

Radiocommunications Advisory Guidelines (Registration of Devices under Spectrum Licences without an Interference Impact Certificate) 1998

Commonwealth of Australia

Radiocommunications Act 1992

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THE AUSTRALIAN COMMUNICATIONS AUTHORITY makes the following guidelines under subsection 262 of the *Radiocommunications Act 1992*

Dated 28 May 1998.

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BACKGROUND

A spectrum licence consists of a frequency band and a geographic area. Interference occurring between adjacent spectrum licences consists of:

- in-band interference, across the geographic boundaries; and
- out-of band interference, across the frequency boundaries.

This interference is managed by creating emission buffer zones along the geographic and frequency boundaries of the licence, using a number of tools provided by the *Radiocommunications Act 1992*. These tools are:

- the core conditions in all spectrum licences (see s.66 of the Act), about:
 - emission limits outside the area; and
 - emission limits outside the band;
- determinations under s.145 of the Act about what constitutes unacceptable interference;
- registration of devices under spectrum licences;
- advisory guidelines made under s.262 of the Act, about managing interference in specific circumstances.

The following advisory guidelines under s.262 of the Act deal with registering a device under a spectrum licence without an interference impact certificate for the device under section 145 of the Act. The device can only be registered when all affected adjacent licensees agree to allow increased levels of in-band and out-of-area emissions from the device to spill into their spectrum space, or when the increased levels are contained within the licence by frequency and distance separation from the boundaries of the spectrum licence.

PART 1 - INTRODUCTION

Title

1.1. These guidelines are the *Radiocommunications Advisory Guidelines (Registration of Devices under Spectrum Licences without an Interference Impact Certificate) 1998*.

Commencement

1.2. These guidelines commence on 28 May 1998.

Purpose of these guidelines

1.3. The purpose of these guidelines is to set out ways in which a device under a spectrum licence can be registered although it does not comply with the requirements of the relevant s.145 determination and therefore, can not have an Interference Impact Certificate issued for it. These devices can only be registered when all affected adjacent licensees agree to allow increased levels of emissions from the device to spill into their spectrum space or when the increased levels are contained within the licence by the virtue of frequency and distance separation from the boundaries of the spectrum licence.

Interpretation

1.4. In these guidelines, unless the contrary intention appears:

Act means the *Radiocommunications Act 1992*.

blocking interference means overloading of the input circuitry of a receiver by closely located transmitters.

device boundary criterion, in relation to the power radiated from a device, means the distance along a radial from the device that is required to ensure that emission levels from the device are below the sensitivity of a notional receiver.

deployment constraints means emission limits that depend on the effective antenna height of a device calculated with reference to the average terrain height in the first 5 minute area segment of sectors formed by radials from the device.

emission buffer zone means a zone along the geographic or frequency boundary of a spectrum licence where emission levels of transmitters are reduced to ensure that significant levels of emissions stay within the geographic area and frequency band of the licence.

guard space means isolation that is necessary to keep significant levels of emission radiated from a radiocommunications device within the spectrum space of its spectrum licence:

- (a) in the form of distance separation (guard area) or frequency separation (guard band) of the device from the boundaries of the licence; and
- (b) in a manner that is in accordance with the objectives of the interference management framework established for the relevant band release.

IIC means an interference impact certificate issued under subsection 145 (3) of the Act.

in-band, in relation to a transmitter operated under a spectrum licence, means the frequencies within the frequency band of the spectrum to which the licence relates.

in-band interference means interference resulting from emissions at frequencies that are in-band.

intermodulation interference means the creation of interfering signals at various arithmetic combinations of the carrier frequencies of closely located transmitters.

RALI LM8 means the Radiocommunications Assignment and Licensing Instruction No. LM8 issued by the ACA as in force from time to time, copies of which are available from the ACA.

Register means the Register established under s.144 of the Act.

s.145 determination, for a device operating under a spectrum licence, means the determination under s.145 of the Act for the part of the spectrum where the device operates.

spectrum map grid means the map grid developed by the ACA for Australia, showing cells the sides of which measure 3 degrees of arc, 1 degree of arc or 5 minutes of arc, published by the ACA.

spectrum space means a 3 dimensional space consisting of a frequency band and a geographic area.

standard trading unit (STU), means a parcel of spectrum space consisting of a geographic area equal to a cell of the spectrum map grid and a frequency band having lower and upper frequency limits defined in accordance with a relevant Spectrum Marketing Plan.

(3) A term used in these guidelines that is defined in a s.145 determination has the same meaning as in that determination.

[NOTE. The following terms, used in these guidelines, are defined in the *Radiocommunications Act 1992* and have the meanings given to them by that Act:

frequency band	interference
ACA	spectrum licence
transmitter.]	

PART 2 - BACKGROUND

2.1 Increasing Flexibility for a Spectrum Licence

2.1 (1) There is already considerable flexibility available for the operation of devices under spectrum licences. This flexibility is clearly specified in the relevant Marketing Plan so that bidders may accurately estimate the utility of the spectrum and hence, estimate its correct value before and during the auction. It would be very difficult to estimate the value of the spectrum if most of its utility depended on the result of agreements between successful bidders, for both coordination and sharing, after the auction. For a particular band, the degree of flexibility depends upon the basis upon which the interference management framework is designed. An important part of this basis is the choice of size for the area and bandwidth STUs. Flexibility increases as the size of the STUs increase. The ultimate flexibility of a spectrum licence, which is an aggregation of STUs, also increases as the size and shape of the licence increases. In some cases, the size of a licence may reach a point where additional flexibility, above that provided under the framework, is possible. These Advisory Guidelines provide indicative criteria and procedures for achieving more flexibility than that available under the relevant framework, depending on the size and shape of the spectrum licence.

2.1 (2) When devices are operated in accordance with the technical conditions of a spectrum licence, significant levels of emission are kept within the spectrum space of the licence in a manner that is in accordance with the design objectives of the interference management framework for the relevant band. The technical conditions create constraints on emission levels as a function of effective antenna height, distance to the geographic boundary and frequency separation from the frequency boundary. If devices do not operate within these constraints then significant levels of emission may spill outside the spectrum space of the licence. Depending on the size and shape of the spectrum space a device may be able to operate outside the constraints by ensuring that there is sufficient guard space for the device. The ultimate flexibility that may be achieved for operation of devices within a spectrum licence depends on the amount of guard space available.

2.1 (3) In some cases, sufficient guard space may be available within the licence itself to allow operation of a device that does not comply with the technical conditions of the licence. Alternatively, the space of the licence may be effectively increased through agreements between adjacent licensees that provide for the sharing of their space in a manner that creates the necessary guard space. In the case of emissions spilling from spectrum licensed space into apparatus licensed space, the ACA may be thought of as being the adjacent 'spectrum licensee' and agreement with the ACA would be necessary regarding sharing of that space.

2.2 Core conditions

2.2 (1) The licensee is primarily responsible for the compliance of devices with the core conditions of the licence. If a device does not comply with these core conditions, the conditions must be varied before the device is operated. The core conditions can only be varied by agreement between the ACA and affected licensees under section 72 of the Act. In the case of emission levels outside the frequency band of a licence, all licensees for a particular band release would normally be affected except when the limits in question relate solely to the protection of services operating outside the designated band. The amended core conditions would then apply to those licences.

2.2 (2) The core conditions mainly restrict levels of emissions outside the frequency band of a licence. However, the core conditions also restrict levels of emission within the frequency band of a licence. For example, for the 500 MHz band, horizontally radiated power (measured within a 12.5 kHz bandwidth) from a fixed transmitter located anywhere in the geographic area of the licence is limited to 49.2 dBm EIRP. This core condition may be varied by agreement between the ACA and the licensee on a case by case basis, and the amended core condition applies to that licence only.

2.3 Device registration requirements

2.3 (1) Each spectrum licence contains a condition that a device operated under the licence must be registered before it can be operated, and the condition can exempt some devices - see s.69 of the Act. The device registration requirements usually further restrict levels of emissions from a transmitter through either the application of device boundary criteria or deployment constraints.

2.3 (2) The registration requirements usually include further limits on emission levels that are based on the deployment of devices in relation to both effective antenna height and the distance to the boundary of the geographic area of the licence. A person accredited under s.263 of the Act takes account of the core conditions of the licence and the other device registration requirements given in the relevant s.145 Determination for the issue of an IIC. Apart from the circumstances set out in these guidelines, an IIC is usually necessary for registration of a transmitter.

[NOTE: The device registration requirements may be varied by the ACA without the agreement of licensees. This would affect all licensees in a particular band.]

2.3 (3) Under s.145(3) of the Act the ACA may require a certificate before registering a device. The ACA will consider registration when an IIC has not been issued for the device if:

- either the device boundary criteria or the deployment constraints are not satisfied, and
- all affected licensees (or licensee when guard space is provided within a single licence) reach alternative arrangements for the management of the increased emission levels.

2.4 Device boundary criteria

2.4 (1) Checking compliance with the device registration requirements involves calculating the effective antenna height of a transmitter. Effective antenna heights are calculated for every 5 minute area segment of sectors formed by radials from the transmitter. Some emission limits depend on the effective antenna height calculated according to the first segment (referred to as “deployment constraints”). Other emission limits depend on the distance along the radials that is required to ensure that the emission levels from the device are below what the ACA considers to be the sensitivity of notional receivers located within adjacent geographic areas (referred to as “device boundary criteria”). Both these constraints keep emissions within the spectrum space of a licence by taking account of the height-gain effect of transmitters.

2.4.(2) The device boundary criteria are based on a mathematical propagation model. If the device boundary so calculated falls outside the geographic area of the relevant spectrum licence the ACA will, generally speaking, refuse to register the device because the levels of emission outside the licence that it would cause will be “unacceptable interference” within the meaning of s.145 of the Act.

PART 3 - VARYING THE DEVICE BOUNDARY CRITERIA

3.1 Varying the device boundary criteria

3.1 A simple and mathematically elegant way of negotiating varied device boundary criteria involves scaling of the device boundary. As mentioned earlier, the device boundary criterion is based on the location of notional receivers within adjacent geographic areas. The location of the notional receiver can be varied and the device boundary expands or contracts accordingly. This controls the size of the emission buffer zone. This process varies a single parameter in the calculation of the device boundary criterion and is equivalent to creating a new virtual boundary, but the use of the device boundary scaling parameter avoids the time consuming task of specifying the coordinates of the new boundary.

3.2 Varying the location of the notional receiver

3.2 The location of the notional receiver is varied:

- for the Lb Lower Band (500 MHz) propagation loss (see Schedule 4 of the Radiocommunications (Unacceptable Levels of Interference) Determination No.1 of 1996), by changing the scaling parameter, the number '22';
- for the Lb Upper Band (500 MHz) propagation loss (see Schedule 5 of the Radiocommunications (Unacceptable Levels of Interference) Determination No.1 of 1996), by changing the scaling parameter, the number '50'; and
- for 800 MHz, 1.8 GHz and other s.145 Determinations, by varying the Device Boundary Scaling Parameter when that parameter is defined.

3.3 Scaling parameter

3.3 The exact number for the scaling parameter may be found by mathematical iteration of a device boundary until the licensees' requirements for keeping the device boundaries of certain transmitters within the existing geographic area along a common area boundary are satisfied. This single number is then accepted under an agreement between area-adjacent licensees as the new device boundary scaling parameter and the emission buffer zone is reduced or increased accordingly.

Note, that there could be different scaling parameters used for adjacent areas.

PART 4—VARYING DEPLOYMENT CONSTRAINTS

4.1 Deployment constraints

4.1 In some cases, for a transmitter with certain effective antenna heights for the first 5 minute segment, a device boundary may not be able to be calculated under the relevant s.145 determination, or the emission limits are severe. These restrictions are referred to as deployment constraints. Deployment constraints are used:

- to provide balanced spectrum utility for transmitters and receivers; and
- to manage intermodulation and blocking interference.

4.2 Types of deployment constraints

4.2 (1) The types of deployment constraints that are necessary for any band release depend on the basis on which the technical framework is designed.

4.2 (2) For example, if transmitters are allowed to operate only at low sites then receivers are being protected from in-band interference at high sites because propagation paths are then usually obstructed. In this case, receivers would not have to be located at great distances inside a spectrum licence to minimise the likelihood of in-band interference from an adjacent spectrum licence. In addition, because of the increased propagation loss caused by obstructions, the size of the zone in which different frequency combinations of transmitters are located that have the potential to cause intermodulation interference in receivers located at high sites is reduced. The deployment constraints also manage interference caused through blocking.

4.2 (3) Conversely, when transmitters are allowed to operate only at high sites then receivers are being protected from in-band intermodulation and blocking interference at low sites.

4.2 (4) By not complying with the deployment constraints, a licensee could be reducing the rights of access to an adjacent spectrum licence. When a licensee's spectrum access rights are being reduced it means that someone else is using the spectrum.

4.3 Guard space

4.3 (1) Devices that do not comply with the deployment constraints may be able to be registered by maintaining guard space:

- by private agreements with affected or potentially affected adjacent licensees; or
- within the spectrum licence.

In this way, non-compliance with deployment constraints will not lead to spectrum space of a licence being used without a licensee's knowledge.

Some guidance is necessary for determining which licensees are going to be affected, or potentially affected, by non-compliance with deployment constraints so that agreement to use their spectrum may be obtained.

4.4 Establishing the necessary size of guard space when transmitters are restricted to low sites

4.4 (1) When a licensee wishes to place a transmitter at high sites but the technical framework constrains them to low sites (for example the 500 MHz upper band), a high-high interference propagation loss path occurs over any geographic and frequency boundaries. In this case there are 3 types of interference that need to be managed: in-band interference, intermodulation interference and blocking interference.

This interference is managed by:

- provision of a guard area; and
- provision of a guard band.

4.5 Guard Area

4.5 (1) The size of the guard area depends on the effective antenna height of the transmitter. The agreement of all licensees within the guard area must be achieved before a device is operated not in accordance with the deployment constraints. Calculating a guard area is similar to calculating a device boundary, except that instead of using effective antenna heights based on sectors and segments and a high-low propagation model, the guard area could be calculated by using a number of path profiles together with a high-high propagation model. In this case, for example, the notional receiver in the 500 MHz upper band would have a benchmark level of protection of -139 and be located at all high sites within range of the transmitter. The benchmark level of protection for 500 MHz is based on maintaining a receiver threshold of -119 dBm within 12.5 kHz for 95% of the time with a level of confidence of 99%. The notional receiver threshold has a corresponding threshold margin of 5 dB above receiver noise.

4.6 Guard Band

4.6 (1) The agreement of all licensees within the guard band must be achieved to operate a device not in accordance with the deployment constraints. The size of the guard band at 500 MHz, for example, is based on the likelihood of intermodulation interference which, in turn, depends on the notional RF selectivity for a receiver (receiver intermodulation is assumed to dominate) and the level of radiated power. At 500 MHz, the notional receiver performance is based on the land mobile service operating in adjacent bands (see RALI LM8). The frequency-distance criteria developed for single frequency services at 500 MHz allows co-siting of transmitters and receivers at a frequency offset of 200 kHz when radiated powers of 83 W EIRP within 25 kHz channels are used.

4.6 (2) Therefore, if a licensee operates in a land mobile environment outside the deployment constraints at 500 MHz but maintains a guard band of at least 200 kHz (either by private agreement or within their licence) then loss of an adjacent licensee's spectrum space through intermodulation and blocking would be considered to be insignificant. In other bands, the guard space would be based on the notional receiver performance defined in relevant advisory guidelines, for example, *Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed Transmitters - 1800 MHz Band) 1998* and *Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed Transmitters - 800 MHz Band) 1998*.

4.7 Establishing the necessary size of Guard Areas and Guard Bands when transmitters are restricted to high sites

4.7 In the case of in-band interference caused by a licensee placing transmitters at low sites when the technical framework constrains them to high sites, a low-low interference propagation loss path occurs over any geographic and frequency boundaries. In this case there are still 3 types of interference, in-band interference, intermodulation interference and blocking interference, that have to be managed simultaneously. While the guard area would be very small, the guard band of 200 kHz is still necessary for 500 MHz devices.

PART 5—REGISTRATION WITHOUT AN INTERFERENCE IMPACT CERTIFICATE

5.1 The Registration Process without an IIC

5.1 (1) Compliance with the relevant s.145 determination and issue of an IIC ensures that a device satisfies the core licence conditions and that operation of the device only uses the spectrum of the licence under which it operates. When a device does not comply with the s.145 determination, and an IIC has not been issued, there is a chance that the device uses spectrum outside the licence. When an adjacent licensee encounters interference caused by this device, the interference settlement process under Part 4.3 of the Act is likely to lead to it being switched off.

5.1 (2) However, if a written agreement exists between adjacent licensees, then, the adjacent licensee would have no basis at some time in the future for demanding that a device, operated in accord with that agreement, be in compliance with the s.145 determination. In these cases, interference complaints would be unlikely to be made.

5.1 (3) Registration of a device is necessary to authorise its operation under the Act. Therefore, to register a device without an IIC, the licensee should:

- show that all licensees who may be affected by the operation of the device have agreed that the device may be operated; or
- satisfy the ACA that sufficient internal guard space will be maintained for the management of interference caused by the device.

Once this is done, the device details would normally be entered into the register and the device authorised to operate under the licence.

[NOTE: Managing interference includes investigating possible causes of interference, taking steps to resolve disputes concerning interference, and taking steps to reduce the likelihood of interference occurring.]

5.2 Compliance with Device Details

5.2 A device registered without an IIC must still comply with the details about it that have been entered in the Register.

PART 6—EFFECT OF TRADING SPECTRUM

6.1 Trading Spectrum Licences

6.1 Spectrum can be traded by trading the whole or a part of a licence - see sections 85-88 of the Act. Agreements between licensees for the sharing of spectrum can only continue to apply while the size and the shape of the spectrum space owned by the licensees remains the same. Where trading of licences takes place and new boundaries are formed, new written agreements will need to be negotiated and provided to the ACA. This negotiation can occur at any time, that is, before or after the trade, so that there is no loss of flexibility to licensees.

6.2 When trading occurs by the division of spectrum space covered by a single licence, a check will be required to ensure that the device boundaries of devices that are to continue operating remain within the geographic area of the resulting licences and, where applicable, that necessary guard space is maintained. This checking can be done by using default or varied device boundary scaling parameters. In addition, if devices do not comply with the deployment constraints, appropriate guard space should be maintained either by new private agreements or within the new licence. The ACA intends to establish provisional licences before a trade to facilitate the redistribution of devices between the portions of spectrum space that occur after a trade.
