Bureau of Meteorology

Submission to the

Productivity Commission's Review of the Radiocommunications Acts and the Role of the Australian Communications Authority

Revision of

29 October 2001

Summary

In regard to the access charges, the Commission has asked for feedback on specific criteria to be used to exempt non-commercial users (including community and emergency services) from charges for use of the spectrum. The following is a list of criteria that could be used, and most of them are directly applicable to the activities of the Bureau.

- Public sector service providers engaged in largely non-commercial activities
- Services provided show significant public good characteristics
- Services are predominantly aimed at ensuring the safety and protection of people and property, hence minimising the impact of natural disasters
- Services provided are essential from a national security and national interest perspective. (An example here would be the meteorological services provided to the defence, aviation and shipping sectors by the Bureau of Meteorology.)
- Services provided meet various international obligations as part of providing a global public good service.

It is plausible that spectrum allocation and use may involve trade-offs between competing objectives. These trade-offs, for example, may relate to making adequate provision for spectrum use by a public, non-commercial service provider vis-à-vis commercial allocation of the spectrum. In working out the trade-offs in such situations, it is important to take account of the public (or social) economic benefits rather than relying purely on private economic benefits of a certain spectrum allocation strategy.

There are several issues relating to the level and structure of charging for the spectrum use when the access to it is essential for providing services in the public interest/national interest.

First, charging at commercial rates for non-commercial use will lead to socially sub-optimal outcomes because the commercial value of spectrum use will differ from its social (or public benefit) value.

Second, exemptions or discounted access to the spectrum for non-commercial use could be argued on public interest grounds. Making transparent the social opportunity cost of the exemption or the discounted access could ensure efficient and effective use of the spectrum under such situations.

Third, if the policy objective is to maintain a 'level playing field' among all users, then the opportunity cost of the exemptions or discounted access to the spectrum by specific non-commercial users could be budget funded separately via matching grants. That way, the matching funds will go to those non-commercial users where access to the spectrum is valued most highly from a public/national interest perspective.

Finally, the Productivity Commission Inquiry into Cost Recovery recommended in its Draft Report in April 2001 that core activities of public sector information agencies should be wholly budget funded and not subject to cost recovery. The Commission also recommended that cost recovery arrangements should not include the cost of activities relating to international obligations. This implies that a great majority of the Bureau's services including the provision of basic meteorological services will continue to be budget funded, given that they are produced for the benefit of the public.

Part 3: Problems the Legislation seeks to address (Section 2.2)

There is no direct reference in the objectives of the Radiocommunications Act 1992 to the protection of certain frequencies or systems. The radio spectrum is a natural resource and some part of it should be protected for use in the public interest. The Bureau considers that the national interest is not necessarily best served by making the entire spectrum available to the highest bidders or the companies with the greatest financial resources.

Part 4: The Approach to Allocating Spectrum Under the Radiocommunications Act (Section 2.2)

The Bureau is concerned by some of the implications of a self regulating environment (if government regulation was reduced to a very low level). Under such a regime it may be difficult to protect the needs of smaller groups or public interest users (such as the Bureau) or to regulate certain frequencies or systems.

Part 5: Charging for the use of spectrum

Apparatus Licences

The issue of a Spectrum Access Tax (SAT) for the utilisation of the spectrum is considered satisfactory. There are however a number of anomalies (eg. the tolerance of the magnatron of a weather radar is about 20MHz. Technically the licence for the radar would have to be amended each time a magnatron was changed.)

The Auction Process

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 currently holds approximately 320 licences for about 1200 devices. In 2001/2002, the Bureau paid licence renewal fees of about $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

As a non-commercial public good organisation, the Bureau would be unable to compete at public auction for spectrum. One potential danger is that the auction process could easily swamp the usually smaller but fundamentally important public interest players. The highest value to society for spectrum does not necessarily equate to the bidder with the most financial resources. In considering whether frequency bands used for meteorology should be subjected to the spectrum auctioning process we believe the following principles should be borne in mind.:

- The Bureau, as a Government funded public good agency, and not a business oriented organisation, does not have the financial resources to participate in spectrum auctions for radio spectrum required by its various radio based instruments and systems.

- Should spectrum needed by the Bureau be 'bought' by a person or organisation, then operation of the Bureau's systems and the provision of its services to the community would be jeopardised.

- Meteorological systems and equipment are designed and manufactured to conform with frequency allocations made through the International Telecommunications Union (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. A list of bands the Bureau proposes be exempted from spectrum auctions is given at Attachment C.

- Satellite systems pose special coordination difficulties because they are implemented by other countries (in accordance with ITU allocations) and require sensitive receivers in urban areas where competing systems are likely to be most prevalent. Therefore the bands required by satellite systems should also be exempt from spectrum auction plans.

Part 6: License tenure and band clearance (Section 2.4)

Licence Tenure

The development by the Bureau of new systems utilising spectrum can often extend over a period of years. As a consequence some security in obtaining and maintaining licences needs to be available.

Licence Re-allocation and Conversion

It is stated that incumbent apparatus licensees have at least two years from when the declaration is made to vacate a section of spectrum. If there is considerable investment in establishing a system, two years may be insufficient for an organisation to relinquish spectrum.

Part 7: Non-commercial use of the spectrum (Section 2.6)

The objectives of the RCA include:

"(a) maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using radiofrequency spectrum; and (b) make adequate provision of the spectrum for use by public or community services."

In this context, it is important to recognise that the Bureau of Meteorology is a public interest agency of the Australian Government and its radiofrequency interests, like those of many other similar agencies, need to be taken into account should any changes to the RCA be envisioned.

The Bureau is a non-commercial user of radiofrequency spectrum. For example some of its most critical functions like warning of weather systems endangering life and property involve direct support and information provision to national, state and local emergency services (Fire, Police, Ambulance) in critical weather situations. The Bureau contributes to national security by providing meteorological services to the Australian Defence Forces.

Typical examples of services rendered in support of safety of life and property are Bureau warnings of severe storms, extreme fire weather risk, or of an approaching tropical cyclone. In and in all these types of cases and for Bureau weather information for the Defence Forces and emergency services, observations and communication systems used by the Bureau require low-cost access to radiofrequency spectrum in the public interest. A similar situation exists for services in which safety of life and property are directly at stake, in which the benefits from those services clearly outweigh the (small) revenues from (commercial) charging for spectrum.

Criteria for exemption include agencies (largely non-commercial and public interest) whose service functions directly mitigate against loss of life, directly mitigate against loss of economic benefit to Australia and/or directly contribute to national security (see criteria listed in Part 2).

Therefore in response to the Section 2.6. question: "*How should 'public or community services be defined'?"* consideration should be given to ensuring that safety of life and property, emergency services and national security and essential services, including weather forecast and warning services, are included.

Section 2.6 also asks the question: "*How should 'adequate' provision of spectrum for public or community services be determined?"* A possible approach to this question would be to quantify the social and economic value in dollar terms of national security, emergency services and weather forecast and warning services and weigh that against any costs imposed by ACA on spectrum access. The argument is that ACA licence fee costs could, if hypothetically imposed, be beyond the resources or running costs capacities of relevant agencies involved in safety of life and national security. Therefore there would be net costs to Australia if such agencies could not meet spectrum licence fees.

While it is accepted that a mechanism is required to ensure that RCA arrangements that are supportive of Government public interest, national security and emergency service requirements do not inadvertently adversely impact on Australia's commercial sector and competitiveness, it is also important to avoid excessive transaction costs resulting from spectrum charges being levied upon one part of the Government by another part of Government

It is also important that the spectrum allocations for Government public interest, national security and emergency services be protected from interference from those commercial operations. The Bureau requests that spectrum allocations for its operations be, as far as practicable, guaranteed protection from encroachment by, or interference from, operations in the commercial sector.

Part 8: Satellites (Section 2.8)

The Bureau of Meteorology is a large user, as are many other meteorological organisations worldwide, of a global network of meteorological and environmental satellites. These satellites provide continuous monitoring of the earth's atmosphere, oceans, land and also provide communications functions such as the relay of data from remote observing systems and search and rescue of platform location capabilities. These satellites support applications including the monitoring of severe weather systems like tropical cyclones, monitoring of greenhouse warming and the El Nino events, ozone hole monitoring, pollution and fire mapping, deforestation, vegetation and crop quality, mineral deposits, surveying, land management, desalination etc.

The operational meteorological satellites are part of the WMO World Weather Watch (WWW) system. The WWW system provides for the free and unrestricted distribution of meteorological data. Therefore access to these satellites is free to National Meteorological Services (such as the Bureau) and in some cases to other users. It is important to recognise that these satellites are not commercial ventures. They are provided by countries like the United States, Japan and China free of charge as part of their voluntary contribution to WWW in the international public interest.

The capital investment in meteorological satellite systems is of the order of tens of billions of dollars. The information provided by the systems is vital to the safety and economic well-being of all sectors of society and to the efficiency and effectiveness of many commercial enterprises. All the satellite systems require radiofrequency spectrum. In Australia, spectrum is required so

that data from satellites can be received or relayed and so that ranging systems can operate which help to maintain various satellites in orbit (e.g. under a Treaty Level agreement between the Governments of Australia and Japan). Multimillion dollar ground station facilities are located in Australia.

Details of frequencies commonly used by meteorological and related satellites are contained in Attachment D. It should be noted that there is a widespread and increasing use of X-band frequencies around 8 GHz compared to L-band around 2 GHz, and many satellite systems now orbiting use X-band as well as L-band frequencies.

Many of the issues pertaining to Earth Exploration Satellite (EES) use of radiofrequency spectrum relate not only to Australian considerations but also to international arrangements for example via the ITU and WRC. This is a complex field. One critical issue is that, in recent years, as alluded to in the Issues Paper, there has been extraordinary pressure on spectrum allocations, often driven by commercial interests including the unprecedented growth in the mobile telephone and related communications sectors.

This has meant that there are increasing threats to spectrum used by EES and related users such as radioastronomy. One difficulty here is the challenge to balance the requirements of mobile telephone and related users with those of the other user groups such as EES and radioastronomy. Many National Meteorological Services do not have the resources to compete with powerful multi-billion dollar multinationals seeking spectrum for commercial mobile phone and related communications purposes. The Bureau has been active in this area of radiofrequency negotiations with representation in national and international fora, for example through explaining the requirements and interests of EES communities to other groups with interests in spectrum, and via sharing studies in which every endeavour is made to maximise efficienct use of spectrum and to share bands where possible.

The Bureau identified a threat to its satellite services when commercial entities requested a new allocation of spectrum for Mobile Satellite Services (MSS) in the meteorological satellite band at WRC-97. The 'space to earth' MSS signals may interfere with GPS signals and the 'earth to space' signals could interfere with Bureau (and other user) reception of critical meteorological satellite data from Japan's Geostationary Meteorological Satellite GMS-5, and from China's similar satellite, FY-2B, if the mobile transmitters are operated in range of Bureau antennas.

Extensive research and calculation by the Bureau which has been well accepted internationally has shown that coordination distances could be 300 to 400 km. An allocation to MSS was denied by WRC-2000 with Resolution 227 calling for further studies on the feasibility of sharing between the mobile service and the meteorological service. The Bureau of Meteorology has been at the forefront in the identification and elucidation of this threat to meteorological satellites from MSS. The Bureau developed the study and has presented it to other interested organisations (e.g. ACA, Space Frequency Coordination Group, WMO, European Space Agency, NASA, China Meteorological Administration, Japan Meteorological Agency). It has joined with these organisations in addressing the implications of the MSS proposal at the international level.

It is important to note that sharing of frequencies used for meteorological and environmental satellites with other major spectrum users such as the MSS is extremely difficult because the signals from space received by satellite earth stations are very weak. While the signals from satellites of importance to Australia like GMS-5 and FY-2B come from a fixed point on the geostationary arc, those received from polar orbiting satellites can be received from any direction above the horizon. The hemisphere around the earth-station above the horizon thus

needs to be kept clear of interfering signals. By the very nature of their mobility, this requirement is almost impossible to achieve for mobile communications transmitters.

In addition to the issue of management of spectrum for equitable access by all involved, charging regimes are also important. The issues paper (Section 2.8) asks: "*What allocation and charging arrangements should apply to spectrum for satellite operations?*" The Bureau considers that, for non-commercial national public interest purposes, EES including meteorological satellite operations should be exempt from charging regimes. The reason is that the satellite data and operations are in direct support of safety of life and property and national defence. The satellite data are made available in many cases free under international exchange arrangements coordinated by the WMO and are not sold.

Part 9: Impact of the legislation on competition (Section 2.9)

Brief comment is provided here. The Issues Paper in Section 2.9 on impact of the legislation on competition asks "*What benefits and costs are associated with any restrictions that the RCA imposes on competition?*" The Bureau would, while noting the principles of competition policy and competitive neutrality, suggest that a careful balance needs to be maintained between those public interest activities that are overwhelmingly dependent on voluntary co-operation on the one hand, and those which rely on the need to foster competition and commercial growth on the other. Many public interest and emergency service and community organisations could not compete with large corporations on pure dollar terms if bidding for spectrum at auction, nor should they realistically be expected to do so. This is one function of a regulatory regime to ensure diverse interests can be met in a mutually acceptable manner and that spectrum is used efficiently.

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Attachment A

Bureau of Meteorology Detailed Use of Radio Spectrum

Meteorological Radars

S-Band (2.7 to 2.9 GHz)
These radars are of critical importance to the Bureau and to National Meteorological and Hydrological Services of most countries throughout the world. The Bureau currently operates 18 radars in this band and expects to continue using it indefinitely. The radars provide an essential observation network to monitor severe weather systems around populated areas including major cities and industries in regional and rural Australia. The 2.7-2.9 GHz band is also available for Air Traffic Control (ATC) radars on a shared Primary basis.

C-Band (5.6 to 5.65 GHz)
This band is also critical to meteorological radar operations in Australia and worldwide. The Bureau has 38 radars operating in this band on an exclusive Primary basis.

X-Band (9.3 to 9.5 GHz)
The Bureau of Meteorology has four radar systems in use in this band. These are planned to be replaced with C-Band radars within 5 years. Operating problems with the increased attenuation of X-Band signals by water vapour in storm cells and the availability of alternative wind-finding technologies, such as profilers and GPS-based systems, have reduced the attractiveness of this band for meteorology. It is, however, used by hundreds of thousands of marine radars worldwide and will no doubt remain a mainstream civilian radar band.

Wind Profiling Radars

The Bureau of Meteorology operates seven of these profilers in Australia. Recent frequency allocations have been made at 54 to 56 MHz (3 profilers), 448 to 450 MHz (none to date) and 1270 to 1295 MHz (1 at NSW EPA). Three other profilers use legacy frequencies of 44.75 MHz (Mount Gambier), 49.68 MHz (Darwin) and 922 MHz.

Radiosondes

The Bureau operates a network of 50 radiosonde stations, which launch radiosondes once or twice per day to determine pressure/temperature/humidity profiles or perform wind-finding. The balloon train carrying the radiosonde also incorporates a radar target used with the Wind finding radars. These radiosondes operate in the Meteorological Aids frequency band from 400.15 to 403.0 MHz.

With the development and availability in the near future, of digital radiosondes with high stability transmitters and synthesised ground receivers for this 402 MHz band, the Bureau of Meteorology has a long term commitment to this Meteorological Aids band.

A small number of wind-finding 1680 MHz Radio-theodolites are proposed to be installed over the next 5 years where the cost of a radar or profiler is not justified.

The Global Positioning System (GPS) is used for wind-finding on the Bureau-developed Autosonde (automated) balloon 'fill and release' system from 12 sites on mainland Australia and from 4 stations in the Antarctic (no radars).

List of meteorological frequency bands which should not be subject to auction (continued)

International bands used for passive remote sensing by Earth Exploration Satellites

1400 – 1427 MHz, 2655 – 2670 MHz, 2690 – 2700 MHz, 10.6 – 10.7 GHz

15.35 – 15.4 GHz, 18.6 – 18.8 GHz, 21.2 – 21.4 GHz, 22.21 – 22.5GHz , 23.6 – 24 GHz

31.3 – 31.8 GHz, 33.5 – 37 GHz, 50.2 – 50.4 GHz, 52.6 – 59.3 GHz

86 – 92 GHz, 100 – 102 GHz, 105 – 112.25 GHz, 148.5 – 151.5 GHz,

155.5 – 158.5 GHz, 164 – 167 GHz, 174.8 – 191.8 GHz, 200 – 209 GHz

226 – 231.5 GHz, 235 – 238 GHz, 250 – 252 GHz

International bands used for active remote sensing by Earth Exploration Satellites

1215 – 1300 MHz, 3100 – 3300 MHz, 5250 – 5460 MHz, 8550 – 9650 MHz,

9500 – 9800 MHz, 13.25 – 13.75 GHz, 17.2 – 17.3 GHz, 24.05 – 24.25 GHz,

35.5 – 36 GHz, 94 – 94.1 GHz, 130 – 134 GHz

Bands involving large capital investment for equipment

Band	**Use**
27.695, 27.745MHz	Waverider buoys
151.5,152.4 and 151.95MHz	Flood warning systems (many hundreds of licences)
450 – 472 MHz	Data Loggers/AWS networks and Telemetry systems
509.55 MHz	AWS networks
853 MHz	Data Loggers/AWS networks and Telemetry systems
929 MHz	Data Loggers/AWS networks and Telemetry systems
10.651GHz	Microwave links

Attachment D

Frequencies used by Meteorological Satellites

The bands of relevance here include:
Space to Earth 1670 to 1710 MHz
Earth to Space near 2000 MHz (TARS, see below)
Space to Earth – about 30 bands for passive remote sensing within the range from around 1.4 to 955 GHz
Space to Earth at X-band.

Space to Earth 1670 to 1710 MHz

The Bureau of Meteorology operates satellite ground stations in Melbourne, Sydney, Perth, Darwin, Crib Point near Melbourne, Casey in Antarctica and Brisbane (planned) to receive Visual and Infrared Spin Scan Radiometer (Stretched-VISSR) and other data from the Geostationary Meteorological Satellite (GMS-5) located at 140° East operated by the Japan Meteorological Agency. GMS-5 is the most important source of meteorological satellite data for Australia.

Stretched-VISSR data is also received at Crib Point, Perth (planned) and Darwin (planned) from the Fen Yung-2B (FY-2B) geostationary meteorological satellite, located at 105°East, and operated by the China Meteorological Administration.

High Resolution Picture Transmission (HRPT) data from the polar orbiting satellites operated by the United States National Oceanographic and Atmospheric Administration (NOAA) is received in Melbourne and Crib Point. This data includes Advanced Very High Resolution (AVHRR) multi-channel imagery and atmospheric sounding data (TOVS) used in weather forecasting and warning, in supercomputer numerical weather prediction models and by users such as Government agencies and the Defence Forces. The Bureau of Meteorology also operates HRPT stations at Darwin, Casey in Antarctica and in Perth. A new station in cooperation with the Australian Centre for Remote Sensing is being established in Alice Springs in late 2001.

The Bureau of Meteorology also receives meteorological transmissions from the Chinese polar orbiting satellite, Fengyun-1C on 1700.5 MHz

<u>An important note on sharing</u>

Sharing of frequencies used for meteorological and environmental satellite communications with other user groups such as the Mobile Satellite Service (MSS) is extremely difficult because the signals from space received by satellite earth stations are very weak. While the signals from GMS-5 and FY-2B come from a fixed point on the geostationary arc, those received from polar orbiting satellites (e.g. NOAA, Terra, Landsat, Spot, ERS) can be received from any direction above the horizon. The hemisphere around the earth station above the horizon thus needs to be kept clear of interfering signals. By the very nature of their mobility, this requirement is almost impossible to achieve for mobile communications transmitters.

Earth to Space near 2000 MHz

HRPT and SV transmissions in the Space to Earth direction are made on frequencies in the 1670 to 1710 MHz band. However, other transmissions associated with satellite station-keeping, telemetry and control occur in both the Earth to Space and Space to Earth directions. For example, The Bureau of Meteorology operates at HMAS Cerberus Naval Base at Crib Point in Victoria, a Turn Around Ranging Station (TARS) for each of the GMS and FY-2 series of satellites. These TARS receive signals from GMS-5 on 1684 MHz and FY-2B on 1690.5 MHz and retransmit them back to the satellites at 2032.2 MHz and 2046.5 MHz respectively.

Space to Earth – about 30 bands for passive remote sensing within the range from around 1.4 to 955 GHz

Passive satellite remote sensing is undertaken by many satellite and airborne sensors. This is for the purpose of applications such as soil moisture, sea temperature, sea state, salinity, rain, snow, ice cover, water vapour, ozone, clouds, oil spills, atmospheric temperature and moisture and constituents and so on. The Bureau and other national meteorological services use this data extensively. The bands are for example 1.4-1.427 GHz, 4.2-4.4 GHz, 6.425-7.25 GHz, 10.6-10.7 GHz, 15.2-15.4 GHz, 18.6-18.8 GHz, 21.2-21.4 GHz and so on with about 23 more bands ending at 952-955 GHz. Decisions have been made at WRC-97 and WRC-2000 concerning the use (e.g. primary or shared, exclusive etc) of these bands.

Space to Earth at X-band

An X-band ground station in Hobart which cost several $M is owned by a Government and University consortium including the Bureau of Meteorology. It operationally receives X-band (high data rate) satellite transmissions from a range of environmental satellites such as Terra, Landsat, ERS, SPOT and Radarsat. Another X-band ground station owned by a similar consortium including the Bureau of Meteorology is being installed in Perth, WA, for the Earth Observation System (EOS) spacecraft, Terra and Aqua, and other X-band satellites. The station will be operational in October 2001. Further X-band ground stations will be installed in Melbourne (2002) and in Darwin (2002/03) and at other sites in the Bureau's national network (e.g. Antarctica).