

**SPECTRUM MANAGEMENT FOR A
CONVERGING WORLD:
CASE STUDY ON AUSTRALIA**



International Telecommunication Union

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The views expressed in this report are those of the author and do not necessarily reflect the opinions of ITU or its membership.

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1 Introduction

Radiofrequency spectrum is a major asset for the telecommunication industry. Wireless systems have been expanding at a phenomenal rate over recent decades and their importance as a tool for development and information access is undeniable.

Given Australia's geography, climate and population distribution, wireless systems play an essential role in connecting its rural as well as metropolitan population, providing high quality and timely access to basic and value-added services that is part of the common life of a developed economy. Airwave television (TV) and radio broadcasting, land and satellite mobile communications, broadband wireless access, for example, form part of those service requirements of a modern society which make extensive use of radio spectrum.

As a consequence, the need for an efficient and transparent spectrum management framework to regulate the Australian wireless industry has been considered by the Commonwealth Government as of essence to the meet the overall objectives of providing the same level of service to all Australians, irrespective of where they are in its continental territory, and to foster competition as a development tool.

More than a decade ago, when the current spectrum management arrangements were established, Australia pioneered the use of innovative approaches which defied the radiocommunication regulations common practices. A profound reform in the regulatory environment resulted in the establishment of the *Radiocommunications Act 1992* and the *Australian Communications Authority Act 1997*, which are the main instruments for spectrum management in Australia. The presence of an independent, strong and skilled spectrum regulatory body, the establishment of market-driven approaches — such as the attribution of property rights on spectrum to licensees allowed to trade their assets, the *spectrum licensing* scheme based on technological neutrality and trading, the allocation of spectrum using price-based methods, the delegation of licensing powers to assigned persons within the industry, a streamlined self-declaration compliance arrangement for radio equipment, electronic and electrical products-and a highly effective consultation-based process for the implementation, revision and improvement of the regulatory framework — make Australia a unique benchmark of modern spectrum management administration.

Following the first ten years of experience with the established spectrum management framework, a series of radiocommunication regulatory reviews was conducted by the Government in full consultation with the industry and the public. Some areas were identified for revision of the applicable laws and proposed amendments are in the process of being implemented or submitted to the Parliament.

The objective of striking a fair balance between community interest and those of commercial users has guided decisions on the management of access to the radiofrequency spectrum in Australia. This progressive attitude of the Government towards spectrum management and the positive responses by the major spectrum users have contributed to establishing adequate conditions for the smooth development of the booming wireless industry in Australia, as well as accommodating the important needs of non-commercial users.

This report describes the main elements of the Australian spectrum management regulatory environment, and portrays some examples of wireless system implementation in application of the existing arrangements. Most of the contents are based on publicly available documentation and the bibliographical references cited in the report. However, the presentation of details and understanding of the processes could not be reached without the benefit of the personal interviews conducted in Australia with representatives of the Government, regulatory bodies and industry (see [Annex 5](#)).

2 Australia facts and indicators

2.1 Geography

At 7,692,024 km², Australia comprises just 5 per cent of the world's land area, yet it is the planet's sixth largest country after Russia, Canada, China, USA, and Brazil¹. Australia is also the smallest continental land mass (or largest island).

¹ [Geoscience Australia](#), Australian Department of Industry, Tourism and Resources.

The Australian continent extends from east to west some 3,860 km and from north to south nearly 3,220 km. It lies between 10° and 39° south latitude (see Figure 2.1). It is on the whole exceedingly flat (the lowest point on the mainland, Lake Eyre, is -15 m and the highest, Mount Kosciuszko, is 2,228 m) and dry (less than 51 cm of precipitation falls annually over 70 per cent of the land area).

Remote from any other continent, Australia has many distinctive forms of plant and of animal life.

Figure 2.1: The Australian continent



Whilst the areas of Canada and the United States are similar to Europe, their populations are markedly smaller, by factors of 18 (3 persons/km²) and 2 (29 persons/km²), respectively. Australia is not far behind in size, but its population compared to Europe is 30 times smaller. Japan's population density is 336 persons/km² and the United Kingdom's is 244 persons/km², compared to Australia's 2.5 persons/km². (See Figure 2.2.)

Figure 2.2: Australia compared with other territories



Europe



United States (mainland)



Japan

Source: Geoscience Australia.

An interesting comparison between the countries in Table 2.1 is the ratio of the amount of arable land to population, which provides some insight into the possible environmental stresses being exerted on their landscapes, where Australia shows the most favourable marks.

Table 2.1: Australia compared with other territories

| COUNTRY | AREA (km ²) | ARABLE LAND (km ²) / (per cent) | POPULATION | RATIO OF ARABLE LAND/POPULATION (km ² /1,000 inhabitants) |
|--|-------------------------|--|-------------|--|
| Australia | 7,686,850 | 461,211 / 6 | 19,169,083* | 24.1 |
| Japan | 377,835 | 41,561 / 11 | 126,549,976 | 0.3 |
| Canada | 9,976,140 | 498,807 / 5 | 31,281,092 | 16.0 |
| USA | 9,629,091 | 1,829,527 /19 | 275,562,673 | 6.6 |
| Europe | 9,892,923 | 1,606,081 / 28 | 582,152,017 | 2.8 |
| United Kingdom | 244,820 | 61,205 / 25 | 59,511,464 | 1.0 |
| United Kingdom & Ireland | 315,100 | 69,322 / 22 | 63 308 721 | 1.1 |
| *) Estimated to have reached the 20 million mark on 4 December 2003. | | | | |

Source: Geoscience Australia.

Although Australia is not densely populated, it is highly urbanized, with an urban population exceeding 90 per cent of the total population, placing Australia alongside Canada and Iceland as among the most highly urbanized Organisation for Economic Co-operation and Development (OECD) member countries. No less than 83 per cent of all Australian households are within 5 km of a telephone exchange.

For the provision of communications services, this population distribution is both a disadvantage (i.e. highly dispersed rural population spread across a large land mass) and an advantage (i.e. high proportion of population in just a handful of urban centres, with around half the total population in Sydney and Melbourne alone). For example, cellular operators can achieve population coverage of 92 per cent with landmass coverage of 3 per cent.

These geographical factors, both physical and human, make Australia — in some terms at least — a uniquely mature telecommunication market [1]. One important focus of telecommunication policy and regulation in Australia has been the desire to ensure that the benefits of affordable communications flow through to rural and remote households.

Owing to the geographical size and population distribution, with vast regions of territory where the population is sparsely distributed, broadband wireless access networks represent an attractive solution in a country like Australia. In Western Australia for example, despite the fact that such networks are not yet widely available, they could represent a timely solution to address the challenges raised in the recently published State Government report on the development of broadband infrastructure for Western Australia [2].

2.2 History, politics and economy

Australia has been inhabited for at least 50,000 years, since the remote ancestors of the current Australian aborigines arrived from present-day Southeast Asia. The land was not discovered by Europeans until the seventeenth century, when it was sighted and visited by several expeditions. It was claimed for the United Kingdom in 1770, and first colonized in New South Wales in 1788 as an English penal colony. In 1901, the former British colonies — now the six States — agreed to federate and Australia became a commonwealth,

or dominion, within the British Empire, thereby becoming independent (though full formal independence took a considerable time after that).

The *Commonwealth of Australia* is a constitutional monarchy based on a federal state system recognising the British monarch as sovereign. The Queen is therefore the official Head of State and is represented by the Governor General, who is appointed by the Queen on advice of the elected Australian Government.² The executive power theoretically vested in the Crown is exercised by an elected cabinet headed by a Prime Minister. The Prime Minister is almost always the leader of the majority party in the House of Representatives (150 seats), which is one of the two chambers of the federal parliament, the other being the Senate (76 seats). Elections for both chambers are held every three years.

The State (New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania) and Territory Governments in Australia are responsible for all matters not assigned to the Commonwealth, e.g. environmental management. State parliaments are subject to the national constitution and federal law overrides any State laws that are inconsistent.

Australia is highly industrialized, and manufactured goods account for most of the gross domestic product (GDP). Its chief industries include mining, food processing, and the manufacture of industrial and transportation equipment, chemicals, iron and steel, textiles, machinery, and motor vehicles. Australia has valuable mineral resources, including coal, iron, bauxite, copper, tin, lead, zinc, and uranium; the country is an important producer of opals and diamonds. The country is self-sufficient in food, and the raising of sheep and cattle and the production of grain have long been staple occupations. Tropical and subtropical produce — citrus fruits, sugarcane, and tropical fruits — are also important, and there are numerous vineyards and dairy and tobacco farms.

Australia has a prosperous economy, with a per capita GDP on a par with the four dominant West European economies. Rising output in the domestic economy has been offsetting the global slump, and business and consumer confidence remains robust. Australia's emphasis on market-based reforms is considered as another key factor behind the economy's strength (see Table 2.2.).

Table 2.2: Economic data

| | 1999 | 2000 | 2001 | 2002 | 2003 ^a |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|
| GDP at market prices (A\$ bn) | 605.8 | 650.2 | 692.8 | 733.6 | 774.4 |
| GDP (US\$ bn) | 390.9 | 376.9 | 358.3 | 398.6 | 502.9 |
| Real GDP growth (per cent) ^b | 4.3 | 3.2 | 2.6 | 3.6 | 2.5 |
| Consumer price inflation (av; per cent) | 1.5 | 4.5 | 4.4 | 3.0 | 2.8 |
| Population (m) | 19.0 | 19.3 | 19.5 | 19.7 | 19.8 |
| Exports of goods fob (US\$ m) | 56,096 | 64,052 | 63,676 | 65,099 | 68,972 |
| Imports of goods fob (US\$ m) | -65,827 | -68,753 | -61,801 | -70,502 | -82,997 |
| Current-account balance (US\$ m) | -22,206 | -15,219 | -8,740 | -17,882 | -30,964 |
| Foreign-exchange reserves excl gold (US\$ m) | 21,212 | 18,118 | 17,955 | 20,689 | 27,915 |
| Total external debt (US\$ bn) | 142.3 | 162.0 | 164.1 | 179.3 | 216.3 |
| Debt-service ratio, paid (per cent) | 32.3 ^a | 25.8 ^a | 31.9 ^a | 35.1 ^a | 36.1 |
| Exchange rate (av, A\$:US\$) | 1.55 | 1.72 | 1.93 | 1.84 | 1.54 |

^a EIU estimates. ^b SA, Calendar years.

Source: [Economist Intelligence Unit](#), The Economist.

² A referendum to introduce a republic, with a president replacing the Queen, was defeated in 1999.

Table 2.3 shows some of the Australian foreign trade relationships. Notably, Australia's economic ties with Asia and the Pacific Rim have become increasingly important.

Table 2.3: Main Australian trade relationships (2002-2003)

| | Exports | Imports |
|--------------------------------|-----------------------|-------------------------------|
| Total | A\$ 115,442m | A\$ 133,131m |
| Main item | coal (10.3 per cent) | cars (7.7 per cent) |
| Main destination/source | Japan (18.8 per cent) | United States (16.9 per cent) |

Source: EIU, The Economist.

Australia's communications, transport, and other infrastructure elements are undergoing major review and restructuring to make them more internationally competitive [3]. Major initiatives since 1996 have included:

- opening Australia's telecommunication market to full competition;
- privatization of airports through the sale of long-term leases;
- establishment of a national heavy vehicle regulation and charging regime and moves towards private investment and participation in road building and management;
- the establishment of a national electricity market in which electricity retailers can compete, and the introduction of free and fair trade, including national open access, in gas markets.

2.3 Communications industry profile

The mobile communications market has been one of the largest areas of growth in Australia in recent years, and the outlook is for continued growth. The number of mobile services increased by 1.6 million over 2002-03. This took the total number of mobile phone services in operation to approximately 14.3 million, representing an annual increase of 12.6 per cent. The mobile communications device penetration rate may exceed 100 per cent within the next five years. On 30 June 2003, there were approximately 11.58 million fixed telephone services in operation compared with 11.4 million recorded in 2001-02 [19].

Interestingly, Australia's terrestrial mobile phone networks can reach approximately 98 per cent of the country's population, but cover less than 18 per cent of the land area (see Figure 2.3).

Figure 2.3: Mobile phone coverage



Source: DCITA

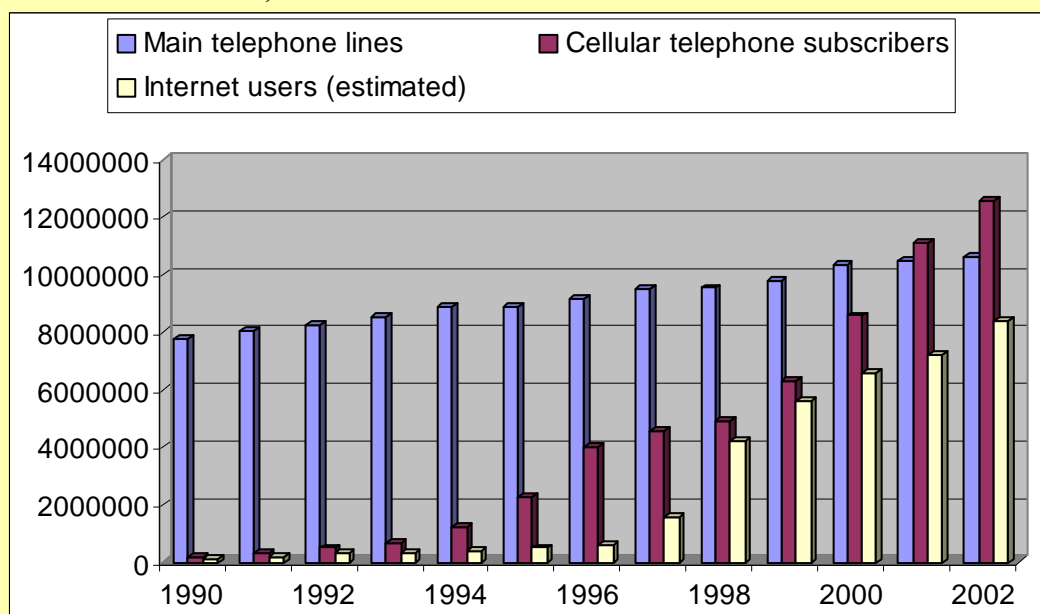
The 1998 and 2000 radiocommunication spectrum auctions in the 800 MHz and 1.8 GHz bands facilitated entry into the market of several new mobile phone carriers. The introduction of low earth orbiting satellites is offering new opportunities to deliver satellite-based mobile phone services covering the entire Australian land mass (a subsidy of up to A\$1,100 is available for the purchase of a satellite mobile phone handset for people who live or work in areas not covered by terrestrial mobile services).

Broadband is provided over a variety of technology platforms in Australia, including cable, satellite (available to all Australians), wireless systems, and the copper wire based telephone network.

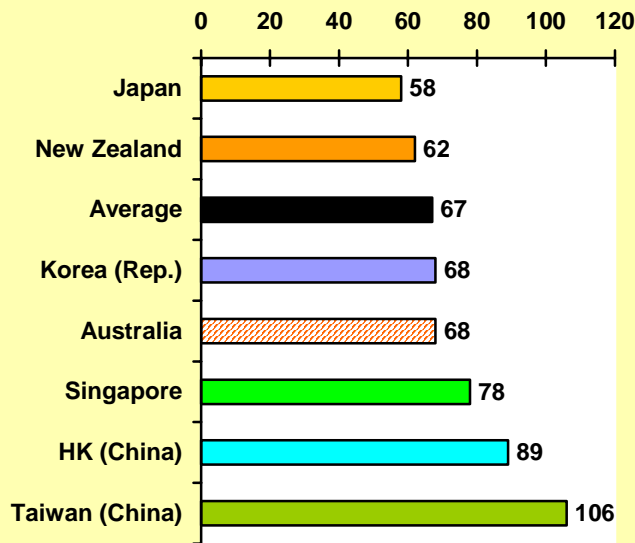
Almost 8.4 million Australians use the Internet to gather information, communicate with others and undertake transactions for business, community and recreational purposes.

The evolution of the main information and communication technology (ICT) indicators for Australia is shown in Figure 2.4 where it is seen that the number of mobile subscribers overcame that of fixed in year 2001. A comparison of mobile phone penetration amongst Asia-Pacific countries is given in Figure 2.5.

Figure 2.4: Evolution of fixed, mobile and Internet users in Australia



Source: [ITU ICT Indicators](#).

Figure 2.5: Mobile subscribers per 100 inhabitants (2002)

Source: [ITU ICT Indicators](#).

2.3.1 Wireless broadband

In May 2002, the House of Representatives [Standing Committee on Communications, Information Technology and the Arts](#) has been asked by the Minister for Communications, Information Technology and the Arts, to inquire into and report on the current and potential use of wireless technologies to provide broadband communication services in Australia, including regional Australia. The Committee's inquiry [report on Wireless Broadband Technologies](#) was published on 11 November 2002. [Annex 4](#) summarizes the recommendations contained in the report. As at the beginning of 2004, the Government had yet to formally respond to the report.

3 The communications environment in Australia

3.1 Evolution of the telecommunication sector

Australia's telecommunication sector has developed progressively from a largely centralised, publicly controlled monopoly structure, through a managed competitive model, to an open and competitive market regime with an emphasis on industry self-regulation [4] (see Table 3.1). Telecommunication policy has been driven by the need to provide services to a population concentrated largely in cities separated by long distances, while also reaching remote areas with basic services, and linking the major cities with high capacity trunk services.

Table 3.1: Evolution of Australian telecommunication sector

| Year | Facts |
|-----------|--|
| From 1901 | Commonwealth Government Postmaster-General's Department (PMG) responsible for telecommunication services. |
| 1946 | Overseas Telecommunications Commission (OTC) established with responsibility for all international telecommunication services. |
| 1975 | Telecom Australia established undertaking PMG's telecommunication functions, becoming the monopoly telecommunication carrier of domestic services and also the technical regulator. |
| 1981 | AUSSAT established as publicly-owned carrier to operate a domestic satellite system starting commercial operations in 1985 when the first satellite was launched. |
| 1989 | Major reforms included: monopolies of Telecom, OTC and AUSSAT retained; competition was introduced in the provision of value-added network services; customer premises cabling; supply, installation and maintenance of customer premises equipment. |
| | AUSTEL established following separation of operational and regulatory functions of Telecom. |
| 1991 | Reform to gradually transition from monopolies to open competition: merger of Telecom and OTC to form Telstra Corp.; licensing of Optus, which took over AUSSAT. |
| 1997 | Legislative reform introduces full competition in the provision of telecommunication carriage services. |

Source: Government of Australia, DCITA.

The challenge for Australia in regional and remote areas is that there is an expectation for access to more than basic communications services. This has been demonstrated by the [Regional Telecommunications Inquiry](#)³, which concluded that Australians generally have adequate access to a range of high quality, basic and advanced services comparable to the leading information economies of the world. The Inquiry research indicates that Australians who live in metropolitan and regional centres enjoy good telecommunication services and are generally satisfied with them. However, a significant proportion of those who live and work in rural and remote Australia have concerns regarding key aspects of services, which, at this stage, are not adequate. Their concerns relate primarily to the timely installation, repair and reliability of basic telephone services; mobile phone coverage at affordable prices; and reliable access to the Internet and data speeds generally. The Inquiry's analysis suggests that the continued development of competition throughout Australia, combined with key government initiatives will have a positive effect on services over the next few

³ Established on 16 August 2002 by the Minister for Communications, Information Technology and the Arts, to assess the adequacy of telecommunication services in regional, rural and remote Australia, and to advise on a number of other policy issues.

years. These developments are likely to materially improve the services available to rural and remote consumers.

3.1.1 Monopoly history: 1901-1975

The Commonwealth Government assumed responsibility for telecommunication services in Australia upon Federation in 1901. Until the introduction of limited competition in 1991, telecommunication services were provided by various publicly-owned monopoly organizations. For a lengthy period, operational and regulatory functions for all telecommunication services resided with the Postmaster General's Department (PMG). In 1946 the Overseas Telecommunications Commission (OTC) was established with responsibility for all international telecommunication services.

The PMG continued to provide all domestic telecommunication services until 1975 when its telecommunication functions were moved to the newly created and subsequently corporatized, Telecom Australia. Telecom became the monopoly telecommunication carrier of domestic services within Australia with exclusive rights to install, maintain and operate the network and supply basic services. As well as being the network provider, Telecom was also the technical regulator in customer equipment, private networks and value-added services.

Throughout the period a major driver of telecommunication policy was to ensure that telecommunication services, in particular those in more remote areas, were reasonably accessible to all people in Australia on an equitable basis. This so-called "universal service obligation" has remained a key plank of the telecommunication framework throughout the liberalization process of the past two decades.

3.1.2 Beginnings of competition

In the late 1970s there was mounting pressure for changes to the industry structure and regulatory frameworks. Technological advances and the emergence of a more service-based economy had fuelled a rapidly increasing demand for high-speed electronic information transfers.

In 1981 the Government established an additional publicly-owned carrier, AUSSAT, to operate a domestic satellite system. AUSSAT started commercial operations in 1985 when the first satellite was launched.

Government inquiries into telecommunication services examined the need for greater private sector involvement in providing terminal equipment, leased and independent networks, and other services. The Government's principal policy objective remained the provision of telephone services throughout Australia at affordable prices.

The scope of competition was expanded in stages, beginning with the marketing of some terminal equipment and the provision of services that did not overlap with the basic network. Leading examples were PABXs and radio paging services. However, the vigour and extent of this competition was limited by Telecom's continuing regulatory role, which gave it the right to approve all equipment attaching to the network.

By 1987, all but the most remote parts of Australia enjoyed basic telephone access and the domestic and international telecommunication networks were well developed.

3.1.3 Separation of policy, regulatory and operational roles

In May 1988, the Government announced directions for restructuring the regulatory environment for the telecommunication industry and the operations of the Government-owned carrier. The reforms were implemented in the *Telecommunications Act 1989* and related legislation.

As part of the major reforms:

- the basic monopolies of Telecom, OTC and AUSSAT were retained;
- competition was introduced in the provision of value-added network services; customer premises cabling; supply, installation and maintenance of customer premises equipment; and
- price control arrangements were introduced for the carriers' reserved services.

Telecom was subjected to a range of accountability and management reforms designed to provide it with more commercial focus, greater operational freedom, management independence and accountability.

In a significant step, the operational and regulatory functions of Telecom were separated. The Australian Telecommunications Authority (AUSTEL) was established in July 1989 as an independent industry-specific regulator with responsibility for technical regulation, protecting the carriers' exclusive rights, protecting competitors from unfair carrier practices, protecting consumers' interests, administering price control and universal service levy arrangements and promoting carrier efficiency. AUSTEL introduced a form of "light-handed" pricing regulation based on a "CPI-X" price cap, with individual sub-caps on some prices.

3.1.4 The telecommunication carrier duopoly: 1990-97

In 1990, the Commonwealth Government, after considerable debate and consultation, announced further reforms of the structure and ownership of telecommunication networks. A phased approach was adopted to transition from a monopoly provider to open competition in basic services. Initially, a general carrier duopoly was established as an interim measure to foster competition. As part of the reform arrangements the second carrier would be given sufficient time and a relatively stable and predictable environment within which to establish itself in the marketplace before the advent of full competition from 1 July 1997.

The strategy was implemented in 1991 and 1992 largely as a function of the *Telecommunications Act 1991*. Key components of the strategy included: merging Telecom and OTC to become Telstra Corporation; licensing Optus (now SingTel Optus Pty Ltd), after a competitive tender process, as a private sector national facilities-based network competitor. Optus was also allowed to take over the national satellite service with the purchase of AUSSAT; licensing three public mobile telecommunication service operators (Telstra, Optus and Vodafone).

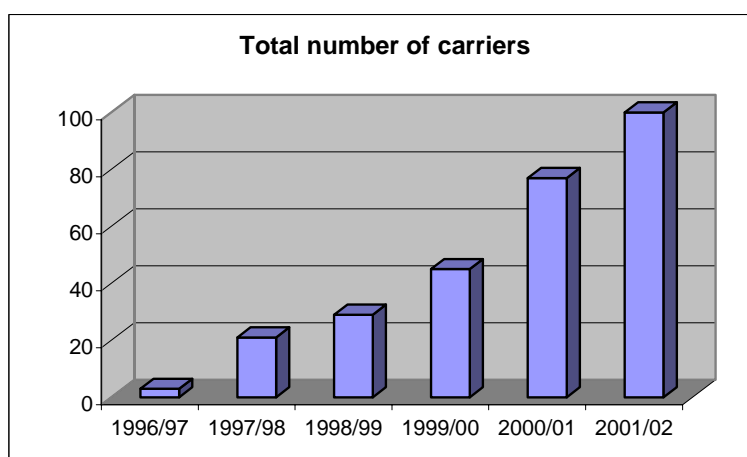
The Spectrum Management Agency (SMA) was created in 1993 to manage the radiofrequency spectrum, taking over this role from the Commonwealth Department of Transport and Communications.

3.1.5 Open competition: 1 July 1997

Prior to 1 July 1997, Telstra, Optus and Vodafone were the only organizations permitted to operate as telecommunication carriers in Australia. A new era of open competition dawned for the telecommunication sector when the *Telecommunications Act 1997* (the *Telcom Act*) and related package of legislation came into force in July 1997. The main policy objective of the legislative reform package is to provide a regulatory framework that promotes the long-term interests of end-users of carriage services, or services supplied by means of carriage services, and the efficiency and international competitiveness of the Australian telecommunication industry. Carriers are able to own certain telecommunication facilities known as "network units" which are used to provide carriage services and include line links, satellite facilities and base stations for mobile services or wireless local loop services. Service Providers either provide carriage services, using network units owned by a carrier which may be supplemented by other infrastructure, or provide content services such as pay TV.

Carrier licences are available on application to the industry regulator. The Government has not set any limit on the number of carriers: as at year-end 2003, 128 carrier licences had been issued, from which more than 20 per cent had been surrendered by the end 2003 (see Figure 3.1 and Table 3.2).⁴

⁴ [ACA Register of Licensed Carriers](#).

Figure 3.1: Evolution in the number of telecommunication carriers (1996-2002)

Source: ACA.

Table 3.2: Australian telecommunication carriers

| Service | Carrier ¹ |
|---|---|
| Fixed (including private mobile) | Telstra Corp., Optus Networks, AAPT, MCI WorldCom Australia, Primus Telecom ² , Macquarie Corporate, SCCL ² , National Power Services, PowerTel ² , Victorian Rail Track Corporation, ETSA Utilities ² , Vertel |
| Mobile (cellular) | Telstra Corp., Optus Mobile, Vodafone, Hutchison, AAPT |
| Satellite | Optus Network, NewTel Networks, PanAmSat, AAPT, Reach Networks |
| Cable-TV¹ | Telstra Multimedia, Optus Vision, Windytide, ntl Telecommunications |
| Broadband | AAPT (LMDS 28/31 GHz), Primus Telecom, Tas 21 ² , NTT Communications ² , Macrocom, Uecomm, AARnet, XYZed, Netspace, Amcom, Agile, Chariot, Eftel, TransACT, SPT, DataFast, Swiftel, Global Dial, WestNet, |
| ¹ 40 highest revenues in 2001-2002. | |
| ² Do not make use of radio frequency spectrum (e.g. fibre-optics, cable, etc). | |

Sources: [Australian Telecommunications Carriers](#) and [ACA](#).

3.1.6 Regulation, self-regulation and institutional arrangements

Regulation of the telecommunication industry has been brought more closely into line with general competition law as governed by the provisions of the *Trade Practices Act 1974 (TPA)*. Australia's single national industry regulatory body, the Australian Competition and Consumer Commission (ACCC), has assumed responsibility for competition and economic regulation of telecommunications.

The reforms also inserted into the *TPA* telecommunication-specific pro-competitive provisions to deal with anti-competitive conduct and to establish an access regime of rights and obligations for carriers and service providers aimed at promoting the long term interests of end-users. In keeping with the broad philosophy of competition policy, reliance on industry self-regulation is promoted to the greatest practicable extent, particularly in technical regulation. The pro-competitive reforms have opened up the opportunity to build and operate telecommunication infrastructure. Past regulatory barriers to market entry, as well as a number of artificial regulatory distinctions, such as between mobile and fixed carrier licences, have been removed. No

restrictions exist on entry to any telecommunication service market and there are minimal restrictions on the types of technology used.

The Commonwealth Government regulator was established in 1997 as the result of a merger between the telecommunication and radiocommunication existing regulators (see section [3.3](#)) and is responsible for administering a range of technical and consumer issues relating to telecommunications, as well as managing the radiofrequency spectrum.

3.1.7 Industry trends

The new open and competitive telecommunication environment in Australia is characterised by increasing number of private sector participants (including foreign communications companies and new players such as utility companies).

Overall, the main service trends in Australia are likely to be characterized by:

- increasing demand for seamless, mobile communications, broadband Internet access, and higher bandwidth to supply multimedia and other high data rate services;
- increasing reliance on Internet-based services; and
- declining demand for fixed line (narrowband) connections due in part to mobile phones being used as a substitute for fixed lines and increasing broadband connectivity removing the need for second lines.

ICT indicators and statistics of the Australian market are given in section [2.3](#) of this report.

3.2 Radiocommunications

Before 1983, radiocommunications in Australia were regulated under the *Wireless Telegraphy Act 1905* [[5](#), [6](#)]. The monopoly carrier provided most radiocommunication services in Australia. 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 radiocommunication devices. Licensees were required to use equipment that conformed to technical specifications developed by the Department. Unlicensed operation of radiocommunication devices was prohibited. Licences were assigned to users on a first-come, first-served basis and administrative fees were charged.

Table 3.3 summarizes the main aspects of the evolution of radiocommunication regulations in Australia.

Table 3.3: Timetable for Australian radiocommunication regulations

| Year | Facts |
|-------------|---|
| From 1901-5 | <i>Wireless Telegraphy Act 1905</i> <ul style="list-style-type: none"> - Postmaster-General's Department administers and Minister licenses - Licences assigned to users on a first-come, first-served basis |
| 1975 | Department of State (Post and Telecommunications Department) controls radiocommunication licensing. |
| 1983 | <i>Radiocommunications Act 1983</i> <ul style="list-style-type: none"> - Licensing of independent paging service - Introduction of <i>class licence</i> - No licence required for receivers - Separation of standards/conformity regime and licensing - Charges for the use of spectrum beyond administrative costs |
| 1992 | <i>Radiocommunications Act 1992</i> <ul style="list-style-type: none"> - provides for management of the radiofrequency spectrum - introduces new licensing regime including <i>spectrum and class licences</i> <i>Broadcasting Service Act 1992</i> <ul style="list-style-type: none"> - Australian Broadcasting Authority (ABA) established. |
| 1993 | Spectrum Management Agency (SMA), an independent regulator, established. |
| 1994 | First Australian spectrum auction: apparatus licence for pay TV and wireless Internet in the 2.3 GHz band. |
| 1997 | <i>Australian Communications Authority Act 1997</i> <ul style="list-style-type: none"> - Australian Communications Authority (ACA) established (merger of SMA and AUSTEL). <i>Radiocommunications Act 1992</i> amended: <ul style="list-style-type: none"> - radiocommunications and telecommunication regimes harmonised; - 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; - mechanism for clearing apparatus licences and re-allocating spectrum bands. First auction of spectrum licences (for land mobile and point-to-point in the 500 MHz band). |
| 1998 | <i>Australian Communications Authority Regulations 1998</i> |

Source: Government of Australia, DCITA.

3.2.1 *Radiocommunications Act 1983*

Pressure for modernization of radiocommunication law in the early 1980s reflected a requirement for greater transparency and accountability in the management of the radio frequency spectrum as the Parliament of Australia became increasingly critical of administrative arrangements that gave unfettered discretion to officials in the handling of matters that affected business affairs.

In 1983, the *Radiocommunications Act 1983* replaced the *1905 Act*. In the overall, 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, for the first time, beyond the collection of fees that

covered only administrative costs. However, the *1983 Act* changed the technical regulation regime in several important ways:

- Where previously the Minister (or delegate) had no obligation to issue radiocommunication licences, applicants now were entitled to a statement of reasons if a licence was refused and they could exercise the right to have the decision reviewed. This change led to the licensing of independent paging services: the first challenge to Australia's monopoly carrier.
- Where previously all operators of transmitters were required to hold a licence, the new legislation allowed the operators to be covered by class 1 licences, or by complete exemptions. (A class licence is not issued individually. It is a general licence that authorises anyone in Australia to operate a device, subject to the technical and operating conditions specified in the licence. For example, class licences have been issued for citizen band radios, mobile telephones and radio-controlled models.)
- Where previously all receivers were required to be licensed, they could now be operated without a licence, except where a specific regulation required it (e.g. for major receive-only earth stations).
- Where previously technical regulation derived solely from the requirement for licensing (i.e. it was a condition of a licence that equipment complied with particular technical specifications) standards and conformity requirements became a separate area of regulation. Standards could be applied to any radiocommunication equipment, whether licensing was required or not.

3.2.2 *Radiocommunications Act 1992*

In line with the growing liberalisation of the radiocommunication sector in the early 1990s, the Commonwealth Government adopted a three-part spectrum management reform strategy, which involved:

- the selective and progressive introduction of a market-based system of spectrum management to operate in defined spectrum segments alongside the administrative system;
- improvements in the efficiency and effectiveness of the current administrative system; and
- the establishment of a spectrum management agency.

This reform culminated with the adoption of the [*Radiocommunications Act 1992 \(RCA\)*](#), which provided the basic framework for the management of the radiofrequency spectrum based on the following objectives:

- (a) maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum;
- (b) make adequate provision of the spectrum 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;
- (h) promote Australia's interests concerning international agreements, treaties and conventions relating to radiocommunications or the radiofrequency spectrum.

The *RCA* established the Spectrum Management Agency (SMA), a statutory agency within the Transport and Communications portfolio, on a cost-recovery basis. The Minister retained responsibility for, and general policy control over, the agency. At the same time, the establishment of the Radiocommunications Consultative Council (RCC) helped to strengthen consultation with the radiocommunication industry.

The market-based reforms which inspired the *RCA* included a new category of licence called "spectrum licensing" (together with the ongoing apparatus and class licensing systems) whereby licences assigning less prescriptive spectrum rights would allow to operate radiocommunication transmitters in a specified frequency band and geographical area, with the ability to trade or lease licences. Other reforms included the selective and progressive introduction of auctions for some licences in some frequency bands.

This more market-oriented licensing regime was seen as a necessary adjunct to the introduction of competition between telecommunication carriers with rival demands for radio frequency allocations. At the same time, a more flexible radio frequency regime was introduced for setting technical standards and managing conformity with standards.

The *RCA* 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.

3.2.2.1 Development of standards-making arrangements

From 1983, a process of public consultation was required before developing standards and frequency plans, even though frequency planning has always worked within the framework of International Telecommunication Union (ITU) agreements.

Until 1992, the Minister had sole authority to set regulatory standards for transmitters and receivers, and to establish frequency plans. Under the *RCA*, the power to make the national spectrum plan and frequency band plans passed to the SMA. [Standards Australia](#) was charged with the responsibility for developing standards, but standards with regulatory force could be adopted only by the SMA.

3.2.2.2 Development of conformity assessment arrangements

Government laboratories conducted all conformity testing until 1992. With the SMA's move to an increased focus on industry, independent testing laboratories were established in 1992. These laboratories (and Government laboratories) needed [National Association of Testing Authorities \(NATA\)](#) accreditation to ensure that they met [ISO](#) standards of competence. No further regulatory assessment or designation of testing laboratories was required after NATA accreditation. Suppliers were given responsibility for labelling their products to show conformity with standards.

3.2.2.3 Amendments

The *RCA* 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. Other amendments have included mandatory health and safety standards for electromagnetic radiation exposure.

The amendment of legislation is an ongoing process. As issues with the existing legislation are brought to the attention of the Government, through entreaty or formal reports, changes are considered by the Government and the Parliament. The Government is currently preparing legislation in response to the Radiocommunications Review Report and the Productivity Commission's Radiocommunications Inquiry Report (see [Annex 3](#)).

Box 3.1: Radiocommunications Act 1992 (RCA)

The *RCA* 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.

Coverage

The *RCA* applies to all forms of radio emission whether intentional or not and to all radiocommunications, defined as all radio emissions for the purpose of communicating between people and/or things. As in all previous radiocommunication legislation, unlicensed radiocommunication activities are unlawful except in cases of emergency. The *RCA* 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), or to radiocommunication activities for the purposes of defence research and intelligence, and certain other defence activities. In addition, the *RCA* allows the Minister to designate spectrum bands for broadcasting and refer them to the ABA for planning and management.

Content

The *RCA* 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:

- i) two new types of licence (spectrum and class licences) in addition to existing apparatus licences, each with different conditions and purposes;
- ii) market-based assignment (including auctions) for spectrum and some apparatus licences. The *RCA* 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; and
- iii) new arrangements for developing and determining technical regulations and standards.

3.3 The Australian Communications Authority (ACA)

Prior to 1997, telecommunication and radiocommunication legislation regulated technical issues differently. In order to promote efficiency and save on administrative costs, the new regime aimed at harmonising these sectors under a common framework⁵.

On 1 July 1997, the new regulator, the [Australian Communications Authority](#) (ACA) was formed by the merger of AUSTEL and the SMA. The ACA was established under the *Australian Communications Authority Act 1997* (the *ACA Act*), and exercises powers under the *RCA*, the *Telcom Act*, and other related legislation. The ACA has the power to make subordinate [legislation](#), including Radio and Telecommunications Determinations, Declarations and Notices. The ACA, along with the Government competition regulator (ACCC), is responsible for regulating radiocommunication and telecommunications, including promoting industry self-regulation and managing the radiofrequency spectrum. The ACA also has significant consumer protection responsibilities.

Access to the radiofrequency spectrum is facilitated by the ACA through planning, licensing, managing interference and ensuring industry compliance with mandatory standards and conditions. Spectrum auctions are used in areas of spectrum scarcity and high market demand as a means of allocating spectrum fairly and efficiently. The ACA also advises on the use of telecommunications and the radiofrequency spectrum and investigates interference complaints.

The ACA monitors compliance with technical standards for communications equipment and cabling, including the new standard for electromagnetic radiation, and for electromagnetic compatibility of electrical and electronic equipment. The ACA is also responsible for standards protecting the integrity of communications networks and the interoperability of the standard telephone service.

The ACA represents Australia's communications interests internationally through its membership of the ITU, the Asia-Pacific Telecommunity (APT) and other appropriate bodies.

⁵ Although there was a move towards harmonisation between technical regulation for radiocommunications and telecommunications in 1997, technical issues are still regulated differently under the relevant Acts (e.g. regulation applicable to radiocommunication devices and telecommunication equipment).

In accordance with the *ACA Act (s.7)*, the ACA's spectrum management functions are as follows:

- to manage the radiofrequency spectrum in accordance with the *RCA*;
- to advise and assist the radiocommunication community;
- to report to and advise the Minister in relation to the radiocommunication community;
- to manage Australia's input into the setting of international standards for radiocommunication (except so far as Standards Australia International Limited is responsible for managing that input);
- to make available to the public information about matters relating to the radiocommunication community;
- to conduct public educational programs about matters relating to the radiocommunication community;
- to give advice to the public about matters relating to the radiocommunication community;
- such other functions as are conferred on the ACA by or under:
 - (i) the *Radiocommunications Act 1992*; or
 - (ii) the *Radiocommunications Taxes Collection Act 1983*; or
 - (iii) the *Radiocommunications (Receiver Licence Tax) Act 1983*; or
 - (iv) the *Radiocommunications (Transmitter Licence Tax) Act 1983*; or
 - (v) the *Radiocommunications (Spectrum Licence Tax) Act 1997*;
- to do anything incidental to or conducive to the performance of any of the above functions.

The ACA oversees the scheme for accrediting suitably qualified people to assign frequencies on behalf of clients as well as the ACA to ensure that standards are maintained. Accredited assigners conduct the majority of assignments (see section [4.3](#)).

Price-based allocation is an important part of the ACA's approach to managing the spectrum. The auction method was adopted as the preferred means of allocation where demand for a particular radiofrequency band is likely to exceed supply, such as those used for mobile telecommunications. Auctions are conducted using an innovative online system known as a simultaneous, multiple round, ascending auction. The ACA is a world leader in conducting online auctions for spectrum allocation (see section [4.3.3](#)).

The ACA consists of a Chairman, Deputy Chairman and at least one, but no more than three, other members. Day-to-day business at the ACA is managed by an executive team—currently the Chairman, the Deputy Chairman, the full-time Member, two Senior Executive Managers, eight Executive Managers and a General Counsel (see [Annex 2](#)). The ACA employs around 400 staff in offices across Australia. It has central offices in Canberra and Melbourne, and regional offices and operations centres around Australia. Regional offices provide access to the radiofrequency spectrum through licensing and frequency assignment services, and undertake interference investigations and audits to ensure compliance with regulatory requirements.

3.4 The Australian Competition and Consumer Commission (ACCC)

The [ACCC](#) was formed in November 1995 by the merger of the Trade Practices Commission and the Prices Surveillance Authority. It administers the *TPA* and the *Prices Surveillance Act 1983* and has additional responsibilities under other legislation.

In Australia, only the Minister for Communications, Information Technology and the Arts (the Minister) may issue a *Direction* to the ACA, under the *RCA (s.'s 60 and 106)*, to impose competition limits on the allocation of radiofrequency spectrum lots. The Department of Communications, Information Technology and the Arts (DCITA) would provide advice to the Minister prior to any such *Direction* being issued to the ACA. The DCITA would consult with both the ACA and the ACCC when preparing its advice for the Minister. The ACCC Panel may formally consider an issue and provide written advice to the DCITA in cases involving substantive competition concerns. If a *Direction* is to be issued, the Department would prepare the documentation for the Minister to sign and organize for it to be published in the [Commonwealth Gazette](#)⁶, as required by the legislation. Competition limits have been imposed on a number of occasions with the allocation of spectrum lots.

⁶ The Gazette is the main publication through which the executive arm of government announces its decisions and actions of interest to the public.

The Minister is also the only person who can revoke a competition limit *Direction* by issuing with a *Direction Revocation* to the ACA, which must also be published in the Gazette⁷. The Minister has issued a *Direction Revocation* on the allocation of residual spectrum lots after reconsidering the ongoing need for the original limits in a changed spectrum market.

The Government has noted⁸ that the existing provisions in the *RCA* dealing with competition limits are strongly pro-competitive and work in harmony with the *TPA*. The competition limits provisions have been used to good effect to provide certainty as to which parties can participate in price-based spectrum licence and transmitter licence allocations and the amount of spectrum or the number of licences that any one party can acquire. They have also been used effectively to encourage new participants to enter the radiocommunication services market.

3.4.1 ACCC's role in the spectrum allocation process

The ACCC currently performs two functions in relation to spectrum allocations, aiming at the promotion of competition:

- ACCC's consultative role, in that the DCITA and the ACA confer with the ACCC concerning competition limits when spectrum is to be auctioned.
- ACCC's role in the application of the *TPA* (s.50) to subsequent acquisitions of spectrum licences.

Competition limits have acted as a supplement to general powers under the *TPA* to promote competition. The ACCC assesses whether the sale of spectrum might raise issues under the *TPA* (s.50) prior to considering whether it should express a view on the desirability or otherwise of the application of competition limits to promote competition.

The ACCC, in conjunction with DCITA, consults with industry participants to determine the likely use of spectrum and to gauge market sentiment about whether any potential bidders should be limited in their participation in an auction. The ACCC uses this information, and other information available to it, to determine whether there are any potential concerns pursuant to the *TPA* (s.50). The ACCC considers that the current arrangements work well.

Where the ACCC identifies any potential *TPA* (s.50) concerns, DCITA is advised accordingly. Consideration is then given to whether pursuing action under *TPA* (s.50) is the most efficient and effective approach. If not, the ACCC will suggest competition limits addressing the *TPA* (s.50) concerns to achieve the desired outcome. Ultimately, DCITA makes the final recommendation to the Minister on appropriate competition limits and is under no obligation to recommend the limits suggested by the ACCC.

The competition implications are assessed for each separate auction on a case-by-case basis, taking into account the particular characteristics and uses for the spectrum and the relevant market conditions and dynamics. The ACCC has supported the application of competition limits for a number of auctions (e.g. the 3.4 GHz and 1,800 MHz auctions) and on other occasions, has considered the application of competition limits as not being required (e.g. the 27 GHz band).⁹

3.5 Broadcasting

Broadcasting services include both commercial and non-commercial radio and television broadcasting (e.g. short wave, AM and FM radio, and VHF/UHF analogue and digital TV), narrowcasting and datacasting. Broadcasters are allocated exclusive use of certain defined broadcasting services bands, designated by the Minister under the *RCA* (s. 31). (The Australian TV broadcasting environment is briefly described in Box 3.2.) They also use a large amount of other spectrum — for example, spectrum for outside broadcasts (e.g. 980 MHz in 2001, for which broadcasters paid licence fees of A\$5.2 million for the use of this spectrum), electronic-news gathering, satellite transmission and fixed links to transfer broadcasting content to transmission towers

⁷ The Minister has issued a [Direction Revocation](#) on the allocation of residual spectrum lots in the 3.4 GHz band after reconsidering the ongoing need for the original limits in a changed spectrum market.

⁸ In the Government response to the Productivity Commission Radiocommunications Inquiry Report of 1 July 2002.

⁹ The ACCC believes that the adoption of competition limits in a number of auctions has achieved the desired effect of increased competition and the entry of new participants in Australian telecommunication markets. For example, as a result of the competition limits set for the 3.4 GHz auction a new competitor in the form of Unwired has entered the market and intending on rolling out a network, which is expected to provide facilities-based competition to Telstra's local loop.

Box 3.2: Australian TV Broadcasting Environment

Australians have access to a range of television services:

- The ABC and SBS provide national (government-funded) television broadcasting services.
- Commercial free-to-air television broadcasters provide television services within a specified licence area. According to the [ABA files](#), there are currently 48 licensed commercial TV broadcasting services operating throughout Australia.
- Community television services provide community based programming.
- Narrowcasting television services have reception limited in some way. There are open narrowcasting services available without cost to consumers, and subscription narrowcasting services available only on the payment of a subscription fee.
- Subscription television services (pay TV) are funded by subscriptions and limited advertising revenue.

Commercial networks with affiliated stations are a dominant force, whilst the two government-funded national networks (ABC and SBS) also draw significant audiences. On the other hand, the technology base of the industry is essentially of European origin, being built on 50 Hz PAL analogue.

Australia has a very diverse range of requirements that needed to be addressed in assessing TV broadcasting:

- approximately half the population is concentrated in the two largest cities, Sydney and Melbourne. These cities have extensive urban and suburban characteristics;
- there are several other cities that have significant concentrations of urban and suburban characteristics;
- the remaining population is spread over a very large proportion of the country with many concentrations of small to medium towns having suburban characteristics.
- for a very large part of the country, the population levels are relatively low but have economic importance to the country from rural and mining activities;

Commercial Television Australia (CTVA)

CTVA is an industry body, which represents all of Australia's commercial free-to-air television licencees. CTVA provides a forum for discussion of industry matters by its members and is the public voice of the industry on a wide range of issues. CTVA was formerly named the Federation of Australian Commercial Television Stations (FACTS), which has represented the industry for over 40 years.

CTVA is governed by a Board of Directors made up of a representative from each of the major member groups; the Nine Network, Seven Network, Network Ten, Southern Cross Broadcasting, Prime Television, WIN and a representative of Swan Television Broadcasters, NBN and Imparja Television. The Board is supported by a number of committees, which formulate advice and recommendations in relation to policy and regulatory issues, engineering and technical issues, marketing, industrial relations and other areas affecting the industry. Project committees are also formed to address specific matters.

CTVA secretariat is based in Sydney, which is responsible for implementing policy decisions of the Board and pursuing a range of activities on behalf of members.

CTVA actively participates in a number of government, industry bodies and overseas broadcast organizations, such as the European Broadcasting Union, the DVB Project, the UK Digital TV Group, Asia Pacific Broadcasting Union, Society of Motion Picture and Television Engineers and the US National Association of Broadcasters.

The Australian Broadcasting Corporation (ABC)

The ABC is an independent statutory corporation established under the *Australian Broadcasting Corporation Act 1983*, which also sets out the ABC's Charter and responsibilities. The ABC provides a main national television service (analogue TV), digital television services, five radio networks and a significant online presence. It also operates an international radio service, Radio Australia, and currently provides an international television and Internet service, ABC Asia-Pacific.

Table 3.4: Broadcasting services bands

| Frequency Band | Use |
|---|---|
| 526.5–1606.5 kHz (MF) | AM radio |
| 45–52 MHz (VHF) | Analogue television band I (channels 0)* |
| 56–70 MHz (VHF) | Analogue television band I (channels 1 and 2) * |
| 85–92 MHz (VHF) | Analogue television band II (channel 3)* ** |
| 87.5–108 MHz (VHF) | FM radio |
| 137–144 MHz (VHF)*** | Analogue and digital television band III (channel 5A) |
| 174–230 MHz (VHF) | Analogue and digital television band III (channels 6, 7, 8, 9, 9A, 10, 11 and 12) |
| 520–820 MHz (UHF) | Analogue and digital television bands IV and V (channels 28–69) |
| <p>*) Television band I (channels 0, 1 and 2) and band II (channels 3, 4 and 5) are not being considered for the introduction of ongoing transmission of digital television services.</p> <p>**) In some regions of Australia there remain TV services allocated on VHF channel 3 that will continue until switch off of analogue broadcasting.</p> <p>***) The ACA and the ABA made an agreement in 2002 allowing for the ACA to issue space apparatus licences in the 137-138 MHz frequency band for radiocommunication devices that operate in the MSS. The agreement was made under the <i>RCA (s.31(2))</i> and can be varied or revoked by either party. This is a culmination of a phase-out of some TV broadcasting services and the shared use of the spectrum with the MSS.</p> | |

Source: ABA (sub. 31, p. 3).

The “broadcasting services bands” (see Table 3.4) are managed separately to all other radiofrequency spectrum. The responsibility for planning and licensing the broadcasting services bands is delegated to the Australian Broadcasting Authority. The rules and procedures that apply to their planning, allocation and assignment are different to those that apply to other spectrum bands.

Unlike other spectrum users, broadcasters pay an annual licence fee for the use of frequencies licensed to them in the broadcasting services bands, which are related to their revenue, not their spectrum use¹⁰. For the use of non-broadcasting spectrum bands, broadcasters pay on the same basis as other spectrum users through apparatus or spectrum licences. While there are incentives to maximize spectrum usage in non-broadcasting bands, broadcasters face no financial incentive to economise on spectrum use in the broadcasting services bands, which, in the case of television broadcasting in particular, can be substantial. However, with the advent of digital transmissions techniques, such as Single Frequency Networks, opportunities are emerging for efficiency in spectrum management being achieved in the broadcasting bands.

3.5.1 The Australian Broadcasting Authority (ABA)

Separate radio broadcasting regulations were introduced in 1923. 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 which were not replaced until the introduction of the *Radiocommunications Act 1983*.

The [Australian Broadcasting Authority](#) (ABA) was established by the *Broadcasting Services Act 1992* (BSA) to administer the regime established by that Act to regulate the broadcasting industry. The BSA defines the role of the regulatory authority, gives the ABA a range of powers and functions, and sets out explicit policy objectives. The ABA is independent from, and has a separate legal identity to, the Australian Government (similar to the ACA). It prepares an annual report for the Minister, which is tabled in Parliament. The BSA provides for the appointment of a Chairperson and a Deputy Chairperson, who are to be appointed as full-

¹⁰ It is noteworthy that the *Broadcasting Services Act 1992* alludes to social and cultural objectives and not just to the pure financial maximization of spectrum use.

time Members, and up to five other Members, who may be full-time or part-time. The *BSA* also states that the Minister may appoint Associate Members to the ABA for general purposes or for specific purposes such as investigations or hearings.

The ABA plans the availability of segments of the broadcasting services bands for analogue and digital broadcasting (*Part 3* of the *BSA*). It can allocate, renew, suspend and cancel broadcasting licences and collect any fees payable for those licences. It also allocates pay TV licences and administers the class licence regime for subscription radio broadcasting and open and subscription narrowcasting services.

In addition, the ABA is required to inform itself and the Minister about advances and trends in broadcasting technology.

3.5.2 Licensing

A licence not only gives the service provider the right to broadcast the service, it also confers a right to use the broadcasting services bands to transmit the service. Therefore, in its statutory role for planning and licensing the broadcasting services bands, the ABA issues most broadcasters with apparatus licences that grant them access to the spectrum when they receive their broadcasting licence. Any spectrum that the ABA determines is not required for broadcasting purposes may be returned to the ACA for other uses.

Most of the broadcasting licences carry the entitlement to sufficient spectrum to maximise coverage in a market while minimising coverage outside it. 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.

Spectrum licences are not available for broadcasting. Systems for allocation of spectrum include auction, tender and predetermined pricing where revenue is concerned, and merit for public-good uses, such as community access radio.

There has been considerable debate in Australia in recent years about the question of how broadcasting spectrum is allocated and charged for. Much of the policy debate is about what broadcasters do under the banner of public interest to make culturally and socially valuable content accessible to large numbers of people.

3.5.2.1 *Spectrum-usage fee*

Debate has been carried out on how much Government should charge from broadcasters for the use of spectrum, recognising that it could be a significant source of revenue¹¹. The key questions raised (but not necessarily answered) revolved around the sustainability of the revenue, given the rapidly changing nature of broadcasting and communications, what the broadcasters get for their money, and the justification of licence fees. Commercial television broadcasters claim that spectrum charges are a form of supertax, which acts as a penalty for the most successful by increasing proportionate to their profit levels.

Discussions regarding the existing linkage between broadcasting licences and transmitters licences gave rise to the argument that if licences providing access to spectrum (currently apparatus licences) were formally separated from licences to provide broadcasting services (broadcasting licences), then spectrum could be priced to reflect its value, and licences to use spectrum could be made transferable. The regulator's view is such that the ABA has no issue with the theoretical benefits of greater separation of content and spectrum access arrangements, nor with the principle of pricing to recover the value of spectrum; however, to realise those benefits, the Government would need to accept that broadcasters were free to trade away their spectrum.

Particularly in the case of television, more work would be needed to chart a politically feasible course away from the present, highly regulated and taxed, situation. Such a course would need to take account of a number of features, including the present licence-fee tax on the gross earnings of commercial broadcasters that is commonly justified by reference to the scarcity of broadcasting channels.

¹¹ By Julian Thomas and Marion McCutcheon (of Swinburne and Murdoch Universities respectively) (<http://www.aba.gov.au/conf04/>).

ABA's opinion is that any spectrum usage-based charge would presumably need to take account of the existence of, if not to replace, the current television licence fee regime. Also, care would be needed in the formulation of spectrum charges for regional licensees. To date these services have been heavily subsidised and, to an extent, sheltered from additional competition, in order to push coverage beyond what might otherwise have been commercially feasible. Any net increase in the total taxes paid by regional and remote licensees and any reduction in fees paid by metropolitan services should be consistent with the current policy emphasis on maximising access to the three network services.

There is some resistance to the current system of charging licence fees for spectrum, because the method by which fees are calculated is seen by many as antiquated and inefficient. The argument is that the fees do not reflect the amount of spectrum used by a broadcaster, they do not reflect the opportunity cost of using the spectrum, and they do not provide an incentive for broadcasters to find more efficient ways of delivering services. One broadcaster may end up paying a very different amount for use of a similar amount of spectrum than another in the same area. Some of the alternatives being considered include the modification of the method of licence fee calculation, turning spectrum rights into a form of property, or strengthening elements of commonality with regard to spectrum.

3.5.3 Access to non-broadcasting spectrum

Broadcasters also use a large amount of non-broadcasting spectrum, for example, for radio microphones, ENG (Electronic News Gathering), outside broadcasting of live events (mainly sports), satellite transmission and fixed links to transfer broadcasting content to transmission towers.

One of the greatest concerns in this respect is the use of the 2.5 GHz band for ENG where the broadcaster are limited by the existing analogue equipment in the market (see section 5.4). The full availability of this band is being under threat from different sources: spectrum licences of this band where a potential large interest can come from the 3G/IMT-2000 industry; and use by non-geostationary broadcasting-satellite as in the Republic of Korea.

Other frequency bands used for fixed links for ancillary broadcasting services are also under a certain pressure (e.g. 7.2, 8.3, 13, and 23 GHz); in particular, half of the 7.2 GHz band was licensed for defence use and is also shared with a space science service (CSIRO earth station south of Canberra).

3.5.4 Digital broadcasting

3.5.4.1 Digital Terrestrial Television Broadcasting (DTTB) planning

Schedule 4 to the *BSA* sets out arrangements for the conversion, over time, of the transmission of television broadcasting services from analog to digital mode. Under the arrangements, the ABA is required to formulate two schemes for the conversion – a commercial television conversion scheme, and a national television conversion scheme:

- the Commercial Television Conversion (CTC) scheme was formulated in March 1999. The scheme commenced on 9 June 1999. The ABA varied the CTC scheme on 21 December 2000.
- the National Television Conversion (NTC) scheme was formulated in December 1999. It was approved by the Minister on 2 February 2000, and commenced on that date. The Minister approved a variation to this scheme on 20 December 2000.

Under both schemes, the ABA must make digital channel plans that allot additional channels to broadcasters so as to enable them to transmit programs in analog and digital modes during a simulcast period (foreseen to last 8 years). 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.

All technical and general assumptions considered by the ABA are set out in the [*DTTB Planning Handbook – As Varied April 2002*](#).

The digital TV system chosen for use in Australia is the DVB-T (Digital Video Broadcasting-Terrestrial)¹². The DVB-T standards have been modified to meet Australian requirements. Australian television broadcasters have been active participants in the international digital TV standardization forums. The first DTTB networks started broadcasting in 2001; currently there are more than 190 transmitter on –air (of which 69 belongs to ABC national network).

3.5.4.2 *Digital radio broadcasting*

One of the big issues in the introduction of digital radio broadcasting in Australia is which of the available technologies would best suit the country's particular circumstances. The commercial radio industry is currently evaluating potential systems for digital radio in Australia. Current planning is based on the Eureka 147 standard in the L-Band but with consideration of VHF spectrum for some areas. In considering the introduction of any new technology the Government is acting to ensure that the implementation is going to be in the public interest such that the technology will promote high quality, sustainable and diverse services particularly in regional areas. In addition, the Government considers that any implementation of digital radio should be based on a responsible management of spectrum resources.

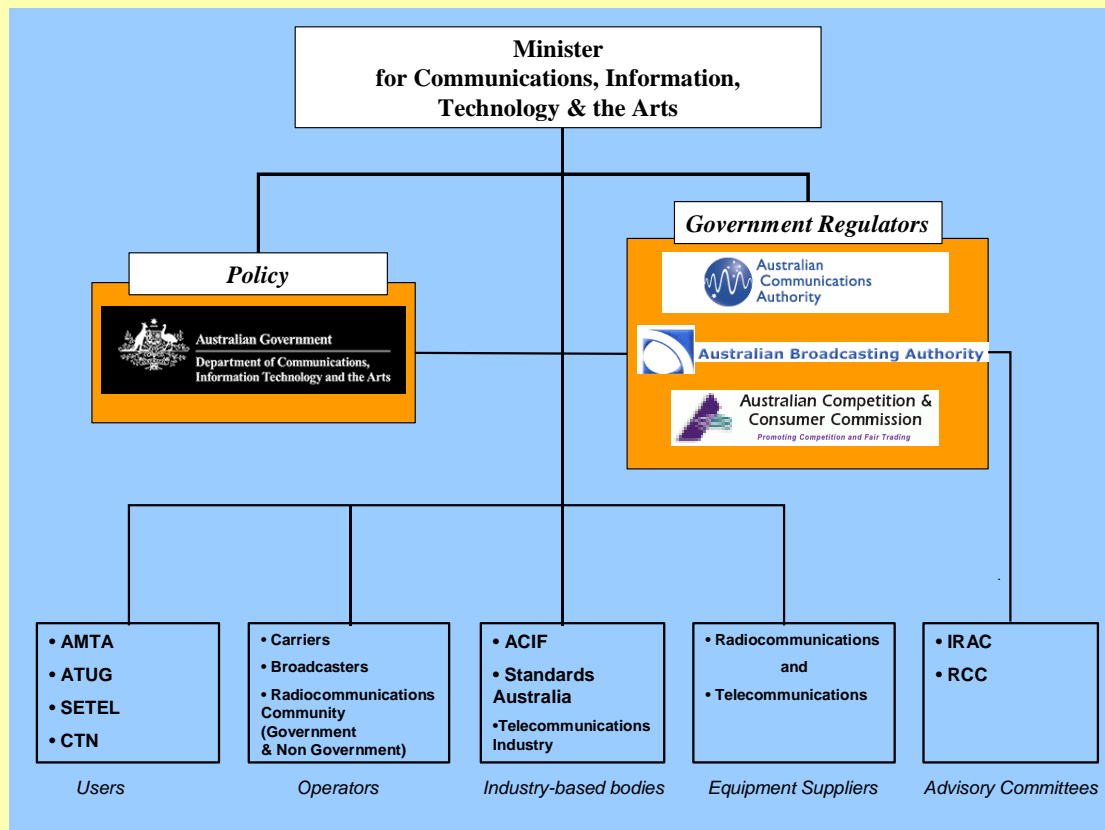
On 6 May 2003, the Minister announced the formation of a Digital Radio Study Group (DRSG) to report on the status of major digital radio technologies currently available internationally (i.e. Eureka 147, IBOC (In-Band On-Channel), DRM (Digital Radio Mondiale) and digital satellite and hybrid satellite/terrestrial services)¹³. The DRSG comprises representatives of the ABA, the ACA and the DCITA. The DRSG is tasked with examining initiatives currently being developed and implemented overseas, in terms of digital radio technology and approaches to service delivery.

The choice of the preferred digital radio technology for Australia will affect the Government implementation strategy, including regarding spectrum implications. For example, the adoption of IBOC would not require the allocation of new spectrum, while the adoption of a Eureka-style system would. In addition, the type of spectrum used to deliver the digital service - for example L Band, VHF Band III, or a combination of the two - will affect implementation. These matters are under consideration by the DRSG.

In October 2003, the ABA endorsed the conduct of digital radio trials in Sydney and Melbourne by Commercial Radio Australia (CRA) and Broadcast Australia (BA), respectively, and both involve the Eureka 147 digital radio technology. The trials will occur on VHF channel 9A in both cities, for a period of up to eighteen months. Other applications from CRA and BA, or applications for extensions of the Sydney or Melbourne trials, will be considered by the ABA.

¹² [Digital Broadcasting Australia](#).

¹³ In <http://www.aba.gov.au/radio/digital/>.

Figure 3.2- Radiocommunication and broadcasting regulation in Australia

The **Minister** has authority under the *RCA* 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 ACA, the ACCC and the DCITA. The *ACA Act* also enables the Minister to direct the ACA in the administration of its duties.

The **DCITA** is responsible for providing radiocommunication policy advice to the Minister.

The **ACA** is a statutory authority, which regulates radiocommunications and telecommunications under the *ACA Act*, the *RCA*, the *Telcom Act* and related legislation. The ACA provides operational advice and information for the Minister. It has international liaison duties in the ITU and other international forums.

The **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.

The **ACCC**, the Government's general competition regulator, has responsibility for administering the *TPA* 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.

[AMTA](#): Australia Mobile Telecommunications Association

[ATUG](#): Australia Telecommunications User Group Ltd.

[SETEL](#): Small Enterprise Telecommunications Centre Ltd.

[CTN](#): Consumers' Telecommunications Network

[ACIF](#): Australian Communications Industry Forum

[IRAC](#): International Radiocommunications Advisory Committee

[RCC](#): Radiocommunications Consultative Council

Source: ACA and Productivity Commission.

4 Radiofrequency spectrum management

4.1 Objectives and approaches of regulations

The *RCA* provides the framework for management of the radiofrequency spectrum and has as the first objective the maximisation of the overall public benefit derived from use of the spectrum. The other objects of the *RCA* provide a fair enumeration of the social and economic factors impinging on spectrum use, including:

- the need for adequate provision for public and community services;
- efficiency, equity and transparency in pricing;
- other communications and industry policy objectives of the Government; and
- the need to promote Australia's interests internationally.

On the basis of the *RCA*, Australia has moved away from the traditional heavily regulated and tightly allocated model of spectrum management. The *RCA* introduced a range of market mechanisms designed to complement or substitute for traditional administrative methods for allocating spectrum. The new form of licensing — spectrum licensing — is one of the most important of these mechanisms. As a technology neutral, largely self-regulating form of licensing, it moves many decisions about spectrum use away from planners/regulators towards licensees.

Spectrum management in Australia is the responsibility of the ACA which system relies on the following key elements:

- *spectrum planning*, to provide predictability and certainty and to establish a framework for minimising interference;
- *licensing*, to define the rights and obligations of spectrum users, especially as part of this interference management framework. This includes:
 - licence fees, to encourage efficient use of the spectrum;
 - auctions, to allocate spectrum where demand exceeds supply;
- *standards*, where these are the most efficient way of managing interference.

4.2 Spectrum planning

Spectrum planning remains a key element of Australia spectrum management regime.

Spectrum planning takes place through a hierarchical process (see Figure 4.1):

- At the highest level, international planning through the ITU establishes broad spectrum uses.

This gives industry a predictable base from which to develop communications systems and products, and helps manage cross border interference that could otherwise result from unplanned spectrum use. The ACA recognises the significant benefits in Australia aligning with international arrangements. As a 'technology taker' Australia thus gain access to radiocommunication equipment at less cost than is likely to be the case if it adopted markedly different spectrum arrangements to the rest of the world. Alignment also provides Australia with the ability to support international safety-of-life services and devices.
- At the national level and next stage in the planning hierarchy, the ACA produces the Australian Radiofrequency Spectrum Plan (the *Spectrum Plan*), which is the overarching domestic planning document (see [Annex 1](#)).

The *Spectrum Plan* generally aligns with the broad ITU spectrum allocations for the Asia-Pacific region. It allocates blocks of spectrum to broad types of services such as fixed, mobile, radionavigation and broadcasting, and provides predictability and transparency to users. It is updated regularly to reflect changes in international arrangements, particularly following ITU World Radiocommunication Conferences (WRCs), currently held every three years.

Based on the *Spectrum Plan*, the ACA adopts frequency *band plans* for specific bands as and when necessary. Such band plans further sub-divide the allocations made in the *Spectrum Plan* to specific service types. They can also be used to administratively reclaim spectrum and re-allocate it from one service to another. Table 4.1 contains a list of ACA's band plans which details are given in [Annex 1](#).

Table 4.1: The ACA's band plans

| Frequency Band Plans | |
|--|------------------|
| (legal instruments that specify the purposes for which bands may be used, and may provide for the reservation of parts of the spectrum for public or community services) | |
| | First Made |
| VHF Mid Band Frequency Band Plan (70 - 87.5 MHz) | 1991 |
| VHF High Band Frequency Band Plan (148 - 174 MHz) | 1991 |
| 900 MHz Band Plan (820 - 960 MHz) | 1992 |
| 1.5 GHz Band Plan (1427 - 1535 MHz) | 1996 |
| 1.9 GHz Band Plan (1880 - 1900 MHz) | 1996 |
| 2.1 GHz Band Frequency Band Plan 2002 | 2002 |
| Mobile-Satellite Service (2 GHz) Frequency Band Plan 2002 | 2002 |
| Multipoint Distribution System Frequency Band Plan 2000 (revoked) | - |
| Administrative Band Plans | |
| (serve a similar purpose to frequency band plans, but without the latter's statutory obligations, providing a policy basis for band usage) | |
| | Last amended |
| 400 MHz Plan (403 - 420 MHz & 450 - 520 MHz) | 10 December 2002 |

Source: ACA.

Both the *Spectrum Plan* and individual band plans are subject to mandatory public consultation processes. They are also (like many other spectrum management issues) discussed within the ACA's consultative bodies, the Radiocommunications Consultative Council (RCC) and the International Radiocommunications Advisory Committee (IRAC).

4.2.1 Spectrum strategy

Recommendations arising from a RCC Working Group's report of April 2002 included a proposal that the ACA publish a forward review of spectrum use in conjunction with every WRC, as well as annual revisions [17]. The revisions were to include any likely changes in band use the ACA became aware of in the previous 12 months. The report envisaged that the forward review would incorporate prospective changes in band use arising from the forward auctions program, the outcomes of WRCs and other ACA planning decisions or proposals such as embargoes, new band plans or changes to existing band plans. These recommendations were aimed at providing greater certainty to licensees about how their spectrum use might be affected by change.

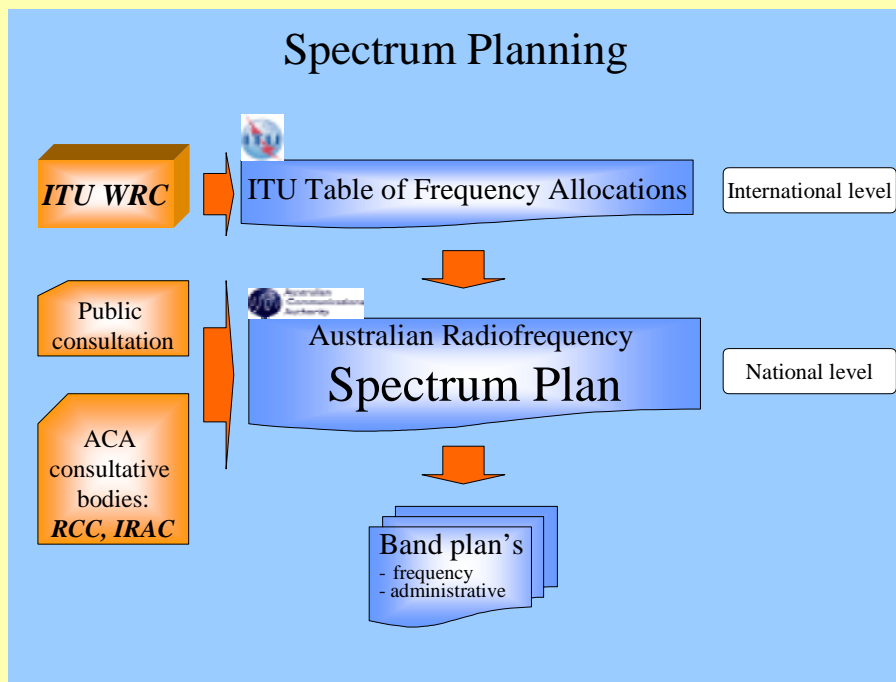
The ACA has acted on those recommendations and commenced work in 2002-03 on its initial spectrum strategy document. While the spectrum strategy will meet the requirements identified by the RCC, the ACA believes it can go further and provide more information to licensees through a more comprehensive document.

The spectrum strategy document will discuss the tensions and trade-offs in spectrum management, key spectrum management issues and the ACA's regulatory philosophy in managing the spectrum. It will also

include a detailed discussion of bands, grouped by application, even where there are no immediate proposals for changing the use of those bands. Such a document will be of practical use to current and intending spectrum users and provide a high level of accountability for the ACA's management of the spectrum.

The ACA intends to publish the spectrum strategy during 2004-05 and to revise it at regular intervals.

Figure 4.1: ACA Spectrum planning process



Source: ACA.

4.3 Licensing regime

Licensing the use of spectrum is the means of defining the rights and obligations of spectrum users. Licensing is the principal means of coordinating different uses of spectrum to provide an environment in which interference can be minimised and managed. Unless one were to accept the risks and consequences of greater levels of interference, it is doubtful that there is any practicable alternative to licensing as a means of authorising access to the spectrum (some form of licensing is applied in all spectrum management systems used in other countries). The overall view is that the licensing system under the responsibility of ACA has been effective in meeting the objectives of the *RCA*, providing a framework for decisions to be made about allocation, use by public or community services, and for an efficient, equitable and transparent system of charging.

The *RCA* (s. 238) provides that the ACA may delegate licensing powers, in relation to broadcasting services bands, to the ABA. The *RCA* makes no provision for delegation of primary licensing powers to parties other than the ABA. In addition, the *ACA Act* (s.'s 49 and 41), allows the ACA to delegate its powers and functions to another authority of the Commonwealth. Therefore, a limited power of delegation is available,

although a proposal to delegate the issuing of licences to a private sector body would require legislative change.¹⁴

One area where there has already been considerable “delegation” of ACA responsibilities is the *accreditation scheme*. Accreditation recognises that many people outside the ACA possess the necessary expertise to enable them to undertake frequency assignment work and coordination activities. The *RCA* (s. 263) provides that the ACA can grant accreditation to issue frequency assignment certificates under apparatus licensing (certifying that the proposed assignment satisfies the licensing conditions required by the ACA) and/or interference impact certificates (which perform a similar function under spectrum licensing) (see Box 4.1). The ACA maintains a [list of accredited persons](#).

In the four years since the accredited persons scheme was introduced, the amount of frequency assignment work done outside the ACA has steadily increased (see Table 4.2). Over 55 per cent of apparatus licensing frequency assignment work, and all device registration work under spectrum licensing, is now undertaken by accredited persons.

Table 4.2: Number of accredited persons and assignments registered, 1999–2003

| | 30.6.1999 | 30.6.2000 | 30.6.2001 | 30.6.2002 | 30.6.2003 |
|---|-----------|-----------|-----------|-----------|-----------|
| Number of accredited persons | 30 | 33 | 39 | 43 | 46 |
| Frequency assignments registered by accredited persons | 4,679 | 8,393 | 17,581 | 8,783 | 8,078 |
| Frequency assignments performed by the ACA | 17,612 | 6,691 | 10,456 | 7,309 | 6,574 |

Source: [ACA](#).

¹⁴ However, commercial band managers could operate under third party authorisation in providing spectrum access to many different clients. In fact, the licensing arrangements allow, via their leasing provisions, for the possibility of private band managers. 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 GHz band.

Box 4.1: The Accreditation Process

The *RCA* by the adoption of suggestions in this sense made provision for a system of “accreditation” whereby “Accredited Persons” (APs) can undertake “frequency assignment” work in competition with the ACA’s own technical staff.

In the case of apparatus licensing, the technical frequency assignment function that is carried out by APs is but one component of the overall licensing process. On completion of his/her work, the AP merely issues a *Frequency Assignment Certificate (FAC)* that the ACA may then consider in deciding whether to issue the apparatus licence. Thus the ultimate licensing responsibility and timescale of the licensing remains with the ACA, including responsibility of the administrative aspects of the licensing process (data entry into the ACA [Register of Radiocommunication Licences](#), fee processing and the issue of paper licences). However, apparatus licences are usually issued within 5 days of a *FAC* being presented to the ACA. A facility for optional [on-line data entry by accredited persons](#) had recently been developed by the ACA at year-end 2003, and was undergoing further definition at the beginning of 2004.

The administration of the spectrum licensing system is fundamentally different to that of apparatus licensing. The difference is due principally to the fact that the spectrum licence is issued at the outset and this licence covers the operation of all devices under the licence. (Apparatus licences on the other hand are issued individually in response to individual applications.) At the day-to-day level, however, spectrum licensing usually requires “device registration¹⁵” prior to the devices being placed in service. (Despite the fundamental differences, the device registration under spectrum licences is often seen as paralleling frequency assignment under apparatus licensing.) Device registration achieves two objectives: the creation of a record in the ACA *Register of Radiocommunication Licences* to identify the operation of the device in order to provide for coordination at a detailed level; and the certification that the operation of the device is in accordance with its core, and other licence, conditions. (Certified registration in a public database creates both a technical basis and a clear chain of legal liability for the detailed management of interference by a licensee.) Certification requires the services of an AP, and may involve the complex device boundary analysis. Unlike apparatus licensing, the responsibility for interference management under spectrum licensing rests with the licensee; whilst the ACA may prepare “guidelines” for the management of interference, the application of these guidelines is not a mandatory part of the device registration process. (While they are not mandatory, an AP’s accreditation may be withdrawn if the ACA considers that the rate of interference caused through certification is unacceptably high. In addition, the AP would normally have an agreement with the licensee to manage interference although it is open to APs to seek to remove the liability associated with this aspect of their function in that agreement.) All device registration work under spectrum licensing is undertaken by APs.

The concept of accredited assigners has proved extremely popular with licensees, to the point where the majority of apparatus licensing assignment work is now done by APs. The initiative appears to have brought benefits both to the user community (faster and less expensive issue of licences) and to the ACA (reduced staffing requirements).

Source: P. Hilly, Spectrum Engineering Australia Pty Ltd.

4.3.1 Radiocommunication Licences

There are three types of radiocommunication licences:

4.3.1.1 Apparatus Licence

An apparatus licence authorises the licensee to operate a radiocommunication transmitter or receiver of a specified kind. In effect, it is a licence to use a specific segment of the radiofrequency spectrum, limited in both frequency and location, for a specified purpose for any period up to a maximum of five years. It involves the payment of annual licence fees.

¹⁵ The ACA is inviting comments until 20.2.2004 on [proposed changes](#) to device registration rules in response to the recommendations of the Productivity Commission’s report into radiocommunications (see [Annex 3](#)). There are two proposed amendments: the first corrects an anomaly in the current process for device registration; the second offers increased flexibility for licensees and accredited persons to choose alternative technical methodologies when applying for a device registration.

Apparatus licensing is the default form of licensing in most bands where services need to be licensed individually. Apparatus licences are administratively simple and can be allocated over the counter (i.e. without a price-based process). They can also be auctioned, although the need and opportunity to auction apparatus licences arises only occasionally.

Apparatus licensing is the form of licensing most frequently used by the ACA and is very similar to licensing models used by other spectrum managers around the world. There are approximately 152,000 apparatus licences currently on issue in Australia, down from a previous high of 200,000 as a result of the replacement of some individual licences through the introduction of new class licences for a range of maritime and aviation applications [17].

Examples of devices subject to apparatus licensing are two-way radio transmitters, fixed links carrying for example telecommunication backbone traffic and mobile phone base stations.

4.3.1.2 *Class Licence*

A class licence: sets out the conditions under which any person is permitted to operate particular radiocommunication equipment; is not issued to an individual user; its location is not recorded in the national data base; and does not involve licence conditions applied to individuals. Class licences authorise users of designated segments of spectrum to operate on a shared basis.

Class licensing is a means of authorising access to spectrum for services which:

- use common frequencies on a non-coordinated basis;
- use equipment that is operated under a common set of conditions; and
- present a low potential for interference.

Class licences are simple for the spectrum user, do not involve any licence fee and generally involve minimum licence administration by the ACA.

On the other hand, they are suitable only for particular equipment types and uses. Class licensed services may suffer interference and generally will not be afforded protection from interference caused by other radiocommunication services. Where a class licensed transmitter causes interference, the onus is generally on the operator to rectify that interference.

Examples of class-licensed devices are 'garage door openers', radio controlled toys, cordless phones and mobile telephone handsets.

Class licensing operates successfully in a number of areas and the ACA has moved recently to also class license certain maritime and aviation licences. It will examine further opportunities for class licences where there are administrative efficiencies and the risks of interference are low or acceptable.

4.3.1.3 *Spectrum licence*

A spectrum licence authorises the licensee to operate any radiocommunication device within the specified spectrum space on any site in that space, provided that operation is in accordance with the conditions of the licence.

Spectrum licences are technology and service neutral, subject to the parameters of the technical framework established for the band. They provide tenure of up to 15 years and offer considerable flexibility to the licensees in terms of the trading of spectrum space. Interference management costs for the services operated under the licence are effectively transferred by spectrum licence conditions to the licensee. Costs of meeting these conditions include characterising the emission performance of the equipment involved, planning use of the band and the area, and registering devices (see Box 4.2).

The decision to allocate a band by issuing spectrum licences rests with the Minister, although the ACA may, at the Minister's request or on its own initiative, make recommendations to the Minister.

Overall, spectrum licensing has resulted in some considerable improvements in the efficiency of spectrum management. It has done this by forcing both regulators and licensees to think more broadly about the real

purposes of spectrum management and challenging the "way things have always been done", by improving flexibility of spectrum use and by introducing more market disciplines into the system.¹⁶

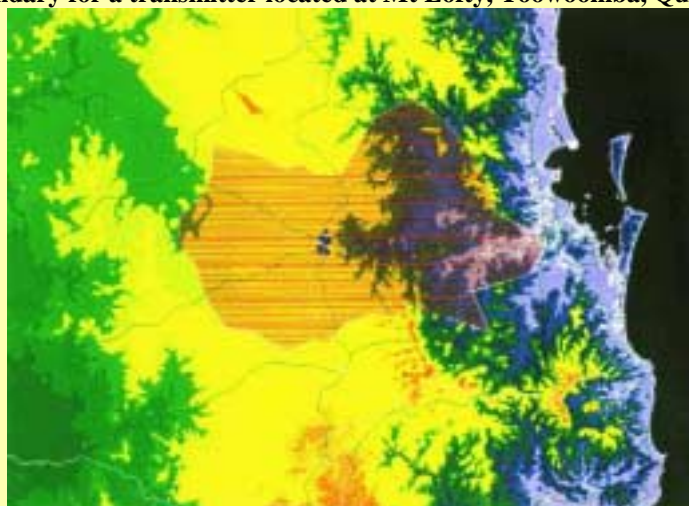
Box 4.2: Harmonization with a spectrum licence

A spectrum licence provides a licensee with access to a parcel of spectrum space. The spectrum space is not only defined in terms of frequency band, geographical area, time and maximum emission levels (the core conditions, as defined in the *RCA (s.66)*), but also through all the other licence conditions that control access to the spectrum space (the access conditions). Different conditions may be applied to different licences. Access is fully defined to allow accurate estimate, even prior to auction, of its economic value and provide certainty especially by minimising the need for, and cost of, interference management through negotiation.

The spectrum space may be used for any type of radiocommunication device as long as its emission complies with the conditions of the licence (e.g. Australian spectrum licenses issued in 1997 permit operation of software-defined radios as well as broadcast services). The access conditions create emission buffer zones along both the frequency and area boundaries of the licence that act to reserve the total spectrum space free from encroachment by neighbouring licensees and conversely provide for the protection of devices operated by those neighbouring licensees. The combination of the core and access conditions is the basis for the design of coordination rules by the licensee for protecting their receivers from external interference.

Devices that operate under a spectrum licence and have a high likelihood of causing interference (e.g. high-power devices) must be registered with the ACA in order to have their use authorised. An important part of this process is the calculation of a *device boundary*. The device boundary is calculated to check that a notional geographic area used by its in-band emission fits within the space of the spectrum licence under which it operates. The device boundary must therefore be located within the geographic area of the spectrum licence. The device boundary is not designed to fully manage interference; it is primarily designed to define the maximum power spectral-density for a transmitter in relation to its location relative to the licence area boundary and when at a given effective height. Consequently, it informs a neighbouring licensee about what levels of interference their receivers may be subject to. The calculation of a device boundary for a transmitter (see Figure 4.2) involves establishing the distance, along radials originating at the device by means of a notional propagation model, that is required for emission levels to drop below a benchmark level of protection for receivers (usually based on the noise floor of the receiver). The concept of a device boundary provides a simple facility for establishing agreements between licensees for sharing spectrum space across area boundaries by varying a single parameter to expand or contract the device boundary to provide more or less in-band protection, respectively. (Some consider that much of industry are not yet fully aware that, in addition to ensuring that the devices comply with the spectrum licensing conditions - which ensures that the device is operating within the 'size' of the licence - the purpose of registration of devices is to manage interference at a detailed level; this unawareness results from the fact that much of the coordination is presently performed indirectly through the configuration of base-mobile two-frequency operation as well as the removal of many former point-to-point services; at a later date it may be necessary to coordinate between other configurations and this is why the spectrum licensing framework is in the form that it is now.)

¹⁶ According to some views, while spectrum licensing has challenged the way things have been done, the net result has been the introduction of a system that is unnecessarily complicated and which has actually reduced the efficiency of the management process, and all of the perceived benefits of spectrum licensing could have been achieved much more effectively by simple refinements and liberalisation of the traditional system of management.

Figure 4.2: A device boundary for a transmitter located at Mt Lofty, Toowoomba, Queensland

Source: M. Whittaker, [Managing Spectrum Licensing in Australia](#).

For bands that may be used in a paired manner (for two-way two-frequency operation), either the upper or lower band will normally be subjected to transmitter *deployment constraints*. The deployment constraints bias spectrum use towards certain service configurations, increase spectrum efficiency for those services and minimise expensive or uncertain negotiations between adjacent licensees. Australian spectrum licensing allows for the registration and operation of transmitters that do not comply with deployment constraints to the extent that larger emission buffer zones, or *guard spaces* (guard area and guard band), are provided by the licensee. These guard spaces must at least be of a size to provide protection to neighbouring licences to the same extent as the protection inherent in the core and access conditions. The necessary guard space is defined in this manner so that there is a single definition for the ‘size’ of the spectrum space that is provided to a licensee.

The conditions of a spectrum licence are frequently seen as acting like a technological neutral generic equipment standard, including a generic receiver, allowing many different standards to operate under a harmonised equipment compliance regime with certification of equipment made a licensee’s responsibility at the device registration stage. Actual receivers are allowed to be better or worse than the generic receiver, it being part of the definition of the level of protection available to a licensee. Essentially, the hidden interference management functions of equipment standards are transferred to the direct visible action of licence conditions.

Source: M. Whittaker, FuturePace Solutions [18].

A spectrum licence must be issued using a price-based allocation process (although apparatus licensees can be offered the opportunity to convert to spectrum licences at a fixed price). This has led to auctioning being equated with spectrum licensing in the minds of some observers. In fact, auctions can be, and have been, held for apparatus licences and spectrum licences have been issued on the basis of a negotiated price. The ACA will allocate spectrum at auction where sufficient demand is demonstrated through an expression of interest process. The ACA sets confidential reserve prices for individual spectrum lots prior to an auction. Spectrum lots that are unsold at auction, or if no auction eventuates, are usually made available over the counter by the ACA at a fixed price, that is non-negotiable, on a first-come-first-purchase basis. This price is usually the auction reserve price. The ACA may negotiate on a price for a specific spectrum lot.

The ACA currently cannot issue spectrum licences that are encumbered with other radiocommunication users (e.g. apparatus licensed services *in situ*).¹⁷

Spectrum licences were allocated for the first time in 1997, following the 500 MHz band auction, and have since been used to license the 800 MHz, 1.8, 2, 2.4, 3.4, 27 and 28/31 GHz bands.

4.3.1.4 Satellite networks

¹⁷ The Productivity Commission in its July 2002 Radiocommunications Inquiry Report recommended (Recommendation 6.9) that the RCA be amended to allow the ACA to issue encumbered spectrum licences (see [Annex 3](#)). The Government is currently considering this recommendation.

The ACA regulates the use of the radiofrequency spectrum by space objects in accordance with:

- Australian legislation such as the *RCA* and the *Telcom Act*:
The main way that a satellite network meets regulations for using Australian spectrum is by acquiring the appropriate operating licence from the ACA.
- International treaty arrangements such as those entered into by Australia with the ITU:
The main way that it addresses international arrangements is by operating in accordance with the ITU Radio Regulations.

Before it can provide radiocommunication services in Australia, a satellite network must have been filed with the ITU, either by the ACA or by another country's Administration. The satellite operator must then apply to the ACA for an appropriate radiocommunication licence to authorise those services. (See Figure 4.3.)

Under the *RCA*, satellite systems communicating with and within Australia are subject to the same licensing provisions as other users of the radiofrequency spectrum [8]. Licensing satellite systems provides licensees with certainty that they will have access to the spectrum they need and that their systems will be taken into account by the ACA when it allocates licences to other (space or terrestrial) users of the spectrum. This certainty can be of considerable significance to potential investors in satellite ventures. The ACA's licensing regime also helps to maintain equity and consistency in the way that similar, and competing, wireless services (such as broadcasting, internet access, fixed and mobile telephony, data services, corporate data, video conferencing and aggregated telecommunication data) are regulated.

The fees for satellite licences are calculated according to the same method as fees for other radiocommunication services. This means that space licensees are subject to the same financial incentives as other (terrestrial) operators to use the spectrum efficiently (see section [A3.3.1](#)).

To accommodate the wide variety of operating systems, the ACA provides a number of different licensing options. The choice of an option made by the respective licensee will depend on the nature of the system, the use of the spectrum and the commercial preferences of the satellite operator. Getting the right licence to operate or communicate with a satellite service depends on how it is to be used within a space network. Up and down links to and from the satellite may be licensed via the ground segment or space segment of the network (see Table 4.3).

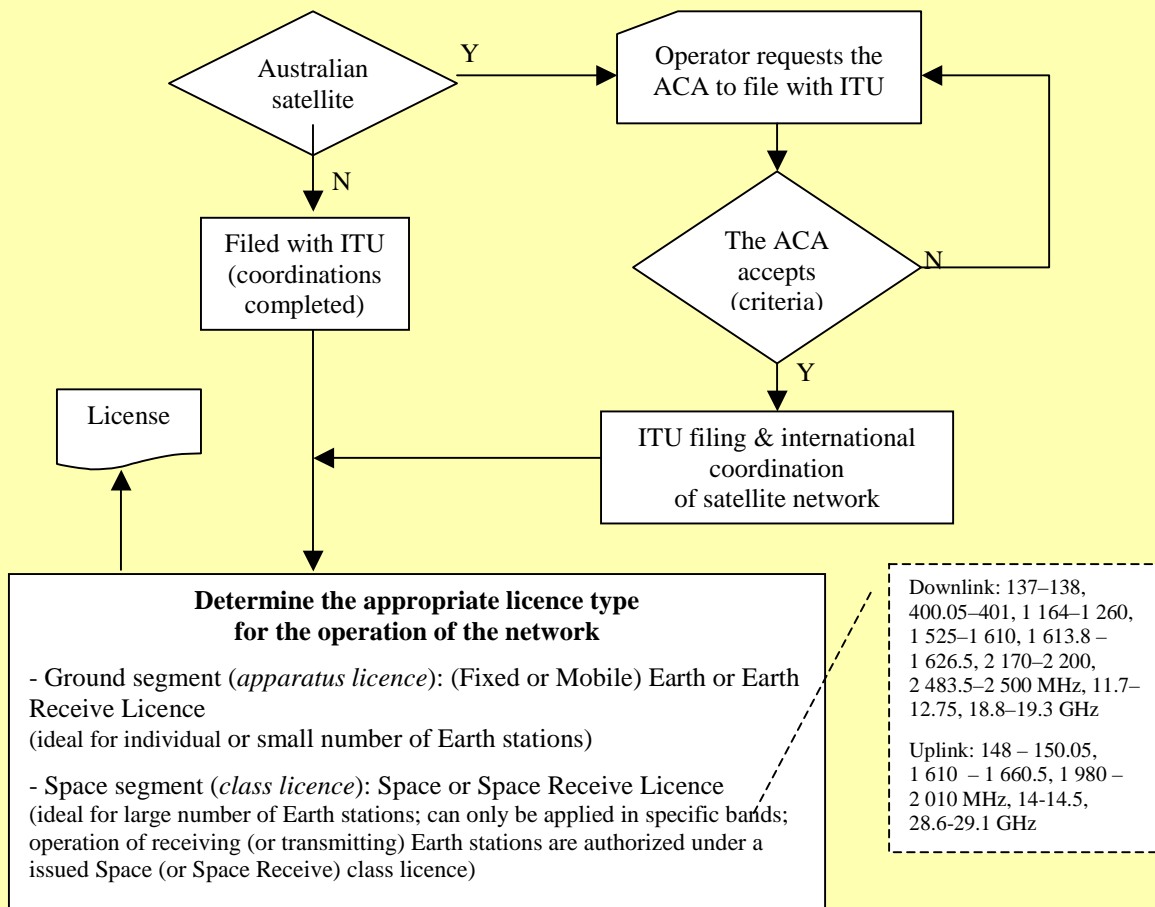
Some typical licensing configurations are shown in the examples contained in Figure 4.4. As shown in the diagrams, both the uplink and the downlink frequencies must be licensed. This can be done by the licensee taking out a licence for the transmitters and receivers (transponders) on the satellite, or for the earth station(s) communicating with the satellite.

When space stations are licensed via the space segment, the operation of ubiquitous earth stations that are communicating with them may be authorised by "[the Class Licence](#)"¹⁸ issued by the ACA. The ACA considers the appropriateness of space segment licensing for specific bands, other than those mentioned in the Class Licence, on a case-by-case basis.

When it is necessary or desirable to licence transponders on satellites to provide services in Australia, the satellite itself must be made subject to the *RCA*. This is achieved by determining if it is either an Australian space object or a foreign space object. This statutory requirement must be met before a Space or Space Receive licence can be issued.

¹⁸ The *Radiocommunications (Communication with Space Object) Class Licence 1998* (the Class Licence) authorises the operation of earth stations that communicate with apparatus licensed space stations where such operation is on authorized frequency bands.

Figure 4.3: Licensing satellite systems



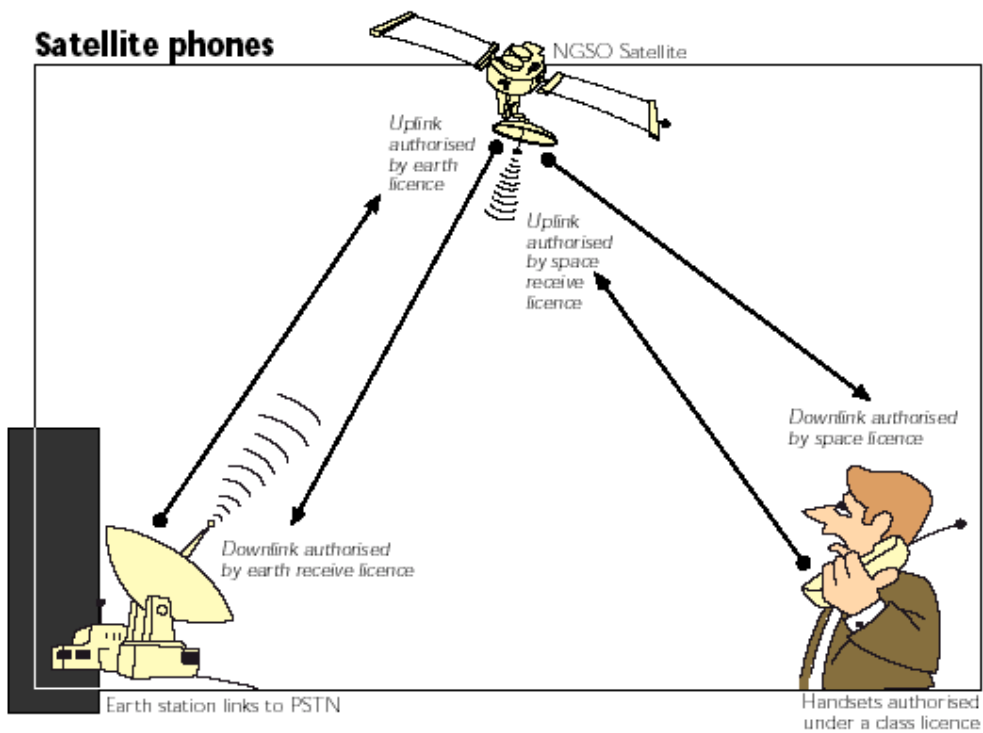
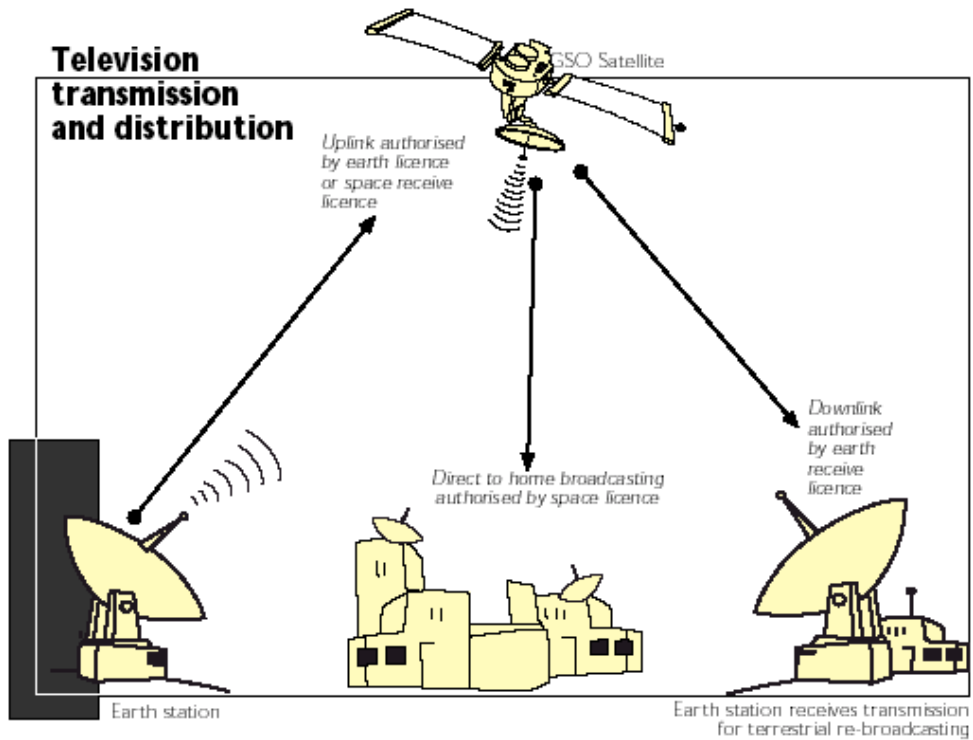
Source: ACA.

Table 4.3: Ground or space segment licensing

| | |
|-----------------------|---|
| Ground segment | <p>If the number of earth stations in the satellite network is small, the most efficient way to authorise their operation is via the ground segment (that is, directly licence the earth stations) using <i>apparatus licences</i> (either an Earth Licence or an Earth Receive Licence).</p> <p>Annual fees are payable for the issue and renewal of apparatus licences.</p> <p>Ground segment licensing results that the earth stations can be individually coordinated with other terrestrial users of the same frequency bands and thereby the potential for interference can be minimized.</p> |
| Space segment | <p>If the number of earth stations in the satellite network is large, the most efficient way to authorise their operation is via the space segment (that is, directly licence the space stations in the network).</p> <p>Operation of earth stations communicating with licensed space stations is authorised by the <i>class licence</i>. This licence specifies broad frequency bands within which Space and Space Receive licences can be issued and only authorises earth stations operating within these bands.</p> <p>There is no need to apply to the ACA to operate a device in accordance with a Class Licence and fees are not payable. However, licence fees are payable to authorise the operation of space stations.</p> <p>Space segment licensing is an efficient way to authorise an area-based service such as DTH services rather than transmission to (or reception from) a fixed point. This type of licensing suits DTH and other ubiquitous services because the earth stations do not then need to be individually licensed (when an apparatus licence authorises the operation of transponders onboard a satellite, the operation of associated earth stations is authorised by a class licence).</p> |

Source: [ACA](#).

Figure 4.4: Typical space licensing configurations



Source: ACA.

4.3.1.5 Application of the different licensing types

Spectrum is assigned to users under different arrangements. Some spectrum bands are designated exclusively for broadcasting and defence uses (e.g. in the VHF band, 67 per cent of frequencies are reserved for these users). Broadcasters and defence are then assigned apparatus licences for equipment using spectrum within those bands.

Spectrum licences are most prevalent in the UHF band, accounting for 12 per cent of frequencies in that band (see Table 4.4). There are no spectrum licences below the UHF band at present.

| Table 4.4: Spectrum allocation by licensing type | | | | | | |
|--|--------------|-----|-----|-----|------------------|---------------------------|
| | 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 | 92 | 32 | 72 | 71 | 64 | 69 |

^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.

Sources: ACA and ABA.

Apparatus licences are defined in terms of channel width. Although it is difficult to determine the amount of spectrum under apparatus licences it 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.

In the spectrum licensed bands, activity can be measured by the number of device registrations received each year by the ACA. Table 4.5 lists the number of devices registered by clients for spectrum licensed bands at June 2002. Most notable is the expansion of mobile networks in the 800 MHz and 1.8 GHz bands, together with the first signs of activity in the 3.4 GHz band since the ACA auctioned licences in 2000.

There are no rules or criteria in the *RCA* that specify circumstances in which spectrum licensing should be used rather than apparatus licensing. The ACA's recommendation on the form of licensing to be used in a particular band is decided only after extensive consultation with industry. The ACA's observation is that, as a general rule, spectrum licensing has been preferred by industry for the higher value, higher risk and newer applications as it offers longer guaranteed tenure and minimises risk to the licensee because of its high degree of technology neutrality and increased trading flexibility.

Table 4.5: Movement in number of devices registered under spectrum licensing

| Spectrum licensed band | Typical service | Client | Dec-01 | Jun-02 | Difference |
|---------------------------------|--------------------|-----------------------------|--------|--------|------------|
| 800 MHz | Mobile | Hutchison Telephone Pty Ltd | 2,498 | 2,513 | 15 |
| | | Telstra Corporation Limited | 5,848 | 6,024 | 176 |
| | | AAPT Wireless Pty Ltd | 368 | 368 | 0 |
| 1.8 GHz | Mobile | Telstra Corporation Limited | 1,270 | 1,428 | 158 |
| | | Vodafone Australia Pty Ltd | 452 | 2,304 | 1,852 |
| | | SingTel Optus Pty Limited | 1,365 | 1,367 | 2 |
| 3.4 GHz | Broadband wireless | AKAL Pty Ltd | 0 | 100 | 100 |
| | | Telstra Corporation Limited | 0 | 69 | 69 |
| 27 GHz | Broadband wireless | Agility Networks Pty Ltd | 24 | 24 | 0 |
| 28/31 GHz | Broadband wireless | AAPT LMDS Pty Ltd | 229 | 288 | 59 |
| Other | | | 12,140 | 12,140 | 0 |
| Total devices registered | | | 24,194 | 26,625 | 2,431 |

Source: ACA.

4.3.2 Spectrum pricing

The Australian spectrum pricing systems is conceived on the assumption that charges to the users of spectrum should serve two objectives:

- act as a rationing device and set in a manner that encourages efficient use of spectrum, and
- deliver a fair return to the community for the private use of a community resource.

The radiocommunication licence taxes (for transmitters and receivers) are based on a formula that takes into account:

- the spectrum location authorised by a licence (some spectrum bands are in higher demand and are therefore more congested than other bands);
- the amount of spectrum (bandwidth) used by a licensee;
- the geographic coverage authorised by the licence; and
- the power of the transmitter (transmitters operating a low power will attract a discount).

The ACA acknowledges 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. It is noted that 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.

While there is some evidence that Australian fees for access to spectrum are high, relative to those charged overseas, there is no evidence available to the ACA that the levels of charges in Australia are such as to deter efficient uses of the spectrum. Since introducing the fee formula in 1995, the ACA has continued to monitor

and adjust the fees. The ACA has a program to review fee levels, in particular in bands, which are experiencing congestion and in which there is arguably a case for increasing fees (see section [A3.3.2](#)).

Ideally, in spectrum bands and geographic locations where there is scarcity and congestion, fees should be set at "market" levels. However, the task of establishing those market levels is very difficult. Methods by which values might be established that would match supply with demand include:

- shadow pricing against auction outcomes;
- shadow pricing against alternative (non-wireless) service delivery mechanisms;
- gathering evidence of market values from observing trading in the secondary market; and
- where there is evidence of congestion (excess demand) in a band or location, gradually increasing annual spectrum charges to the level which causes an easing of that congestion.

The ACA will continue to use these methods to assess, refine and develop its approach to the pricing of spectrum.

By means of example, annual licence fees and the distribution of spectrum by use are summarized in Table 4.6.

Table 4.6: Radiocommunication annual licence fees, 2001-2003

| <i>Spectrum use</i> | <i>Revenue 2001-02</i> | <i>Revenue 2002-03</i> |
|-----------------------|------------------------|------------------------|
| | A\$ million | A\$ million |
| Fixed | 32.5 | 32.5 |
| Land mobile | 16.9 | 15.7 |
| GSM 900 MHz | 55.4 | 55.4 |
| Non-assigned services | 1.7 | 1.7 |
| Spectrum licences | 0.4 | 0.3 |
| Other | 15.1 | 14.3 |
| Total | 122.0 | 119.8 |

Revenue from radiocommunication licence fees and charges declined by 1.8 per cent in 2002-03, mainly because of a decline in revenue from MDS and land mobile system licences. MDS apparatus licences are being phased out under the ACA [2.1 GHz Band Frequency Band Plan 2002](#) to make way for point-to-point links displaced by the auction for 3G services. The apparent reduction in revenue from land mobile licences is due to timing differences in payments for licences renewed around the end of the financial year.

While the total amount of revenue for fixed services is stable, the market is dynamic. Some licensees have been rationalising their networks of fixed services. At the same time, some companies are continuing to expand their fixed networks, for example, to support the rollout of 3G networks.

Source: ACA [17].

4.3.3 Auctions

In Australia, as in other countries, most spectrum is not allocated using auction or other price-based allocations but is allocated "over the counter" on a first-come first-served basis [10]. The ACA has a very large number of clients in spectrum where there is no exceptional demand or technology basis for changing the use of a band, or for using price-based allocations. Administrative allocation will thus continue to be used extensively, indeed in most cases. Administrative allocation is also useful as a means of ensuring access to spectrum for low commercial value but essential or useful services, such as the aeronautical or maritime bands or spectrum for emergency services.

In the view of the ACA, administrative allocation is poorly suited, however, to situations where demand for a spectrum band exceeds the available supply. 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. In these circumstances, there is no

administrative allocation method that can guarantee that spectrum will be allocated to its most efficient uses, and to those users who value it most highly.

The ACA considers that decisions about use of the spectrum are usually more appropriately made by operators of communication systems rather than by regulators. The ACA considers that, in general, spectrum will be used most efficiently where it is allocated to those who value it most highly. Allocations made in the marketplace are likely to be better at ensuring that spectrum is allocated to its highest valued, and more efficient, use. Such allocations are also likely to be fairer than inevitably arbitrary decisions by regulators as to the best use for a band. Market allocations also help to ensure a fair return to the taxpayer for private access to a public resource.

Australia was one of the pioneers in spectrum auctions. The first spectrum auction was conducted in 1994 and, as shown in Table 4.7, auctions have been used on a regular basis since that time (see Table 4.8).

Table 4.7: Past Australian auctions

| Year | Band | Description |
|-------------------------------|----------------|--|
| 1994-1995 | 2300 MHz | Multipoint Distribution Station (MDS)* |
| 1997 | 500 MHz | Land Mobile |
| 1998 | 800 & 1800 MHz | 1st PCS Allocation |
| | 800 & 1800 MHz | 2nd PCS Allocation |
| 1999 | 800 MHz | 3rd PCS Allocation |
| | 28/31 GHz | Broadband wireless access |
| | 800 MHz | Trunked Land Mobile Service: TLMS* |
| 2000 | 1.8 GHz | PCS 2000 |
| | 3.4 GHz | Fixed wireless access |
| | 27 GHz | Broadband wireless access |
| 2001 | 2 GHz | 3G Mobile |
| | 11.7-12.2 GHz | Space Licences |
| | 87/88 MHz | Low Power Open Narrowcasting: LPON – 1st allocation |
| 2002 | 87/88 MHz | LPON – 2 nd to 6 th allocations |
| 2003 | 87/88 MHz | LPON – 7 th to 9 th allocations |
| *) Apparatus licence auction. | | |

Source: ACA.

Table 4.8: Examples of current and potential bands for price-based spectrum allocation

| Band (Main use) | Comment (<i>priority</i>) |
|---|--|
| Current projects | |
| 87.5-88.0 MHz (LPON) | <p>LPON transmitter licences allow for the provision of niche radio broadcasting services, such as tourist and racing information, or ethnic and religious programming.</p> <p>Where there is only one applicant, the ACA offers the applicant the opportunity to acquire a licence for its reserve price; where there is more than one applicant, the ACA holds an open-outcry auction to allocate lots.</p> |
| 500 MHz (Land mobile services) | <p>The 500 MHz band spectrum licences were originally allocated in 1997 by auction. At the close of the allocation some of the auction lots remained unsold and it is this residual spectrum which is now available.</p> <p>Where there is only one applicant, the ACA will offer the applicant the opportunity to acquire a licence for its reserve price; where there is more than one applicant, the ACA will conduct an auction to allocate the licence.</p> |
| 3.4 GHz (Fixed Wireless Access) | Residual spectrum at 3 425-3 492.5 MHz and 3 542.5-3 575 MHz, which remain available from the original 3.4 GHz auction conducted by the ACA in October 2000. |
| Potential projects | |
| 1.5 GHz (Digital Sound Broadcasting) | Subject to outcome of Government policy decisions (<i>medium priority</i>). |
| 2.3 GHz (MDS) | Some Multipoint Distribution System (MDS) licences available in remote areas only (<i>low priority</i>). |
| 2.5 GHz (Mobile communications) | This expansion band for 3G/IMT-2000 is currently used for TOB services and unlikely to be reallocated before end 2004 (<i>low priority</i>). |
| 7.2 GHz (TOB) | Possible conversion of existing Television Outside Broadcast (TOB) licences to spectrum licences (<i>medium priority</i>). |
| 27 GHz (LMDS) | Some 500 MHz suitable for broadband wireless applications remains available for auction in most areas of Australia; subject to demand (<i>medium priority</i>). |
| 40-42.5 GHz (HDFS) | Subject to the development of demand for High Density Fixed Services (HDFS) (<i>medium priority</i>). |
| 47 GHz (HAPS) | Spectrum suitable for deployment of High Altitude Platform Stations (HAPS); subject to international development of this technology (<i>low priority</i>). |
| Geostationary Satellite Networks | The assignments in the BSS Plan at 164E and the FSS Plan at 144.1E are still available; allocation subject to demand (<i>medium priority</i>). |

Source: ACA.

In the auctions described in Table 4.7, the ACA has used traditional open-outcry auctions, as well as the simultaneous, multiple-round auction system, developed by the US Federal Communications Commission (FCC). Through observing Australian and overseas experience with allocation systems, the ACA considers that, as a general rule, the simultaneous, multiple-round auction system is the most appropriate allocation method where there are multiple lots on offer and when the lots are substitutable or complementary.

The attraction of this form of auction is that it enables bidders to form aggregations of spectrum to suit their specific business needs. It also allows bidders to change their bidding strategies, if necessary, during the course of an auction. A simultaneous multiple-round auction will also enable the market's valuation of the spectrum to be revealed. A bidder is therefore not bidding blindly, as he would in a sealed bid tender, but will have knowledge of how other bidders value the spectrum. The ACA acknowledges that the simultaneous, multiple-round auction system is more complex and more time consuming to set up and conduct than other forms of allocation, but considers that these disadvantages are substantially outweighed by the benefits of the allocation method.

The ACA believes that its auction processes have been extremely transparent, and have not had a significant influence on the choice of technology adopted by bidders. Great care in auctioning has been taken to ensure that there is extensive public consultation and that potential bidders have the opportunity to influence the parameters of the auction such as lot size that may impact on technology choice. Where there is a conflict between bidders on lot size, the ACA seeks to adopt the 'lowest common denominator' that enables all potential systems to be accommodated.

Questions have been raised on whether the charge for spectrum licences should consist of an upfront payment or an annual charge. The main reason that the ACA has used upfront charges is that there is a significant risk to the government and taxpayer from annual charges. An example is the so-called 'C block' PCS auction conducted in the USA. The FCC provided in the auction for payments to be made over ten years rather than upfront. In the event, several companies defaulted on payments at the end of the first year. The ACA believes that the risk of defaults needs to be factored in to any decision on the method of payment. With payment upfront, the risk of default is ameliorated by the ACA not issuing the licence. The licence is thus immediately available for re-allocation.

4.3.4 Spectrum trading

Spectrum trading is provided by the *RCA (s.85)* and was introduced in Australia in 1997 [7]. There are two types of tradable licences:

- spectrum licences, which are auctioned and then fully tradable thereafter;
- apparatus licences, which are technology specific and site and service specific. A number of types of apparatus licences have been sold over the years.

The main challenges faced by the ACA with the introduction of spectrum trading were:

- defining spectrum licences in engineering terms for allocating and trading spectrum property, namely trading rules,
- managing interference,
- management of spectrum and the secondary market, and
- the transition from government to industry.

4.3.4.1 Spectrum Licences

The ACA developed the *Standard Trading Unit (STU)* to produce a small commodity-like unit of spectrum that would seem to be easily tradable. The *STU* is like a building block and covers a geographic area authorised by a licence¹⁹. The area is like the floor of the cube and the radio frequency bandwidth is represented by the height of the cube. *STUs* can be stacked vertically to provide increased bandwidth or horizontally to cover a larger area. Ownership of an *STU* cannot be shared and this allows exclusivity of access to be preserved. Sharing is a matter for the access right holder to manage and not the ACA.

Spectrum licences can be aggregated or sub-divided to form new licences. Licensees who wish to trade part of a licence can sub-divide the licence into its component *STUs* and sell them individually or in multiples. A

¹⁹ Australia shares few radiocommunication borders with its neighbours. Its population is concentrated into reasonably small and isolated pockets. Australia's demographic make-up enables the ACA to define market and radiocommunication service areas fairly clearly. Spectrum property concepts would need to be adapted to local conditions.

single *STU* is the smallest unit of spectrum space for which the ACA will issue a licence or register trading. The frequency bandwidth of *STUs* may vary in size depending on the spectrum band in which licences are being issued, but the area grid will be constant for all bands.

4.3.4.2 *Competition*

The ACCC is responsible for competition concerns regarding the acquisition of spectrum. So far, the competition authority has not been faced with any significant competition matters concerning spectrum trading. However, it is believed that smaller users of spectrum would not be comfortable with the idea of leasing spectrum from larger incumbent users of spectrum because of concerns expressed as competition.

4.3.4.3 *Availability of information*

The ACA maintains a searchable public on-line [register](#) of radiocommunication licences to facilitate trading. There also exists an informal market of intermediaries, namely firms that provide spectrum consultancy services like [Market Dynamics](#) and [Futurepace Solutions](#). A private on-line spectrum trading desk has been established by the Australian merchant bank [Macquarie Bank](#). That trading platform is the first centralised Australian secondary market to trade spectrum rights, although there has been limited activity so far.

4.3.4.4 *Observations on spectrum trading in Australia*

At present, there are few countries where spectrum trading has been introduced; the largest of these is Australia.

Further, in Australia, there were approximately 55 trades in spectrum licences in 2001. This can be used as a basis from which to estimate the potential number of trades in public mobile and fixed links, which are the other two areas where trading is likely to occur. Therefore it is assumed that there were around five trades per year in the public mobile sector and 50 trades a year in the fixed links sector.

Trading in spectrum licences has occurred in a number of bands, including the 500 and 800 MHz, 2.3 and 3.4 GHz bands [6]. For example, Television and Radio Broadcasting Services Australia sold its spectrum licences in the 2.3 GHz band to Austar in 2002, while Telstra purchased spectrum in the 3.4-GHz band through the secondary market.

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 [6]. There have been trades in land mobile radio licences and quasi-broadcasting licences such as those for open narrowcasting services. Trading in apparatus licences is often indirect, occurring when businesses are sold with licences attached. (See Box 4.3.)

The following observations are worth noting in respect of spectrum trading in Australia:

- Creation of spectrum licences with division of spectrum into small geographic and frequency units required much work and produced relatively few gains as most trades were in whole licences.
- As a consequence of the liberalisation of technical rules associated with the introduction of spectrum licences giving licensees greater flexibility, trading has been made a little easier although some express the view that it has been slow to develop.
- As a consequence of spectrum trading: a) one company accumulated a number of private business radio licences in order to create a new public network; b) introduction of two-way broadband microwave distribution system was assisted; and c) additional spectrum was made available on a short-term basis for coverage of a major sporting event (Olympic Games in 2000).
- Some claim that spectrum trading is barely occurring in practice for the lack of an actual secondary market.

Box 4.3: Transfer of 2.4 GHz licences from TARBS to Austar

In October 2001, Austar, an Australian radio and television broadcaster with interests in Internet and data communications services, purchased the MMDS (Multimedia Multipoint Distribution Service) licences of TARBS, a pay TV and radio broadcaster targeting ethnic communities. Austar wanted to use this spectrum to provide high speed data services to business and high end consumers.

Nature of Trade

98 MHz of spectrum was transferred in the 2.4 GHz band covering the geographical metro-city areas of Sydney, Melbourne, Brisbane, Canberra, Adelaide and Perth. To enable the change of use from television and radio broadcast to delivering high speed data services, TARBS had to convert its MMDS licences from apparatus licences to spectrum licences and was charged an administrative fee for doing so.

Economic value of trade

Austar paid TARBS A\$140m for the licences, which TARBS had acquired for A\$60m (This included the cost of converting the apparatus licences to tradable spectrum licences.). This represented a gain to TARBS of A\$80m or 133 per cent, excluding transaction costs. Austar also agreed to explore opportunities to distribute TARBS pay TV content over its own networks (and those of its parent UGC), however the value of this commitment is difficult to estimate.

TARBS also incurred additional costs in moving the customers previously served by MMDS to satellite service delivery. These included any additional capital and operating costs in using satellite as opposed to MMDS and reconfiguring and/or replacing customers' TV sets.

Conclusions

Substantial economic benefits were unlocked by this trade and in particular by the fact that a change of use was allowed. The spectrum was more valuable to Austar for delivering high-speed data services than to TARBS in its initial use of broadcasting, therefore economic efficiency was increased.

Source: UK [OFCOM/RA Joint Consultation on Spectrum Trading](#).

4.4 Standards compliance arrangements

Under the *RCA (s.162)*, the ACA is empowered to make radiocommunication standards for the performance of specified devices or the maximum permitted level of radio emissions from devices within specified parts of the spectrum. The aim is to contain interference to and from a range of radiocommunications and non-radiocommunication devices and to protect personal health and safety.

Pursuant to fulfilling this legislative responsibility, the ACA has established a broad standards framework. The framework encompasses regulatory arrangements for radiocommunication equipment, the electromagnetic compatibility (EMC) performance of electronic and other electrical devices, as well as restricting the level of non-ionising electromagnetic radiation (EMR) exposure from intentional emitters.

In each case, technical regulation entails legal provisions requiring compliance with specified mandatory standards. Self-declaration based on an appropriate level of testing, a labelling regime, sample auditing, and prescribed penalties contribute to the basis for ensuring compliance with the standards. This approach minimises the costs of interference investigation and resolution by controlling equipment at the point of supply rather than attempting to resolved interference problems once the equipment is in operation.

The draft standards are developed by [Standards Australia](#) for the ACA through a cooperative process involving industry, government and user representatives. Where possible, the standards are based on existing international or regional equivalents but are only voluntary in nature unless the ACA empowers them through adoption.

Extensive consultation with industry and stakeholders occurs whenever the ACA introduces or amends legal instruments for standards and labelling. Under the *RCA (s.163)*, the ACA must ensure that interested persons have the opportunity to make representations and that due consideration is given to any representation made. Information on impending amendments is advertised in newspapers or mailed to the suppliers on the ACA database. The ACA also consults the [Office of Regulation Review](#) in the development of Regulatory Impact Statements so as to ensure that regulation does not impose undue costs on businesses and the community.

Pursuant to the *RCA (s.182)*, the ACA has introduced the “C-Tick” labelling for equipment suppliers (importer, manufacturer, their authorised agent) as a way of introducing industry self-regulation (see Box 4.4).

Unlike certification and pre-market approval systems utilised in the past by regulators, the ACA’s regulatory arrangements do not require formal certification or approval of products, thus eliminating lengthy delays to market caused by the certification or approval process. The ACA utilise self-assessment by suppliers or accredited assessors. Through a “Declaration of Conformity”, suppliers take responsibility for compliance, while the mandatory regulatory arrangements provide certainty that products supplied to the Australia market meet ACA requirements. The detailed requirements are set out in a series of labelling notices, one for each set of regulatory arrangements (i.e. radiocommunications, EMC, EMR regulatory arrangements) that may be applicable to the different types of communications devices²⁰.

Box 4.4: Compliance labelling using the C-Tick mark



The compliance label indicates that the product complies with the applicable standard and establishes a traceable link between the equipment and the manufacturer, importer or their agent responsible for compliance and for placing it on the Australian market.

Suppliers have a choice of four labelling formats that they may use to identify products. The compliance label has become widely recognised both domestically and internationally as a mark that demonstrates compliance with the ACA’s regulatory requirements.

Source: [ACA’s compliance marks](#).

The ACA ensures the integrity of the regulatory arrangements by conducting post-market audits of compliance records. The costs to suppliers subject to standards include testing, maintenance of compliance records and labelling, compared to a product approval process are minimal. The required documentation by suppliers to demonstrate compliance is in accordance with the level of risk posed to other devices using the radiofrequency spectrum. For the vast majority of products, product testing represents a one-off cost to the supplier and testing may be conducted in-house or by an accredited laboratory.

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 considered to be a model of open, transparent and cost effective standards and compliance development. ACA standards set the minimum performance requirements necessary to minimise interference and optimise use of the radiofrequency spectrum. A key feature of the ACA regime is that standards are set in consultation with manufacturers, importers and suppliers, and this leads to objectives being met cost-effectively to benefit consumers as well as spectrum users.

4.4.1 Radiocommunication equipment regulatory arrangements

To effectively manage the radiofrequency spectrum, the ACA has introduced a radiocommunication equipment compliance scheme (see Figure 4.5) that ensures that radiocommunication products meet relevant mandatory standards before such products are placed on the Australian market. The scheme has separate levels of compliance and is based on a declaration process. The manufacturer, importer or authorised agent must also affix a ‘compliance label’ to their product and hold documents supporting claims of compliance with the standards (see Box 4.4). For radiocommunication equipment, the compliance and labelling

²⁰ Certain products such as computers containing wireless LAN cards may have to meet the requirements of both radiocommunications and EMC regimes and also the EMR regime requirements. Under the *Telcom Act*, similar regulatory arrangements and technical telecommunication standards would apply to those customer equipment or customer cabling that can be connected to a public telecommunication network operated by a carrier or carriage service provider. Telecommunication customer equipment are labelled with an A-Tick instead of the C-Tick label to demonstrate compliance with additional ACA telecommunication regulatory requirements.

arrangements complement the ACA's licensing conditions for users and operators of devices by addressing potential interference issues at the point of supply.

Due to the world's regional differences, land-based equipment standards from around the world are often incompatible as they are developed for totally different radiocommunication environments. Australian radiocommunication standards set the minimum performance requirements to meet Australia's spectrum planning needs and the management of interference.

4.4.2 Electromagnetic compatibility regulatory arrangements

To deal with the problem of Electromagnetic Interference (EMI) from a wide range of electrical and electronic products, the ACA has introduced the Electromagnetic Compatibility (EMC) regulatory arrangements²¹. Factors that strongly influenced the need to implement EMC regulatory arrangements included the need to:

- protect the radiofrequency spectrum from electromagnetic interference;
- preserve and extend export market opportunities for Australian electrical and electronic products;
- enhance the level of skills in Australia, particularly in the area of product design and testing.

To ensure compliance with the EMC regulatory arrangements, suppliers must satisfy four basic requirements. Depending on the compliance level applicable for the product, they must establish sound technical grounds for product compliance; make and hold a "Declaration of Conformity"; prepare and keep compliance records; and label the product as directed (see Figure 4.5).

The [EMC standards](#) state the minimum requirements to prevent interference from products used in the domestic, commercial and industrial environments. Only conducted and radiated emissions, the major contributors to interference, have been mandated under the standards. To establish compliance with the regulatory arrangements, suppliers must demonstrate that products meet relevant standards before such products are placed on the market. From 1 January 1999, all products that fall within the scope of the regulation are subject to compliance with the arrangements and must be appropriately labelled.

Where possible, standards are harmonised with those implemented internationally to prevent the need for retesting products before they can be sold in Australia or exported. With this regulatory arrangement in place, products tested in Australia are acceptable for sale in an importing country without delay or regulatory impediments to trade²². Therefore, the EMC regulatory arrangements have provided the confidence and certainty required for the government to participate in bilateral and multilateral mutual recognition arrangements (MRAs) to align Australia with its major trading partners. The alignment of compliance procedures with other countries will assist trade by facilitating the movement of goods and services.

The ACA has been considered a pioneer in promulgating self-regulation in this area. Many countries, including New Zealand, EU, and in the Asia Pacific region have adopted the Australian model and implemented similar self-regulatory arrangements.

In the year 2000, the ACA reviewed and consulted with industry to improve EMC arrangements, and the legislative instruments have been updated in the year 2001. Harmonisation with New Zealand under the Trans-Tasman Mutual Recognition Arrangement (TTMRA) was obtained.

4.4.3 Electromagnetic radiation regulatory arrangements

The ACA regulates human exposure to electromagnetic radiation (EMR) emitted by radiocommunication transmitters. Portable transmitters with integral antennas, such as mobile telephones and hand-held two-way radios, are regulated at point of supply. Responsibility for compliance rests with the manufacturer or importer. Other transmitters, such as mobile telephone base stations and television broadcast towers, will be regulated through licence conditions and the responsibility for EMR compliance will rest with the licensee.

²¹ Introduced in 1997, the Australian EMC regime was also in part a response to the adoption by the European Union of the Electromagnetic Compatibility Directive (89/336/EEC). Compliance with the ACA scheme was originally on a voluntary basis, but since 1999 compliance has been mandatory for all applicable products on the Australian market.

²² From 1 November 2001, the EMC arrangements in Australia and New Zealand were harmonised by adopting the same suite of EMC standards and similar compliance labelling requirements. Australia also has MRAs with the EU, Switzerland and APEC economies on EMC.

The possibility of health effects associated with human exposure to radiofrequency EMR has long been a topical issue in the Australian community. Using its standards-making powers under the *RCA*, the ACA has developed regulatory arrangements to address these concerns.

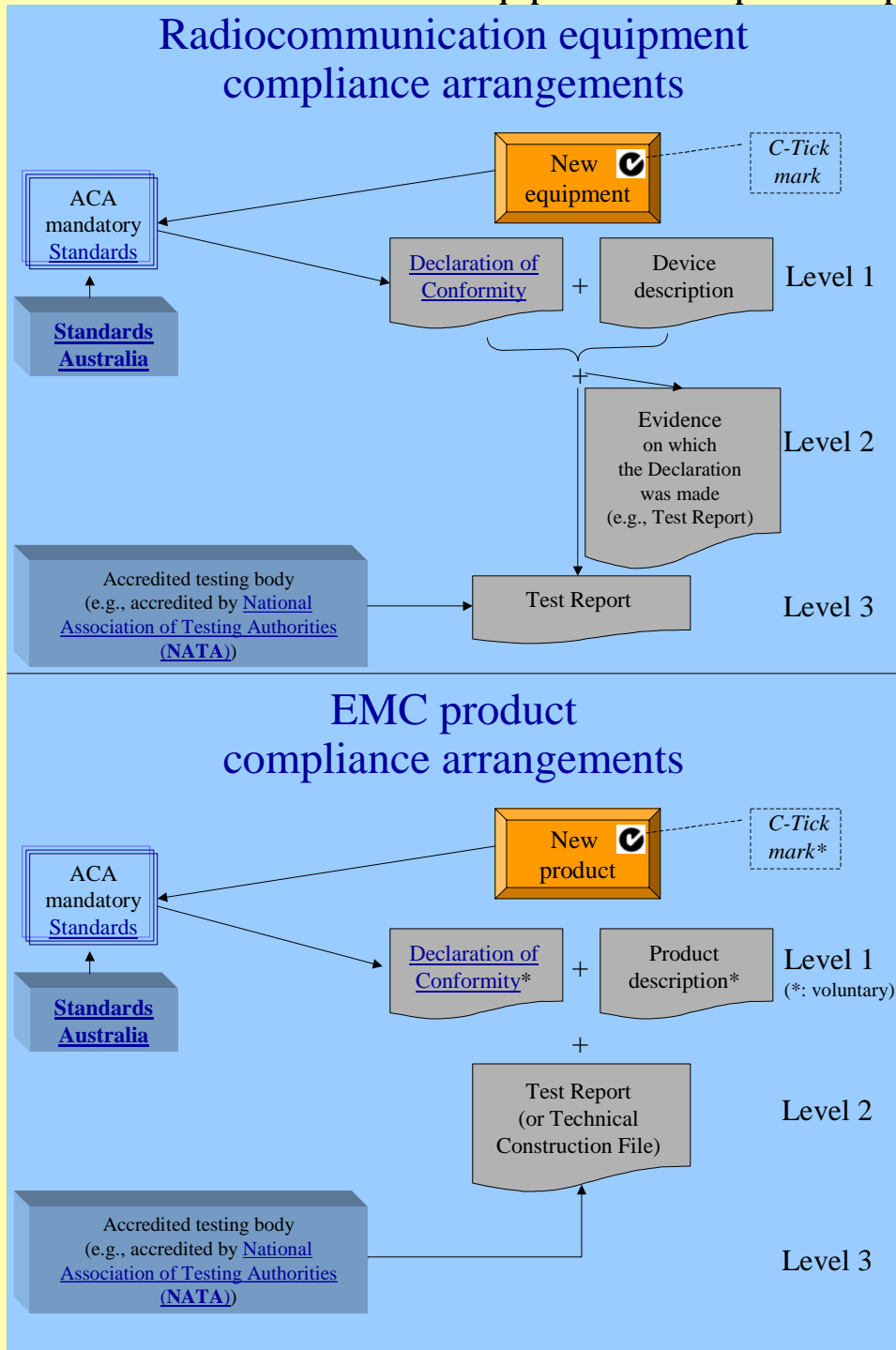
The basis of the EMR arrangements is a mandatory standard based on the exposure limits as well as a test methodology and compliance requirements. The [standard](#) sets maximum limits for human exposure to radiofrequency fields from mobile and portable transmitting equipment (mobile/cordless/satellite phone handsets and cradles and all mobile phone base stations) in the frequency range 800-2 500 MHz. It was developed by Standards Australia and Standards New Zealand following a review of the relevant scientific literature and is in accord with the recommendations of the World Health Organization²³, the International Radiation Protection Association ([IRPA](#)), and other major national reviews and guidelines.

The ACA's EMR regulatory regime also includes the Australian Communications Industry Forum ([ACIF](#)) Industry code [Deployment of Radiocommunications Infrastructure](#) (the *Code*) which came into full effect in April 2003. The *Code* provides for the adoption of a precautionary approach to the siting, design and operation of radiocommunication infrastructure such as mobile phone towers by carriers. It also establishes obligations for consultation procedures and mandatory notification to local government of all facilities, including 'low impact' facilities. Registration of the *Code* by the ACA means that it is now compulsory for all mobile phone carriers to abide by it. Carriers that do not comply can be directed to do so by the ACA and face fines.

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. Secondly, the standards provision 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.

²³ WHO [International EMF Project](#).

Figure 4.5: ACA's schemes for radiocommunication equipment and EMC product compliance



Source: [ACA](#).

5 Spectrum uses and applications

5.1 Licensing of the 2 GHz band (3G/IMT-2000)

In March 2001, the ACA auctioned spectrum in the 2 GHz band. Although the licences auctioned were spectrum licences, and may therefore be used for any number of different technologies, the 2 GHz spectrum auction was designed and completed with the needs of 3G investors/suppliers in mind.

Applications to participate in the auction to allocate licences to use the spectrum opened in early December 2000, once the Government and the ACA announced the reallocation of spectrum in the 2 GHz bands in anticipation of that spectrum being used for 3G services and that licences to use the spectrum would be awarded using the simultaneous ascending auction system. The Government imposed competition limits under which no bidder could acquire more than 25 per cent of the spectrum available in metropolitan areas and no more than 50 per cent of the spectrum available in regional areas. These limits were intended to allow a minimum of four licence holders (or competitors) in metropolitan areas and two in regional areas. The spectrum was divided into 58 lots.

Table 5.1 shows, in chronological order, the history of consultation and key events involved in the development of the 2 GHz spectrum licences.

Table 5.1: History of the 2 GHz (3G/IMT-2000) auction

| Period | Subject & Actions |
|-------------------|--|
| 1998 | Spectrum blockage - Government embargoed the spectrum from 1 900-1 980 MHz and 2 110-2 170 MHz to prevent further licensing in this band. |
| May-Dec. 1999 | Planning Issues - ACA RCC Working Group to consider and report on spectrum planning issues associated with the proposed deployment of 3G systems in Australia. - WG Report . |
| May-June 2000 | Public Consultation on 3G spectrum - Invitation to Comment (discussion paper on possible allocation options for the 1 900-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz bands). - Summary of submissions. |
| August-Sept. 2000 | Technical framework - ACA Technical Liaison Group (TLG) with industry to assist in developing the technical framework for spectrum licensing in the 2 GHz bands. |
| July-October 2000 | Reallocation declarations - ACA draft spectrum reallocation declarations for the 2 GHz band for public comment. - summary of submissions - Minister signs reallocation declarations for the 2 GHz band (which defined the frequency bands and the geographic areas to be allocated by means of a price based allocation (auction) and the time period by which pre-existing licensees had to cease operation). |
| Sept-Nov. 2000 | Packaging options - ACA's packaging options paper - proposed lot packaging |
| December 2000 | Allocation scheme - Spectrum licence Determination (detailed auction requirements) |
| March 2001 | Auction - Closed at round 19. |

Source: [ACA](#).

The auction raised A\$1.17 billion from 48 (of the 58) lots of spectrum sold to the following successful bidders: Telstra (A\$302.02 million); Vodafone Pacific (A\$253.55 million); Optus (A\$248.87 million); Hutchison (A\$196.10 million); 3G Investments/Qualcomm (A\$159.00 million); CKW Wireless/ArrayComm (A\$9.45 million) (see Figure 5.1).

To put the Australian auction in perspective, the price paid by Telstra, for example, represented less than 10 per cent of that paid by comparable carriers in the United Kingdom and Germany and 25 per cent of the amounts paid in Italy and the Netherlands for 3G spectrum last year [11] (see Figure 5.2).

Information on the status of deployment of 3G/IMT-2000 systems in Australia is provided in Box 5.1.

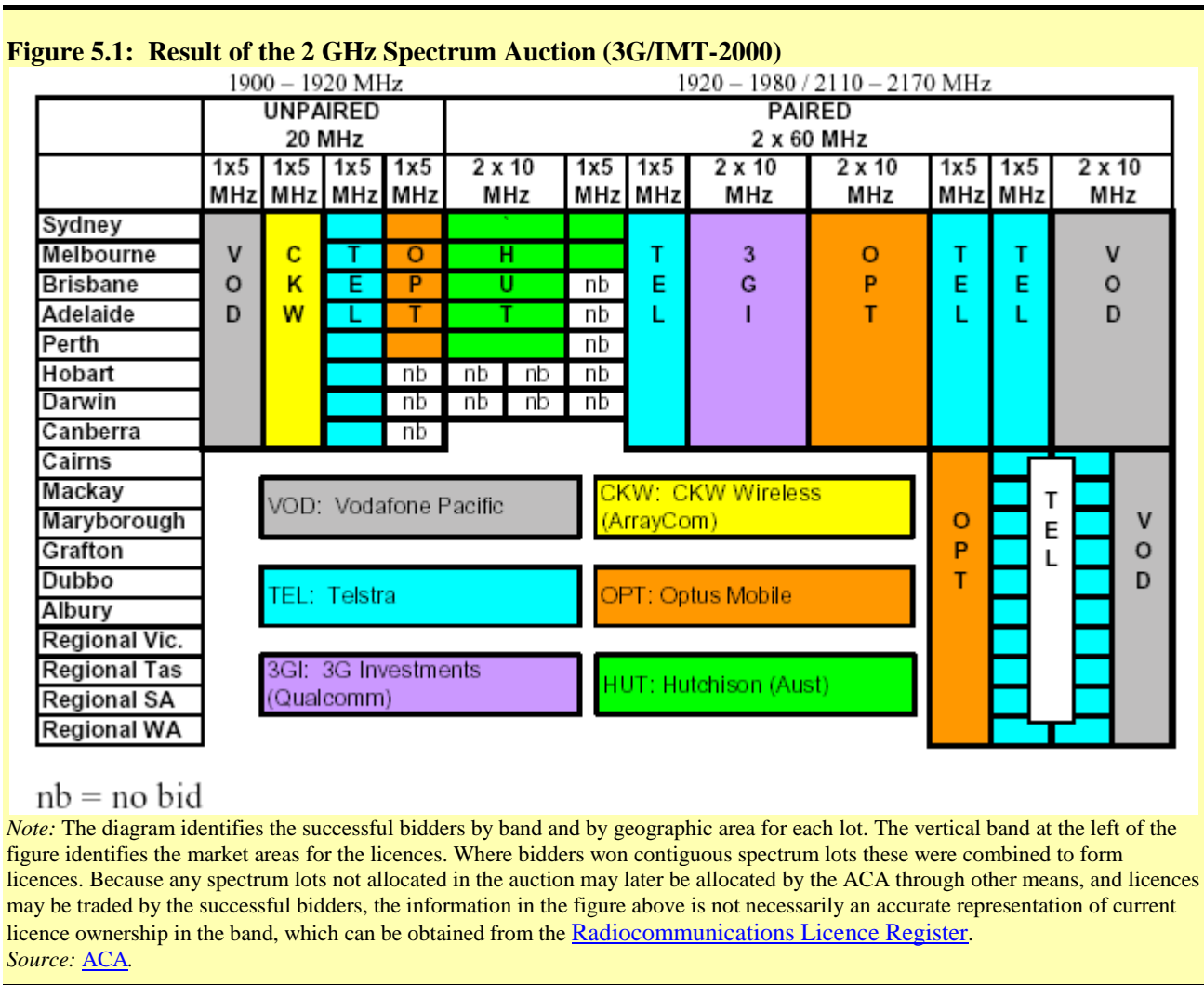
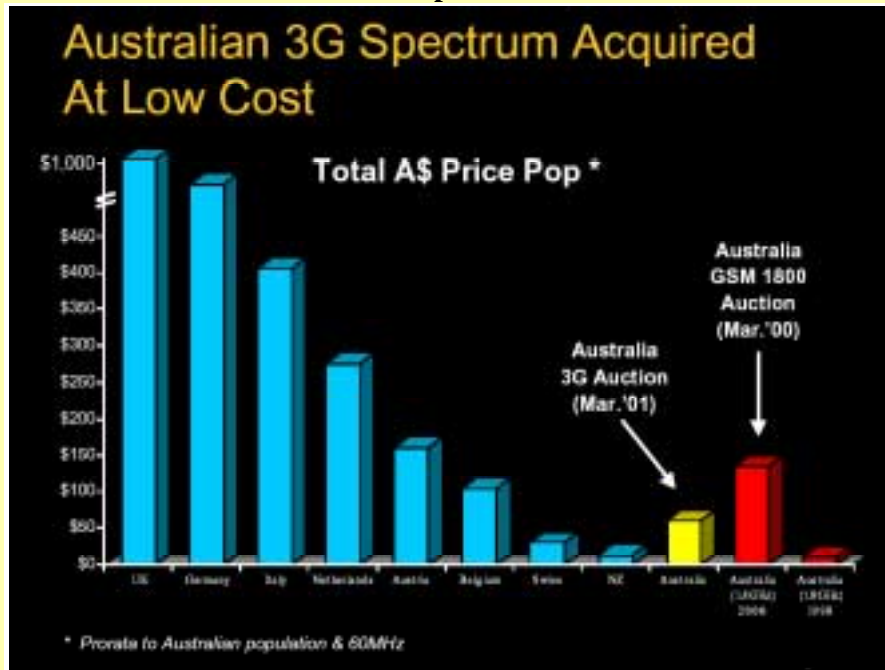


Figure 5.2: Australian 3G/IMT-2000 auction compared with others



Source: [Optus](#).

Box 5.1: IMT-2000 deployment in Australia

Telstra

Telstra currently operates a GSM network (all capital cities; some regional coverage) and a CDMA network (all capital cities; significant regional coverage). In late 2002 it upgraded its 800 MHz CDMA network to a CDMA 1xRTT capability. The service, marketed as [Telstra Mobile Loop](#), was initially targeted at business users but is now trying to attract non-business (e.g. residential users). Service features include: real-time chat; multimedia messaging; on-line games; information services (e.g. sport, weather, directory, finance); email. Telstra has not yet revealed publicly its plans to roll-out a W-CDMA network.

Hutchison

Hutchison Telecommunications currently operates a (2G) CDMA network in major Australian capital cities. In March 2003, Hutchison, under the brand name '3', began offering its W-CDMA service. The '3' service is accompanied by a very aggressive marketing and pricing campaign. The full range of applications and services are available in the major capital cities of Melbourne, Sydney, Perth, Adelaide and Brisbane, as well as Canberra and the Gold Coast. Key features of the 3 service include: video-on demand (including major sporting events); video-telephony; instant messaging; email retrieval; information services (e.g. finance, weather). Subscriber numbers are estimated to be close to 50,000.

Vodafone

Vodafone currently operates a GSM network in all Australian capital cities, and some regional areas. Although Vodafone purchased spectrum in the 2 GHz auctions, it has not revealed publicly any definite plans for rolling out its own IMT-2000 service, other than to suggest that it may offer IMT-2000 services by mid-2005. However, Vodafone is a member of the Personal Broadband Australia consortium (see below).

Optus

Optus currently operates a GSM network in all Australian capital cities, and some regional areas. Like the other incumbent 2G mobile carriers in Australia, it purchased spectrum in the 2 GHz auctions. Optus has been cautious in its public statements about its plans for rolling out an IMT-2000 network in Australia (Optus' parent company, SingTel is rolling out an IMT-2000 network in Singapore). However, Optus has been trialling a W-CDMA network in certain major capital cities without committing publicly to a timeframe for commercial deployment.

CKW Wireless/Personal Broadband Australia

CKW Wireless purchased 5 MHz of unpaired spectrum in the 2 GHz spectrum auctions. CKW Wireless has since formed a consortium with OzEmail (one of the largest Internet service providers in Australia), Crown Castle (which owns and maintains mobile infrastructure on behalf of mobile carriers), Vodafone, UTStarcom (manufacturer and supplier of IP switching solutions) and TCI (specialist project management group providing turnkey solutions to communications industries) to offer broadband mobile Internet access using the ArrayComm 'i-Burst' technology. The consortium, known as Personal Broadband Australia ([PBBA](#)) has completed a trial in Sydney involving more than 400 participants, who received unlimited wireless broadband access over 2-month time. PBBA has deployed for the trial six base stations providing network coverage of more than 100 km² and reaching 1 million people. PBBA is working to begin commercial services with customers by end 2003.

Source: [APT IMT-2000 Forum](#), November 2003.

5.2 Licensing of the 3.4 GHz band (wireless access systems)

In October 2000, the ACA auctioned spectrum in the 3.4 GHz band. The licences auctioned were spectrum licences and therefore successful bidders can use the spectrum for a range of purposes, including broadband Internet delivery or wireless local loop services.

The 3.4 GHz auctioned spectrum auctioned comprised a total of 100 MHz in each of 14 major town and city areas and 65 MHz in each of five regional areas, as standard size lots of 3.5 MHz with the exception of two lots of 4.5 MHz in each of the 19 market areas:

- 35 MHz of A Block spectrum (i.e. 3 425-3 442.5 MHz and 3 475-3 492.5 MHz) in the major population areas of Adelaide, Albury, Bendigo, Brisbane, Cairns, Canberra, Hobart, Launceston, Melbourne, Perth, Rockhampton, Sydney, Toowoomba and Townsville; and

- 65 MHz of B Block spectrum (i.e. 3 442.5-3 475 MHz and 3 542.5-3 575 MHz) on a nationwide basis except in north-western Australia.

Competition limits for the 3.4 GHz band auction were established as follows:

- a zero limit on Telstra for major population areas (A and B Blocks) and a 22 MHz limit in each of the 3 442.5 – 3 475 MHz band and the 3 542.5 – 3 575 MHz band (B Block) for each auction lot area which is outside the major population areas; and
- a 67.5 MHz limit (A and B Blocks) on each other bidder for each auction lot area in a major population area (no other restriction will apply to such bidders in areas other than major population areas).

The purpose of these limits were to exclude Telstra from both the A and B Blocks in major population areas but enabled it to bid for a total of 44 MHz of spectrum in regional areas. All other bidders were restricted to 67.5 MHz in major population areas, with no limit in regional areas. The rules were determined after consultation with the ACCC and were designed to minimise any possible breach of the anti-competitive provisions of the *Trade Practices Act*.

The auction closed after 54 bidding rounds and raised A\$112.17 million for 95 per cent of the 482 lots on offer to the following successful bidders: AKAL (A\$95.28 million), Austar (A\$14.07 million) and Walker Wireless (A\$2.81 million) (see Figure 5.3). Information on the status of licensees' deployment plans of BWA systems in Australia is provided in Box 5.2.

On 2 July 2002, the ACA invited applications for the allocation of the remaining 22 spectrum lots in the band [17]. Although the ACA received one application for the remaining lots, the applicant declined to accept the ACA's offer of allocation of licences at predetermined prices. Those prices were based on the average of the sale price of similar lots in the auction conducted in October 2000, discounted to reflect the shorter licence term now available. On 29 October 2002, the ACA again publicly invited applications from interested parties for the allocation of the 22 residual lots at the same predetermined prices. The residual lots remained unallocated on 30 June 2003. The lots were offered to the market on a continuous or rolling basis, with applications closing on the last working day of each month and those received after the closing date processed in the following month's round. If a single application was received for a lot or lots, allocation was to be at the predetermined price. In the event of more than one applicant for any lot or lots in any one round, the ACA was to allocate those lots by auction.

Box 5.2: Broadband Wireless Access (BWA) deployment in Australia

Unwired

[Unwired Australia Pty Ltd](#) holds (via a wholly owned subsidiary Akal Pty Ltd) national 3.4 GHz licenses, covering approximately 95 per cent of the Australian population. In the spectrum auction conducted by the ACA in late 2000, Unwired purchased 2 x 32.5 MHz paired in the 3.4 GHz band, and in 2001 acquired 2 x 17.5 MHz from Austar.

Unwired now owns close to 100 per cent of the 100 MHz of 3.4 GHz spectrum that was made available in Sydney and Melbourne, and a majority of the spectrum in Australia's other capital cities. Unwired uses this spectrum to participate in the rapidly expanding broadband Internet market by rolling out Fixed Wireless Access (FWA) and by delivering bundled voice and broadband access services to carriers and ISP's (Internet Service Providers) (retail service providers) for residential customers, SOHO (Small Office/Home Office) and SME (Small and Medium Enterprise) customers.

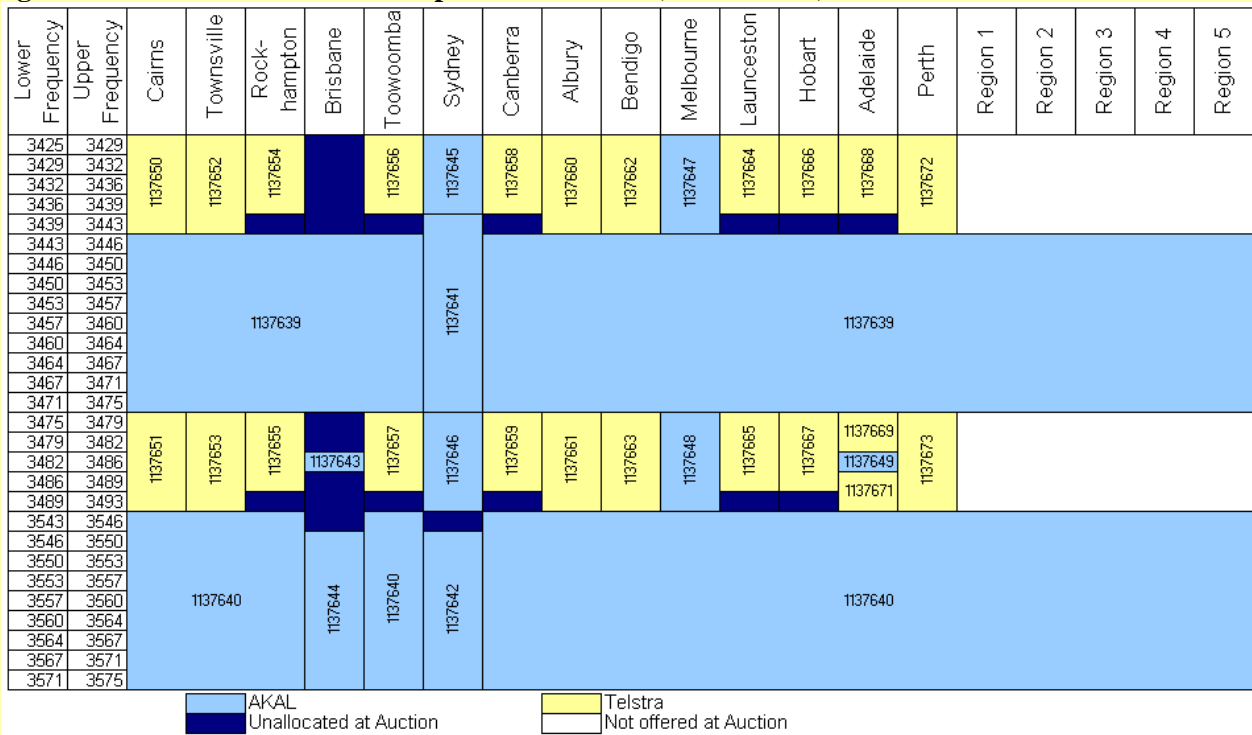
Unwired plans commercial launch of its fast broadband Internet service for residential and business customers in Sydney using next generation wireless technology by the end of first quarter 2004.

Telstra

Telstra is currently using its spectrum to provide FWA services to regional communities beyond the reach of ADSL. For this purpose, Telstra has registered with the ACA devices in the 3.4 GHz band, mainly in low-density areas, and is leasing spectrum from Unwired to supplement its own licences in that band.

Sources: ACA, Unwired and Telstra.

Figure 5.2: Result of the 3.4 GHz Spectrum Auction (as of 31.1.02)



Note: The diagram identifies the successful bidders by band and by geographic area for each lot, showing the licence numbers relating to all spectrum lots sold.. The horizontal band at the top identifies the market areas for the licences. Where bidders won contiguous spectrum lots these were combined to form licences. Because any spectrum lots not allocated in the auction may later be allocated by the ACA through other means, and licences may be traded by the successful bidders, the information in the figure above is not necessarily an accurate representation of current licence ownership in the band, which can be obtained from the [Radiocommunications Licence Register](#).

Source: [ACA](#).

5.3 Satellite

The importance of satellites to communications, space science and navigation services in Australia is illustrated by the different and constantly growing type of applications, particularly for the provision of broadcasting and broadband services to many underserved areas of the country. Currently, the following are the main satellite communications services available in Australia:

- Direct-to-Home television (DTH): remote area commercial free-to-air services and pay-TV; uses Ku-band (11-12 GHz);
- Mobile-Satellite Service (MSS): uses geostationary and non-geo (GlobalStar and Iridium) satellite based networks (Optus MobileSat and Inmarsat Mini-M); uses L-band (1.5/1.6 GHz);
- Broadband: one-way and two-way high-speed Internet access.

Table 5.2 shows the list of commercial satellite networks serving Australia.

A distinct use of satellites in Australia relates to AsiaSpace Ltd., which is the Australian subsidiary of [WorldSpace](#) Corporation, a USA-based global satellite digital audio broadcasting (DAB) operator. AsiaSpace currently operates the Australian notified satellite AsiaStar (ITU name is ASIABSS), which is delivering DAB and multimedia services to Asia-Pacific countries. The WorldSpace system transmits within the 1 452-1 492 MHz broadcasting-satellite service band. The uplinks (or feederlinks) for the Asiastar satellite uses the 7 025-7 075 MHz band and are operated by AsiaSpace at their headquarters located in Melbourne downtown. AsiaSpace holds apparatus (Fixed Earth) licences for the operation of the 7 GHz band service for its Melbourne earth station.

Table 5.2: Satellites (geostationary) serving Australia

| Operator | Satellites (orbital position) | No. of transponders (frequency band) |
|---|---|---|
| Optus | Optus B1 (160E) Optus B3 (152E) Optus A3 (164E) Optus C1 (156E) Optus D1 (160E) (service: 2005) Optus D2 (156E) (service: 2006) | 15 (L & Ku-bands) 15 (L & Ku-bands) 15 (Ku-band) 20 (UHF*, X*, Ku, Ka*-bands) 24 (Ku Band) 32 (Ku band and BSS Plan) |
| PanAmSat | PAS-2 (169E) PAS-8 (166E) | 12 (C & Ku-band) 24 (C & Ku-band) |
| Asia Satellite | AsiaSat 3S (105.5E) AsiaSat 4 (122E) | 8 (C & Ku-band) |
| Intelsat | IS-604 (178E) IS-802 (174E) IS-702 (55E) IS-701 (180E) IS-906 (64E) | 64 (C-band), 24 (Ku-band) 64 (C-band), 16 (Ku-band) 42 (C-band), 24 (Ku-band) 42 (C-band), 24 (Ku-band) 72 (C-band), 22 (Ku-band) |
| New Skies Satellites | NSS-703 (57E) NSS-6 (95E) | 26 (C-band), 10 (Ku-band) 17 (Ku & Ka-bands) |
| APT Satellite | APSTAR 5 (138E) | 38 (C-band) |
| Shin Satellite | IPSTAR (service: 2004) | 18 (Ku-band) |
| *) Defence payload: UHF (290-320/240-270 MHz), X (7.9-8.4/7.25-7.75 GHz), Ka (30.0-31.0/20.2-21.2 GHz) bands. | | |

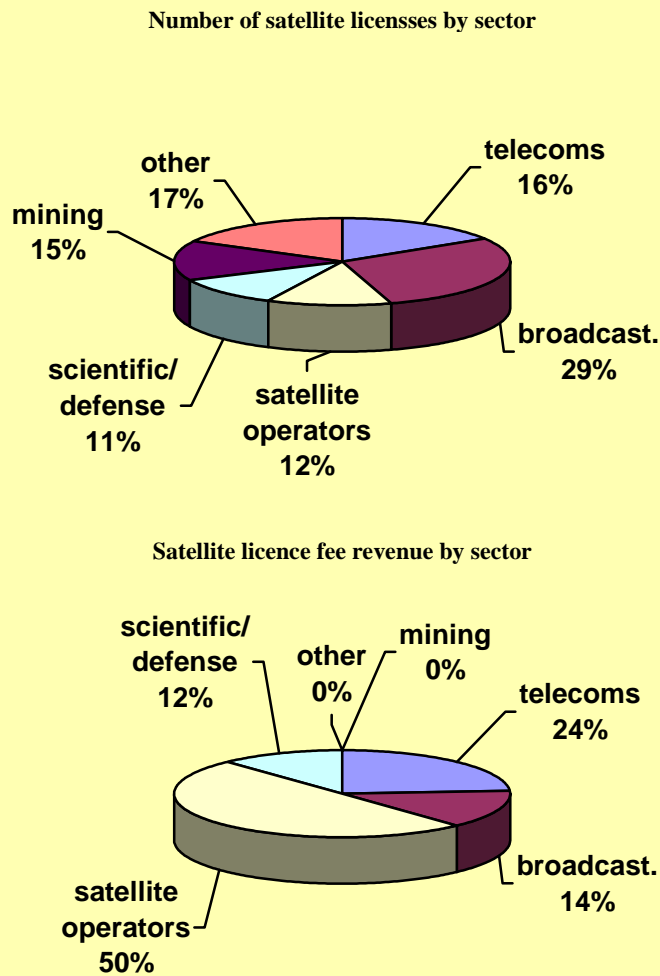
Source: ACA.

As seen in section 4.3.1.4, satellite network regulatory arrangements are based on the ground segment and space segment licensing. The latter is normally based on the Class Licence scheme, which is supported in a specified set of frequency bands²⁴.

The services provided under satellite licences tend to fall into two distinct categories of applications—services to end users such as broadcasting, telephony and Internet access, and backbone services linking into or augmenting the terrestrial backbone network. The majority of these are in the broadcasting (29 per cent) and telecommunication sectors (16 per cent). Figure 5.4 shows the breakdown of satellite licences by sector.

²⁴ Although Australian allocations are broadly aligned with the ITU requirements for Region 3, a number of variations exist due to the unique needs of Australian spectrum users. An example of a variation between the ITU Table of Frequency Allocations and the Spectrum Plan is the spectrum allocation between 3 400 and 3 600 MHz. For Region 3, the former provides for fixed-satellite (space-to-Earth) primary and radiolocation secondary while the allocations for Australia are radiolocation primary and fixed-satellite (space-to-Earth) secondary.

Figure 5.4: Breakdown of satellite licence number and revenue by sector



Source: [ACA Connections, March 2003](#).

Table 5.3 shows the current list of licensees under the Class Licence arrangement (see section [4.3.1.4](#)).

Table 5.3: Licensees of current space licences (in the Class Licence spectrum)

| Licensee (service provider) | Spectrum range | Application |
|--|---------------------------------|--|
| ARBT Pty Limited | 12.5 GHz | Internet services |
| Comdek Limited | 14/12.5 GHz | Fixed and transportable voice and data services |
| CSIRO | 313 & 400 MHz | Science services |
| Department of Defence | 1160, 1220 & 1570 MHz | Defence |
| FOXTEL Management Pty Ltd | 11.9 GHz | BSS Plan at 152°E |
| Gatecom Australia Pty Ltd | 1 985–2 010 /2 170–2 200 MHz | |
| Inmarsat Ltd | 1.5/1.6 GHz | Phone, fax and data communications for Ships, vehicles, aircraft & portable terminals. |
| Iridium Australia LLC | 1.6 GHz | Mobile satellite communications |
| KITComm Pty Ltd | 1.5/1.6 GHz | Data communications |
| KJ Kirkby and Associates Pty Ltd | 12.6 GHz | Internet services |
| LBF Australia Pty Ltd | 11.6 GHz | DTH television |
| Localstar Holdings Pty Ltd | 1.6/2.5 GHz | Mobile satellite communications (Globalstar) satellite |
| Mediasat Pty Ltd | 14 GHz | Broadcasting & IP data services |
| New Skies Networks Pty Ltd | 14/12 GHz | Voice, data, fax, video and internet services |
| Optus Networks Pty Ltd | 1.5/1.6 GHz & 14/12 GHz | Mobilesat terminals, DTH television, point to point communications, VSAT networks |
| Orbcomm Australia Pacific Limited | 137 MHz, 149 MHz & 400 MHz | Data & messaging communications |
| Television & Radio Broadcasting Services Australia Pty Ltd | 12 GHz | TV broadcasting |
| Telstra Corporation Ltd | 14/12 GHz | |
| TVB (Australia) Pty Ltd | 12.5 GHz | TV broadcasting |

Source: [ACA](#)

5.4 Television Outside Broadcast services

Television Outside Broadcast (TOB) services provide temporary wideband point-to-point links, principally in support of television broadcast events. Such events are normally of a short-term nature, ranging from a few minutes (ENG) up to several days or longer (e.g. sporting events and the special case of the 2000 Olympics). Accordingly, although TOB services are classified as fixed services, their nomadic operational characteristics set them apart from other point-to-point fixed applications.

TOB services are normally licensed on an area-wide basis, either as individual apparatus licences authorised to operate within a certain distance of a defined location as a “TOB System Licence” for a specified location(s) or a “TOB Network Licence” providing for the use of unspecified number of apparatus Australia

wide. TOB Network Licences are allocated to the three commercial TV networks (TEN, Nine and Seven) and the national TV network (ABC). They are licensed under the ACA *Radiocommunications Licence Conditions (Fixed Licence) Determination 1997*²⁵.

Discussions on revised arrangements for TOB services in the 7.2 GHz band were concluded this year [17]. New arrangements that come into force in 2005 are designed to give broadcasters more flexibility in implementing future digital technology, including high definition television. The arrangements also take account of two other important users of the band:

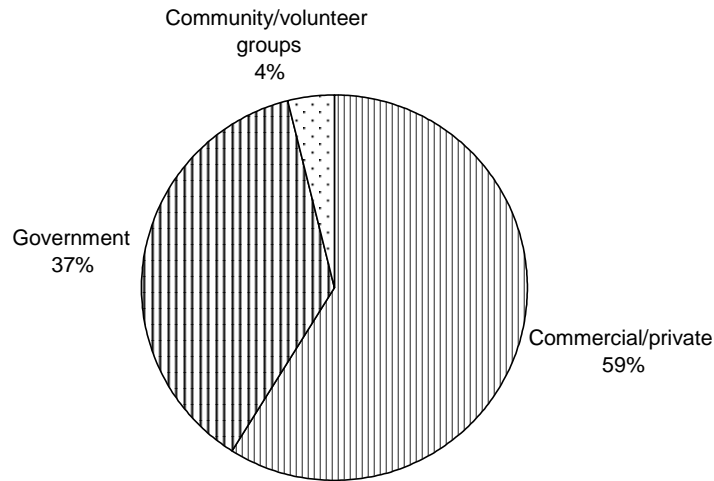
- the Department of Defence, which will use a portion of this band for defence satellite operations via the Optus C1 spacecraft; and
- the space research community, which uses a portion of this band for communications for near Earth and deep space missions.

In Australia and a number of other countries, the band 2 520-2 670 MHz is used by TOB fixed service systems, including ENG, similar itinerant broadcast support point-to-point applications and radio cameras. The current Australian 2.5 GHz (2 450-2 690 MHz) analogue ENG RF channel arrangements provide for eight 28 MHz channels. Australian broadcasters are assessing the migration path from analogue to digital technology, but significant migration is subject to the availability of equipment that meets the user requirement for ENG. As the proposed 2.5 GHz band is now a widely accepted ITU-R channel arrangement, suitable equipment products are readily available. However, this band has been selected for other uses including broadcasting satellite using non-geostationary satellites, and it was further identified in ITU to terrestrial and satellite based IMT-2000 mobile services. The spectrum sharing among the various services competing for this band is being studied by an ITU expert group²⁵.

5.5 Non-commercial users of spectrum

Non-commercial users of spectrum (including government, community and volunteer groups) comprised 41 per cent of all frequency assignments in 2001 (see Figure 5.5). 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.

²⁵ In anticipation of a possible future requirement to relocate ENG services, WRC-03 considered a proposal initiated by the Australian broadcasting industry to study the possibility of a harmonised international band for ENG and TOB. A status report on the subject prepared by the ITU-R will be provided to WRC-07.

Figure 5.5: Frequency assignments, by type of user (March 2001)

Source: ACA.

Non-commercial users of the spectrum are treated differently from other spectrum users under current arrangements. For example, Defence and free-to-air broadcasters are reserved spectrum in the *Spectrum Plan*. Other users may seek fee exemptions or concessions from the ACA (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 the science service community) argue that they too should be treated differently because their work has public benefits and is non-commercial.

5.5.1 Defence

According to the *RCA (s.30(2)(b))*, the *ACA Spectrum Plan* must designate one or more bands to be used primarily for the general purposes of Defence ([Department of Defence](#)). However, these bands are not 'exclusively' for defence use. Nevertheless, it remains the expectation of Defence that very little civilian use will be made of the bands designated for defence, and that such civilian use will normally be transient and limited to special events.

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). Some defence allocations are placed on a 'classified' register, which is not publicly available.

The bands identified for defence are insufficient to support the totality of defence use of the spectrum. As a consequence, major Defence deployments and exercises must make extensive, but temporary, use of spectrum usually used by the civilian community. The planning and coordination of this is a significant issue and, as the use of the spectrum throughout Australia by the civil community increases, it is becoming progressively more difficult to satisfy military requirements. Additionally, the requirement for Defence to coordinate its temporary demand for civilian spectrum could betray the intent and nature of impending military operations and, for security reasons, therefore make coordination inherently problematic.

Nearly all defence spectrum use is subject to apparatus licencing. However, it is Defence's view that the existing apparatus licensing categories are best suited to civil situations and often do not readily meet the needs of Defence. An example is the difficulty of licensing telemetry transmitters on missiles communicating to a ground station. This telemetry facilitates essential test and evaluation activities by transmitting performance data from the missile under test to a ground station where it is recorded for subsequent analysis. The transmitter on the missile does not use aeronautical or radiodetermination frequencies and therefore could not be authorised by an aircraft licence or an aeronautical licence. The only option is to license the missile with a land mobile licence, which is used for applications such as taxi radios.

Defence has particular difficulties with the spectrum licensing regime, since it is very difficult for Defence to exploit spectrum licensed spectrum when it needs to. Unlike the apparatus licensing regime, much of the responsibility for managing interference is with the spectrum licensee. The mobility attributes of many Defence applications creates a situation where Defence would be required to coordinate with a wide variety of individual spectrum licensees before the spectrum subject to licensing can be used. This is impracticable for logistic and security reasons.

Defence pays licence fees for apparatus licences, calculated on the same basis as other apparatus licences. Defence pays around A\$8.4 million each year for spectrum reserved in the defence bands. It pays a further A\$979,000 for spectrum it uses outside the defence bands and A\$245,000 for classified assignments²⁶. It may be difficult to make judgements about opportunity costs in the defence environment, for example security reasons may prevent full disclosure of the purpose for which spectrum is used. It may also be difficult to fully 'price' services provided for defence.

The ACA believes that charges for defence spectrum should continue to be made on the same basis as for other users. This provides the best assurance that there will be an incentive for Defence to make efficient use of spectrum, including surrendering spectrum that it no longer requires. (It should be noted that there have been several examples where Defence has been willing to give up or share spectrum.) If there is still a concern about the adequacy of pricing signals, the ACA notes that the July 2001 Report of the Radiocommunications Review, recommended that "arrangements for the Defence use of spectrum should be reviewed periodically by the ACA and the Department of Defence" [12, p.50]. Such a periodic review could help to ensure that the need for Defence use of spectrum is subject to continuing scrutiny.

5.5.2 Emergency services

In Australia, emergency services for public protection and disaster relief are primarily a function of States and Territories [14]. As a consequence, spectrum for emergency services is generally organized by individual State and Territory Governments, or by individual agencies (see Box 5.3). In the late 1970s, a block of 64 two frequency land mobile channels in the 450-470 MHz band was arranged on a national basis for emergency services following on from issues arising after the 1974 Cyclone Tracy devastation of the city of Darwin, in the northern part of Australia. ITU allocations for distress and safety related services, such as EPIRB frequencies, are respected.

Most Australian States currently have a number of narrowband analogue mobile systems in operation, primarily in the 150 MHz and 400 MHz land mobile bands (the 400-430 MHz band is where most Australian emergency service communications has been focusing their radio needs in recent years). Planning of new systems or expansions are now focusing on digital implementations. One Australian State has chosen to implement a system designed to meet the [ANSI-accredited Project 25](#) standard, as doing so provided a migration from earlier analogue equipment. In another State, a spectrum sharing agreement has been established with Department of Defence to utilise parts of the 420-430 MHz band for essential and emergency services (i.e. public protection). A TETRA system is being implemented. The ACA has made provision for this spectrum to be used for this purpose by other Australian States, should they wish to adopt it²⁷; at this time, one other State has established a spectrum sharing agreement with Defence under this arrangement.

²⁶ Department of Defence, December 2001.

²⁷ The ACA had decided that it would support adaptation of the Western Australia arrangements to other States if requested; access to the 420-430 MHz band for mobile communications would be preserved for essential and emergency services and not be made available to commercial operations for the time being and licensing for the essential and emergency services would be by apparatus licences over-the-counter.

The ACA has also made provision for use of parts of the 450-470 MHz band by law enforcement and emergency agencies in an effort to improve cross-border communication during national and State disasters.

Although pre-planned use of spectrum in support of emergencies is the usual situation, national legislation does allow for emergency services to access any appropriate radio spectrum in an emergency situation.

Box 5.3: Emergency Services

The Bureau of Emergency Services Telecommunications (BEST), Department of Justice, is responsible for the procurement and delivery of a range of public safety communications services to Victoria's emergency services organizations.

BEST has been responsible for the procurement, implementation and operation of a multi-agency computer-aided call-taking and dispatch (CAD) system, by the private sector, for Victoria's emergency services organizations (ESOs). The role of BEST extends beyond the management of the CAD contract to assisting in government policy development relating to the delivery of further public safety communications projects.

BEST is responsible for the State-wide Integrated Public Safety Communications Strategy (SIPSaCS). This strategy identifies synergies in current and planned needs of the ESOs and associated major stakeholders for public safety communication services in Victoria over the next decade. It forms the basis for the delivery of public safety communication services to meet the demands of the Victorian Community.

5.5.3 Meteorology

The [Bureau of Meteorology](#) is the national meteorology authority for Australia. The Bureau's functions include: the taking and recording of meteorological and related observations; and the issue of forecasts and warning of weather conditions likely to endanger life or property.

Specific uses of the radiofrequency spectrum by the Bureau of Meteorology include:

- weather watch and wind finder radar (S-band: 2.7-2.9 GHz, C-band: 5.6-5.65 GHz, and X-band: 9.3-9.5 GHz);
- radiosondes (400.15-403 MHz), i.e. weather balloons equipped with instrumentation for measuring geophysical parameters like temperature and humidity;
- upper-air wind finding using GPS satellites;
- meteorological-satellite communications at VHF, S-band and X-band;
- active and passive remote sensing via meteorological-satellites over a wide frequency range;
- communication with remotely located automatic weather stations (VHF and multiple HF frequencies);
- locating and interrogating drifting meteorological, and oceanographic (including climate monitoring) buoys (402-403 MHz band via satellite);
- wind profiling radars which sense upper air conditions, often at airports or major cities (54-56, 448-550, and 1 270-1 295 MHz typically);
- telemetry of radar and satellite data to central sites (404, 450-460 MHz typically);
- broadcast of meteorological information to ships via radio facsimile and voice (multiple HF frequencies) in conformity, *inter alia*, with Australia's obligations under the International Convention for Safety of Life at Sea (SOLAS); and
- broadcast of marine forecasts and warnings and collection of ship observations via the commercial Inmarsat C and SafetyNet services.

From the point of view of the Bureau of Meteorology, a key issue relating to the use of the radiofrequency spectrum is ensuring secure and uninterrupted access to the relevant parts of the spectrum for meteorologically related activities on public interest grounds. The Bureau believes that its current use of the spectrum is undertaken efficiently and effectively, fully reflecting the social and public benefit value of the usage.

While the Bureau is happy to pay the cost of the administration of device licences, it considers that, since its functions are almost all in the public interest and it directly supports emergency and safety-of-life services as well as national security via services to the Defence Forces, it should be exempt from radiofrequency spectrum auctioning procedures. By way of example, the Bureau used to hold approximately 320 licences for

about 1200 devices in 2001/2002, having paid licence renewal fees of about A\$86,000. The Bureau's budget for such running costs is extremely limited. Increasing pressures for more fully commercialised management and sale (for example by auction) of the entire spectrum will impact adversely on the Bureau and could ultimately severely impair its services in support of safety-of-life and property. Moreover, meteorological systems and equipment are designed and manufactured to conform to frequency allocations made through the ITU, which are similar or in many cases the same throughout the world. Therefore, internationally allocated bands for meteorological purposes need to be reserved for this purpose in Australia because of the Bureau's inability to use other parts of the spectrum due to global technical standardisation and ITU frequency allocations. Therefore, in the Bureau's view, the meteorological bands should be exempted from spectrum auctions.

5.5.4 Science services

The frequency bands allocated to the different science services on a primary or secondary basis are specified in the Australian Frequency *Spectrum Plan*. Normally, spectrum is assigned to science services via apparatus licences and fees are paid in the common practice.

The [Commonwealth Scientific and Industrial Research Organisation \(CSIRO\)](#) has major facilities on lands close to population centres. Accordingly, CSIRO has a record of cooperation with carriers in providing access to CSIRO land for telecommunication facilities such as cellular base-stations. CSIRO also works with and supports many commercial users of the spectrum. However, there are several CSIRO sites where the research activities carried out could be seriously impeded by the presence of a close transmitter. One example is the Australia Telescope National Facility (ATNF), which operates extremely sensitive radio-telescopes at Narrabri, Parkes and Coonabarabran, operating in the allocated spectrum for the radio astronomy service in bands from 1 to 100 GHz. These large antennas use cryogenically-cooled receivers to receive extremely weak radio signals from the extreme depths of space. These systems already use substantial interference mitigation techniques and further interference can reduce the ability of these major investments to perform their function. The success of future radio astronomy facilities will depend on the ability to use wide interference-free bands at frequencies between approximately 100 MHz and 20 GHz. To achieve such an interference-free environment, the concept of "Radio-quiet Zones" has been proposed and it is actively being investigated. It is being proposed that such a Zone should be located in an isolated area with low population density and hence low spectrum use in defined bands.

The Australian science service community is particularly concerned with the protection of passive remote-sensing of the Earth and its atmosphere using microwaves. Microwave techniques render possible observation of the Earth's surface and its atmosphere from space orbits even in the presence of clouds, which are almost transparent at frequencies below 100 GHz. One of the best-protected band on a worldwide basis is the 23.4-24 GHz (used to measure water vapour and cloud liquid water), where any man made emission is forbidden. However, the Short-range Automobile Radar frequency Allocation (SARA) is currently being promoted worldwide by the automotive and electrical manufacturing industries as the first high volume civilian use for UWB technology²⁸. This application does not require the ground penetrating qualities used in some imaging systems and has been proposed for a centre frequency near 24 GHz.

One important science service and space operation development in Australia is the [Canberra Deep Space Communication Complex](#) (CDSCC), part of the NASA Deep Space Network and operated by CSIRO. The Canberra complex features a number of antennas that are required daily to receive from, and transmit information to a wide variety of spacecraft out to distances exceeding 13 billion km, utilizing very large, expensive antennas with extremely sensitive LNA's operating with system noise temperatures down to 12.5 K. Similarly, the European Space Agency also operates near-Earth and deep space Earth stations near Perth in West Australia. The antennas and data delivery systems make it possible to: acquire telemetry data from spacecraft, transmit commands to spacecraft, track spacecraft position and velocity, perform very-long-baseline interferometry observations, measure variations in radio waves for radio science experiments, gather science data, and monitor and control the performance of the network. The CDSCC earth stations uses spectrum in the science service allocations in the 2, 7, 8, 14, 15, 32, 34 and 50 GHz bands for which CSIRO has the corresponding apparatus licences. The nature of the operation of these stations demand an extremely high level of protection from interference (both in-band and adjacent band) from other incompatible users of

²⁸ The proposed short range (<50 m) radar systems aim to achieve high range and position accuracy to provide localised collision avoidance, restraint system arming and parking assistance in the next generation of motor vehicles.

the spectrum. The longevity of typical deep space missions also requires stability of tenure of frequency allocation.

The science services community celebrated in the end 2002 the launch of the FedSat non-geostationary satellite comprising communications, space science, navigation and computing payloads (see Box 5.4).

Box 5.4: The FedSat Australian microsatellite

FedSat is the first Australian-built satellite in over thirty years. It was launched successfully on 14 December 2002 and has been delivering scientific data to its ground station at the University of South Australia in Adelaide almost daily. This information is used by Australian and international researchers to study space weather, to help improve space computers, communication systems and other satellite technology, and to research on navigation and satellite tracking.

FedSat was built and is operated by the [Cooperative Research Centre for Satellite Systems](#), which combines the resources and skills of 12 Australian organizations.

[CSIRO](#) has developed the compact, lightweight and low-cost Ka-band (20/30 GHz) transponder used onboard the FedSat.

Source: CSIRO.

5.6 New technologies

5.6.1 Short range spread spectrum devices

Spread spectrum devices are defined as radiocommunication devices that employ direct sequence spread spectrum modulation techniques, frequency hopping spread spectrum modulation techniques, or both, to transmit information. The class licence supports the use of short range spectrum devices used in applications such as bar code readers, point of sale networks, radio local area networks (RLANs) and wireless private automatic branch exchanges (PABXs).

The operation of short range spread spectrum devices is authorised under the [Radiocommunications \(Spread Spectrum Devices\) Class Licence 2002](#) (the Spread Spectrum Devices Class Licence) within the frequency bands and power limits indicated in Table 5.4.

Table 5.4: Spread spectrum device frequency bands and power limits

| Frequency Band (MHz) | Maximum Equivalent Isotropically Radiated Power (EIRP) |
|----------------------|---|
| 915 to 928 | 1 watt |
| 2 400 to 2 483.5 | 4 watts (devices other than frequency hopping devices with a bandwidth greater than 1 MHz) |
| 2 400 to 2 483.5 | 500 milliwatts (frequency hopping devices with a bandwidth greater than 1 MHz) |
| 5 725 to 5 875 | 1 watt |

Source: [ACA](#).

Spread spectrum devices operating under the class licence:

- must not cause interference to other radiocommunications services and will not be afforded protection from interference caused by other radiocommunication services; and

- when operating in bands designated for industrial, scientific and medical (ISM) applications will not be afforded protection from interference which may be caused by ISM applications (e.g. microwave ovens).²⁹

5.6.2 Wireless local area networks (WLANs)

In Australia, the use of WLAN (or RLAN) devices are currently authorised under the class licences covering different technologies and frequency bands. In order to cope with advances in WLAN technology since the mid 1990s, the ACA spectrum planning and licensing arrangements have evolved and updated as summarized in Table 5.5.

In July 2003, WRC-03 made spectrum allocations that could support RLANs in the 5 150-5 350 MHz and 5 470-5 725 MHz frequency ranges. The ACA is currently considering how it should support these allocations in Australia and recent started a public consultation on that matter with closing date for comments on 20 February 2004. How the ACA will proceed will depend on the responses received to the discussion paper. It is unlikely that any new arrangements would be in place before mid-2004.

Table 5.5: WLAN spectrum planning and licensing schemes

| Date | Action |
|---|--|
| 1995 | Consultation: discussion paper Proposed Spectrum Management Framework for Spread Spectrum Devices - SPP 1/95 |
| May 1996 | SS Class Licence: low-powered SS devices in 920 MHz, 2.4 GHz and 5.8 GHz (including RLANs using 802.11b technology). |
| May 2000 | Consultation: discussion paper <i>Introduction of Spectrum Arrangements for Radio Local Area Networks (RLANs) in the 5 GHz Frequency Range - SP 1/00</i> |
| Late 2000 | LIPD Class Licence: RLANs in the 5.2 and 5.8 GHz bands (including RLANs using 802.11a technology). |
| July 2002 | Review: report WLANs Interference Management on the spectrum/interference management arrangements for various types of IEEE 802.11 devices. |
| December 2002 | SS Class Licence : updated to include other RLAN technologies in 2.4 GHz band. |
| July 2003 | LIPD Class Licence : update to support the use of digital modulation transmitters in the 900 MHz, 2.4 GHz and 5.8 GHz bands (including many RLAN technologies which use digital modulation techniques). |
| January 2004 | Consultation: discussion paper Proposals for Spectrum Arrangements for RLANs and FWA in the 5 GHz Frequency Range post WRC-03 , reviews arrangements for support of RLANs in the 5 GHz band following WRC-03 spectrum allocations. |
| Legend: SS: Spread spectrum; LIPD: Low interference potential devices | |

Source: [ACA](#).

5.6.3 Ultra Wideband (UWB) technology

UWB technology generally involves the radiation, reception and processing of very wide bandwidth radiofrequency emissions for short-range applications. UWB applications include automotive collision-avoidance systems and high data rate interference-tolerant communications.³⁰

²⁹ The relevant ISM bands are 918-926 MHz, 2 400-2 500 MHz and 5 725-5 875 MHz.

³⁰ Typically, the emissions from a UWB transmitter will span a number of radiofrequency bands that have been allocated for a range of different purposes. For example, a 24 GHz UWB transmitter might occupy a bandwidth around 5 GHz, which would span frequencies used for such purposes as microwave fixed links, space research, radio astronomy, amateur radio and satellite communications.

UWB emissions may, however, pose a significant interference risk to existing services [13]. A proliferation of UWB emissions could, for example, reduce the coverage and service quality of a number of current “narrowband” systems. This has the potential to endanger users (in the case of safety-of-life communications) and adversely affect the viability of existing services. Examples of such services are land mobile services, global positioning systems (e.g. GPS), radio-astronomy and Earth exploration satellites.

By early 2003 the development of an international regulatory framework generally applicable to UWB was at an early stage. Two general concerns were raised internationally to be resolved: the potential for interference to the services already using those bands and the regulatory method for accommodating these devices within the international Radio Regulations.

The results of the technical studies being carried out in ITU-R (2004 is the target year to complete that work) can be expected to have a strong influence on the ACA's future regulatory arrangements for UWB. Additionally, the ACA and DCITA are working on various licensing issues that will need to be resolved before, generally speaking, the ACA will have sufficiently flexible licensing powers to be able to authorise the use of UWB devices in Australia.

The Australian radiocommunication licensing arrangement closest in its effect to the arrangements put in place in Part 15 of the FCC Rules and Regulations and proposed by CEPT for short range devices is that of class licensing. In fact, existing ACA class licences currently support the operation of a number of types of conventional short-range devices covered by CEPT and the FCC.

The use of low power short range UWB devices such as RLANs could be made possible under a UWB specific class licence or by amendment to an existing class licence – most likely the ACA *Radiocommunications (Low Interference Potential Devices) Class Licence*. The technical conditions for the class licence would be based on sources such as ITU-R Recommendations, the FCC Rules and Regulations, and European arrangements, with the overall objective of harmonisation, as far as practicable.

Arrangements to support the use of UWB ground penetrating radar and UWB imaging systems is less clear with overseas regulatory arrangements indicating far greater concern that these devices pose an interference risk to existing services. The results of compatibility studies around the world should shed light on whether licensing arrangements that place greater responsibility on the operator to determine potentially affected services will be necessary.

6 Conclusions

This case study report aimed at providing an overall description of the main aspects and issues concerning the planning, regulatory and practical aspects of the use of the radiofrequency spectrum in Australia. The mature stage of the Australian radiocommunications sector, where innovative spectrum management schemes have been implemented for more than a decade now, made Australia an ideal choice to illustrate the different ways to handle such a complex issue.

Australia was one of the first countries to recognise the potential for the use of market-based mechanisms in the radiocommunication sector, using property rights, to increase efficiency in spectrum use. Already in the early 1990s, the RCA went beyond the traditional, equipment-specific licensing approach to introduce flexible and technology-neutral licence types to meet the needs of new technologies.

The arrangements currently in place in Australia are based on clear roles for the main actors in the radiocommunication scene. Whilst the Government defines policy, market forces, industry and users alike, operate systems, implement devices, and enjoy the services and applications made available through the use of spectrum. Finally, the independent regulator is responsible for managing the spectrum resources, planning its use and implementing the regulatory and technical arrangements put in place within the framework of the RCA. To reflect the particular emphasis Australia puts on fair trade practices, competition is monitored by a separate regulator.

A basic challenge the Australian communications regulator-the ACA-has faced is that management of access to the radiofrequency spectrum must balance community interests and those of commercial users. It must also take international demands and requirements and new technological developments into account. For this purpose, it has established the following key objectives [17]:

- 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; and
- 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.

The existence of a comprehensive, technically sound, stable but adaptive *Spectrum Plan* gives Australia the necessary certainty required by spectrum users to implement their medium and long term plans towards deployment of new radiocommunication systems.

The licensing regime, based on the tripodal licence scheme: *apparatus* (device-based), *class* (application-based), and *spectrum* (technological and service neutral), is deemed to be well serving the needs of the Australian market. The innovative licensing arrangement introduced by the *spectrum licence* is supposed to have added flexibility and fostered technological innovation in the implementation of modern radio systems by the licensees, despite the claimed resulting technical complexities to codify licensee's rights and responsibilities in managing interference and to facilitate trading of spectrum assets. At present, approximately 2.7 GHz of bandwidth is spectrum licensed.

The accredited person scheme, where part of the regulator's duties is transferred to the licensees, is being pursued as a cost reduction measure by giving more autonomy to the spectrum users.

Australia has pioneered the use of price-based spectrum allocation. Auction has become the principal path to the allocation of spectrum which follows the *Forward Program of Future Spectrum Auctions*. However, owing to the business climate and other factors affecting the telecommunication industry, there has been little industry interest in accessing new spectrum bands through auctions over the past two years.

Spectrum trading was introduced in Australia in 1997 and stable market practices are in place, although there has been limited activity so far.

A flexible regulatory regime for setting technical standards and managing conformity with standards based on self-declaration compliance arrangement for radio equipment, electronic and electrical products has placed Australia in the forefront of modern national spectrum management administrations.

The ability of the Australian spectrum management system to accommodate new advanced wireless technologies has been permanently challenged during recent years. Many examples were cited in the report as the introduction of digital broadcasting, short range devices, WLAN, etc. Currently, the regulator is consulting on the use of broadband powerline communications systems and its impact on existing radio systems. The Australian regulator's experience has shown so far that advances in technology have led to more competing and intensive use of spectrum, but at the same time have provided new flexibility for its management.

Despite the overall satisfactory performance of the Australian spectrum management environment, many challenges will continue to require creative and timely responses from the Government, industry and user communities. The series of regulatory reviews conducted in the recent years has identified areas for amendments and improvement, which are being implemented in the tradition of transparency and consultation that has prevailed in Australia, which are key factors for the success of its spectrum management regulatory regime.

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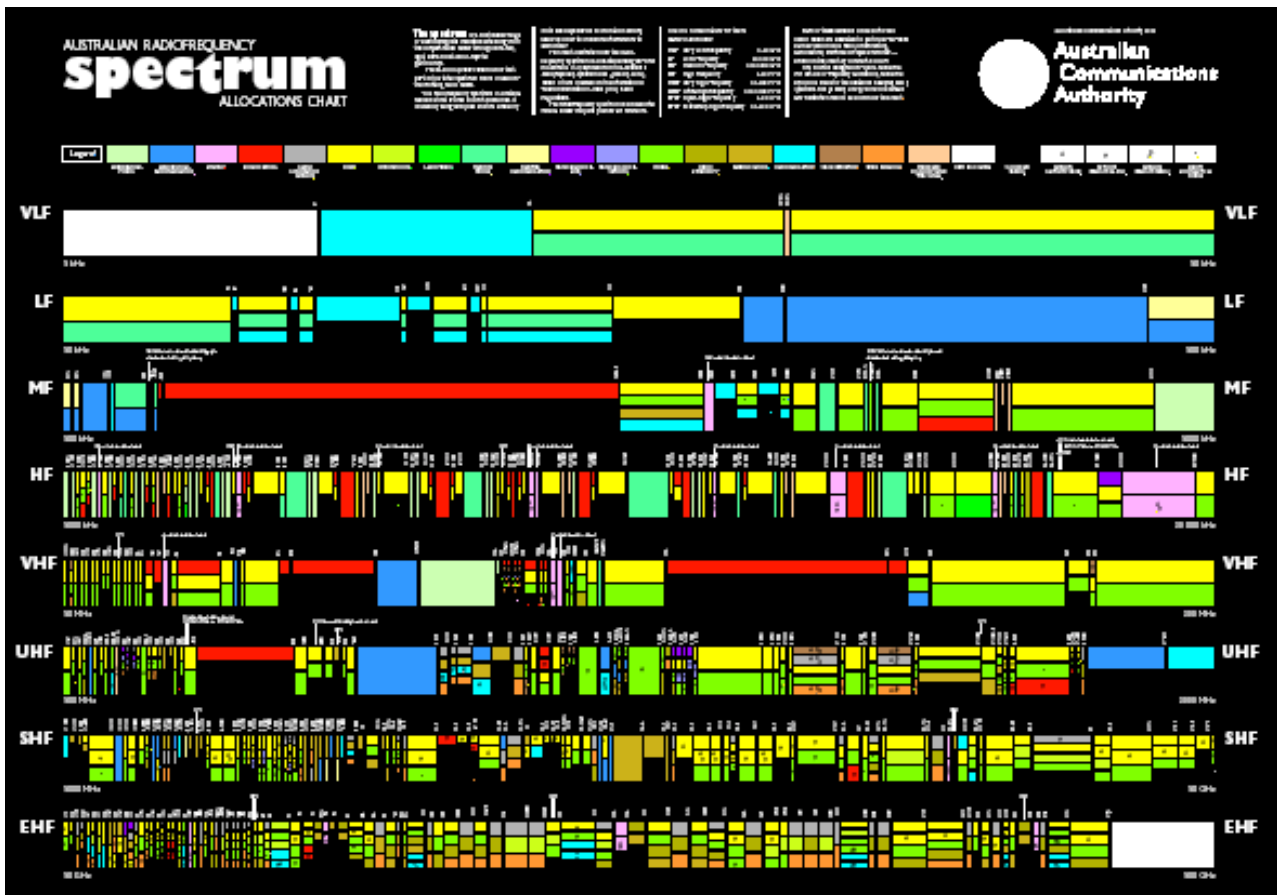
ABBREVIATIONS AND ACRONYMS

| | |
|-----------------|--|
| 2G: | Second-Generation mobile communications |
| 3G: | Third-Generation mobile communications |
| ABA: | Australian Broadcasting Authority |
| ABC: | Australian Broadcasting Corporation |
| ACA: | Australian Communications Authority |
| ACA Act: | <i>Australian Communications Authority Act 1997</i> |
| ACCC: | Australian Competition and Consumer Commission |
| ACIF: | Australian Communications Industry Forum |
| ADSL | Asynchronous DSL |
| AMTA: | Australia Mobile Telecommunications Association |
| ANSI | American National Standards Institute |
| AP: | Accredited Person |
| APEC: | Asia-Pacific Economic Cooperation |
| APT: | Asia-Pacific Telecommunity |
| ATNF: | Australia Telescope National Facility |
| ATUG: | Australia Telecommunications User Group Ltd. |
| AUSTEL: | Australian Telecommunications Authority |
| BEST: | Bureau of Emergency Services Telecommunications |
| BSA: | <i>Broadcasting Services Act 1992</i> |
| BSS: | Broadcasting-Satellite Service |
| BWA: | Broadband Wireless Access |
| CAD: | Computer-aided call-taking And Dispatch |
| CDSCC : | Canberra Deep Space Communication Complex |
| CEPT: | European Conference of Postal and Telecommunications Administrations |
| CPI: | Consumer Price Index |
| CRA: | Commercial Radio Australia |
| CSIRO: | Commonwealth Scientific and Industrial Research Organisation |
| CTC: | Commercial Television Conversion |
| CTN: | Consumers' Telecommunications Network (scheme) |
| CTVA: | Commercial Television Australia |
| DAB: | Digital Audio Broadcasting |
| DCITA: | Department of Communications, Information Technology and the Arts |
| DRM: | Digital Radio Mondiale |
| DRSG: | Digital Radio Study Group |
| DSL: | Digital Subscriber Line |
| DTH: | Direct-To-Home |
| DTTB: | Digital Terrestrial Television Broadcasting |
| DVB-T: | Digital Video Broadcasting-Terrestrial |

| | |
|----------------------|--|
| EMC: | Electromagnetic Compatibility |
| EMI: | Electromagnetic Interference |
| EMR: | Electromagnetic Radiation |
| ENG: | Electronic News Gathering |
| ESO: | Emergency Services Organisation |
| EU: | European Union |
| FAC: | Frequency Assignment Certificate |
| FACTS: | Federation of Australian Commercial Television Stations |
| FCC: | Federal Communications Commission |
| FSS: | Fixed-Satellite Service |
| FWA: | Fixed Wireless Access |
| GDP: | Gross Domestic Product |
| GPS: | Ground Positioning System |
| HAPS: | High Altitude Platform Station |
| HDFS: | High Density Fixed Service |
| IBOC: | In-Band On-Channel |
| ICT: | Information and Communications Technology |
| IMT-2000: | International Mobile Telecommunications 2000 |
| IRAC: | International Radiocommunications Advisory Committee |
| IRPA: | International Radiation Protection Association |
| ISM: | Industrial, Scientific and Medical |
| ISP: | Internet Service Provider |
| ITU: | International Telecommunication Union |
| ITU-R: | ITU Radiocommunication Sector |
| LAN: | Local Area Network |
| LIPD: | Low Interference Potential Device |
| LMDS: | Local Multipoint Distribution Service |
| LNA: | Low Noise Amplifier |
| LPON: | Low Power Open Narrowcasting |
| MDS: | Multipoint Distribution System (or Station) |
| The Minister: | The Minister for Communications, Information Technology and the Arts |
| MMDS: | Multimedia Multipoint Distribution System |
| MRA: | Mutual Recognition Arrangement |
| MSS: | Mobile-Satellite Service |
| NATA: | National Association of Testing Authorities |
| NTC: | National Television Conversion (scheme) |
| OECD: | Organisation for Economic Co-operation and Development |
| OTC: | Overseas Telecommunications Commission |
| PC: | Productivity Commission |
| PCS: | Personal Communications Service |

| | |
|----------------------------|---|
| PMG: | Postmaster-General's Department |
| PSTN: | Public Switched Telephone Service |
| RCA: | Radiocommunications Act 1992 |
| RCC: | Radiocommunications Consultative Council |
| RLAN: | Radio LAN |
| SARA: | Short-range Automobile Radar frequency Allocation |
| SETEL: | Small Enterprise Telecommunications Centre |
| SIPSaCS: | State-wide Integrated Public Safety Communications Strategy |
| SMA: | Spectrum Management Agency |
| SME | Small and Medium Enterprise |
| SOHO | Small Office/Home Office |
| SOLAS: | International Convention for) Safety of Life at Sea |
| SS: | Spread Spectrum |
| STU: | Standard Trading Unit |
| <i>Telecom Act:</i> | <i>Telecommunications Act 1997</i> |
| TLG: | Technical Liaison Group |
| TLMS: | Trunked Land Mobile Service |
| TOB: | Television Outside Broadcasting |
| TPA: | Trade Practices Act 1974 |
| TTMRA: | Trans-Tasman Mutual Recognition Arrangement |
| UWB: | Ultra WideBand |
| VSAT: | Very Small Aperture Terminal |
| WLAN: | Wireless LAN |
| WRC: | World Radiocommunication Conference |

ANNEX 1:
The Australian Radiofrequency [Spectrum Plan](#)



A1.1 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.

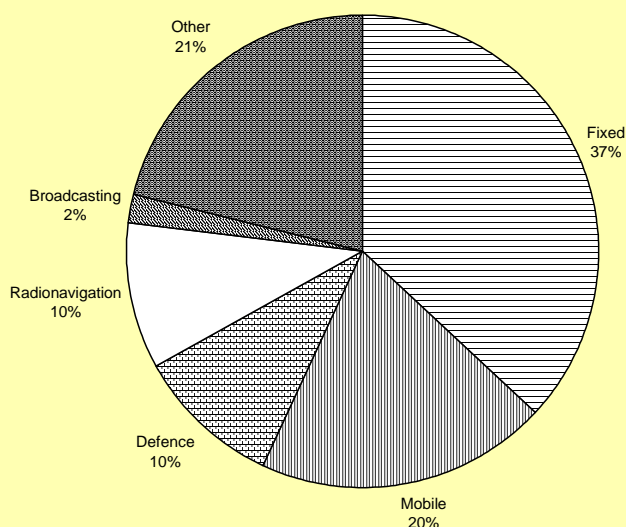
Footnotes list services for spectrum allocation in addition to those in the international plan. Footnotes also provide a mechanism for countries to re-prioritise the status of allocated services from the international plan.

The *Spectrum Plan* has 93 Australia-only footnotes. AUS 57, for example, enables Defence to operate services in the band 3 155–3 200 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 3 155–3 195 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.

All spectrum between 9 kHz and 300 GHz is allocated to different spectrum uses according to the *Spectrum Plan* 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. The main uses of spectrum are for fixed links, broadcasting, mobile phones, defence and radionavigation; other spectrum uses include radioastronomy, meteorology and satellite. The share of spectrum allocated to major spectrum uses in Australia is presented in Figure A1.1.

Figure A1.1: Spectrum allocations to major spectrum uses in Australia



Source: ACA.

A1.2 Frequency band plans

The *RCA* (s.32) 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 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 1 452–1 492 MHz and mobile–satellite at 1 525–1 530 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 telecommunication 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 2 076–2 111 and 2 300–2 400 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 would be excluded from operating at 2 076–2 111 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 2 076–2 111 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 MSS and set out the conditions of the incumbent licensees who operate in the 2 GHz bands (specifically 1 980–2 010 MHz and 2 170–2 200 MHz) (ACA 2002h).

ANNEX 2: Australian Communications Authority - Organizational Structure (effective : 13 November 2003)

Bob Horton
A/g Chair

Allan Horsley
A/g Deputy Chair

Geoff Luther
A/g Member

David Round
Member (part time)

John Grant
A/g Senior Executive Manager
Radiocommunications

Roslyn Kelleher
Senior Executive Manager
Telecommunications

Mark Loney
Executive Manager

Tom Motherwell
A/g Executive
Manager

Maureen Cahill
Executive Manager

Hugh Milloy
Executive Manager

Paul White
Executive Manager

John Neil
Executive Manager

Grant Symons
Executive
Manager

John Haydon
Executive
Manager

David
Brumfield
Senior
Manager

| Radio-frequency Planning Group | Spectrum Marketing Group | Customer Services Group | Corporate Management Group | T/Comms Licensing Group | T/Comms Analysis Group | Standards & Compliance Group | Consumer & Universal Service Obligation Group | Legal |
|---------------------------------------|---------------------------------|---------------------------------|-----------------------------------|--|-------------------------------|---|--|--------------|
| Spectrum Planning | Spectrum Marketing | Strategy & Planning | Human Resources | Numbering | Industry Analysis | T/comms Standards | Consumer Awareness | |
| International R/comms | Market Strategy | Customer Services Coordination | Finance | Network Selection | Industry Monitoring | R/comms Standards | Codes & Consumer Safeguards | |
| Space & Terrestrial Systems | Market Analysis | Compliance & Technical Services | Facilities & Services | Licensing & National Interests | Industry Reporting | Customer Cabling & Access | Subsidies & Funding | |
| | | Regional Offices | Communications | Market-based Number Allocation Project | Futures Panel | International T/comms | | |
| | | | Corporate Governance | Submarine Cable Protection | | | | |
| | | | Information Management | Special Projects | | | | |
| | | | Computing Services | | | | | |

Associate Member
Mr Michael Gordon-Smith

ANNEX 3:

The Spectrum Management Review Process

Radiocommunication regulations including spectrum management arrangements have been recently the aim of two important reviews. The main focus was the assessment of legislation restricting competition or imposing costs or benefits on business.

The two review reports were tabled in the Australian Parliament along with the Government's response on 5 December 2002.

A3.1 Radiocommunication review

The Radiocommunications Review was established in response to the Commonwealth's commitment made in 1995 under the Competition Principles Agreement with the States and Territories to identify regulation that might be inappropriate, outdated and costly.

The purpose of the Review was to evaluate the appropriateness, effectiveness and efficiency of the provisions of the *Radiocommunications Act 1992* and related legislation and the associated administrative processes that underpin the regulatory framework for spectrum management in Australia.

The Review was undertaken by a taskforce of officials drawn from the DCITA (Chair), Department of Defence, Department of Transport and Regional Services and the ACA. An Independent Reference Group oversaw the review process. The taskforce conducted two stages of consultation with interested parties - the first commenced in July 1997 and the second followed the release of a discussion paper in December 1998. The Radiocommunications Review Report [\[12\]](#) was publicly released in August 2001 and addresses the issues raised in response to a wide ranging Discussion Paper published in December 1998.

The Radiocommunications Review evaluated the appropriateness, effectiveness and efficiency of the radiocommunication regulatory regime and made a total of 18 recommendations. These recommendations are mostly concerned with enhancements to the ACA administrative processes in order to improve the efficiency and transparency of spectrum management in Australia. The recommendations are grouped by topic and summarized in the following:

- Spectrum Planning: Streamline processes in relation to re-allocation; increases ACA consultation; restate mandatory nature of Spectrum Plan; promote industry self management of interference and planning.
- Licensing: DCITA and the ACA continue to consult on the requirements for more flexible licensing; the ACA accelerates accessibility to the public to the electronic Licence Register.
- Frequency coordination: The ACA continues to monitor development of the private frequency assignment arrangements and promote the professional competence of frequency assignors.
- Taxes and Charges: Do not replace upfront fees with annual fees for spectrum licences; do not extend the range of groups eligible for licence fee exemptions; apparatus licences should be devolved to class licences where appropriate; the ACA continues to consult on the charging model.
- Standards and technical regulation: Evaluate the need for mandatory standards on an individual basis and accelerate harmonisation between the technical regimes.
- Tenure, compensation and band clearance: Increase the maximum duration of apparatus licences to at least 10 years.
- Defence and other public purpose uses for spectrum: The ACA provides technical assistance if State and Territory emergency and police services seek to cooperate in establishing a national emergency services network; the ACA and the Department of Defence review periodically arrangements for the Defence use of spectrum.

- Satellites: The ACA monitors developments in satellite charging internationally and conducts periodical public reviews of satellite licence fee charging.
- Telecommunications universal service: No special regulatory treatment for spectrum used for the delivery of services under the telecommunications Universal Service Obligation
- Operator proficiency: The ACA and amateurs continue to explore areas for further devolution of the ACA's regulatory activities regarding amateurs.

A [Government Response](#) to the Radiocommunications Review was developed in consultation with interested parties through the RCC and has rejected only one recommendation (on the extension of the duration of apparatus licence).

A3.2 Productivity Commission Inquiry

The [Productivity Commission's Inquiry](#) was undertaken following the 1995 Competition Principles Agreement between the Australian Government and the States and Territories to review all legislation that restricts competition and imposes costs on business in Australia. It fulfils a commitment contained in the ensuing Commonwealth Legislation Review Schedule for a National Competition Policy review of the market-based legislative reforms administered by, and the activities of, the Australian Communications Authority.

The purpose of the Inquiry was to review the market-based radiofrequency spectrum management reforms incorporated into the *RCA* and related legislation and the performance of the ACA in administering these reforms. The PC's Inquiry was complementary to the Radiocommunication Review.

The PC's Inquiry involved extensive public consultation including the release of a discussion paper, receipt of over 300 written submissions, the conduct of public hearings, release of a draft report (followed by a second round of public hearings) before finalising its report to Government.

The PC's public inquiry into Review of Radiocommunications Acts and of the Market-Based Reforms and Activities Undertaken by the ACA was concluded in 2002 and the final inquiry report [6] was released by the Commonwealth Government on 5 December 2002.

The PC concluded that the ACA has performed at a commendable level in managing the use of the radiofrequency spectrum in a challenging technical and commercial environment. Box A3.1 contains the key messages from the Inquiry. The PC has made 29 recommendations to improve the radiocommunication legislative framework and to enable the ACA to further and more efficiently progress the market-based reforms underpinning this framework. The recommendations are grouped by topic and summarized in Table A3.1.

A [Government Response](#) to the PC's Radiocommunications Inquiry Report was developed and has rejected five recommendation (the most significant of which dealt with changes to competition rules).

Table A3.1: Recommendations of the PC's Radiocommunications Inquiry

| Subject | PC Inquiry Recommendations |
|----------------------------------|--|
| Objectives of Legislation | <p>The primary objective of the <i>RCA</i> should be to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum.</p> <p>The <i>RCA</i> should also require the spectrum regulator to have regard to:</p> <ul style="list-style-type: none"> • 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. |
| Licensing | <p>The <i>RCA</i> should be amended to allow the ACA to issue spectrum licences in unencumbered spectrum without the need for a Ministerial designation under <i>section 36</i>.</p> <p>The ACA 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.</p> <p>Competition limits should not apply to the primary issue of radiocommunication licences. Therefore:</p> <ul style="list-style-type: none"> • the competition limit provision in the <i>RCA</i> (<i>s's 60 & 106</i>) should be repealed; and • the ACCC should amend its merger guidelines to address the assessment of the acquisition of radiocommunication licences under the <i>TPA</i> (<i>s. 50</i>). <p>In the event that the Government decides to retain the competition limit provisions, the <i>RCA</i> should be amended to specify that:</p> <ul style="list-style-type: none"> • competition limits be applied consistently with the <i>TPA</i> (<i>s. 50</i>); • determinations imposing competition limits be issued by the ACCC; • determinations imposing competition limits be disallowable instruments for the purposes of the <i>Acts Interpretation Act 1901</i> (<i>s.46A</i>); and • determinations are subject to appeal to the Australian Competition Tribunal. <p>The <i>RCA</i> (<i>s. 130</i>) should be amended to specify that apparatus licences generally will be renewed unless:</p> <ul style="list-style-type: none"> • 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. <p>The <i>RCA</i> should be amended so that the ACA is required to complete the market-based re-assignment of spectrum licences three years before they are due to expire.</p> <p>The "public interest" tests in the <i>RCA</i> (<i>s. 82</i>) should be amended to:</p> <ul style="list-style-type: none"> • restrict the scope for their use to spectrum licences issued before a date to be set by Government; and • allow licences to be re-issued once only and for a maximum term of five years. <p>The amendments should also direct the ACA to:</p> <ul style="list-style-type: none"> • hold a public inquiry before the Minister makes any determinations under <i>section 82(3)</i> that must: <ul style="list-style-type: none"> - 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 potential affected spectrum licences; • use shadow pricing, where feasible, to price spectrum licences re-issued under <i>section 82</i>; • publish the prices paid for spectrum licences re-issued under <i>section 82(1)(a)</i>; and • publish its reasons for re-issuing spectrum licences under <i>section 82(1)(b)</i> and the prices paid for those licences. <p>The conversion process in the <i>RCA</i> should be amended to allow the ACA to:</p> <ul style="list-style-type: none"> • 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. |

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| | Where it is cost-effective to do so, the ACA should convert wide area apparatus licences into spectrum licences. |
| | The <i>RCA</i> should be amended to allow the sale of encumbered spectrum licences. The ACA should develop the necessary arrangements and identify suitable bands for its implementation. |
| Secondary Markets | The <i>RCA</i> should be amended so that: <ul style="list-style-type: none"> • purchases of traded licences are required to notify the ACA of the prices paid for licences; and • the ACA 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. |
| Charging for Spectrum | The ACA 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. |
| | The ACA 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. |
| | The ACA 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. |
| | 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 exist, charges should not exceed full cost recovery. Charges should not be aimed at raising government revenue or providing a return to the community. |
| | The ACA should implement a more transparent and flexible model for calculating the apparatus licence tax. In particular, it should ensure that all elements required for the calculation of fees is given to licensees, and that, as far as possible fees vary in a continuous-rather than discrete-fashion. |
| | 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. |
| Managing Interference | 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 determination under the <i>RCA</i> (s. 145) should not be mandatory. |
| | The ACA 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. |
| | In the case of 'lawful' interference, the ACA should continue to recover the costs of interference investigation according to the cost recovery arrangements for indirect costs. In cases of 'unlawful' interference, the ACA should endeavour to recover the reasonable costs of interference investigations from persons making the unlawful transmissions. |
| | The Commission recommends that the ACA, in consultation with industry, develop and publish dispute resolution guidelines setting out the principles to be applied in interference disputes. |
| Managing Spectrum for Non-commercial and Broadcasting Services | The Commission recommends that: <ul style="list-style-type: none"> • the <i>RCA</i> (s. 31(1b)) should be repealed, transferring responsibility for the broadcasting services bands of the spectrum to the ACA, to be managed under the provisions of the <i>Act</i>; • licence 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 the broadcasting services bands reserved for non-commercial broadcasting services should be estimated and reported publicly; and • the ABA 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. |
| | 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 |

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| | full value of their current spectrum use, that is the value of licence fees and the cost recovery charges levied by the ACA. |
| | The criteria for eligibility for government assistance to meet the costs of spectrum access should be reviewed periodically. |
| | 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. |
| Operations of the ACA | The ACA should delegate the conferring of amateur radio operator certificates. |
| | The ACA 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. |
| The Way Ahead | The provisions in the <i>RCA</i> 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 ACA. |
| | Spectrum licences issued after July 2004 should be made perpetual. |

Source: [6].

Box A3.1: Key messages from the Productivity Commission's Radiocommunications Review Report

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 *RCA* 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 *RCA* 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 the *TPA* (s.50).
- 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 ITU commitments, but equipment availability would in any case encourage service providers to comply with the ITU spectrum plan.

Source: [6].

A3.3 Actions by the ACA on the review recommendations

A3.3.1 Review of satellite fees

In August 2003, the ACA has completed a public review of satellite licence fee charging as recommended in the *Radiocommunications Review Report 2001*. Following careful consideration of the issues and the comments received, the ACA does not propose to make any significant changes to the licence fee regime at this time [9].

A3.3.2 Reviews of spectrum pricing and cost recovery

The review processes made recommendations relating to spectrum pricing and recovery of spectrum management costs. These were directed towards the possible development of a new system for recovering the indirect costs of spectrum management, the basing of spectrum charges on opportunity cost, and the development of a new model for calculating apparatus licence taxes. In its response to the review reports, the Government committed the ACA to reviewing these matters in the 2003 calendar year and providing advice to government on the outcome of its examinations. The reviews were commenced during 2003 and are still ongoing.

A3.3.3 Possible merging of apparatus and spectrum licensing

The ACA is exploring whether the distinctions and differences that exist between apparatus and spectrum licensing inhibit flexibility, both for the ACA and its clients, and whether a broad continuum of licensing options would better serve the interests of spectrum management [17]. In October 2002, the ACA presented a proposal to the RCC for a possible merging of the apparatus and spectrum licence types. The issues were debated at RCC meetings in 2002-03, and the ACA will arrange a workshop for more detailed examination of the issues during 2003-04.

A3.3.4 ACA Workshop on Spectrum Licensing

On 6 March 2003, the ACA held a [Workshop on the Review of Spectrum Licensing](#) issues. The purpose of the Workshop was to seek industry input on whether the rules applying to spectrum licensing could be improved. The ACA had prepared a [Discussion Paper](#) outlining a range of issues relating to the operation of spectrum licensing and posing some questions for discussion and invited submissions on the issues raised in that paper and related issues in late 2002. The main outcomes of the Workshop are reproduced in Table A3.2.

Table A3.2: Outcomes of the ACA Workshop on Spectrum Licensing

| Subject | Outcome |
|--------------------------------|--|
| Interference management | The outcomes of the discussion were: <ul style="list-style-type: none"> • the need to retain the degree of legal certainty that is available under the current licence conditions; • that more detailed and accurate modelling could provide technically robust management of interference but that any such arrangement would need to provide legal certainty to the licensees; and • that the ACA should consult widely in the development of any new approach. |
| Device registration | The need for device registration is generally accepted, except for those low interference impact devices as may be defined in licence conditions in particular bands. The ACA was encouraged to look at re-assessment of low interference impact devices during the licence period at the request of the licensee. In examining device registration requirements for future spectrum licensing, the ACA could consider allowing greater discretion for risk management by licensees where devices have low interference potential. |
| Certification | Most current licensees generally accept the continuation of the current certification process. There was a view that the ACA could examine whether the current levels of certification produce the optimal outcome. |
| Documentation | Although there was little discussion on this issue at the Workshop, the ACA advised that it would re-examine the layout and presentation of the documentation and procedures for spectrum licensing. |

Source: ACA.

A series of amendments of the *RCA* was adopted by the Parliament and entered into force on 28 November 2003 to reflect emergency service, defence, national security priorities [15].

A3.4 ACA/ABA merger proposal

The telecommunication and broadcasting industries are currently regulated by the ACA and the ABA. However, changes in industry structures and new technologies led the Australian Government to request that a detailed proposal for a merger of the two organizations be prepared, in discussion with the ABA and the ACA and in consultation with industry, to enable a more complete consideration of the merits of a merged organization in comparison with retaining the existing institutional arrangements.

A discussion paper released in August 2002 by the DCITA (*Options for Structural Reform in Spectrum Management*) canvassed industry and public views on three institutional reform options:

- a) creation of a single agency with responsibility for broadcasting, telecommunications, radiocommunications and online regulation;
- b) transfer of the ABA's spectrum planning, licence allocation and enforcement functions to the ACA;
- c) transfer of the ABA's broadcasting spectrum planning functions to the ACA.

Following this first round of discussions, the Government decided to develop a detailed proposal for a merger in discussion with the ABA and the ACA for [consultation with industry](#), which will enable a more complete consideration of its merit in comparison with retaining the existing institutional arrangements. For this purpose, a [discussion paper](#) detailing some of the key issues that would need to be addressed were the ACA and ABA to become a single communications regulator was prepared by the DCITA. The deadline for public comment on the issues and options raised therein, to assist the Government in assessing the merits of a combined regulator compared to the current approach expired on 15 September 2003.

In the light of the submissions, the Australian Government is considering whether change to the current arrangement is desirable and what, if any, legislative amendments or transitional arrangements would be required.

ANNEX 4:**Recommendations from the Wireless Broadband Technologies Report**

| Improving the general take-up of wireless broadband |
|--|
| <p>1. that the ACA and ABA develop a scheme to allow the use of unallocated VHF and low UHF TV channels for rural wireless broadband links, and that they examine the possibility of allocating spectrum in the 400-500 MHz range for CDMA-450 on, at least, an experimental basis.</p> <p>2. that the requirement for carrier licences on the ISM bands be eliminated for both commercial and non-commercial operation. This will allow Australian broadband customers easier access to WLAN as a broadband alternative, and also enable Australian wireless engineers to compete with overseas entities in this burgeoning field. ISM band power limits should remain unchanged unless an exemption applies in non-metropolitan areas (see the Committee's later recommendation in this regard).</p> <p>3. that the ACA provide education programs for prospective wireless operators. These programs should explain the technologies, the law and ACA services.</p> <p>4. that the Minister for Communications, Information Technology and the Arts ensure training programs are in place to increase the knowledge of prospective wireless operators about the wireless market and customer requirements.</p> <p>5. that the government determine whether there are legislative, regulatory and business impediments to the interoperation of wireless ISPs and their access to the Internet backbone and, if so, eliminate them.</p> <p>6. that the Minister for Communications, Information Technology and the Arts ask the ACA to investigate the establishment of a conflict resolution service for users of the ISM bands.</p> <p>7. that the ACA and ABA develop procedures that facilitate the migration of wireless activities from ISM bands to adjacent licensed spectrum by streamlining equipment qualification procedures.</p> <p>8. that the ACA develop a system for licence renewal that evaluates the use of spectrum, utilising clear criteria established and communicated to spectrum holders well in advance of renewal dates. This could be implemented using fixed-term renewable spectrum allocations.</p> |
| Improving the take-up of wireless broadband in regional areas |
| <p>9. that the ACA and the ACCC develop a mechanism whereby small wireless Internet service providers can negotiate wholesale prices for Internet backbone connections, possibly introducing appropriate conditions in the carrier Universal Service Obligation. For a service provider to be eligible under this scheme, they must demonstrate that they are serving an eligible customer base. Eligibility would be automatic where DSL/wire-line connectivity was not currently available (such as in some regions of Australia) or simply where broadband wireless take-up had not yet occurred.</p> <p>10. that the Minister ask the ACA to examine the implications of raising the power limits on the ISM band to the equipment's rated values for service providers in those areas of Australia where DSL or other broadband wire-line connections are not yet in place.</p> <p>11. that the ACA and ABA form a spectrum bureau to: (1) monitor the effects of spectrum auction on local wireless use; (2) facilitate the trading and cross-leasing of spectrum and the migration of ISM wireless activities to licensed spectrum, and (3) recommend regionally adjusted spectrum auction reserve prices and financing terms.</p> |
| Wireless broadband services for the hearing impaired |
| <p>12. that the Commonwealth develop the means to provide hearing-impaired people with mobile telephones compatible with hearing aids, portable wireless devices that can communicate through the National Relay Service, and appropriately adapted video compression and transmission technology for video communication using sign language.</p> |
| General regulatory issues |
| <p>13. that the Commonwealth establish an inquiry into the possible amalgamation of the ACA and the ABA. This would allow for more streamlined regulation of the dynamic and converging technologies of broadband telecommunications and broadcast transmission.</p> |
| Security issues |
| <p>14. that the ABA, ACA and law enforcement agencies establish a standing bureau (or working party) to maintain a watching brief on the potential for Wi-Fi and other ISM networks to be used for illegal activities.</p> |

Source: [16].

ANNEX 5:**Interviews conducted in Australia**

(3 to 10 December 2003)

| Organization | Official | Venue and date |
|---|--|-----------------------|
| Government | | |
| Department of Communications, Information Technology and the Arts | Angela Tidmarsh, David Jordan, David Luck, Jason Ashurst, Trish Barnes, Daniel Boardman, Duncan McIntyre | Canberra, 3 Dec. |
| Department of Defence | Michael Brown | Canberra, 4 Dec. |
| Bureau of Meteorology | Glen Gould, Roger Atkinson, Michael Berechree, Dennis Hermann | |
| Department of Justice (Victoria): Bureau of Emergency Services Telecommunications (BEST) | Ian Vaskess, Paul Harris, Grantly Mailes | Melbourne, 8 Dec. |
| Regulatory Authorities | | |
| Australian Communications Authority (ACA) Radiofrequency Planning Group Spectrum Marketing Group International Radiocommunications | Mark Loney, Geoff Hutchins, Geoff McMillen Tom Motherwell, Jeanette Radcliffe Erik Lensson | Canberra, 3 Dec. |
| Australian Broadcasting Authority (ABA) | Fred Gengaroli, Alastair Gellatly, Ennio Ravanello | Canberra, 5 Dec. |
| Accredited assigners | | |
| Spectrum Engineering Australia Pty Ltd | Peter Hilly | Canberra, 4 Dec. |
| FuturePace Solutions (Spectrum Management International Pty Ltd) | Michael Whittaker, Barbari Phi | |
| Operators | | |
| Telstra Corporation Limited | Stewart Wallace | Melbourne, 8 Dec. |
| AsiaSpace | Richard Butler, Les Davey | |
| SingTel Optus Pty Limited | J. A(Lex) Vipond | Sydney, 9 Dec. |
| Personal Broadband Australia Pty Ltd. | Charles Reed | |
| Unwired Australia Pty Ltd. | Hendrik Prins | |
| Broadcasting | | |
| Australian Broadcasting Corporation | Colin Knowles | Sydney, 10 Dec. |
| Commercial Television Australia (CTVA) | Roger Bunch, Bruce Robertson, Ian Wyles, Andrew King | Sydney, 9 Dec. |
| Research & Development | | |
| Commonwealth Scientific and Industrial Research Organisation (CSIRO) – Science Services | Richard Jacobsen | Canberra, 5 Dec. |