

Commonwealth of Australia

Radiocommunications Act 1992

Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed and Class-licensed Transmitters - 1800 MHz Band) 1999

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

Dated 3 November 1999.

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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
- the determination under s.145 of the Act about what constitutes unacceptable interference;
- 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, have been made for the management and settlement of interference to receivers operating under spectrum licences in the 1800 MHz band and caused by transmitters operating under apparatus licences or class licences. In all cases, the receivers and transmitters are radiocommunications devices located at a fixed point on land or sea and not established for use while in motion.

PART 1 - INTRODUCTION

Title

1.1. These guidelines are called the *Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed and Class-licensed Transmitters - 1800 MHz Band) 1999*.

Commencement

1.2. These guidelines commence on 3 November 1999.

Purpose of these guidelines

1.3. The purpose of these advisory guidelines is to manage in-band and out-of-band interference by providing for the protection of fixed receivers operating under spectrum licences issued for the 1800 MHz band from interference caused by fixed transmitters operating in adjacent bands under apparatus licences and licensed after the issue date of the *Radiocommunications Spectrum Marketing Plan (800 MHz and 1.8 GHz Bands) 1998*, or under class licences.

Interpretation

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

1800 MHz band means the frequency bands:

- (a) 1710 MHz - 1785 MHz, the **lower band**;
- (b) 1805 MHz - 1880 MHz, the **upper band**.

Act means the *Radiocommunications Act 1992*.

adjacent channel selectivity means a measure of the ability of the receiver to receive a wanted signal without exceeding a specified degradation in output quality due to the presence of an unwanted adjacent channel signal.

blocking means a measure of the ability of the receiver to receive a wanted signal without exceeding a specified degradation in output quality caused by the presence of a high level off-tune signal overloading the receiver's front-end.

emission buffer zone means a zone along the frequency or geographic 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.

fixed receiver means a radiocommunications receiver located at a fixed point on land or sea and not established for use while in motion.

intermodulation immunity means a measure of the ability of a receiver to receive a wanted signal without exceeding a specified degradation in output quality caused by the presence of two or more unwanted signals with a specific amplitude and frequency relationship to the wanted signal frequency.

Register means the Register established under s.143 of the Act.

s.145 determination means the *Radiocommunications (Unacceptable Levels of Interference - 1800 MHz Band) Determination 1999*.

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

spurious response immunity means a measure of the ability of the receiver to discriminate between the wanted signal at its nominal frequency and an unwanted signal at any frequency at which the receiver responds.

(2) In these guidelines, the range of numbers that identifies a frequency band includes the higher, but not the lower, number.

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

[NOTES: 1. The following terms, used in this determination, are defined in the *Radiocommunications Act 1992* and have the meanings given to them by that Act:

ACA	frequency band
interference	spectrum licence
transmitter.	

2. The following terms are defined in the *Radiocommunications (Unacceptable Levels of Interference - 1800 MHz Band) Determination 1999* and have the meanings given to them by that Determination:

area of high mobile use	effective antenna height
fixed transmitter	in-band]

Revocation

1.5 The *Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed Transmitters - 1800 MHz Band) 1998* are revoked.

PART 2 - MANAGING INTERFERENCE FROM FREQUENCY ADJACENT AND AREA ADJACENT SERVICES

In-band interference

2.1 In-band interference caused in a receiver operating under a spectrum licence and caused by a transmitter operating under an adjacent spectrum licence is managed by core conditions under s.66 of the Act and device boundary criteria under s.145 Determinations of unacceptable levels of interference. In-band interference caused in a receiver operating under a spectrum licence and caused by a transmitter operating under an apparatus licence that is issued after the issue date of the *Radiocommunications Spectrum Marketing Plan (800 MHz and 1.8 GHz Bands) 1998*, is managed as if the transmitter is operated under a spectrum licence. The same device boundary criteria, as applied to spectrum licensed transmitters is also applied to new apparatus licensed transmitters. Therefore, spectrum licences are afforded the same level of in-band protection from new apparatus licensed transmitters as they are afforded from transmitters operated under adjacent spectrum licences. In-band interference caused in a receiver operating under a spectrum licence and caused by a transmitter operating under a class licence is taken not to be unacceptable.

[Note: Spectrum licensees must accept any interference caused by apparatus licensed transmitters whose licences were issued before the issue date of the *Radiocommunications Spectrum Marketing Plan (800 MHz and 1.8 GHz Bands) 1998*]

2.2 Application of the device boundary criteria manages in-band interference and these criteria incorporate emission limits that provide reasonable protection throughout the total geographic area of a licence. Emission limits are also used to manage out-of-band interference but these do not provide protection along the frequency boundaries of a spectrum licence throughout the entire geographic area. Because of the nature of out-of-band interference, emission limits cannot be used to provide protection from out-of-band interference for devices that are located near each other, for example, at communal sites.

Out-of-band interference

2.3 Out-of-band interference is difficult to predict because the levels and frequencies of unwanted emissions depend on both the nearness of, and the operating frequencies of transmitters and receivers that are close in terms of both frequency and distance. In addition, out-of-band interference:

- can extend for many MHz either side of the frequency boundary of a spectrum licence;
- is dependent on the quality of the receiver as well as the levels of transmitter emission; and
- cannot be accurately modelled.

Because the interference extends for many MHz, it is possible for devices operating under non-adjacent spectrum licences to interfere with each other.

2.4 If emission limits were used to manage out-of-band interference for devices in close proximity, the interference modelling inaccuracy would require large

probability margins to need to be added to those limits. These margins would place severe constraints on use of the spectrum because the frequency boundaries of a licence extend throughout the entire geographic area of a licence. Therefore, emission limits that manage out-of-band interference for the entire geographic area of a spectrum licence (including communal sites) can not be used because they would lead to a severe loss of utility of the spectrum on both sides of the frequency boundary.

2.5 Instead of making large tracts of spectrum space unusable through the imposition of emission limits, the interference is managed through interference management procedures based on a compatibility requirement for existing receivers. Because the performance level of receivers affects both the level of interference and is likely to vary widely for receivers operating under spectrum licences, a minimum level of receiver performance has to be specified in conjunction with the compatibility requirement.

Recording device details in the Register

2.6 A receiver will not be afforded protection unless details of the receiver are in the Register.

Mobile devices

2.7 The compatibility requirement does not apply to mobile devices operating under apparatus or spectrum licences because the transient nature of mobile devices prevents the use of a practical interference management procedure. Spectrum licensees operating receivers will need to employ hardware or siting schemes in accordance with mobile equipment standards for apparatus licensing to guard against interference caused by those emissions.

PART 3 - MINIMUM LEVEL OF RECEIVER PERFORMANCE

3.1 The level of interference caused by out-of-band emissions depends on the interference susceptibility of a receiver. Emission levels from transmitters should not have to be reduced below a point where the performance of the receiver is really the problem. Therefore, it is necessary to establish a benchmark notional receiver performance level when setting a compatibility requirement for receivers. The notional receiver performance level is in Schedule 1. A receiver must meet the notional level of performance to gain protection. Therefore, coordination procedures may be confidently developed when based on the notional level of performance.

Basis for Device Registration by Agreement

3.2 A transmitter may be registered by the ACA upon presentation of an Interference Impact Certificate from a person accredited under s.263 of the Act stating that the device complies with the relevant s.145 determination of Unacceptable Levels of Interference (the determination). Compliance with the Determination ensures that the full utility of the spectrum is reserved for a licensee because application of the Determination prevents adjacent spectrum licensees from using each others' spectrum space.

3.3 The ACA may also register a transmitter that does not comply with the Determination but in that case, larger emission buffer zones along both the frequency and area boundaries are required to reserve the utility of adjacent spectrum licences. However, utility only needs to be reserved when the licensees involved require their full utility to be maintained. Therefore, there are two options for registering devices that do not comply with the Determination. These devices may be registered when larger emission buffer zones of an appropriate size are created using spectrum space either:

- (a) within the spectrum licence under which operation of the device is authorised; or
- (b) outside the spectrum licence, when the licensee has agreements with all potentially affected spectrum licensees to use their spectrum space.

3.4 In the case of 3.3(b) and the provision of larger emission buffers along the boundary of the geographic area, the licensee need only provide evidence, when required to do so by the ACA, that the affected licensees agree to the operation of the device. Those agreements would not normally have to be registered with the ACA before the device is operated. However, in the case of 3.3(b) and the provision of larger emission buffers along the frequency boundary, the licensee will need to negotiate with the ACA as well as adjacent licensees before the device is operated, in order to vary the core condition relating to levels of emission outside the band, so that the core conditions of the licence are not breached.

3.5 The ACA intends to use the notional receiver performance level in Schedule 1 as a basis for the criterion for establishing the extent of the larger buffer zone at the frequency boundary and hence, in the case of 3.3(b), ensuring that all the potentially affected licensees across that boundary are identified.

PART 4 - COMPATIBILITY REQUIREMENT

4.1 A fixed transmitter operating under an apparatus licence must meet the compatibility requirements in Schedule 2 in relation to a fixed receiver:

- (a) with a notional level of performance; and
- (b) registered before the issue of the apparatus licence under which the transmitter operates; and
- (c) operating under a spectrum licence inside an area of high mobile use:
 - (i) in the lower band, with an effective antenna height (in each segment 1, $he_1(\phi_n)$) greater than 20 metres; or
 - (ii) in the upper band, with an effective antenna height (in each segment 1, $he_1(\phi_n)$) less than 10 metres; or
- (d) operating under a spectrum licence in the 1800 MHz band outside an area of high mobile use with an effective antenna height (in each segment 1, $he_1(\phi_n)$) less than 10 metres.

[NOTES: 1. The effective antenna height (in each segment 1, $he_1(\phi_n)$) for a receiver is calculated in accordance with the relevant s.145 Determination as if the receiver is a transmitter.

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2. The 20 and 10 metre effective antenna height limits for areas of high mobile use is chosen to be consistent with common deployment practice.

4.2. A fixed transmitter operating under a class licence must comply with the conditions of the class licence.

SCHEDULE 1

Clause 3.1

NOTIONAL RECEIVER PERFORMANCE LEVEL

The notional level of performance for a receiver operating under a spectrum licence issued for the 1800 MHz band in relation to interfering signals from a transmitter operated under an apparatus licence and with frequency offsets specified with reference to the upper and lower limits of the frequency band of the spectrum licence under which the receiver operates is:

- (a) an adjacent channel selectivity of greater than or equal to 18 dB for an interfering signal with a frequency offset of at least 0 kHz; and
- (b) an adjacent channel selectivity of greater than or equal to 50 dB for an interfering signal with a frequency offset of at least 200 kHz; and
- (c) an adjacent channel selectivity of greater than or equal to 58 dB for an interfering signal with a frequency offset of at least 400 kHz; and
- (d) an intermodulation immunity of greater than or equal to 52 dB for two equi-level interfering signals with frequency offsets of at least 800 kHz and 1600 kHz, or their equivalent; and
- (e) a blocking level of greater than or equal to 85 dB with a frequency offset of at least 1 MHz; and
- (f) a spurious response performance of greater than or equal to 65 dB.

This level of performance is taken to be a notional level of performance to achieve an output quality equivalent to a 9 dB wanted to unwanted ratio with reference to a notional receiver sensitivity level of -114.5 dBm measured within a 30 kHz rectangular bandwidth that is within the frequency band of the spectrum licence. All levels are referenced to the antenna connector of the equipment.

A notional RF selectivity for the receiver (between the antenna and the antenna connector of the equipment) may be assumed to be at least equal to:

- (a) $2 + 60 \cdot \log_{10}[1 + (2 \cdot \text{FreqOffset}/10)^{1.8}]$ dB for $\text{FreqOffset} \leq 20.5$ MHz; and
- (b) 70 dB for $\text{FreqOffset} > 20.5$ MHz

The notional antenna for a receiver has a gain of 19 dBi, a feeder loss of 4 dB and a combiner loss of 0 dB in all directions and is located at the phase centre of the actual antenna.

SCHEDULE 2

Clause 4.1

COMPATIBILITY REQUIREMENT

The compatibility requirement for a fixed receiver operating under a spectrum licence to be provided by a transmitter operating under an apparatus licence is:

- an output quality equivalent to a wanted to unwanted signal level ratio that is not less than 9 dB for more than 1% of the time in any 1 hour period; and
 - with the wanted signal never less than -114.5 dBm; and
 - when measured within a 30 kHz rectangular bandwidth that is within the frequency band of the spectrum licence.
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