FOREWORD

After five years experience of spectrum licensing, the ACA is examining the structure of this licence format and its implementation. Many spectrum licences acquired at auction in the last few years are now being exploited through the installation of devices and the establishment of commercial networks. With the deployment of systems in spectrum licensed bands, some administrative and conceptual issues relating to use that have remained in the background are becoming more prominent.

Recently a number of persons working with or operating under spectrum licences made submissions to the Productivity Commission’s Review of Radiocommunications and spectrum licence utility and administrative issues featured in these discussions. The paper below outlines some issues relating to spectrum licensing and poses some questions for discussion. The paper is not intended to outline a preferred ACA view, or necessarily foreshadow changes to regulation. Rather it is an opportunity to begin debate about the effectiveness of the spectrum licensing concept. The ACA welcomes submissions on these issues or any other matters relating to spectrum licensing.

Submissions will be made public and will form the basis for debate at a workshop on spectrum licensing to be held in the near future.

Submissions or comment should be directed to:

David Brumfield
Manager
Spectrum Marketing Team
Australian Communications Authority
PO Box 78
Belconnen ACT 2616

Facsimile: 02-6219-5231
Email: david.brumfield@aca.gov.au

to arrive at the ACA by Tuesday 19 November 2002.

This Discussion Paper provides background information to assist people in making comments to the ACA. Nothing in this paper should be taken to bind the ACA to any particular course of action in later processes.
The Spectrum Licensing Approach

1. Spectrum licensing introduced the concept of spatial licensing to Australian radiocommunications administration for the first time in 1997. Spectrum licensing provides licensees with rights over parcels of spectrum defined by geography and bandwidth. Within the area of the licence, the licensee is free to make decisions about the number and location of transmitters to be deployed and the services/technologies for which those transmitters are used. In this way spectrum licensing passes key decisions about spectrum use to the licensee.

2. Licensees are also free to trade and lease spectrum space within their spectrum licences. The ACA remains strongly committed to the concepts underlying spectrum licensing. However, it considers that with the five years’ experience with the implementation of spectrum licensing it is appropriate to consider whether the rules surrounding the interference management frameworks for this type of licensing can be refined.

3. A fundamental objective of spectrum licensing is to facilitate market determination of spectrum use in terms of:
   - which and how many licensees obtains access to the spectrum;
   - how much spectrum each licensee uses;
   - the location or area of operation;
   - the services offered; and
   - the technologies used.

4. To implement this concept, it is necessary to codify the spectrum asset in a way that identifies the parcel of spectrum concerned and defines the rights and obligations of neighbouring licensees. This “product definition” is especially important given the associated price-based allocation process and the potential for dispute as to the rights and obligations of successful bidders.

5. To facilitate maximum flexibility, spectrum licences are designed to be sub-divisible or able to be aggregated in each of the spectrum domains of area, bandwidth and time. This reconfigurability in the area and bandwidth domains is facilitated by allowing secondary trading of spectrum assets down to small parcels known as Standard Trading Units (STUs).

6. It is important to recognise some key differences in the coordination processes required for over-the-counter apparatus licence and those required for spectrum licences:
   - coordination between over-the-counter apparatus licences usually deal with known services using mature algorithms;
   - coordination between over-the-counter apparatus licences is usually between a device at one point and devices at other points. Devices in spectrum licensed bands must be coordinated against the space of a
neighbouring licensee using some sort of generic algorithm that tries to be technology neutral.

- area wide apparatus licences do not have the risk/need for precision relationship that it necessary to support the reconfigurable spectrum licensing concept.

7. Also, the amount of interference that is tolerable usually varies from one type of service to another. Consequently, it is difficult to design a technical framework that is truly technology neutral. While there are some common features, there are also differences between the technical frameworks in the various bands designed so far.

8. The need for device registration is a separate but related issue. In considering this issue, it is important to remember the design objectives of spectrum licensing, that is, to support the sub-division or amalgamation of small spectrum parcels in a secondary market in order to facilitate market determination of spectrum use.

**Managing Interference**

9. Where transmitters are deployed, the licensee is obliged to abide by an interference management framework designed to minimise interference with surrounding services. To achieve this, levels of unacceptable interference are defined in terms which set limits on the maximum permitted level of radio emissions outside the geographic and spectrum boundaries of a licence. The emission limits are incorporated into the core conditions of the licence.

10. Rules about unacceptable interference for spectrum licensed bands are contained in Determinations made by the ACA under section 145 of the *Radiocommunications Act 1992*. The ACA has made such a Determination for each spectrum licence band release (eg 800MHz, 1.8 GHz, 3.4 GHz etc). These Determinations set out a measurement methodology, using concepts such as “device boundary polygons” and “transmitter groups” to encapsulate the flexibility of device deployment intended for a spectrum licence while seeking to protect against unacceptable interference.

11. Current interference management arrangements are strongly supported by some parties, who argue that they are integral to protecting the utility of spectrum under spectrum licensing. Others, however, have suggested that the arrangements undermine the concept of technology neutrality, are overly complex, provide no guarantee that transmitters will not cause interference, and that the measurement methodology might be simplified to achieve necessary interference mitigation with less complexity. Critics also suggest that the complexity of the interference management arrangements has deterred accredited frequency assigners from offering their services to spectrum licensees and has constrained the market for frequency coordination services. (In this regard, the ACA notes that very few accredited persons have been active in device registrations.)
Issue: Interference management regime

Do the core conditions of spectrum licences, combined with the interference management arrangements, unnecessarily limit the range of services and technologies which can be operated within a spectrum licence?

Are there models which offer a more effective and/or simpler means of managing interference?

Certification

12. At the inception of spectrum licensing, it was intended that conformity to the core conditions of a licence would be established by the production of an Interference Impact Certificate (IIC). This derives from Section 145 of the Radiocommunications Act 1992 which provides that:

- the ACA may refuse to register devices under spectrum licensing if it is satisfied that the transmitter could cause unacceptable interference; and
- the ACA may require the presentation of a certificate by an accredited person that operation of the device will not cause unacceptable interference.

To produce an IIC an accredited person must assess each proposed device against a number of measurement parameters, and warrant that, against these criteria, the device will not cause unacceptable interference within the meaning of the relevant Determination made by the ACA under section 145 of the Radiocommunications Act 1992.

13. The provision of such certificates is not mandatory under the Act. However, under the ACA’s implementation of spectrum licensing, production of an IIC is mandatory, except where the spectrum licensee has:

- obtained the agreement of other potentially affected spectrum licensees to allow increased levels of in-band and/or out-of-area emissions to spill into their spectrum space; or
- sufficient guard space – i.e. when the increased levels of emissions are contained within the licence by frequency and distance separation from the boundaries of the spectrum licence.

14. A feature of the guard space route is the requirement, under section 145 of the Act, that the ACA must be satisfied that the device will not cause unacceptable interference. As a matter of policy the ACA requires that registration applications using this route be submitted by an accredited person. In effect, this imposes the overlay of assessment by an accredited person without the methodology attached to IICs.

15. Some parties have argued that certification by an accredited person imposes an unnecessary financial impost on spectrum licensees as it is costly and, arguably, provides no guarantee against interference. Moreover, the frameworks adopted by the ACA require the accredited person issuing the certificate to follow the
particular methodology prescribed for the band. Critics consider that, as the licensees have an obligation to adhere to the core conditions of the licence, it should be the prerogative of licensees to decide how those obligations will be met.

16. The ACA in spectrum management is moving to more of a risk management approach to dealing with interference issues. Increasingly, both planning requirements and compliance activities are taking into account the nature and likelihood of the inherent risks involved and dealing with those risks if they eventuate, rather than the more traditional approach of imposing rules that attempt to cover any eventuality in advance. Moreover, the ACA believes that spectrum users should bear more of the responsibility for managing their own spectrum (and for managing the risks of interference). Within such a risk management context, one alternative to certification at the time of registration could be a “certification on demand” system under which devices might be registered without an accompanying IIC. Under this approach, a licensee would be required to produce an IIC, only if interference were to occur at some later point.

17. This approach would allow some reduction in the initial costs of establishing conformity through registration by focussing on instances where interference has, or is likely, to occur.

18. One concern under a “certification on demand” regime is that there may be little incentive to undertake full co-ordination in advance. There is some likelihood that licensees would perform only basic (or perhaps no) co-ordination in advance and then deal with interference or other problems as and when they occur. To ensure that the removal of up-front certification does not lead to the operation of non-conforming devices, the remedial action and rights of the parties in the event of interference would need to be clearly enunciated in advance. To provide for expedient resolution of interference it may be appropriate to limit the time allowed to produce the certification. Remedial action would also need to account for the possibility that prior establishment of the non-conforming device may have conferred some unfair commercial advantages, or that service recipients (that is, customers) may be disadvantaged by changes needed to bring the device into conformity.

**Issue: Simplification of Certification**

*Would a certification on demand approach, in lieu of certification at the time of registration, be a more expedient means of managing interference?*

**Registration of Devices**

19. The Act provides that the ACA may require registration of such details of the devices operated under spectrum licences as the ACA determines. When originally considering how to implement spectrum licensing, the ACA proposed to exempt from registration low power mobile units. This intention was carried into practice and mobile handsets are exempt from the registration requirement and the registration of receivers is effectively optional.
20. For some terminal style equipment, group registration procedures have simplified the assessment and reporting requirements prior to registration. Nevertheless, for the majority of deployed equipment, individual device registration is mandatory.

21. Registration of devices is said to enable coordination of new services with existing services, thus minimising the potential for interference. Registration of devices also provides information about devices which is useful in resolving interference if it occurs, and provides some basis for settling interference disputes.

Rationalising Device Registration Requirements?

22. Details of registration requirements for devices operated under spectrum licences are set out at Attachment A. The ACA is aware of opposing views, within industry, as to whether these requirements are appropriate. On the one hand, some parties have urged the ACA to maintain the current registration requirements without any simplification. Those parties contend that simplification of device registration details would undermine the broader utility of the spectrum and constrain alternative uses. On the other hand, some observers have suggested that given the requirement for spectrum licensed devices to meet conditions so as not to unacceptably interfere, the need for registration is reduced when the adjacent service is also spectrum licensed.

23. Some parties argue that the data requirements are excessive and that particular data fields can be inferred or be re-constructed from other data items and that only site coordinates and centre frequencies are required. Among those proposing reduced registration requirements some have extended this argument to suggest rationalised registration requirements for spectrum licensed devices generally, while others have suggested removal of the requirements only for certain classes of devices which in their view are less likely to cause interference.

24. The Productivity Commission, in its draft report on Radiocommunications dated February 2002, noted that “While the Commission observes that device registration has become an important component of the ACA’s spectrum licensing process, it is not clear whether such detail is necessary. The costs imposed on spectrum licensees in preparing and registering all this information may outweigh any benefits from the information in terms of interference management and spectrum trading. It may be possible to reduce the compliance costs to spectrum licensees by reducing the level of detail, while still retaining any benefits of device registration.”

Customer Premises Transmitters

25. A specific issue that has been raised with the ACA is whether registration requirements should apply to widespread deployments of transmitters that are installed at customer premises. The registration and certification process recognises that there is a greater interference potential for devices with antennas
over the effective height of 10 metres\(^1\) as against antennas less than 10 metres by allowing lower antennas to be registered as part of a group in some circumstances. The example of 10 metres is based on the effective antenna height that applies to the 3.4 GHz band. In the 2 GHz band the effective antenna height is 20 metres.

26. Group registration of transmitters is possible where transmitters have the same centre frequency and emission designator, and are intended to communicate with the same receiver or group of receivers. Part of the criteria for inclusion of a transmitter within a group is that every transmitter in the group must have an effective antenna height of less than 10 metres and must not operate for more than 5% of any one hour period. Whether customer premises transmitters are able to meet the 5% duty cycle requirement depends to some extent on the type of service that is intended. Current arrangements require that where transmitters that would otherwise meet the group registration requirements but do not meet this requirement must be registered individually.

27. Options for future treatment of customer premises transmitters with effective heights below 10 metres (based on the 3.4 GHz example above) could include, for instance:

(a) exempting these devices from registration altogether as their interference potential is low;

(b) relaxing the 5% duty cycle requirement to enable their registration as part of a group; or

(c) allowing licensees to decide whether or not to register customer premises transmitters but subjecting un-registered transmitters to a no-interference/no-protection rule.

28. In relation to (c) above, an un-registered customer premises transmitter would still be required to comply with core licence conditions. Circumstances of interference would be managed in the following ways, assuming that, in all of the scenarios, the parties involved were operating within their licence conditions:

<table>
<thead>
<tr>
<th>Source of Interference</th>
<th>Sufferer of Interference</th>
<th>Responsibility for Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unregistered transmitter (spectrum licensed)</td>
<td>Registered transmitter (apparatus or spectrum licensed)</td>
<td>Operator of unregistered transmitter</td>
</tr>
<tr>
<td>Registered transmitter (apparatus or spectrum licensed)</td>
<td>Unregistered transmitter (spectrum licensed)</td>
<td>Operator of unregistered transmitter</td>
</tr>
<tr>
<td>Unregistered transmitter (spectrum licensed)</td>
<td>Unregistered transmitter (spectrum licensed)</td>
<td>Commercial negotiation between the parties</td>
</tr>
</tbody>
</table>

\(^1\) The effective height is height of the antenna above the surrounding average terrain height. A 10m effective height generally means that antennas would be above the clutter layer (due to buildings, trees, etc) and would have a relatively clear view of other receivers that could suffer interference, whereas if antennas are below a 10m effective height they are more likely to be in the clutter layer and therefore not have a clear view of other receivers and in consequence would be less likely to cause interference.
29. These rules would acknowledge that an unregistered transmitter cannot be wholly protected from interference i.e. the normal ‘first-in-time’ rule can be used to resolve interference disputes only where the relevant transmitters are registered. The rules would allow a licensee, operating equipment at customer premises, to evaluate costs, risks and other factors in deciding whether to register a transmitter.

**Issue: Device registration requirements**

*Could the level of detail required for device registration be rationalised without compromising the technical integrity of spectrum licensing - if so, which of the current registration requirements could be rationalised.*

*Is there a case for altering registration requirements for customer premises equipment, and, if so, in what manner?*

**Notifying de-commissioned devices**

30. A related issue is the absence of any requirement on licensees under the current regulatory arrangements to advise the ACA of the removal or decommissioning of devices that are no longer in use. While registered devices under spectrum licenses will be confined to the spectral boundaries of the licence and are not likely to interfere with neighbouring services, over time the build up of non-operational or decommissioned devices registered against the licence will distort the picture of licence use. A misleading pattern of usage might also pose difficulties for licensees themselves in the event of licence aggregation, subdivision, trading, or leasing where the ACA register is the main source of information. Arguments for the retention of current comprehensive registration requirements rely to some extent on the accuracy of registration information supplied and accessed. If this information is distorted by the inclusion of aggregated decommissioned devices the value of registration is reduced.

**Issue: Accuracy of the register**

*Should there be an obligation on spectrum licensees to remove registrations when a service is de-commissioned or is not deployed?*

**Complexity of Documentation**

31. The ACA has been made aware that some parties consider that the documentation associated with spectrum licensing is overly complex. They point out, for example, that a spectrum licence has to be read in conjunction with various other legal instruments including:

- a marketing plan;
- a determination of unacceptable levels of interference;
- guidelines on managing interference to apparatus licensed receivers;
• guidelines on managing out-of-band interference to receivers operating in spectrum licensed space;
• rules on third party use;
• a determination on registration requirements;
• a determination on trading rules; and
• guidelines on registration of devices without an interference impact certificate.

32. Those parties have called for the better integration of documents and have also commented on convoluted technical and legal definitions used in those documents and the need for simple, plain English.

**Issue: Simplification of documentation**

*Should technical conditions, relating to managing unacceptable interference, be included in the licences rather than in determinations as at present?*

*Should the language and definitions used in Spectrum licensing documents be simplified, and if so, should the new, simplified wording be the subject of consultation with interested parties?*

*Could prescriptive guidelines be replaced by more generalised statements of unacceptable interference?*
REGISTRATION REQUIREMENTS FOR DEVICES OPERATED UNDER SPECTRUM LICENCES

(1) The part of the Register relating to spectrum licences must contain the details set out in this clause about:

   (a) each transmitter authorised to be operated under each spectrum licence, unless registration of the transmitter is exempt under a condition included in the licence relating to the transmitter under subsection 69(2) of the Act; and
   (b) if a licensee registers a receiver-each receiver to be registered.

(2) The details are:

   (a) the licence number;
   (b) the registration number assigned by the ACA to each device;
   (c) whether the device is a transmitter or a receiver;
   (d) the number assigned by the ACA to the person who applied to register the device;
   e) if the device is a transmitter-the client number assigned by the ACA to the person accredited under section 263 of the Act who issued the interference impact certificate for the device;
   (f) the date and time of registration of the device;
   (g) an indication of whether the operation of the device is authorised during certain times only;
   (h) the parameters relating to the operation of devices that are used in working out unacceptable levels of interference under the section 145 determination and levels of protection under the Marketing Plan;
   (i) the identification number assigned by the ACA to each centre location of the device;
   (j) the latitude and longitude of each centre location of the device, worked out in accordance with the section 145 determination;
   (k) the effective radius of the centre location of the device in kilometres, worked out in accordance with the section 145 determination;
   (l) the name of each centre location of the device.

(3) The details about the antenna of the device are:

   (a) the identification number assigned by the ACA;
   (b) the intended polarisation;
   (c) the forward gain for the intended polarisation, in units of dBi;
   (d) the 3 dB beamwidth for the intended polarisation, in degrees;
   (e) the front to back ratio for the intended polarisation, in decibels;
   (f) the azimuth for a device using a directional antenna, being the bearing along the centre of the beamwidth;
(g) the height above ground, worked out in accordance with the section 145 determination.

(4) If the device is a transmitter, the details are:
(a) the emission centre frequency;
(b) the emission designator;
(c) the effective occupied bandwidth;
(d) the radiated power, within the meaning of the section 145 determination.

(5) If the device is a receiver, the details are the level of protection.

Details for groups of devices operated under spectrum licences
(6) A transmitter that is part of a group of transmitters may be included in the part of the Register relating to spectrum licences as part of the group or as a single transmitter.

(7) A receiver that is part of a group of receivers may be included in the part of the Register relating to spectrum licences as part of the group or as a single receiver.

(8) If a device is included in the register as part of a group, the Register must contain the details set out in this clause for each group of devices.

(9) The details are:
(a) the registration number assigned by the ACA to each group of devices;
(b) whether the group consists of transmitters or receivers;
(c) the number assigned by the ACA to the person who applied to register the group of devices;
(d) in the case of a group of transmitters-the number assigned by the ACA to the person accredited under section 263 of the Act who issued the interference impact certificate for the group;
(e) the date and time of registration of the group of devices;
(f) an indication of whether the operation of any device in the group is authorised during certain times only;
(g) the parameters relating to the operation of the group of devices that are used in working out unacceptable levels of interference under the section 145 determination and levels of protection under the Marketing Plan;
(h) the identification number assigned by the ACA to each centre location of the group;
(i) the latitude and longitude of each centre location of the group, worked out in accordance with the section 145 determination;
(j) the effective radius of each centre location of the group in kilometres, worked out in accordance with the section 145 determination;
(k) the name of each centre location of the group.

(10) The details about the antenna are:
(a) the identification number assigned by the ACA;
(b) the intended polarisation;
(c) the forward gain for the intended polarisation, in units of dBi;
(d) the 3 dB beamwidth for the intended polarisation, in degrees;
(e) the front to back ratio for the intended polarisation, in decibels;
(f) the height above ground, worked out in accordance with the section 145 determination.

(11) If the group is a group of transmitters, the details are:
(a) the emission centre frequency;
(b) the emission designator;
(c) the effective occupied bandwidth;
(d) the radiated power, within the meaning of the section 145 determination.

(12) If the group is a group of receivers, the details are the level of protection.

[NOTE: Because of the definitions of group of transmitters and group of receivers, the information mentioned in subclauses (5), (6) and (7) will be the same for each member of the group.]