protect incumbents from the competitive forces of potential entrants who, if they were able to purchase the spectrum at a competitive auction, might be able to supply either the same service more efficiently, or another more highly valued service.

The Commission recommends that any new licences should not be eligible for re-issue under the public interest tests. If the Government were to apply the tests to existing licences, they should be tightly controlled and emphasis given to the public interest in the efficient use of spectrum. The Commission recommends that the Ministerial test be informed by a public inquiry, where the incumbents are required to demonstrate why it would *not* be in the public interest to proceed to competitive allocation. The alternative public interest test, that can be used by the ACA in ‘special circumstances’, appears to apply only in unique circumstances to a particular licence at a particular time. If it is applied, the ACA should be required to publish the reasons for its decision.

The application of the tests should be limited to current licences. The tests should be allowed to be used only once per licence, and the re-issued licences should not have a duration of more than five years. Thereafter, all licences should be re-issued by market-based means.

Special treatment given to some spectrum users

Competition and economic efficiency in spectrum use are affected by giving some users access to spectrum on preferential terms and conditions. Many public and community users argued for preferential access to spectrum and/or preferential pricing. They argued that commercial pressures for access to spectrum were growing and that they would not be able to afford the spectrum they need at the prices associated with recent spectrum sales. In fact, so far the encroachment on frequencies used by non-commercial operators has been limited. Moreover, some heat has gone out of the market.

In some cases, preferential access is appropriate. For national security reasons, Australia's defence forces need exclusive access to some spectrum. And there are some arguments to make special arrangements for radioastronomy, which is particularly sensitive to interference. But for the most part, public and community users can be accommodated readily within the same framework as other users.

Irrespective of the nature of the outputs of public and community users, spectrum needs to be treated like any other input and priced accordingly. Concessional pricing dulls incentives to use spectrum efficiently and discourages the search for cheaper, alternative ways of meeting communication requirements.

The current practice of declaring parts of the spectrum to be for broadcasting purposes, and setting fees based on broadcasting revenue, restricts competition. With no link between fees paid and spectrum used there is no incentive for broadcasters to economise on spectrum use. This is a particular issue for television, where large amounts of valuable spectrum are assigned to the incumbent broadcasters. While limits on entry into broadcasting and the conditions of licences are covered under the *Broadcasting Services Act 1992*, the broadcasting spectrum should be allocated under the RC Act and priced competitively. Splitting the current broadcasting licence into a licence to operate a broadcasting business and a separate licence to use spectrum would create the conditions for more efficient use of spectrum.

The Commission's focus on improving the efficiency of spectrum use by broadcasters and public and community users does not mean that the government should compromise its pursuit of other objectives. For example, several inquiry participants pointed out that the government is pursuing a range of social and cultural objectives in broadcasting policy (including the content and coverage of services). The Commission does not question the importance of these and other non-economic objectives. But they can be better achieved using more direct policy instruments, for example, the use of explicit budget funding instead of concessions and exemptions. This approach is consistent with the general CPA principle that legislation which restricts competition should be retained only if the benefits to the community as a whole outweigh the costs and the objectives can be achieved only by restricting competition.

12.3 Improving the licensing system

The Commission considers that the current licensing structure is a good basis on which to build, and that proposals to implement a single licence should be resisted. The Commission has outlined various measures to boost spectrum licensing and improve apparatus and class licensing. This section summarises those measures and discusses how the roles of the ACA and Minister could be redefined to streamline the re-allocation process. One of the most significant issues raised in this inquiry has been the tenure of licences. In this section the Commission puts its case for perpetual spectrum licences.

Spectrum licensing

There are four major reforms the Government and the ACA can implement to improve the issue of spectrum licences.

Conversion

Conversion of apparatus licences to spectrum licences should be promoted. At present, rights to access spectrum are skewed towards apparatus licences. This report has argued that, because spectrum licences will deliver efficiency gains in most circumstances, more emphasis should be given to them where feasible.

Amendments to the conversion process in the RC Act will help. Overlapping apparatus licences could be converted into spectrum licences, and where a number of apparatus licences are held by one operator, they could be combined into a comprehensive spectrum licence. All wide area services should be considered for spectrum licensing.

Sale of encumbered spectrum

Encumbered spectrum should be sold as a going concern. Rather than giving apparatus licensees notice to quit, the spectrum could be offered for sale as a right to manage the existing body of licences. This could accommodate technically prescribed uses, much as apparatus licensing currently does. It would be up to band managers how they went about this. They may decide to follow the example of the

ACA and issue leases that closely resemble apparatus licences. Alternatively, they could offer a much wider choice of spectrum leases.

Although no encumbered bands have been sold as going concerns, it is already possible for spectrum licensees to lease all or part of their spectrum to other users. While some have entered into leases, this has been an interim arrangement as they roll out their own services. No spectrum licensee has deliberately set themselves up as a band manager. This may be because the licensees purchased unencumbered spectrum for a particular use. A better test of the potential for private band managers would be to auction bands of spectrum containing fixed links and other technically prescribed uses. Apparatus licensees could be transferred as tenants to the band manager on broadly similar terms to those they currently have under the RC Act.

Sale of vacant spectrum

As a general rule, spectrum licences could be issued for all spare spectrum on the ACA's books. Rather than waiting for competition to emerge, the ACA could be pro-active by issuing licences and allowing markets to allocate the spectrum over time. The ACA would prepare a schedule of such licences and invite expressions of interest. Where more than one person expressed interest in a licence, an auction would be arranged. Even if only one person expressed interest, the ACA should sell the spectrum licence at an appropriate price that recovers costs. The core conditions for such licences should be based on standard boundary conditions.

Redefining the roles of the Minister and the ACA

Spectrum licensing could be given an important fillip by redefining the roles of the Minister and the ACA. It is inappropriate that spectrum licences, with all their advantages, can only be issued after extensive planning and consultation, while in most circumstances apparatus licences can be issued more or less immediately. There are good reasons for some of the planning and consultation processes, where incumbent apparatus licensees must either make way for new spectrum licensees or be converted. But it is questionable whether they are always needed, or should be so time consuming.

The Minister for Communications has a direct role in certain administrative decision-making processes, mainly relating to the implementation of spectrum licences. Currently, the Minister must formally designate a band for spectrum licensing, before licences can be issued. He (or she) can also declare parts of the spectrum for re-allocation and set competition limits for the auction of spectrum licences. The Minister also has general powers to direct the ACA through the *Australian Communications Authority Act 1997*.

These Ministerial checks may have been appropriate when spectrum licences were first introduced. However, they seem cumbersome now that the ACA and spectrum users have gained experience of — and confidence in — the spectrum licensing process.

Simplifying administrative decision-making processes would help to speed up the extension of spectrum licensing and improve its consistency. It would also promote the separation of policy from regulatory administration, which is an important principle of good government regulation.

Since the creation of the SMA in 1992, the intention to make such a separation between policy and administration in radiocommunications regulation has been apparent. However, it appears this separation could benefit from further clarification. Vodafone Australia (sub. 23, p. 5) and Optus (trans., p. 31) suggested that 'the Minister's role should be narrowed' to 'directing the broad regulatory framework' in order to improve certainty and efficiency in administrative processes and to 'avoid interventions' that may 'distort the market'. Similarly, the recent Cave review in the United Kingdom recommended:

> The Government should limit its powers to intervene in the details of spectrum licensing … [to] essentially political judgments about the allocation of spectrum between different classes of use; … (such as defence). … Ministers should refrain from taking powers to direct Ofcom in the specifics of spectrum management tools, such as assignment methods, auction design, administrative incentive pricing, and exemptions from licensing. (Cave 2002, p. 36)

This separation has been largely achieved in Australian radiocommunications regulation, except in the few areas noted above. Now that the spectrum licensing system is operating effectively, Ministerial approval for individual spectrum conversion and re-allocation decisions no longer seems necessary. Instead, the Minister — following appropriate public and industry consultation and advice from the department — could approve a forward work program for the ACA.

Currently, the ACA produces a forward program of spectrum auctions and conversions. A Radiocommunications Consultative Council working group recently considered ways to extend and improve this program, including its revision every three years to coincide with the output of the International Telecommunications Union's triennial World Radio Conference. The Commission sees merit in this approach and suggests that it could be taken further. Specifically, the forward work program could be developed as a blueprint for the issue of licences over the next three years, whether by conversion, re-allocation or the sale of unencumbered spectrum. Following appropriate industry consultation, the forward program could be formalised though approval by the Minister (for example, on a rolling three year basis). The ACA could then manage the spectrum in accordance with the approved forward program and any other written directions from the Minister. This would speed up the issue of spectrum licences and improve the predictability of spectrum availability.

RECOMMENDATION 12.1

The provisions in the **Radiocommunications Act 1992** ***which require the Minister to designate bands for spectrum licensing and issue spectrum re-allocation declarations should be removed. A new section should be inserted allowing the Minister to approve a forward work program of the Australian Communications Authority.***

Apparatus licences

The expansion of spectrum licensing should be complemented by action on apparatus licences. Some apparatus licences are going to exist for some time yet, and it would be inefficient and inequitable not to attend to any faults. Nevertheless, care should be taken *not* to vest them with features — such as significantly longer terms — that would further lock in spectrum use. The Commission agrees with the ACA that the current presumption of renewal be made explicit. However, because apparatus licences are technically prescribed and inflexible, the nominal licence period of five years and the current two years notice to vacate should be retained. Some inquiry participants expressed concern about only being given two years notice, but in practice incumbents are given much more notice to vacate than the statutory minimum.

Class licences

Class licensing should also be progressed. By providing an efficient way of regulating the use of radiocommunications devices that have minimal interference problems, class licences reduce the need for individual licences. This approach has been used for a variety of devices, such as wireless LANs, cordless telephones and aviation and maritime radio. It may become more important in the future as new technologies create more opportunities for multiple users to share spectrum.

Currently, class licences are device specific; that is, different parts of the spectrum are class licensed for specific devices. Using spectrum licences as an analogy, it might be possible to adopt a more flexible approach which allows any sort of device to be used in class licensed spectrum, so long as the equipment meets appropriate performance standards. This would encourage innovation.

Perpetual spectrum rights

While the RC Act was a major step forward, it adopted a relatively cautious approach to the duration of spectrum licences. The RC Act was influenced by reports by the Bureau of Transport and Communications Economics (BTCE 1990) and the House of Representatives Standing Committee on Transport, Communications and Infrastructure (HORSCOTCI 1991). Both reports argued for time-limited licences, on the grounds that this would minimise the cost of re-allocating the spectrum to another use.

At the time, various groups echoed the concern that a market-based approach to allocating spectrum would lock in spectrum use and hamper long term planning (HORSCOTCI 1991, pp. 97–8). These concerns were based on presumptions that the licences would only be used for designated purposes. Hence, they would have to be cancelled or allowed to expire to change spectrum use, or licensees would have to negotiate with the ACA on changing licence conditions.

In consequence, the RC Act was introduced with a ten year maximum for spectrum licences (later extended to 15 years). However, the irony is that spectrum licences do not dictate the use to which they may be put, thus largely addressing the issues raised by BTCE and HORSCOTCI, and diminishing the arguments for time-limited spectrum licences. With some attention to creating core conditions that are as technologically neutral as possible, spectrum licences would have the characteristics required for perpetual rights.

In comparison, apparatus licences specify use and (usually) are also highly prescribed in other ways. It is therefore appropriate for the RC Act to include powers to resume apparatus licences to change spectrum use. As discussed previously, it is not so much the term of the licence but the length of time given to quit the spectrum that influences tenure.

Why tenure is important

The tenure of licences influences the certainty with which licensees can plan their investments. Longer licences give licensees more time to recoup the costs of their investments and more flexibility in choosing between different investment options. If spectrum users face different investment options with different income profiles, they may be inclined to choose projects that match the term of the licence, rather than those that use spectrum most efficiently. This could bias investment expenditure and lead to an inefficient use of spectrum.

Furthermore, most infrastructure investments do not occur all at once, but over time. An initial roll-out may be followed by periodic upgrades or extensions. In such circumstances, limited licence tenure will discourage investments that otherwise might be made in the latter part of the licence.

Similar influences can be expected to discourage trading on the secondary market. Purchasing a licence part of the way through the term leaves less time to recoup investment costs. If purchasers lack assurance that they will be able to regain the licence after it expires, they will be less inclined to enter the secondary market. This effect becomes more pronounced as the term of the licence approaches expiry.

The effect of time-limited licences on investment and economic efficiency was summarised by Network Economics Consulting Group, which stated that:

> … the investment will be tailored to fit the tenure period *ex ante*, regardless of whether or not such an investment is socially optimal. (sub. 73, p. 10)

Perpetual licences therefore offer important advantages. They reduce uncertainty, which helps licensees to plan efficiently. They also remove the need for periodic re-allocation of licences, and reduce economic waste associated with industry lobbying, ACA administration and other transactions costs, such as those of conducting auctions.

Even so, there appears to be a reluctance to take this additional step. Governments have traditionally acted cautiously in allocating perpetual rights to use publicly owned resources, fearful that they might close off unforeseen future opportunities. But perpetual rights would not lock in spectrum use. On the contrary, their greatly improved marketability would emphasise the opportunity cost of not using licences efficiently. Competing users, new technologies and changing market opportunities would impose a discipline on incumbents to use the spectrum efficiently or sell or lease it to others who can.

Perpetual licences would allow market participants to choose if and when they enter or exit the industry. Instead of facing an arbitrary cut-off date, licensees could match their licence holdings to their business plans. Perpetual licences should also result in a wide variety of leasing arrangements, as band managers respond to the needs of the market for leases of different terms and conditions.

While markets are generally better at anticipating and adapting to changing uses than governments, it is possible that a new public or community use may emerge that requires access to spectrum. The Government could provide for this by funding the appropriate group to purchase spectrum in the market place. If necessary it can also resume spectrum licences (and pay compensation).

The government may also be reluctant to introduce perpetual licences because this would mean giving up future revenue raising opportunities. The Commission has emphasised that revenue raising should not be a consideration in its own right, but the consequence of the efficient allocation of spectrum. The consequences of selling perpetual rights to use spectrum would involve some trade-offs. The government would forgo revenue in the future that it would otherwise raise from the periodic auctioning of re-issued licences. But it would raise more now. To the extent that perpetual licences are more valuable than a series of sequential 15 year licences, the revenue raised from their sale may be higher in present value terms.

Allocating perpetual licences does not eliminate the role of the ACA. It may still need to assist licensees to adapt core conditions to new uses and deal with interference investigation. But the ACA would not need to resume licences. In some respects, the ACA would take on a role similar to that governments have with freehold land. Changes in the conditions of land use may occur from time to time (for example, rezoning or changes to building codes), but these do not require landholders to surrender their titles.

The ACA and Minister might also be involved in the application of the public interest tests. But by quarantining these tests to existing licences and limiting the term of re-issued licences to five years, these licences would subsequently be issued with perpetual terms through market-based assignment.

Introduction of perpetual licences

Perpetual licences could be introduced as soon as the RC Act is amended. However, secondary markets in spectrum licences are not yet well developed, although they will benefit from the greater issue of spectrum licences. One approach would be to monitor the secondary market to determine when it is active enough to allow perpetual licences to be introduced. On the other hand, time-limited licences may be impeding the development of a strong secondary market. Committing to a date, after which all new and re-issued spectrum licences would be perpetual, would create certainty and promote a robust market.

The date of expiry of the first spectrum licences to be issued could provide a benchmark. These were ten-year 500 megahertz (MHz) licences auctioned in 1997, which will expire in 2007. Applying the Commission’s proposed three year rule would require their auction in 2004. This provides a reasonable time frame in which to consult with industry and develop the appropriate core conditions for perpetual licences.

RECOMMENDATION 12.2

Spectrum licences issued after July 2004 should be made perpetual.

12.4 Conclusion and summary of recommendations

In chapter four, the Commission identified three broad options for reforming radiocommunications regulation: the *status quo*; incremental change to maintain the momentum of reform; and a market-based system, in which the allocation of perpetual rights to use spectrum is determined by market forces.

The Commission considers that, while the RC Act was a significant step forward, it can be improved. The Commission therefore concludes that incremental reforms of the regulatory structure are required to make it work more efficiently and transparently, including the retention, but improvement, of the current three licence types.

By recommending perpetual rights for spectrum licences, the Commission is going one step beyond the incremental option. However, the option of adopting a pure market-based approach for allocating all spectrum, is not appropriate. The Commission supports the retention of some safeguards in the RC Act for public and community users.

Perpetual rights seem a big step to take, but they are the logical extension of the reforms in spectrum regulation over the last decade. They would create more certainty, promote investment and stimulate secondary markets. The need to re-allocate licences periodically would be removed, and costs associated with industry lobbying and government administration reduced. Introducing perpetual licences would complete the market-based reform process started in 1992.

The Commission proposes a package of recommendations that, while retaining a mixed approach, will result in a more efficient use of radiofrequency spectrum. The following table identifies the major steps that the Commission puts forward for consideration (table 12.1). Some require that the RC Act be amended, most others require action by the ACA. Some will require action by other agencies; for example, the ACCC amending its merger guidelines to acknowledge the explicit links between the RC Act and the TPA.

Table 12.1 **Implementation summary**

Measure to be implemented[a]	*Recommendation*
Amendments to the *Radiocommunications Act 1992*	
Clarify objects of the RC Act	5.1
Allow ACA to issue spectrum licences in unencumbered spectrum without Ministerial designation	6.1
Repeal competition limits or amend to make consistent with Trade Practices Act and introduce appeal mechanism	6.3
Statutory presumption of renewal for apparatus licences	6.4
Market-based re-assignment of spectrum licences three years before expiry	6.5
Public interest tests grandfathered. Inquiry to be held before licences re-issued under Ministerial test. ACA to publish reasons for ‘special circumstances’ test decisions	6.6
Amend processes for converting apparatus licences to spectrum licences	6.7
Allow ACA to sell encumbered spectrum licences	6.9
Prices of trades in spectrum licences to be provided to the ACA and published, subject to confidentiality requirements	7.1
Spectrum licensees to certify compliance with core conditions, but not necessarily using the ACA’s device boundary construct	9.1
ACA to register devices where accredited person has certified compliance	9.2
Management of broadcasting services bands by the ACA under the RC Act	10.1
ACA to delegate conferring of certificates of proficiency for amateurs	11.1
Minister to endorse a forward work program in place of powers to make designations and determinations for issuing spectrum licences	12.1
Perpetual spectrum licences issued after July 2004	12.2
Actions by the Australian Communications Authority	
Issue spectrum licences in areas of low demand	6.2
Conversion of wide area apparatus licences to spectrum licences	6.8
Assess the potential of combinatorial auctions	8.1
Clarify the purpose of the spectrum licence tax	8.2
Examine the cost-effectiveness of a new system for recovering indirect costs	8.3
Charges for spectrum to be based on opportunity cost	8.4
Implement more transparent and flexible model for the apparatus licence tax	8.5
Make shadow pricing transparent and adjust to make comparisons meaningful	8.6
Recover costs of interference investigation of: ‘lawful’ interference according to the cost recovery arrangements for indirect costs; and ‘unlawful’ interference from source	9.3
Publish dispute resolution guidelines	9.4
Radioastronomy sites designated as ‘radio sensitive sites’ under Spectrum Plan	10.4
Consult on reserve prices used in auctions	11.2
Other reforms	
ACCC to amend merger guidelines to address acquisition of radiocommunications licences	6.3
Replace exemptions and concessions from spectrum charges with explicit budgetary support	10.2
Criteria for eligibility for government assistance to be reviewed periodically	10.3

[a] Column presents a summary of relevant recommendations. Refer to previous chapters for the full text of recommendations and associated discussion.

APPENDICES

A Conduct of inquiry

This appendix outlines the inquiry process and lists the organisations and individuals that have participated.

As in all of its inquiries, the Commission aims to improve the overall performance of the Australian economy. The full terms of reference are on page iv.

Following receipt of the terms of reference on 16 July 2001, the Commission placed a notice in the press inviting public participation in the inquiry and released an issues paper to assist participants in preparing their submissions. The Commission received 304 submissions before releasing the draft report in February. A further 47 submissions were received following the release of the draft report (a total of 351). Those who made individual submissions are listed in table A.1. The Commission received multiple copies of two submissions from different participants. Those participants are listed separately in table A.2 and A.3.

The Commission also held informal discussions in Sydney, Melbourne and Canberra with organisations and Commonwealth Government departments and agencies. This visit program assisted the Commission to obtain a wide understanding of the issues and the views of participants. Organisations visited by the Commission are listed in table A.4.

In October and November 2001 the Commission held pre-draft public hearings in Sydney, Canberra and Melbourne. In addition, the Melbourne public hearings included video conferences with participants from South Australia and Tasmania. Following the release of the draft report, a second round of public hearings were held in Canberra and Melbourne (including video conferences with participants from South Australia) in April 2002. Participants in the public hearings are listed in table A.5. Submissions and transcripts of the hearings are publicly available.

Following an open tender process the Commission appointed a consultant, Pondarosa Communications to provide additional independent technical advice to the inquiry on radiocommunications technologies, devices and interference.

A.1 Submissions received

Table A.1 **Individual submissions**

Participant	*Submission no.*
2KY Broadcasters	10
Aime Goyette	245
Airservices Australia	19, DR322
Andy Dunlop	300
Anthony J. Hughes	271
Anthony J. Renk	83
Anthony Van Vugt	14, 297, DR306, DR347
Arthur Moore	293
Austar United Communications	32
Australia Telescope National Facility CSIRO	13
Australian Broadcasting Authority	31, DR321
Australian Broadcasting Corporation	21
Australian Communications Authority	9, DR324, DR333, DR340, DR345
Australian Competition and Consumer Commission	282, DR334
Australian Electrical and Electronic Manufacturers' Association	36, DR320
Australian Maritime Safety Authority	4
Australian National 4WD Radio Network Inc.	7
Australian Security Intelligence Organisation	35, DR330
Barry Whittle	276
Bob Myers	289
Bramex	64
Bureau of Emergency Services Telecommunications	11
Bureau of Meteorology	5
Centre for Telecommunications Information Networking	DR327
Cher and Wayne Hill	291
Chris Zingler	233
Country Fire Authority (Victoria)	29
CSIRO Telecommunications and Industrial Physics	12
Daniel Jones	237
Denis McNeill	295, DR332, DR336
Department of Defence	25, 298, DR329
Department of Transport and Regional Services	62, DR335
Dougal Johnston	3, DR351
Earl	229
Elbert E. Ford	290
Electricity Supply Association of Australia	279
Electronic Frontiers Australia	DR318
Ericsson Australia	DR325
Federation of Australian Commercial Television Stations	28, DR338
Federation of Australian Radio Broadcasters	161, DR339
Floyd and Darlene Minor	224
FuturePace Solutions	18, 34, 59, DR314, DR342, DR343, DR348
Gary Morrison	248
Hydro Tasmania	24
James L. Cate Jr.	DR346
Jerry Skiles	231
John and Jo Ann Aklonis	226
John and Rija van Logchem	246
John Macey	DR331, DR349
John McCahan	DR305
Keith Benton	225
Len Gibson	250
Les Dembski	228
Lester Litton	302
M.W. Beacock	223
Marjorie L. and Neil C. Smith	82
Malcolm D. Foley	DR315
Market Dynamics	33
Mary and Christian Verlaque	227
McInnes Pynt Solicitors	16
Michael Meyer	299, 303
Michel Gagnon	244

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Table A.1 (continued)

Participant	Submission no.	Participant	Submission no.
Mike Harris	DR313	Roger Gerber	230
Mobile Communication Systems	DR350	Ronald Verschuyl	DR310
Molonglo Radio Observatory, University of Sydney	304	Rudolf Kruggel	DR309
		SBS Corporation	26, DR344
Network Economics Consulting Group	73	Security Services Spectrum Committee	20
Noel G. MacDonald Productions	8	Seven Seas Cruising Association Members	274
NSW Government	27	Simon Hackett	87
NSW State Emergency Service	2	Sony Australia	6
NTL Australia	22	South Australian Government	1
Onlooker Investigative Newsletter	DR328	Spectrum Engineering Australia	30
Optus	17	Steve Waterman	296,301, DR307, DR341
OzProspect	DR317	Tasmanian Government	65
Paul Fay	286	Telstra	63, DR323
Peter Niehoff	61	Thomas A. Rader	78
Phil and Marg Armitage	254	Tom Purcell	234
Philip Collins and Associates	58	Unwired Australia	DR319
Philip Cazaerck	DR311	Users of Winlink 2000	269
R.D. (Bob) MacDonnell	DR337	Vernon and Marie Rodgers	292
Rich and Cyndi West	249	Vodafone Australia	23, DR326
Rick Muething	DR308	Wireless Institute of Australia	15
Robert Harris	232	Wulf and Karin Knedlik	288
Robert Reed	DR312		

DR Denotes submissions received after the release of the draft report

Table A.2 **Multiple submissions — same text as submission no. 37**

Participant	Submission no.	Participant	Submission no.
Adrian Ford	281	Bignon	92
Andre Janel	91	Bob Bingham	51
Andres Soriano	141	Borge Muller	174
Andrew Chambers	151	Burger Zapf	206
Basil Davoren	179	C.O. Shaw	207
Ben Murphy	150	Calvin Huggins	68
Benjamin Cukok	251	Charles Simms	40
Benjamin Shaw	213	Charlie Brown	114
Berndt-Joerg Neubauer	199	Christoph Vogelsang	215
Bert J. Novak	193	Clifford P. Haycock	255
Beth and Kevin Hansen	194	Cogghe Andre	67

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Table A.2 (continued)

Participant	Submission no.	Participant	Submission no.
Connie L Traines	242	Herbert L. Drake	187
Dale Coleman	104	Ian Cooke	177
David R. Stone	144	Ian Walker	252
David Telander	189	Ingmar Svensson	54
Denis Laidlaw	209	J. David Socash	142
Detlev E. Hasselmann	216	J. de Ruiter	60
Dianne Dubin	57	J. Jay Mautner	45
Don Henry	46	J.M.C. Markesteijn	172
Donna Ferguson	85	Jacque and Jim Cottingham	247
Donna Maloney	236	James Demetrion	160
E.C. Jones	273	James Hegland	76
Ed and Daisy Marill	195	James Prentice	198
Edmond	94	Jan Twardowski	105
Emilio Veronese	66	Jean-Marie Houle	49
Erdogan Pancaroglu	146	Jean-Pierre Sauvain	69
Eric Simmons	100	Jeanne Hitchings	202
Fernando Arroyo	240	Jeff Hayden	74
Francis Lente	294	Jeff Kuhlman	107
Francis Ordoveza	147	Jeff Tyrrel	109
Frank H. Scotland	44	Jeffrey C. Lloyd	50
Frank T. Holland	90	Jens Moeller	200
Frank Wegori	164	Jim	182
Frank Wingerter	77	John Francis	253
Fred M. Lightfoot	53	John Giles	134
George Grossen	72	John J. Burke	101
Gerd Specht	284	John Moffitt	84
Gerrit te Grotenhuis	158	John Vovo	108
Grady Williams	159	Jose M. Soriano Jr.	155
Gregor Popp	171	Judy McGuire	43
Gun-Britt Svensson	55	Juraj (Juro) Babel	220
Gustaf Hulthe	238	Jurgen Schultze-Rohl	48
Gustav Ragge Jagero	211	Jytte J. Jarl	243
Hans A. Kessler	97	Katren Tyler	133
Harald Werth	89	Kenneth R. Martin	175
Hartmut Mueller	167	Konrad Schwaier	285
Helen Proudlock	275	Lance M. Brasseur	197
Helmut Klingemann	165	Lawson Thomas Riddell	176

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Table A.2 (continued)

Participant	Submission no.	Participant	Submission no.
Lena Blais	95	Richard Simpson	145
Leonard J. Kassian	270	Rick Muething	41
Les Abbott	170	Rob Dubin	56
Linda Shotwell	185	Rob Rutter and Judy Aumann	181
M.K. Tanco	156	Robert Fryberger	70
Manfred Ploetz	106	Rod McLennan	166
Marjusz Osinski	96	Roger A. Ganly	180
Mary C. Boyko	149	Roger Bohl	201
Matz Toermark	235	Ronald Gary	241
Mavis Coslovi	204	Ronald Verschuyl	178
Michael Lachance	218	Ross Biddle	110
Michael P. Wilson	186	Rudolf Kruggel	37
Michael S. Boadwine	79	Sandra Sargent	205
Mike Burton	42	Santi Picornell	148
Milan Ford	280	Sidney Shaw	287
Miles Tracy	113	Stan Krug	154
Millard F. Brown	80	Stephen Renfree	163
Nigel Heasman	212	Steve Austin	278
Pam Demetrion	162	Steve Waterman	38
Pamela Dage	214	Steven Vaughn	47
Patrick R. McKeeby	39	S.V. Aurelio	191
Paul Balbin	88	Svante Jacobson	173
Paul van der Eijk	143	Terry Sargent	210
Peter Balding	81	Thaddeus A. Arnold	190
Peter Capotosto	153	Thomas Ferguson	75
Peter Giles	283	Tom Lafleur	192
Peter J. Bowman	188	Tom Surles	52
Peter King	152	Tony Bull	169
Pim Snoeks	277	Udo Trost	86
R. Dale Godkin	157	Valerie and Barry Watts	196
Raul Verdecie	222	Van and Norma Stoffer	221
Ray Greeley	217	Wayne Peterson	208
Reginald McCluskey	239	Wes Whitley	184
Renate Christ	168	William A. Shlar	203
Richard Cross	272	William G. Cassellius	99
Richard J. Clow	183	Wolf	93
Richard J.A. Desomme	98	Yves Legault	219

Table A.3 **Multiple submissions — same text as submission no. 102**

Participant	*Submission no.*	*Participant*	*Submission no.*
Barbara G. Dallas	102	Jocelyn C. Dunstan	124
Betty and George Salley	265	John McCahan	118
Bev and Bob Warren	115	Joyce Irwin	111
Bob Mitchell	137	Judy Tremarco	117
Brian and Sharon Kelly	125	Linda Opperman	266
Clyde D. Little	123	Maria Waring	258
Cynthia E. Plante	112	Mary Tyner	129
David Havanich	267	Michael and Susan Heath	261
David R. Harriman	120	Michael C. Dallas	103
Denise Gagne	135	Peter Irwin	126
Earl Weener	131	Phil and Sarah Lowe	260
Edwin Gimble	132	Robert and Sandra Buchanan	119
Gordon C. Groves	262	Robert M. Whittemore	127
Greg and Margaret Konrad	264	Robert Perritt	263
Guy Davis	116	Robert R. White	256
Heather and Murray Rand	140	Ron Elkind	257
Herman Kuipers	139	Shane O'Neill	121
Ian Milne	136	William Bauer	259
James E. Roberts	138	William D. Drane	130
Jerry Dutton	268	William Stearman	128
Jerry MacNab	122		

A.2 Visits

Table A.4 **Visit participants**

Organisation
AAPT
Airservices Australia
AOL
Austar
Australian Communications Authority
Australian Competition and Consumer Commission
Australian Telecommunication Users Group
CSIRO
Department of Communications, Information Technology and the Arts
Department of Defence
Department of Transport and Regional Services
Emergency Management Australia
Ericsson Australia
Federation of Australian Commercial Television Stations
FuturePace Solutions
Macquarie Bank
Marconi
Market Dynamics
Motorola
National Economic Consulting Group
New Zealand Ministry of Economic Development
Nortel
NSW Department of Information Technology and Management
Optus
Telstra
Vodafone Australia
Wireless Institute of Australia

A.3 Public hearings

Table A.5 **Public hearing participants**

Sydney, 23 October 2001
CSIRO
Noel MacDonald Productions
Optus
Sydney, 24 October 2001
Vodafone Australia
NSW Department of Information Technology and Management
Federation of Australian Commercial Television Stations
Canberra, 29 October 2001
Market Dynamics
Australian Maritime Safety Authority
Wireless Institute of Australia
Australian Communications Authority
Australian Electrical and Electronic Manufacturers' Association
Canberra, 30 October 2001
Department of Defence
Australian Broadcasting Authority
FuturePace Solutions
Spectrum Engineering Australia
Department of Transport and Regional Services
Melbourne, 7 November 2001
Telstra
Australian National 4WD Radio Network
Melbourne, 8 November 2001
Bramex
Hydro Tasmania
Bureau of Meteorology
Network Economics Consulting Group
Melbourne, 9 November 2001
Australian Broadcasting Corporation

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Table A.5 (continued)

Canberra 18 April
Australian Broadcasting Authority
Airservices Australia
Unwired Australia and Market Dynamics
Melbourne 23 April
OzProspect
Centre for Telecommunications Information Networking
Ericsson Australia
Telstra
Vodafone Australia
Melbourne 24 April
FuturePace Solutions
Electronic Frontiers Australia
Australian Communications Authority

B Spectrum planning

There are both international and domestic dimensions to radiofrequency planning. The International Telecommunications Union (ITU) develops and coordinates international plans, while the Australian Communications Authority (ACA) undertakes domestic planning at several levels.

B.1 International Telecommunications Union

The ITU was established as a United Nations agency in 1947, but its precursors can be traced back to the nineteenth century. It currently has over 180 members (signatory nations). In 1992, the ITU adopted a three-part structure encompassing the radiocommunications sector (ITU-R), the telecommunications standardisation sector (ITU-T) and the telecommunications development sector (ITU-D). The operations of the ITU-R are of most relevance to this inquiry.

The ITU-R produces technical recommendations on radiocommunications issues and develops Radio Regulations through the World Radiocommunications Conferences (WRCs). Its recommendations are not legally binding on ITU members, but they assume legal effect if they are adopted as treaty-level Radio Regulations at a WRC. The objectives of the ITU-R Regulations are in box B.1.

Box B.1 **ITU-R Regulations**

The regulations of the ITU-R set out to achieve the following:

- facilitate equitable access to and rational use of the spectrum and orbit resources;
- ensure the availability and protection from harmful interference of frequencies provided for distress and safety purposes;
- assist in the prevention and resolution of cases of harmful interference between the radio services of different administrations;
- facilitate the efficient and effective operation of all radiocommunication services; and
- provide for, and where necessary regulate, new applications of radiocommunications technology.

Source: Cave (2002, p. 211).

There are three levels within the structure of the ITU-R. The WRC is the highest level. Below this are the Conference Preparatory Meetings and Study Groups. Study Groups establish Working Parties and Task Groups and develop recommendations to be discussed at the WRC through the Conference Preparatory Meetings.

The international spectrum plan

The ITU's Table of Frequency Allocations is contained in Article s. 5 of the ITU Radio Regulations. The Radio Regulations allocate services to separate plans for three broad geographic regions. Region 1 includes Africa and Europe. Region 2 includes North and South America. Australia is located in Region 3 which includes China, Japan, Southeast Asia and the South Pacific.

Separate planning regions emerged due to differences in equipment and practices between Europe and North America. Region 3 emerged to accommodate countries such as Australia that import a mix of equipment from both of these major markets.

Decisions regarding spectrum allocations are revised every three years at the WRC. This is an opportunity to discuss and adjust existing allocations and to make new allocations to support new technologies. Decisions are influenced in part by the availability of equipment and inter-operability for international users and services.

If equipment is not available to be used in a particular band, it is unlikely that the ITU will allocate that band for that type of use. Conversely, manufacturers often rely on allocations made in spectrum plans in making their business decisions (BTCE 1990, p. 25). It is not uncommon for manufacturers to try to influence spectrum allocations to make their proposed services possible.

B.2 Australian Radiofrequency Spectrum Plan

The Australian Radiofrequency Spectrum Plan (Spectrum Plan) is the primary document in Australian spectrum management. Other tools also contribute to managing spectrum: frequency band plans; marketing plans; spectrum embargoes and the technical conditions attached to the spectrum, apparatus and class licences.

The Spectrum Plan is broadly consistent with the ITU allocations for Region 3, although there may be some variations. The Spectrum Plan (like the plan for Region 3) provides for multiple possible uses of some parts of the spectrum. However, the use of footnotes to designate the use of spectrum and the status of these services (either primary, co-primary or secondary) gives Australia flexibility in departing from the plan for Region 3 and managing interference.

Footnotes list services for spectrum allocation in addition to those in the international plan. Footnotes also provide a mechanism for countries to re-prioritise the status of allocated services from the international plan.

The Spectrum Plan has 93 Australia-only footnotes. AUS 57, for example, enables defence to operate services in the band 3155–3200 kilohertz (kHz) on the condition that the services do not cause interference with other services operating in the band. This band is allocated on a co-primary basis in Australia and Region 3 to fixed services and mobile services (except aeronautical mobile services). It is also subject to international footnote 116 across Regions 1, 2 and 3, which authorises the use of low power wireless hearing aids to operate at 3155–3195 kHz.

Footnote AUS 75 of the Spectrum Plan enables mobile services to operate on a secondary basis in the band 12 100–12 230 kHz on the condition that the services do not cause harmful interference. The band is allocated to fixed services on a primary basis in Australia and Region 3.

B.3 Changes to the Spectrum Plan

The current Spectrum Plan came into effect on 1 January 2002, replacing the Spectrum Plan of January 1999. The revised Plan incorporates changes to the ITU-R frequency allocations plan made at the WRC in 2000.

The changes to the Spectrum Plan were developed to support both international and domestic developments. The international amendments to frequency allocations included:

- identifying additional spectrum to support third generation (3G) mobile;
- allocating spectrum for fixed services in high-density applications;
- allocating additional spectrum for radioastronomy and space science services;
- allocating spectrum for improved global radionavigation-satellite systems; and
- simplifying ITU Radio Regulations (ACA 2002e).

Other amendments to the Spectrum Plan reflected domestic developments. Mainly related to defence, they involved increasing spectrum allocations, promoting existing allocations from secondary to primary status, and clarifying the intent and nature of defence interests through the use of footnotes.

B.4 Frequency band plans

Section 32 of the *Radiocommunications Act 1992* enables the ACA to produce frequency band plans. These plans are legal instruments that subdivide the broad allocations (made under the Spectrum Plan) into specific service types. There are only seven frequency band plans. These cover bands where the ACA has identified a need for closer spectrum management. These bands are often characterised by containing multiple uses, each with different interference characteristics and/or the need to facilitate the re-location of existing uses to accommodate anticipated demand for new services.

VHF Mid Band Frequency Band Plan (70–87.5 MHz) 1991

This band plan was developed in 1991 to support the anticipated growth in demand for land mobile services and technologies. It was amended in 1996 and 1998 to change the conversion dates outlined in the Plan. The 1999 amendments provided continued support for narrowband area services (ACA 1999b).

VHF High Band Frequency Band Plan (148–174 MHz) 1991

The purpose of this band plan was to encourage the use of land mobile services and a more efficient use of spectrum by accommodating two frequency systems. This was achieved by replacing 30 kHz channelling with 12.5 kHz (ACA 1999a).

900-MHz Band Plan (820–960 MHz) 1992

This band plan was developed to provide spectrum allocations for cordless telephone services, including public access cordless telephone services, and to provide for the transition from analogue to digital cellular mobile telephone services (using GSM technology).

The Plan was updated in 1997 and again in 1999 to remove conditions that may have inhibited the closure of the analogue mobile telephone service (ACA 1999c).

1.5-GHz Band Plan (1427–1535 MHz) 1996

This band plan was introduced to assist the introduction of new technologies by restricting further assignments of frequencies for fixed services. In 1996, the 1.5 gigahertz (GHz) band supported a range of services including point-to-point, point-to-multipoint, mobile–satellite, and aeronautical mobile telemetry services.

The 1992 WRC led to the development of this band plan, as additional services were allocated to the 1.5-GHz band (namely broadcasting and broadcasting–satellite at 1452–1492 MHz and mobile–satellite at 1525–1530 MHz) (ACA 1998h).

1.9-GHz Band Plan (1880–1900 MHz) 1996

The purpose of this band plan was to promote the use of cordless telecommunications systems (either mobile service or point-to-multipoint fixed services). These systems have numerous applications at low power including wireless local area network, wireless local loop and wireless PABX. This band plan also supports the operation of existing fixed links (point-to-point services).

Sharing in this band is possible due to the low power of the mobile services. However, in some areas, cordless telecommunication services are unable to operate due to the potential for interference with (or from) fixed links (ACA 1998i).

2.1-GHz Band Frequency Band Plan 2002

This band plan came into effect on 1 May 2002 and replaces the Multipoint Frequency Band Plan 2000, and prior to that, the Frequency Band Plan for the 2076–2111 and 2300–2400 MHz Bands of June 1988 (and subsequent amendments). The main purposes of the Plan are to:

- set a termination date of 25 July 2002 after which multipoint distribution frequency (MDS[A]) services will be excluded from operating at 2076-2111 MHz in most parts of Australia;
- allow MDS(A) services to continue at specific locations in Alice Springs, Broken Hill, Tasmania and North Queensland until 30 September 2003 so as to maintain the delivery of pay-television services in these areas; and
- provide fixed point-to-point services at 2076–2111 MHz to make way for the planned introduction of 3G mobile in other parts of the spectrum (ACA 2002g).

Mobile-Satellite Service Band Plan (2 GHz)

This band plan came into effect on 1 May 2002. The purpose of the Plan is to facilitate the introduction of a new Mobile-Satellite Service (MSS) and set out the conditions of the incumbent licensees who operate in the 2-GHz bands (specifically 1980-2010 MHz and 2170-2200 MHz) (ACA 2002h).

C Spectrum management in other countries

This appendix discusses spectrum management in other countries, including Canada, Denmark, Hong Kong, New Zealand, the United Kingdom and the United States. It examines licence types, fees, assignment, ongoing spectrum management and non-commercial spectrum use.

Internationally, spectrum management agencies share similar objectives and responsibilities. Like the Australian Communications Authority (ACA), spectrum managers in other countries generally aim to facilitate efficient use of the radiofrequency spectrum. Their duties include liasing with the International Telecommunications Union (ITU) and other countries, allocating spectrum, assigning licences to users, managing interference between users and collecting licence fees.

C.1 Spectrum regulation agencies

Spectrum regulation and planning is conducted at both international and national levels.

International agencies

The main international agency responsible for planning and coordinating the allocation of spectrum to different uses is the ITU. The allocation of spectrum in most countries largely follows planning decisions made within the ITU (see appendix B).

Many radionavigation services (for example, services for ships and aircraft moving across borders) require international equipment and operating standards. The ITU establishes these standards, working with the International Maritime Organisation (IMO) for maritime systems and with the International Civil Aviation Organisation (ICAO) for aviation systems. The ITU, IMO and ICAO are specialised treaty organisations of the United Nations (NTIA 1995). In a similar fashion, other international industry and scientific organisations are involved in ITU spectrum planning for their own fields of expertise and interest (see chapter 3).

Certain aspects of World Trade Organisation (WTO) regulations are also relevant to radiocommunications. The WTO's overarching objective is to help trade flow smoothly, fairly and predictably. Signatories to the WTO's Technical Barriers to Trade Code are required to harmonise technical regulation and accept mutual recognition of technical standards (ACA, sub. 9, p. 17).

Regional organisations

A number of regional bodies also participate in ITU processes. Detailed regional spectrum planning for forty-four European and neighbouring countries is conducted through the European Radiocommunications Committee of the European Conference of Postal and Telecommunications Administrations (box C.1).

Box C.1 **Functions of the European Radiocommunications Committee**

The committee undertakes the following functions for forty-four European and neighbouring countries:

- it produces reports, recommendations and decisions concerning spectrum use;
- it coordinates long-term spectrum planning in Europe and produces the European Common Allocation Table, a harmonised frequency table for Europe covering most of the useable spectrum; and
- it coordinates European preparation and input for World Radiocommunications Conferences through its Conference Preparatory Group.

Source: RA (2001b, p. 102).

The European Union is also involved in European spectrum management. The EU framework 'defines the scope for individual licences and general authorisations and endeavours to promote a harmonised market for radiocommunication services, particularly where international mobility is involved' (Burns, Kirtay and Court 2001, p. 5).

As is necessary for all countries with common borders, the United States co-ordinates the use of radio services with neighbouring countries Canada and Mexico. Prior to ITU World Radio Conferences, the United States also engages in bilateral or multilateral discussions with other ITU member administrations to promote United States interests in international radiocommunications (FCC 1999).

In the Asia–Pacific region, the WTO and Asia Pacific Economic Cooperation (APEC) members facilitate the direction and pace of liberalisation of telecommunication services. The Asia Pacific Telecommunity also plays a role in the planning and development of regional telecommunication networks (OFTA 2001a).

National spectrum regulation agencies

Each country is responsible for its own spectrum allocations and assignments, although all national allocations and assignments follow ITU agreed plans to some extent. In all countries examined, national spectrum management is the responsibility of one or more government agencies (table C.1). These agencies vary in their level of authority and degree of separation from the government. Some are part of larger government departments, while others operate independently and answer directly to a minister or parliament.

Table C.1 **Institutional arrangements of national spectrum regulators**

Country	*Agency*	*Type of agency*
Australia	Australian Communications Authority	Statutory authority reporting to the Minister for Communications, Information Technology and the Arts
Canada	Industry Canada	Part of the Ministry of Industry
Denmark	National Telecom Agency	Government agency under Ministry of Research and Information Technology
Hong Kong	Office of the Telecommunications Authority	Executive agency of the Telecommunications Authority
New Zealand	Radio Spectrum Management Group	Part of the Ministry of Economic Development
United Kingdom	Radiocommunications Agency[a]	Government agency under Department of Trade and Industry
United States	Federal Communications Commission (manages non-government spectrum use)	Independent government agency
	National Telecommunications and Information Administration (manages government spectrum use)	Agency of Department of Commerce

a The UK Government plans to replace the Radiocommunications Agency with an Office of Communications (Ofcom).

Source: Telestyrelsen (2000, p. 21).

C.2 Types of licence

Spectrum management agencies in other countries issue various types of licences to use spectrum. Many of these licence types are similar to Australia's apparatus, spectrum and class licences (see chapter 6). Some agencies maintain more complicated licensing systems — for example, the Radiocommunications Agency (RA) in the United Kingdom and the Office of the Telecommunications Authority (OFTA) in Hong Kong (see below).

Canada

Industry Canada administers ‘radio’ and ‘spectrum’ licences. According to the Canadian Radiocommunications Act 1985, radio licences are issued in ‘respect of radio apparatus’ while spectrum licences are issued in ‘respect of the utilisation of specified radio frequencies within a defined geographic area’. These licence types are analogous to Australia’s apparatus and spectrum licence types.

Canadian spectrum licences are offered for 10 years with an expectation of renewal at the end of the term. The Canadian Radiocommunications Act allows the Minister to amend the terms and conditions of spectrum licences, after full consultation (Industry Canada 2000, p. 13).

In 2001, Industry Canada introduced ‘system licensing’ for mobile dispatch systems (two-way radiocommunications) and paging systems (one-way radiocommunications). In most cases, only the service provider’s repeater station or paging terminal requires a system licence. Individual subscribers to the service are exempt from licensing requirements. System licence eligibility depends on the frequency range used, effective radiated power, the position of the antenna installation, the height of an external antenna and whether the radio equipment is certified (Industry Canada 2001b).

Denmark

The Danish national regulator, Telestyrelsen, issues licences for the use of radio frequencies in accordance with the National Frequency Plan. Licences are granted as either ordinary licences or research and development licences. Telestyrelsen also issues licences for operating public mobile communications networks. A licence to use particular frequencies is needed in addition to this licence (Telestyrelsen, pers. comm., 12 January 2002).

Hong Kong

The licensing system in Hong Kong consists of several categories of licence: exclusive licences, carrier licences and other licences (box C.2). The OFTA administers these licences.

Box C.2 Licence types in Hong Kong

Exclusive licences are issued on an exclusive basis for the operation or provision of telecommunication networks, systems, installations or services. The Chief Executive in Council may determine the conditions of the licences, including the period of validity, the payment of fees and royalties, and the frequency of any payments. The Office of the Telecommunications Authority (OFTA) does not have the power to issue these licences. At present, no such licences have been issued.

Carrier licences are issued for the establishment or maintenance of a telecommunications network carrying communications to or from the public. The facilities to be regulated under a carrier licence involve substantial investment and provide services to a wide section of the public. Examples include local fixed telecommunications services, external facility-based fixed telecommunications services and third generation (3G) mobile services.

Other licences are private telecommunication service or system licences. They have fewer restrictions than those of exclusive or carrier licences. Examples include paging services and private mobile radio systems. OFTA is planning to replace these licences with 'class' licences for such cases as in-building telecommunications, terminal equipment and low power devices.

Source: OFTA (2001a).

New Zealand

Three mutually exclusive licensing systems operate in New Zealand: general user, radio and spectrum licences. General user licences are similar to Australia's class licences. They are typically used for short-range devices, spread spectrum devices and citizen band radio (Ministry of Economic Development 2002). Radio licences are similar to Australia's apparatus licences (see chapter 3).

New Zealand's spectrum licensing system differs from Australia's system in several ways. The most important difference is that New Zealand spectrum licences provide two types of spectrum property right: licence rights and management rights. Both types of spectrum licences can be assigned up to a maximum of 20 years (Ministry of Economic Development 2000, p. 32). Over time, these property rights may be created for all bands in which the spectrum is used for commercial purposes (Ministry of Economic Development, pers. comm., 18 January 2002).

Management rights cover a block of the radio spectrum. They allow a licensee to issue licence rights for the use of that part of the spectrum, in much the same manner as a tenant can sub-lease a building.

There were eighty-one management rights were current at October 2001. The New Zealand Government retains ownership of eighteen of these, including those covering the public broadcasting spectrum (radio and television). The Government issues licences within the Government-owned bands according to a mix of commercial and social policies. Private sector managers in the remaining sixty-three bands are free to issue licences according to their own policies (Ministry of Economic Development 2001b). This system of private spectrum management appears to be unique to New Zealand.

The creation and sale of private sector management rights has not been as extensive as originally contemplated when the New Zealand Radiocommunications Act 1989 was introduced.

United Kingdom

The Wireless Telegraphy Act provides the mechanism by which the Radiocommunications Agency (RA) of the United Kingdom licences 'apparatus for the transmission or reception of wireless telegraphy signals' (Cave 2002, p. 95). The three broad types of licence are similar to apparatus licences issued by the ACA, as they are technical and service specific. These are: pre-packaged licences, customised licences and spectrum licences (box C.3). The term of the licences issued by the RA varies. For example, the five licences auctioned for 3G services in 2000 expire at the end of 2021 (Cave 2002, p. 128). However, the three 28 GHz Broadband Fixed Wireless Access licences that were auctioned in 2000 were for a term of 15 years (RA 2000d).

For administrative convenience, the RA groups its application forms, licence requirements, charges and common terms into specific licence 'classes' (for example, the aeronautical ground station licence class and the point-to-point links licence class). These licence classes are further grouped into business sectors (for example, aeronautical and fixed services) under which they are managed (RA 2001b, p. 109).

United States

The Federal Communications Commission (FCC) in the United States issues several types of licence, including those for personal communication services, specialised mobile radio services, multichannel multipoint distribution systems, direct broadcast satellite, satellite digital audio radio and wireless communications. Licences that have been issued via auction are generally for a term of 10 years and ‘would be renewed if the licensee has complied with the applicable FCC rules and has provided substantial service’ (ITU-R 2000, p. 56).

Box C.3 **Licence types in the United Kingdom**

Pre-packaged licences have parameters agreed in advance for pre-set frequencies. No further frequency assignment is involved. Examples include ship or aircraft radio licence classes where there is no customised frequency assignment (RA 2000b). The Radiocommunications Agency is considering whether some pre-packaged licences, such as citizen band licences, could be further simplified. This new system would resemble Australia’s system of class licensing (RA, pers. comm., 9 January 2002).

Customised licences involve authorisation of specific frequencies for each station or site in which the licensee operates, with the details set out in technical schedules. The spectrum used varies for each licence. Services that require customised licences include private mobile radio, fixed links, satellite earth stations and services ancillary to broadcasting.

Spectrum licences cover the authorisation of frequencies (often for networks) for broad geographic areas or the whole country. The licences do not need to detail each base station (although users may need to notify the agency and gain approval if they fall outside certain operating limits). These licences tend to apply to public networks and larger private systems.

Source: RA (2000c, Appendix E, p. 1).

C.3 Licence fees

Radio spectrum agencies worldwide have adopted varying approaches to charging for the use of radio spectrum. There are at least three different methods for calculating spectrum charges in other countries:

- *administrative pricing*, whereby the spectrum manager sets licence fees or charges for spectrum rights;
- *incentive pricing*, which is a variant of administrative pricing, whereby an attempt is made to set prices at a level that promotes efficient spectrum use. Licences are administratively priced to reflect the value of the spectrum used. Where spectrum is in heavy demand, for example, higher prices may be set. This can deter hoarding and encourage efficient use. Where spectrum is underused, prices may be lowered to encourage more use (see chapter 8). Incentive-based pricing can be limited to cost recovery or can extend to market value; and
- *market-based pricing*, which uses market mechanisms such as auctions to set prices (ERC 1999, p.1).

The ratio of fees to administrative costs and the basis of charges (administrative or incentive) for a selection of countries are summarised in table C.2. Like Australia, most other countries use forms of incentive-based pricing to encourage efficient use of spectrum.

Table C.2 **Ratio of agency revenue to agency costs and basis for fees**

Country	*Revenue as a percentage of costs*[a]	*Basis of charges*
	%	
Australia	400	Incentive pricing
Canada	500[b]	Incentive pricing
Denmark	100	Incentive pricing
Hong Kong	100	Incentive pricing
New Zealand	100	Incentive pricing[c]
United Kingdom	130	Incentive pricing
United States	<100[d]	Administrative pricing

[a] Revenue does not include auction revenue. [b] Industry Canada is presently reviewing its spectrum licence fee system. [c] Incentive pricing will be introduced in the second half of 2002. [d] The FCC in the United States is not authorised by Congress to collect revenues above its operating costs, but the ratio fluctuates from year to year.

Source: Adapted from Telestyrelsen (2000, p. 14).

In Australia, Canada and the United Kingdom, agencies raise more in licence fees than their operating costs (Telestyrelsen 2000, p. 24). In other countries examined, licence fees are limited to cost recovery.

Canada

Industry Canada is reviewing its spectrum licence fee system. The proposed new system for calculating licence fees is based on three dimensions: bandwidth, geography and exclusivity (box C.4). Industry Canada has conducted an analysis of the new system's likely impacts, but an implementation date is yet to be determined (Industry Canada, pers. comm., 12 January 2002). Licences that are not issued competitively (by auctions or 'beauty contests') are subject to a standard radio licence fee. The station type, the radio system type and the desired licence term determine the fee. The licence fee system is based loosely on cost recovery (Telestyrelsen 2000, p. 41).

Box C.4 **Proposed method for calculating licence fees in Canada**

1. Measure the amount of spectrum occupied by each licence using: the bandwidth measured in kilohertz (kHz); the area over which spectrum is reduced or denied to other users; and the exclusivity required by each user.
2. Measure the amount of spectrum that is being used by all users in a band and geographic area, and the amount available for allocation. This indicates ‘spectrum saturation’ — that is, the ratio of spectrum used to spectrum available.
3. Based on saturation, assign a value in $/kHz to each cell in a geographic spectrum grid for each band.

Calculate the licence fees for a radio system.

Source: Guiness Gallagher (2000, p. 22).

Denmark

Telestyrelsen uses an incentive-based approach, whereby fees are set at a level that recovers costs overall. The amount paid comprises a fixed charge per licence and a spectrum charge that depends on:

- the bandwidth assigned;
- whether coverage is national or not. National frequency use is charged at five times the fee of single transmitter positions — that is, an average re-use factor of five is assumed;
- whether the transmissions are low powered. A fixed fee is set for low power use regardless of the frequency use;
- whether the frequency band is shared. A fixed fee is charged to users who share channels (for example maritime and amateur radio) and to users who share a band and are not offered interference protection in that band. This fee is the same as the fixed fee for low power use; and
- the frequencies used. Frequencies above 3 gigahertz (GHz) attract one tenth the charge set for use of frequencies below 3 GHz.

The basic unit of calculation in this model is a fee for a 25 kHz channel below 3 GHz (Telestyrelsen 2000, pp. 12–13).

Hong Kong

Licence fees in Hong Kong cover the administrative cost of the spectrum assignment and the amount of frequency used. Fees depend on the amount of spectrum used because ‘the more frequency used the greater the problems of monitoring and managing interference’ (OFTA 2001a). Fees also include a variable to encourage the use of higher frequencies, because lower frequencies tend to be more ‘crowded’.

New Zealand

Under the current system of licence fees, fees are collected for specific licence types. They are set on a per licence basis (for example, land mobile or fixed service licence) or per station basis (for example, amateur, ship or aeronautical station) (Ministry of Economic Development, pers. comm., 18 January 2002).

In January 2001, the New Zealand Radio Spectrum Management Group released a discussion paper proposing an incentive-based method of calculating licence fees. The new method is a formula-based approach to the calculation of fees, which are to be limited to cost recovery.

Factors included in the proposed formula are bandwidth, exclusivity (or the ability to share the same spectrum), transmitter location, location within spectrum, transmitter power and licence category (Ministry of Economic Development 2001a). The Radio Spectrum Management Group will adopt this approach in the second half of 2002 (Ministry of Economic Development, pers. comm., 18 January 2002).

United Kingdom

The United Kingdom recently implemented an incentive-based approach to spectrum pricing, replacing the previous cost-based approach. The new regime was introduced in three phases (beginning in 1998) to allow users time to adjust (ERC 1999, p. 37). The new system is described in chapter 8.

The RA has adopted the Spectrum Tariff Unit as a reference measure against which spectrum charges for different services are established. Standard Tariff Units for mobile and fixed services have been derived, based on the estimated value of 1 MHz of spectrum covering one kilometre across the United Kingdom. It is used to calculate the licence fee as follows:

Licence fee = [Spectrum Tariff Unit] × [bandwidth in MHz] × [area sterilised] × [modifier]

Bandwidth and area sterilised give a measure of the amount of spectrum that is denied to others. The area sterilised is affected by the transmission power and frequency band, and also by other factors such as antenna characteristics and surrounding topography. Area sterilised also indicates the re-use factor, which indicates how many times a frequency can be re-used for the same type of spectrum across the country (Guiness Gallagher 2000, p. 14; Telestyrelsen 2000, p. 50).

United States

The United States Congress limits FCC fees to cost recovery. The total amount recovered varies from year to year, depending on the expectation of demand for radio spectrum in the coming fiscal year. The FCC uses an administrative approach to charging.

The FCC collects application fees and regulatory fees. Application fees are intended to cover only the direct administrative costs of processing a licence application. They are set according to the type of service and are regularly reviewed.

Regulatory fees for spectrum users cover the cost of the agency's broad range of enforcement, policy development and international activities. By statute, the total fees collected must cover (but cannot exceed) the level of funding appropriated by the US Congress for these activities. These fees are assessed annually and vary from service to service. City population and class of radio station data are used to differentiate between stations. This results in spectrum users in metropolitan areas paying more for licences than by those in rural areas (Guiness Gallagher 2000, p. 12). These fees do not apply to government entities, amateur radio operator licensees and non-profit entities (FCC 1999).

C.4 Licence assignment

After spectrum is allocated to particular uses through ITU and national spectrum plans, it is assigned to individual users through various types of licence (section C.2). National spectrum regulation agencies employ several methods for licence assignment. These include a first-come, first-served basis; 'beauty contests'; tenders and auctions (see chapter 8 and appendix D).

The assignment methods used by Australia, Canada, Denmark, Hong Kong, New Zealand, the United Kingdom and the United States are summarised in table C.3. All use the first-come, first-served method for some licence assignments (typically for those similar to Australia's apparatus licences), and all but Hong Kong and Denmark have used auctions for at least some types of licence assignment. The assignment methods employed by each country are discussed in the following sections.

Table C.3 **Spectrum assignment methods**

Country	*First-come, first-served*	*Beauty contests*	*Auctions*
Australia	Yes	No	Yes
Canada	Yes	Yes	Yes
Denmark	Yes	Yes	No
Hong Kong	Yes	Yes	No
New Zealand	Yes	No	Yes
United Kingdom	Yes	Yes	Yes
United States	Yes	No	Yes

Source: Adapted from Telestyrelsen 2000; Ministry of Economic Development 2000.

Canada

Most licence applicants in Canada for fixed and mobile radio facilities are assigned frequencies on a first-come, first-served basis, so long as there is sufficient spectrum to meet demand. Where demand is greater or expected to be greater than the spectrum available, competitive licensing processes (comparative tenders or auctions) are used.

One example of comparative tenders in Canada relates to the assignment of multipoint communication systems at 2500 MHz. No restrictions were placed on the type of services that could be offered in this band. However, licence applicants were compared on the basis of their proposed use of the licences to ‘support lifelong learning for the good of the Canadian public as part of their commercial services’ (Telestyrelsen 2000, p. 42).

Industry Canada also has provisions to assess whether a licensee has demonstrated an acceptable use of the spectrum within five years from the close of an auction. For example, licences for the 2 GHz auction were required to establish coverage of at least 50 per cent of the population within a service area (Industry Canada 2000, p. 15). If targets are not met within five years of the close of the auction, the licensee must demonstrate why the licence should not be revoked.

Industry Canada monitors frequency bands and identifies ‘factors or trigger points’ above which a competitive process will be considered. Examples of such triggers include the introduction of new technology with significant public benefit, the band nearing exhaustion (75 per cent full) or requests for a significant quantity of spectrum (25 per cent of the band) (Telestyrelsen 2000, p. 42).

Industry Canada does not use auctions where licensing involves special users of the spectrum such as national defence, public safety or essential government operations (Industry Canada 2001c).

Denmark

Where there is sufficient supply, Telestyrelsen assigns spectrum on a first-come, first-served basis. Otherwise, a public tender is conducted. Criteria used by Telestyrelsen (2000, p. 43) for public tenders include:

- the range and quality of services;
- prices offered for the services;
- the degree of coverage; and
- efficient radiofrequency use.

Telestyrelsen held a 3G auction in September 2001, which required the enactment of new legislation. A review of the Act on Radiocommunications and Assignment of Radio Frequencies 1997 will consider whether to add auctions as a regular assignment method (Telestyrelsen, pers. comm., 12 January 2002).

Hong Kong

Frequencies in Hong Kong are generally assigned on a first-come, first-served basis. Where there is insufficient spectrum available, OFTA uses ‘beauty contests’ to assign spectrum (OFTA, pers. comm., 18 January 2002). ‘Beauty contests’ may differ depending on licence category and type, but the procedure for assignment generally includes some or all of the following steps:

- taking into account the demand from the markets;
- consultation among interested parties and experts;
- the preparation of a guidance note for the relevant licence;
- an invitation to interested parties to submit their proposals (or licence applications) in accordance with the guidance note;
- an evaluation of the proposals received by a selection committee composed of senior officers from OFTA and other government departments (such as the Department of Justice) on their merits, having regard to the information provided as requested and to the broad licensing criteria outlined in the guidance note; and
- the granting of the licence (OFTA 2001b).

OFTA has the power to assign spectrum licences using auctions but no such auctions have occurred to date. In September 2001, the Hong Kong Government cancelled plans to auction 3G mobile phone licences due to a lack of demand. Instead, it awarded the four licences at the minimum reserve price — one to each of the four companies that came forward.

New Zealand

In New Zealand, legislation does not require the use of any particular method for assignment Until 1988, New Zealand radio licences were assigned on a first-come, first-served basis. In 1989, the New Zealand Cabinet introduced apparatus licences, spectrum licences and management rights (section C.3). These spectrum and management rights were initially assigned using a tender system. In 1996, an Internet-based auction system was developed for the assignment of spectrum licences.

Where demand does not exceed supply, the first-come, first-served approach is still used. Management and spectrum rights, however, generally are not assigned using this approach (Ministry of Economic Development, pers. comm., 18 January 2002).

United Kingdom

Where demand is easily satisfied, the RA assigns licences on a first-come, first-served basis (Telestyrelsen 2000, p. 23). Where the number of potential applicants is expected to exceed the available supply of spectrum, licences are awarded by competitive means. During the 1990s, competitive assignments were made using ‘beauty contests’.

Auctions are also used in the United Kingdom. Despite fierce debate about the use of spectrum auctions in the light of the high sums bid for 3G licences in the United Kingdom (and in Germany), the RA (2001a, p. 104) said ‘auctions are a useful spectrum management tool to be used in appropriate circumstances’. The Cave Review (2002, p. 38) also recommended that auctions should be the default means of assigning spectrum licences.

United States

In the past, the FCC relied on ‘beauty contests’ to award licences where two or more applicants filed applications for the same spectrum. Comparative hearings proved time consuming and resource intensive, however, so the FCC also used lotteries to award licences in some cases. Lotteries, however, created an incentive to acquire licences on a speculative basis and re-sell them. More recently, the United States has turned to auctions to assign licences.

The FCC considered that auctions were ‘not appropriate in all circumstances’. As in Canada, it argues that a competitive bidding mechanism may not serve fundamental public policy goals in cases such as public safety and national defence (FCC 1999).

The FCC also has found cases in which the most efficient and effective use of spectrum is achieved not by granting exclusive licences to winning bidders, but through the shared use of the spectrum, either on a licensed basis (as with most private services in the United States) or an unlicensed basis (FCC 1999, p. 5).

Auction design

Australia, Canada, New Zealand, the United Kingdom and the United States all use a simultaneous ascending auction design. Denmark was the first country in the world to use a sealed-bid auction for its assignment of 3G licences. Hong Kong has not used auctions for spectrum assignment.

New Zealand was the first country to conduct spectrum licence auctions, doing so in 1990 and 1992. The first three auctions used the ‘second price’ tender method, whereby the highest bidder wins each lot, but pays a price equal to the value of the second highest bid for that lot.

For the next three tenders, the more conventional ‘first price’ tender method was used, whereby the price paid for each lot was equal to the value of the highest bid. It has been argued, however, that bidders still lacked information on the value that other market players placed on the spectrum being allocated (Ministry of Economic Development 2000, p. 25). Subsequent auctions have been run on a simultaneous ascending bid basis, with the first being held in 1995.

Subsequent auctions in other countries addressed the lessons learnt from these early auctions in New Zealand. The FCC in the United States has conducted simultaneous ascending auctions of licences since 1994. Industry Canada and the RA in the United Kingdom followed in 1999 and 2000 respectively.

Comparisons of auction results are difficult, but Coutts (2001) compared the normalised price for equivalent spectrum from a number of auctions for 3G or similar spectrum. While results have varied greatly, the United Kingdom and Germany stand out with very high prices paid per MHz and head of population (table C.4).

Table C.4 **Revenue raised from 3G auctions**

Country	*Normalised price*	*Frequency type*
	US$/MHz/pop	
Australia	$0.75	30 MHz paired GSM 1800 spectrum
	$0.25	60 MHz paired and unpaired 3G spectrum
Germany	$4.75	60 MHz paired 3G spectrum
Italy	$1.40	55 MHz paired 3G spectrum (5 MHz by application)
Netherlands	$1.30	60 MHz paired 3G spectrum
New Zealand	$0.07	100 MHz paired 3G and GSM 1800 spectrum
United Kingdom	$5.00	60 MHz paired 3G spectrum

Source: Coutts (2001).

Secondary trading

The existence of secondary markets for spectrum is limited to Australia, New Zealand and Canada. Spectrum management agencies in the United States and United Kingdom are currently planning the introduction of secondary trading, while spectrum agencies in Denmark and Hong Kong have no such plans.

Secondary trading in New Zealand has been limited. The Ministry of Economic Development noted that very little trading had occurred in New Zealand by June 2000 (Ministry of Economic Development 2000, p. 46). At present, Canada has completed only two auctions of tradeable spectrum licences.

In December 2000, the FCC in the United States released a policy statement setting out their plans for facilitating secondary markets for radio spectrum. The FCC plans to allow licensees to make all or part of their assigned frequencies and/or service areas available to other users and uses. Current FCC policies allow certain licensees to market only portions of their spectrum use rights to others (FCC 2000b).

The United Kingdom is the only member state of the European Union pursuing the option of secondary trading (Burns, Kirtay and Court 2001, p. 39). The Cave Review (2002, p. 106) recommended that secondary trading be introduced in the United Kingdom as soon as is practicable; however, there are institutional constraints on spectrum trading due to EU requirements. The 1999 European Commission Review stated that the EC would amend the ‘Licensing Directives’ to allow, not mandate, Member States to make provision for spectrum trading in radiocommunications (EC 1999, p. 36).

C.5 Ongoing management

This section discusses how various regulatory agencies manage licence re-allocation, broadcast spectrum and consultation arrangements.

Licence re-allocation

Like Australia, spectrum management agencies in most other countries have the power to re-allocate spectrum with no legal requirement to compensate displaced spectrum users. Notice periods for spectrum re-allocation vary from one to five years. Table C.5 summarises the available information about re-allocation rules for Australia, Canada, Denmark, Hong Kong, New Zealand and the United Kingdom.

Table C.5 **Re-allocation of licences**

Country	*Minimum notice period*	*Right to compensation*
Australia	Two years	No
Canada	Formal notice period is 60–90 days. In practice at least two years is given.	No
Denmark	Typically one year	No
Hong Kong	One to three years	No
New Zealand	Five years	No
United Kingdom	Varies depending on particular circumstances	No

Sources: Telestyrelsen (2000, p. 30); Telestyrelsen, pers. comm., 12 January 2002.

Canada

Industry Canada's Spectrum Transition Policy recognises the need to provide a reasonable period of notice for displacing incumbents. In most cases, a minimum of two years notice is given (Telestyrelsen 2000, p. 42). There is no liability or responsibility for the department to compensate financially the spectrum users who are displaced. Further, as new services have been introduced, Industry Canada has not required new spectrum users to compensate users who are being displaced. Private payment arrangements, however, may be made voluntarily between new radio users and existing users to encourage the incumbent to vacate the spectrum more quickly (Industry Canada 2001a, p. 5).

Denmark

Telestyrelsen has administrative powers to re-allocate spectrum before licences expire, with a minimum notice period of one year. Section 10 of the Act on Radiocommunications and Assignment of Radio Frequencies states, however, that:

> … when there is a pressing scarcity of frequencies which … prevents the provision of telecommunications services clearly in demand or ... which … is restricting or distorting competition within parts of the telecommunications sector, the Minister of Research and Information Technology may exceptionally stipulate a notice shorter than one year. (Telestyrelsen, pers. comm., 12 January 2002)

Displaced incumbents have no right to compensation (Telestyrelsen, pers. comm., 12 January 2002).

Hong Kong

Provided reasonable notice is given, OFTA has the power to re-allocate radio frequencies. It usually offers affected users alternative allocations. The notice period varies from one year to three years, depending on the impact of the re-allocation and the time required to switch bands (OFTA, pers. comm., 18 January 2002).

New Zealand

New Zealand policy does not require the Government to pay the costs of adjustment to, or replacement of, radio equipment if frequencies are re-allocated. Relocation generally is negotiated and includes opportunities to acquire long-term licences in alternative frequencies (Ministry of Economic Development 2000, p. 32).

United Kingdom

While the RA does not accept legal responsibility to pay compensation, it does note that:

> Human Rights legislation and general principles of public law mean that [the agency has] to give a reasonable period of notice, the length of which will depend on circumstances, such as the level of investment in legacy systems. (RA, pers. comm., 9 January 2002)

The RA has powers under s. 4 of the Wireless Telegraphy Act 1998 to pay selective grants to accelerate re-allocation. To date, however, no such grants have been made (RA, pers. comm., 9 January 2002).

United States

The US Communications Act 1934 states that use of spectrum is temporary, limited and subject to withdrawal. Section 304 of the Act requires applicants seeking to use spectrum to ‘waive any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States' (FCC 2000b, p. 10). No compensation for re-allocation is payable.

Responsibility for managing broadcast spectrum

Responsibility for the management of broadcast spectrum varies across countries. Like Australia, Canada and Hong Kong have separate agencies that issue and renew broadcast licences: the Canadian Radio-Television and Telecommunications Commission and the Hong Kong Broadcasting Authority. The spectrum agencies in Denmark, New Zealand and the United Kingdom, however, manage all spectrum, including that used for broadcasting. In the United States, the NTIA manages all non-commercial use of spectrum.

Consultation

Like Australia, most countries carry out some form of consultation, however this may take different forms. Consultation arrangements for selected countries are discussed below.

Canada

The Radio Advisory Board of Canada is an association with representation from service providers, equipment manufactures and radio user sectors. The Board regularly meets with Industry Canada to advise on issues relating to spectrum management that include policy, standards and technical procedures (ITU-R 2000 p. 83).

Industry Canada publish forward plans and strategies and provide interested parties with a minimum of four weeks to respond to proposed policies (Telestyrelsen 2000, p. 41).

Denmark

In Denmark, consultation is often duplicated. Initial input from industry is sought out by Telestyrelsen which then presents the results in the form of recommendations to the Minister. The Minister then consults again on the recommendations received. Telestyrelsen stated the 'procedures for major assignment decisions are unduly long' as a result of consultation (2000, p. 6).

Hong Kong

OFTA consults with two separate committees about various aspects of radiocommunications. The Radio Spectrum Advisory Committee (RSAC) discusses the allocation and use of specific frequencies and Hong Kong's position in international fora; the Telecommunications Standards Advisory Committee advises on the technical standards for equipment.

RSAC is chaired by OFTA and meets quarterly. Its membership includes various consumer user groups, licensees and government departments, as well as 'three independents' — either academics and/or technical specialists (OFTA 2002).

New Zealand

Consultation undertaken by the Ministry of Economic Development closely resembles the processes followed by the ACA in Australia. The Ministry has established study groups that mirror those found at the ITU. The Ministry has also established a separate consultative body, the New Zealand Radio Sector. This is made up of government agencies and industry representatives with an interest in spectrum management such as the New Zealand Defence Force and the Civil Aviation Authority, as well as study group members. The Radio Sector is an advisory body only and the Ministry is under no statutory obligation to act on its recommendations.

United Kingdom

The Spectrum Management Advisory Group (SMAG) was established in 1998 by the Minister, in response to industry concerns about the effects of spectrum pricing. The Group meets five to six times each year and provides strategic advice on spectrum management to the Minister and the RA (SMAG 2002).

The RA regularly consults with manufacturers, industry and users of the spectrum through formal committees on mobile radio, fixed links and space service. These committees respond to consultative documents and proposals on topics such as licence fees, technical standards and strategies for the future use of spectrum (RA 2002a).

Consultation also takes place informally, via *ad hoc* meetings, seminars and 'roadshows' organised by the Agency. 'Roadshows' are held annually and provide an opportunity for customers to question senior members of the Agency (Telestyrelsen 2000, p. 51).

United States

Both the FCC and NTIA undertake various forms of consultation in the United States. The FCC has a system of ‘negotiated rulemakings’ that enable interested parties to contribute to the development of the regulations and standards that will be used to regulate their activities though open advisory committees (ITU-R 2000, p. 85).

The NTIA seeks advice from the Interdepartment Radio Advisory Committee (IRAC) and the Spectrum Planning Advisory Committee (SPAC). The IRAC is chaired by the NTIA and incorporates representatives from various departmental agencies such as energy, treasury and NASA, as well as a liaison from the FCC (NTIA 2002a).

The SPAC membership consists of fifteen non-government members with a background in industry, academia and technical expertise, as well as four government members appointed by the Secretary of Commerce (NTIA 2002b).

D Alternative market-based mechanisms

D.1 Introduction

Section 60 of the *Radiocommunications Act 1992* (RC Act) allows the Australian Communications Authority (ACA) to use the following four market-based licence assignment mechanisms: auctions; tenders; sale at a pre-determined price; and sale at a negotiated price.[1]

For each of these assignment methods, the RC Act also offers the ACA the latitude of choosing the mode of payment of the licence. For example, in relation to auctions of spectrum licences, s. 60(2) states that:

> (2) The procedures for allocation by auction may, for example, deal with any of the following matters:
>
> …
>
> (f) methods of payment for licences.

When the Spectrum Management Agency (SMA), the ACA's predecessor, first considered the implementation of spectrum licences, it proposed to use auctions or tenders as the primary mechanism for allocation. It also proposed to use negotiated price mechanisms where spectrum is passed in at auction. Finally, it proposed to sell any lots remaining after price negotiations at pre-determined prices (designed to recover SMA costs) on a first-come, first-served basis. Regarding payment mechanisms, the SMA considered the possibility of payment in instalments — under some circumstances — in addition to upfront payments (SMA 1995a).

In practice, only auctions have been used to date, and only with upfront payments. In auctions when only one bidder registered, the bidder was offered the licence at the reserve price. When spectrum lots are passed in at auction, the ACA reserves the right to assign them later, using any of the four mechanisms mentioned above. In practice, it has used auctions when re-offering licences for sale.

[1] Tenders — a form of auction also known as a sealed-bid auction — are not considered separately in this section. See Chan et al. (2002) for a comparison of different auction mechanisms.

The ACA justified its rejection of pre-determined or negotiated prices as follows:

> The ACA does not consider that [pre-determined prices and negotiated prices] would be appropriate for the allocation of … spectrum licences. These methods would only be appropriate where demand for spectrum was not expected to exceed the available supply. Where this condition is not met, they would not meet the principal test for an efficient allocation; that is, ensuring that spectrum goes to the most highly valued uses. (ACA 1998g, p. 2)

The ACA's use of auctions is part of a growing international preference for this spectrum allocation mechanism. Most countries have relied on auctions for the sale of third generation (3G) spectrum (table D.1). Around half of the countries listed in table D.1, however, have opted for alternative methods of assignment, including comparative hearings and pre-determined prices. The relative merits of these methods are examined in section D.2. In section D.3, the use of payment mechanisms other than upfront payment is discussed.

Table D.1 **Assignment methods for 3G licences worldwide[a]**

Auction	*Comparative hearings*	*Comparative hearings and auction*	*Fixed price*
Argentina	China	Austria	Czech Republic[b]
Australia	Estonia	Croatia	Greece
Belgium	Finland	Hong Kong	
Canada	France	Indonesia	
Denmark	Iceland	Italy	
Germany	Ireland		
Hungary	Luxembourg		
India	Norway		
Israel	Portugal		
Jamaica	South Korea		
Latvia	Spain		
Netherlands	Sweden		
New Zealand			
Poland			
Singapore			
Switzerland			
Taiwan			
United Kingdom			

a Actually used or planned. **b** One of four licences was auctioned.

Source: UMTS Forum (2001).

D.2 Alternative assignment mechanisms

This section examines the advantages and disadvantages of three auction alternatives for the assignment of spectrum rights: comparative hearings, pre-determined price and negotiated price.

Comparative hearings

The second most popular method by far for assigning 3G spectrum has been comparative hearings, also known as 'beauty contests'. With hearings, the price that the firm is prepared to pay for spectrum is only one of several criteria that the spectrum manager takes into account. Other factors may include ability to pay (financial soundness), technological know-how and social considerations.

Historically, beauty contests have been a common way of allocating spectrum in situations of excess demand. They were used in the United States before 1981, for example. In Australia, telecommunications carrier licences were allocated to Optus and Vodafone Australia in 1991-92 using a combination of beauty contest and tender. The RC Act does not explicitly provide for comparative hearings to be used for the assignment of spectrum licences or apparatus licences. However, ss. 39 and 60 of the Act allow spectrum licences to be allocated at a negotiated price. The ACA has responsibility under the RC Act for determining (in writing) the procedures for allocating licences in this way (s. 60[1]). Further, the Act states:

> (4) The procedures for allocation for a pre-determined or negotiated price may, for example, deal with any of the following matters:
>
> (a) the way in which prices are to be determined or negotiated; (RC Act, s. 60[4])

This appears to give the ACA latitude to conduct comparative hearings to allocate spectrum licences based on a price negotiated in the light of some other (unspecified) characteristics of the firms competing for the licence.

Comparative hearings have some perceived advantages. First, they can incorporate social considerations in the selection process. If, for example, diversity in spectrum ownership were sought for distributional reasons, then it could constitute one of the criteria by which participants are judged.

Some forms of beauty contests have also been used in some countries to address market failures. Concerns that imperfect capital markets and liquidity constraints may have prevented innovative but unproven firms from raising the requisite funding have resulted in licences being assigned based on criteria other than price. In the United States, some spectrum licences that normally would have been auctioned have been reserved for technology 'pioneer' firms (McMillan 1994).

Comparative hearings also are often said to be able to gauge a firm's ability to pay (not its willingness to pay) and technical know-how. To the extent that they eliminate ill-prepared bids and inexperienced firms, they can reduce transaction and litigation costs, and enhance consumer choice and innovation. According to Scanlan (2001), the bankruptcies recorded in the United States by several winning bidders in the C Block Personal Communications Services (PCS) auction persuaded some European spectrum regulators to shy away from auctions.

Other cited reasons for favouring comparative hearings over auctions include promoting government objectives for the telecommunications market, ensuring low prices for consumers and ensuring the provision of technically advanced services.

Some inquiry participants invoked combinations of the reasons above to recommend that the ACA adopt beauty contests alone (Simon Hackett, sub. 87, p. 1) or a mixed comparative hearing and auction assignment process (Bramex, sub. 64, pp. 6–7; Hydro Tasmania, trans., p. 347).

Comparative hearings suffer from a number of shortcomings, however. First, they are less transparent than auctions. They require assessment of competing firms on criteria other than willingness to pay, which can make the selection process subjective. This subjectivity and lack of transparency can encourage inefficient rent-seeking behaviour on the part of firms, ranging from lobbying to litigation and bribery. This is illustrated by the action taken by a number of US firms against the Federal Communications Commission (FCC) for excluding them from the pioneer program (Hazlett 2001).

Second, comparative hearings do not necessarily protect the government against defaults by winning firms. A change in market conditions or sentiment can mean that beauty contest winners are unable to meet their commitments, financial or otherwise. This appears to have been the case in France in 2001 when, despite a comparative hearing allocation process for 3G licences, one of two winning firms subsequently threatened to withhold payment to the French Government, on the grounds that the crash in telecommunications stocks made previously agreed spectrum prices untenable. The Government eventually agreed, drastically reducing the required entry price and imposing a royalty system for determining future payments (Girard and Orange 2001).

Moreover, Scanlan (2001) suggested that the payment defaults experienced in the US C Block auction were due to flaws in that particular auction's rules rather than to the auction process. These flaws included the introduction of instalment payments, the length of the payment window and the timing of property rights transfers.

Third, auctions are not precluded from accounting for social imperatives. In the PCS auctions held in the US, ‘designated’ bidders such as small businesses, minority-owned or women-owned businesses and rural telephone companies were assisted (through bidding credits, reserved bands and payment facilities) in bidding for spectrum. Contrary to comparative hearings, a designated bidder system makes clear the amount of government assistance that such bidders receive. With beauty contests, any trade-off between equity and efficiency is hidden from view.

Finally, comparative hearings are time-consuming and inflexible. It takes time both for firms to prepare proposals meeting several criteria, and for regulators to assess them. Moreover, the choice of criteria — or the choice of weights applying to those criteria — cannot be easily adjusted in the face of changing market conditions. The subjectivity of some criteria can add to the length of time taken to complete the allocation process, as decisions are more likely to lead to appeals and litigation.

Pre-determined prices

As well as negotiated prices, the RC Act provides for the sale of spectrum licences at pre-determined prices. Under the Act, the ACA is entrusted with setting these prices. This process is similar to that used in the recent auction of space (apparatus) licences. In that auction, the Ministerial determination held that the ACA, if able to allocate licences to highest value users without conducting an auction, was permitted to charge a pre-determined price equal to the starting bid for that licence (Radiocommunications [Space Licence Allocation] Determination 2001). When only Foxtel registered for the auction, it was able to acquire one of the two licences at the reserve price.

The setting of pre-determined prices encounters the same difficulties that exist with the setting of apparatus licence fees and auction reserve prices. It is difficult for an administrative agency to know or calculate the value of the spectrum, when such value varies across users, uses, bands and over time. Pre-determined prices therefore carry the risk that spectrum will not be allocated to the highest value use or that, if it is, it will be sold at a price below or above its true valuation.

Pre-determined prices also lack the flexibility to adjust to rapid changes in technology that serve to alter the value of the spectrum. If a technological advance were to make part of the spectrum suddenly commercially attractive, excess demand would be likely to develop before prices could adjust. This would impair the efficiency of spectrum allocation in the intervening period.

The disadvantages of pre-determined prices are reflected in the setting of reserve prices for spectrum auctions by the ACA. In some auctions, significant amounts of spectrum have remained unsold because the minimum price required was higher than what bidders were prepared to pay. That is, excess supply existed at those prices, which may have resulted in a loss in community welfare from unused spectrum (see chapter 11).

Negotiated price

Under this assignment method, the government selects a few potential buyers and then negotiates with each of them individually. Negotiations are primarily over price, although the conditions of the licence will influence the price the buyer is willing to pay and the seller willing to accept.

Price negotiation between a seller and a buyer generally leads to inefficient allocations. According to a number of authors (Bulow and Klemperer 1986; Milgrom 1989), negotiation results in both revenue and efficiency losses. This is because allocation choices are restricted to a single buyer at any stage of the process, not allowing for a simultaneous comparison of competing bids.

Moreover, when other factors have a bearing on price, the negotiation is usually affected by two-sided asymmetric information, whereby the seller does not know the true cost to the buyer of fulfilling certain obligations (a universal service obligation, for example) and the buyer does not know how much revenue the seller is willing to give up to have that obligation met (Schmidt and Schnitzer 1997).

D.3 Alternative payment mechanisms

Internationally, the two main alternatives to payment upfront for auctioned spectrum are payment by instalments and royalties. Instalments have been used by the United States, the United Kingdom and Spain, royalties by Hong Kong and France.

In Australia, modes of payment for spectrum licences (following auctions or conversions) were discussed in the final review of the Radiocommunications Review (DCITA 2001a). The review identified the following disadvantages of staggered repayments.

- The transferral of risk from firms to the Government. If firms are allowed to pay for winning bids in instalments rather than upfront, then the Government is exposed to the risk of default, as happened in the US C Block auctions. The transaction costs involved in recovering bids and property rights in the courts are likely to be high. Upfront payments remove any risk for the Government.[2]

- The insulation of bidders from poor commercial decisions. Beyond transferring risk to the Government, payment in instalments could increase the level of risk. For example, having to commit less funds at the outset could encourage firms to bid beyond their ability to pay, thus increasing the probability of default. Speculative bidding of this kind appears to have been a consequence of the introduction of deferred payment facilities in the US C Block auction, transforming it into a competition for *options* in licences, biased towards bidders with low risk aversion and few previous assets (Scanlan 2001).

Some inquiry participants advocated greater freedom to choose between upfront and staggered payments (Optus, sub. 17; Bramex, sub. 64). One argument in favour of staggered payments is that new entrants in the telecommunications industry may not generate sufficient cash flow in the first few years of operation to be able to service any debt incurred for the purchase of the licence. This financial capacity argument is also behind the use of royalties on revenue or profits in some countries. The Australian Broadcasting Corporation favoured that method for the payment of spectrum licences (sub. 21, p. 11). However, another inquiry participant suggested that such a system would go against the goal of technology neutrality:

> … if you link payment to commencement of services or to revenue generated using certain services, you're then effectively saying this spectrum is going to be used to provide this particular service … (Optus, trans., p. 45)

It is not clear that the mode of payment necessarily influences a bidder's ability to pay for a licence. If that ability is predicated on a sound business case, there is no reason why the bidder should not be able to borrow against future earnings. If borrowing is a problem because of capital market imperfections, targeted government subsidies represent a more transparent form of support than payment in instalments. Moreover, subsidies do not carry the risk of open-ended legal costs to the taxpayer (for example, when attempting to recover a licence from a defaulting bidder).

Further, linking payments for spectrum to an indicator other than the value of the spectrum used — as would be the case under a royalty arrangement — may create perverse incentives for the firm to engage in royalty avoidance activities. This would detach the price of spectrum from its opportunity cost and lead to inefficient use.

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2 If the winning bidder defaults on the upfront payment, then the licence immediately can be re-auctioned or allocated to the second highest bidder (provided property rights are retained by the regulator until payment is made).

A deferred payment alternative to instalments and royalties is a ‘two-part’ charging mechanism, combining an upfront payment with annual fees. Such a mechanism has been used for the Multipoint Distribution Station (MDS) apparatus licences auctioned in Australia in 1994 and 1995.[3]

In its Broadcasting report (PC 2000), the Commission stated that, in certain circumstances, a two-part mechanism can have advantages over a single upfront payment. For example, in the absence of an active secondary market, it can allow payments made by the licensee to be varied in response to changes in the value of spectrum. This would mean that the licensee faces incentives to use spectrum efficiently; for example, by handing back spectrum that is surplus to requirements.

In the broadcasting context, this would be a desirable outcome of any charging mechanism, as long as apparatus licences to use broadcasting spectrum remain non-tradeable on their own and market entry is restricted by legislation. These constraints do not apply in the broader radiocommunications context, which means that market forces are better able to ensure efficiency-promoting price variations.

[3] Some of these licences have now been converted to spectrum licences. Remaining MDS licences will terminate in 2002 (see chapter 6).

E Special users

This appendix presents descriptive material on the special arrangements received by some spectrum users, including defence and national security, broadcasters, emergency service providers, satellite and amateur operators and the Bureau of Meteorology.

Special arrangements occur in both the allocation of, and charging for, spectrum. Some spectrum users are allocated spectrum free of charge or on a concessional basis. Other users are allocated spectrum at the international level but are not granted fee exemptions or concessions. Spectrum is reserved for broadcasters and they pay indirectly for their spectrum use.

E.1 Defence and national security

The Department of Defence (Defence), the Australian Secret Intelligence Service (ASIS) and the Australian Security Intelligence Organisation (ASIO) use radiofrequency spectrum for defence and national security purposes.

Under the Australian Radiofrequency Spectrum Plan (the Spectrum Plan) spectrum is set aside for defence purposes in ‘defence bands’ (table E.1). When convenient, Defence allows civilian users conditional access to certain frequencies in the defence bands, where the possibility of interference with defence systems is small (Defence, sub. 298). Generally, non-military use of the defence bands is expected to be limited to short periods and special events (Defence, sub. 25). Spectrum is not set aside for ASIS or ASIO.

Defence, ASIS and ASIO personnel are exempt from the provisions of the *Radiocommunications Act 1992* (RC Act) under ss 24–27, which means they can use the spectrum without obtaining a licence from the Australian Communications Authority (ACA). However, in most instances, spectrum use for defence and national security purposes is authorised through apparatus licences issued by the ACA. The details of these licences are maintained on a classified register which is not available to the public (see chapter 9).

Table E.1 **Defence bands**

Band	*Total defence allocation*	*Number of discrete bands*	*Uses*
0–30 MHz	1133.15 kHz	20	Mainly maritime and aero mobile
30–70 MHz	5000 kHz	6	Fixed, mobile
70–960 MHz	198.1 MHz	16	Fixed, mobile, space operation
960 MHz–2.69 GHz	0	na	na
2.69–5 GHz	890 MHz	5	Radiolocation, fixed, mobile
5–8.5 GHz	475 MHz	7	Radiolocation, amateur
8.5–31.3 GHz	5.522 GHz	14	Radiolocation, fixed, mobile, space research
Above 31.3 GHz	6.300 GHz	6	Radionavigation, fixed and mobile satellite

na Not applicable.

Source: DCITA (1998a).

E.2 Broadcasting

Spectrum is the dominant platform for delivering broadcasting services in Australia. Under s. 31 of the RC Act, the Minister designates which part(s) of the spectrum will be used primarily for broadcasting (table E.2). The Australian Broadcasting Authority (ABA), which is responsible for planning and licensing the broadcasting services bands, issues most broadcasters with apparatus licences that grant them access to the spectrum when they receive their broadcasting licence.[1] Any spectrum that the ABA determines is not required for broadcasting purposes may be returned to the ACA for other uses.

Table E.2 **Broadcasting services bands**

Band	*Use*
526.5–1606.5 kHz (inclusive)	MF–AM radio band
45–52 MHz (inclusive)	VHF television band I (channel 0)
56–70 MHz (inclusive)	VHF television band I (channels 1 and 2)
85–108 MHz (inclusive)	The VHF–FM radio band in 87.5–108 MHz.
137–144 MHz (inclusive)	VHF television band III (channel 5A)
174–230 MHz (inclusive)	VHF television band III (channels 6, 7, 8, 9, 9A, 10, 11 and 12)
520–820 MHz (inclusive)	UHF television bands IV and V (channels 28–69)

Source: ABA (sub. 31, p. 3).

[1] Current narrowcasting and subscription television licences do not include access to spectrum in the broadcasting services bands. Instead, operators must obtain apparatus licences from the ACA. The ABA can also issue broadcasting licences to commercial and community free-to-air broadcasters that do not intend to use spectrum in the broadcasting services bands to deliver services. Eleven such licences have been issued, of which ten have commenced broadcasting.

Broadcasting licences, most of which carry the entitlement to sufficient spectrum to maximise coverage in a market while minimising coverage outside it, are used to regulate the number of broadcasters, their behaviour and the content of broadcasts. These broadcasting licences may be transferred as a complete package, but it is not possible under the current regulations to transfer access to the spectrum separately from the licence to broadcast.

Three commercial television and 25 commercial radio licences have been auctioned since 1992, raising $358 million (table E.3). Prices paid for television licences ranged from $2.1 million for Darwin to $36 million for a licence covering remote and regional Western Australia. Prices paid for radio licences ranged from $10 000 for a licence in Mildura to $155 million for a licence in Sydney.

Table E.3 **Commercial broadcasting auction results and licence fees**

	Television	*Radio*	*Total*
	$m	$m	$m
Prices paid at auction			
Total	41.3	317.1	358.4
Highest	36.0	155.0	na
Lowest	2.1	0.01	na
Licence fees (1999–2000)			
Metropolitan	179.2	13.0	192.2
Regional	38.1	1.8	39.9
Total	217.3	14.8	232.1

na Not applicable.

Source: ABA (unpublished).

In addition, annual licence fees are imposed on holders of commercial television and radio licences. Commercial broadcasters pay a percentage of their gross earnings from the broadcast of ‘advertisements or other matter’. The percentage that each licensee pays varies according to a sliding scale — 0.5–9.0 per cent for television licensees and 0.25–3.25 per cent for radio licensees. Non-commercial broadcasters (such as the national and community broadcasters) do not pay any fees for the spectrum they use in the broadcasting services bands.

The Commonwealth Government collected approximately $232 million in licence fees from commercial broadcasters in 1999–2000 (table E.3). Television broadcasters contributed 94 per cent of this amount. These fees represent only a small proportion of the value that commercial broadcasters place on their licences; for example, Channel Seven valued its commercial television licences (covering Brisbane, Sydney, Melbourne, Adelaide and Perth) at over $1 billion in 2001 (Seven Network Limited 2001, p. 56).

Incumbent television broadcasters have been 'lent' additional spectrum to simulcast their analogue signal in digital form during the conversion period. Most of the lent spectrum is used to provide services in both high definition and standard definition digital formats. Any spectrum left over may be used for datacasting. The commercial television broadcasters are not required to pay additional fees for this spectrum unless they use it for datacasting. Fees for using the spectrum for datacasting are based on gross earnings from datacasting. At the end of the conversion period, the spectrum used for analogue transmission is intended to be returned to the regulator.

Broadcasters also have licences from the ACA for the use of non-broadcasting parts of the spectrum (for example, for microwave or satellite links). They pay for these on the same basis as other spectrum users.

E.3 Emergency and safety-of-life uses

The use of spectrum for emergency and safety-of-life purposes falls into three different categories:

- emergency transmissions;
- emergency service providers (such as police, fire brigades, ambulance services, the Royal Flying Doctor Service and surf life-saving associations); and
- maritime and aeronautical services that provide safety-of-life functions.

Emergency transmissions

Emergency transmissions are exempt from licensing requirements and the offence provisions of the RC Act under s. 49 and s. 172 respectively. An emergency transmission is defined as a transmission made to:

- secure the safety of a vessel, aircraft or space object that is in danger;
- deal with an emergency that poses a serious threat to the environment;
- deal with an emergency causing a risk of death or injury to persons; or
- deal with an emergency creating a risk of substantial loss or substantial damage to property.

Emergency service providers

Emergency service providers operate under apparatus licences issued by the ACA, most commonly in the 400–430 megahertz (MHz) band. State and territory Governments provide most of these services, which pay fees and charges on the same basis as other spectrum users. The fees paid by some emergency services are presented in table E.4. A relatively small number of providers are either exempt from paying fees or pay a discounted fee (see chapter 10).

Table E.4 **Licence fees paid by selected emergency service providers**[a]

Organisation	*Licence fees*
	$
Queensland Police Service	338 514
New South Wales Police Service	273 150
Victoria Police	252 136
West Australia Police Service	184 448
Metropolitan Fire and Emergency Services Board (Victoria)	104 801
South Australia Police	103 872
Queensland Ambulance Service	91 007
Metropolitan Ambulance Service (Victoria)	85 107
Australian Federal Police	70 949
Ambulance Service of New South Wales	60 724
New South Wales Fire Brigades	59 744
Ambulance Service Victoria	42 349
South Australia Ambulance Service	33 033
Northern Territory Police	23 255

a Approximate value of licences held at 30 November 2001, assuming licence fees are paid annually.

Source: ACA (unpublished).

Other safety of life services

Other services, such as aeronautical and maritime services, also provide safety-of-life services. The International Telecommunications Union (ITU) specifies the frequencies, bandwidth and emission characteristics (equipment standards) for distress and safety communications for maritime and aeronautical services. The spectrum identified for aeronautical services, for example, is shown in table E.5.

Table E.5 **Aeronautical safety service bands**

Band	*Use*
160–285 and 315–405 kHz	Non-Directional Beacons
2.1–28 MHz (various bands)	Aeronautical Mobile (R) and (OR) Service
74.8–75.2 MHz	Instrument Landing System Marker Beacon
108–118 MHz	Radionavigation Aids: VHF Omnidirectional Range; Instrument Landing System Localizer; Terrestrial Augmentation for RNSS
118–137 MHz	Aeronautical Mobile Communications
121.45–121.55 MHz	Aeronautical Emergency Location
242.95–243.05 MHz	Aeronautical Emergency Location
328.6–335.4 MHz	Instrument Landing System Glide Slope
960–1 215 MHz	Aeronautical Radionavigation Aids: Distance Measuring Equipment; Tactical Air Navigation; Radar Beacons; Secondary Surveillance Radar; Airborne Collision Avoidance System; Radionavigation Satellite Systems
1 215–1 400 MHz	Aeronautical Radar
1 215–1 260 MHz	Radionavigation Satellite Systems
1 545–1 555 MHz (s-E)	Aeronautical Mobile Satellite Communications
1 559–1 610 MHz	Radionavigation Satellite Systems, Terrestrial and Satellite-Based Augmentations for Satellite Navigation Systems
1 646.5–1 656.5 MHz (E-s)	Aeronautical Mobile Satellite Communications
2 700–2 900 MHz	Radar (Aeronautical Radionavigation)
4 200–4 400 MHz	Airborne Radio Altimeter
5 000–5 250 MHz	Microwave Landing System, Radionavigation Satellite Systems
5 350–5 470 MHz	Airborne Weather Radar
8 750–8 850 MHz	Airborne Doppler Radar
9000–9500 MHz	Precision Approach Radar
13.25–13.4 GHz	Airborne Doppler Radar
15.4–16.6 GHz	Airport Surface Detection Equipment, Weather Radar, Aircraft Landing System, Radar Sensing and Measurement System
24.25–24.65 GHz	Airport Surface Detection Equipment
31.8–33.4 GHz	Airport Surface Detection Equipment

Source: Airservices Australia (sub. DR322, pp. 5–6).

Aeronautical spectrum use is divided into two main functions: ground to air communications and radio navigation. Exclusive allocations are normally made worldwide for aeronautical mobile (route) services, aeronautical radio navigation services and satellite navigation services. Other satellite-based services (for communications, navigation and surveillance/air traffic management) are likely to be introduced in the future, in line with policies approved by the International Civil Aviation Organisation Council. In Australia, aeronautical users of spectrum pay apparatus licence fees on the same basis as other users.

E.4 Satellites

The ITU co-ordinates satellite systems which can potentially provide services across a large portion of the Earth's surface. Each member country has access to geostationary orbital positions in 'planned bands'. The Broadcasting Satellite Service Plan and the Fixed Satellite Service Plan allocate both orbital positions and specific frequencies to member countries for use under particular technical and operational conditions. All other frequency bands allocated to satellite services are 'unplanned' bands. These are accessed on a first-come, first-served basis.

Under ITU regulations, the ACA is responsible for ensuring that Australian spectrum users do not interfere with satellite services in other countries. Some terrestrial fixed link services provided in Australia, for example, can interfere with satellite services. Australia has agreed to restrict the growth of fixed links in some bands (such as the 2-GHz band) to avoid potential interference with satellite services (Federation of Australian Commercial Television Stations, sub. 28). The ACA is also responsible for ensuring Australian space objects (as determined under the Radiocommunications [Australian Space Objects] Determination 2000) do not cause interference with spectrum users in other countries. The four Optus satellites are examples of Australian space objects.

Within Australia, Australian space objects and foreign space objects may provide satellite services. Unlike Australian space objects, which are subject to the RC Act at all times and in all places (as a result of Australia's international obligations), foreign space objects (as determined under the Radiocommunications [Foreign Space Objects] Determination 2000) are subject to the RC Act only in relation to services provided in Australia. The Globalstar satellites are examples of foreign space objects that the ACA has determined to be subject to the RC Act. Vodafone uses these satellites to provide mobile phone services in Australia.

Australian and foreign satellite operators that use spectrum to provide services in Australia are licensed by the ACA and subject to licence fees. The fees for satellite services are based on technical and operational characteristics, not on the country of origin. The same fees apply, therefore, to satellites with identical spectrum use, regardless of whether a satellite is Australian or foreign.

Previously, some satellite services operating in Australia were not licensed (for example, the global positioning system [GPS] navigation services provided by the United States Department of Defense). As a result, users of GPS services were not guaranteed protection from interference because services in other bands could interfere with GPS signals. Defence has since purchased apparatus licences for the frequencies used for GPS services (1575.42 MHz and 1227.6 MHz). These licences provide protection from interference for military and civilian users of GPS services and need to be renewed annually.

E.5 Amateur operators

Amateur radio operators are licensed to use the spectrum for personal ‘hobby’ reasons, not for pecuniary reasons. The activities of amateur operators include communications, technical experimentation and assistance to emergency service providers (for example, through the Wireless Institute Civil Emergency Network). Approximately 16 000 amateurs operate in specified bands across the spectrum in Australia (table E.6).

The ITU Radio Regulations require amateurs to have appropriate operational and technical qualifications, although the details of technical proficiency are left to each country. The ACA determined that persons operating transmitters under an amateur licence must be qualified. The minimum qualifications required depend on the licensing option.

Currently, the Wireless Institute of Australia, on behalf of the ACA, conducts much of the teaching and examination of amateur operators. However, the ACA approves the examination papers and issues the individual certificates of proficiency. It is moving towards outsourcing more of these responsibilities (see chapter 11).

The fees for amateur operators are $51.80 per year, comprising a tax component of $32 and an administrative charge of $19.80.

Table E.6 **Amateur bands**

Primary use bands[a]		*Secondary use bands*[b]	
Band	*Use*	*Band*	*Use*
1800–1825 kHz	Amateur	1825–1875 kHz	Amateur
3500–3700 kHz	Amateur	No secondary allocation in this band	
7000–7100 kHz	Amateur, amateur-satellite	7100–7300 kHz	Amateur
14000–14250 kHz	Amateur, amateur-satellite	No secondary allocation in this band	
14250–14350 kHz	Amateur	No secondary allocation in this band	
18068–18168 kHz	Amateur, amateur-satellite	No secondary allocation in this band	
21000–21450 kHz	Amateur, amateur-satellite	No secondary allocation in this band	
28000–29700 kHz	Amateur, amateur-satellite	No secondary allocation in this band	
52–54 MHz	Amateur	50–52 MHz	Amateur
144–146 MHz	Amateur, amateur-satellite	No secondary allocation in this band	
146–148 MHz	Amateur	No secondary allocation in this band	
No primary allocation in this band		420–450 MHz	Amateur
No primary allocation in this band		1240–1300 MHz	Amateur
No primary allocation in this band		2300–2450 MHz	Amateur
No primary allocation in this band		3300–3600 MHz	Amateur
No primary allocation in this band		5650–5830 MHz	Amateur
No primary allocation in this band		5830–5850 MHz	Amateur, amateur-satellite
No primary allocation in this band		10–10.45 GHz	Amateur
No primary allocation in this band		10.45–10.5 GHz	Amateur, amateur-satellite
24–24.05 GHz	Amateur, amateur-satellite	24.05–24.25 GHz	Amateur
47–47.2 GHz	Amateur, amateur-satellite	No secondary allocation in this band	
77.5–78 GHz	Amateur, amateur-satellite	76–77.5 GHz; 78–81 GHz	Amateur, amateur-satellite
134–136 GHz	Amateur, amateur-satellite	136–141 GHz	Amateur, amateur-satellite
248–250 GHz	Amateur, amateur-satellite	241–248 GHz	Amateur, amateur-satellite

a Primary use bands are allocated to two or more spectrum uses but a single primary use is defined. Remaining uses are classified as secondary uses, and are unable to claim protection from, or cause interference with, the primary use. **b** Secondary uses operate on a shared basis in frequencies allocated to primary and co-primary uses. Secondary uses are unable to cause interference with the primary services and, in turn, they have no protection from interference caused by the primary or co-primary services.

Source: ACA (2002a).

E.6 Bureau of Meteorology

The Bureau of Meteorology uses spectrum to collect and disseminate information about Australia's weather, climate and hydrological conditions. It operates via a network of meteorological observation stations and forecasting offices across Australia, Antarctica and remote islands.

The Spectrum Plan identifies certain bands for meteorological purposes, such as the use of meteorological aids (for example, radiosondes to measure temperature and humidity) and the use of meteorological satellites (table E.7). These satellites use spectrum for collecting meteorological information (using remote sensing techniques) and for communicating with ground stations (that is, relaying information on meteorological conditions).

The Bureau of Meteorology also uses spectrum outside these bands for a range of other activities such as:

- marine radio weather broadcasts (2–16 MHz);
- aeronautical VHF broadcasts (126.25, 126.4 and 128.6 MHz);
- waverider buoys (27.695 and 27.745 MHz);
- wind profiling radars (44.75, 49.8, 54.4, 55.0, 920 and 1283 MHz);
- mobile communications (27, 164 and 476 MHz); and
- low-level windshear alert systems (853.9 and 929.9 MHz).

Like Defence and State Government emergency services (such as the police and fire services), the Bureau of Meteorology operates under the apparatus licensing system and pays for its spectrum use on the same basis as commercial apparatus licensees. It paid apparatus licence fees of approximately $86 000 in 2001-02 (Bureau of Meteorology, sub. 5, p. 7).

Table E.7 **Meteorological bands**

Band	*Use*
137–138 MHz	Meteorological–satellite (space to Earth)
400.15–401 MHz	Meteorological–satellite (space to Earth)
401–403 MHz	Meteorological aids, meteorological–satellite (Earth to space)
403–406 MHz[a]	Meteorological aids
460–470 MHz[a]	Meteorological–satellite (space to Earth)
1668.4–1670 MHz	Meteorological aids
1670–1675 MHz	Meteorological aids, meteorological–satellite (space to Earth)
1690–1700 MHz	Meteorological aids, meteorological-satellite (space to Earth)
1700–1710 MHz	Meteorological–satellite (space to Earth)
7450–7550 MHz	Meteorological–satellite (space to Earth)
7750–7850 MHz	Meteorological–satellite (limited to non-geostationary satellite systems)
8175–8215 MHz	Meteorological–satellite (Earth to space)
35.2–36 GHz	Meteorological aids

[a] Secondary use.

Source: ACA (2002a).

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