

# Radiocommunications Advisory Guidelines (Managing Interference to Receivers — 2.3 GHz Band) 2009<sup>1</sup>

Radiocommunications Act 1992

The AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY makes these Advisory Guidelines under section 262 of the *Radiocommunications Act 1992*.

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#### Page

### Contents

| Background |     |                                                      | 3  |
|------------|-----|------------------------------------------------------|----|
| Part 1     |     | Preliminary                                          |    |
|            | 1.1 | Name of Advisory Guidelines                          | 4  |
|            | 1.2 | Commencement                                         | 4  |
|            | 1.3 | Purpose of Advisory Guidelines                       | 4  |
|            | 1.4 | Interpretation                                       | 4  |
| Part 2     |     | Interference                                         |    |
| :          | 2.1 | In-band interference                                 | 6  |
|            | 2.2 | Out-of-band interference                             | 6  |
| Part 3     |     | Minimum level of receiver performance                |    |
|            | 3.1 | Recording receiver details in the Register           | 8  |
| :          | 3.2 | Mobile devices                                       | 8  |
| :          | 3.3 | Receiver performance level                           | 8  |
| Part 4     |     | Compatibility requirement                            |    |
|            | 4.1 | The acceptable unwanted signal level at the receiver | 9  |
| Schedule 1 |     | Receiver performance level                           | 10 |

## Background

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

- (a) in-band interference, across the geographic boundaries; and
- (b) out-of-band interference, across the frequency boundaries.

Interference can also occur between spectrum licensed systems and systems operated under apparatus and class licenses.

Interference between systems operated under spectrum licences 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* (the *Act*). These tools are:

- (a) the core conditions in all spectrum licences (see section 66 of the Act), about:
  - (i) emission limits outside the area; and
  - (ii) emission limits outside the band; and
- (b) the determination, under section 145 of the Act, about what constitutes unacceptable interference; and
- (c) advisory guidelines, made under section 262 of the Act, about managing interference in specific circumstances.

Interference between systems operated under spectrum licenses and other licence types are managed on a first in time basis in accordance with published frequency planning documents (eg RALI FX-3) and advisory guidelines made under section 262 of the Act.

The following Advisory Guidelines under section 262 of the Act have been made for the management and settlement of interference to receivers operating under spectrum licences in the 2.3 GHz band caused by transmitters not operated by the licensee. In all cases, the receivers are radiocommunications devices located at a fixed point on land or sea and not established for use while in motion.

#### Part 1 Preliminary

#### 1.1 Name of Advisory Guidelines

These Advisory Guidelines are the *Radiocommunications Advisory Guidelines (Managing Interference to Receivers — 2.3 GHz Band) 2009.* 

#### 1.2 Commencement

These Advisory Guidelines commence on the same day as the *Radiocommunications Spectrum Marketing Plan (2.3 GHz Band) 2009.* 

#### 1.3 Purpose of Advisory Guidelines

The purpose of these Advisory Guidelines is to manage interference, by providing compatibility requirements for registered fixed receivers operating under spectrum licences issued for the 2.3 GHz band from interference caused by fixed transmitters operated under other licences.

#### 1.4 Interpretation

(1) In these Advisory Guidelines:

ACMA means the Australian Communications and Media Authority.

Act means the Radiocommunications Act 1992.

*compatibility requirement* means a receiver grade of service based on the conditions for wanted and unwanted signal levels at the receiver's input, as set out in Schedule 1.

#### *in-band* means:

- (a) for a transmitter operated under a spectrum licence the frequencies within the frequency band to which the licence relates; and
- (b) for a receiver operating within the space of a spectrum licence the frequencies within the frequency band to which the licence relates; and
- (c) for a transmitter or receiver operating under an apparatus licence the frequencies within the lower frequency limit and the upper frequency limit of its spectrum access.

*Note* For an apparatus licence, the lower frequency limit and the upper frequency limit of its spectrum access are published by ACMA on the Register of Radiocommunications Licences on its website and on CDROM. The bandwidth contained by those limits often appears on the licence as the 'chargeable bandwidth'.

*in-band interference*, for a receiver, means those levels of emissions from a transmitter that are permitted under the conditions of the licence under which it operates, and:

(a) for a spectrum licensed receiver, the emissions at frequencies within the frequency band of the spectrum licence; or

(b) if the receiver is operated under an apparatus licence, the emissions at frequencies between the lower frequency limit and the upper frequency limit of the spectrum access of the apparatus licence.

*Note* When interpreting 'in-band interference', it is important to keep in mind that 'those levels of emissions from a transmitter that are permitted under the conditions of the licence' relate to in-band as well as out-of-band emissions.

*Marketing Plan* means the *Radiocommunications Spectrum Marketing Plan* (2.3 *GHz Band*) 2009.

*out-of-band interference* means interference relating to selectivity, blocking, intermodulation immunity and spurious response immunity, and:

- (a) if the receiver is a spectrum licensed receiver interference caused by emissions at frequencies outside the frequency band of the spectrum licence; or
- (b) if the receiver is operated under an apparatus licence interference caused by emissions at frequencies outside the band that is between the lower frequency limit and the upper frequency limit of the spectrum access of the apparatus licence.

*Note* This definition of out-of-band interference should not be confused with 'out-of-band emission', a term used in apparatus licensing to refer to emissions at frequencies outside a channel.

*Register* means the Register of Radiocommunications Licences established under section 143 of the Act.

*section 145 determination* means the *Radiocommunications* (Unacceptable Levels of Interference — 2.3 GHz Band) Determination 2009.

*selectivity*, for a receiver, means a measure of the ability of the receiver to receive a wanted signal in the presence of an unwanted frequency-adjacent signal at a given frequency offset.

(2) A term used in these Advisory Guidelines that is defined in the section 145 determination has the same meaning as in that determination.

*Note* The following terms used in these Advisory Guidelines have the meaning defined in the Act:

- apparatus licence
- class licence
- frequency band
- interference
- spectrum licence
- transmitter.

#### Part 2 Interference

#### 2.1 In-band interference

- (1) In-band interference caused in a receiver operating under a spectrum licence by a transmitter operating under an adjacent spectrum licence is managed by:
  - (a) the core conditions of the licence under section 66 of the Act; and
  - (b) the device boundary criteria under the section 145 determination.
- (2) In-band interference caused in a receiver operating under a spectrum licence by a transmitter operating under an apparatus licence that is issued after the issue date of the Marketing Plan is managed as if the transmitter is operated under a spectrum licence.
- (3) The same device boundary criteria that apply to spectrum licensed transmitters also apply 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.
- (4) ACMA will not regard in-band interference to a receiver operating under a spectrum licence caused by a transmitter operating under a class licence as unacceptable if the operation of the transmitter complies with all relevant conditions of the class licence.

*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 (2.3 GHz Band) 2009.* 

#### 2.2 Out-of-band interference

- (1) Out-of-band interference is difficult to predict because the levels and frequencies of unwanted emissions depend on both the proximity and the operating frequencies of transmitters and receivers. In addition, out-of-band interference:
  - (a) can extend for many MHz either side of the frequency boundary of a spectrum licence; and
  - (b) is dependent on the quality of the receiver as well as the levels of transmitter emission; and
  - (c) is difficult to accurately model.

- (2) 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 be added to those limits. These margins would place severe constraints on use of the spectrum because the frequency boundaries of a spectrum licence extend throughout the entire geographic area of the licence.
- (3) Therefore, emission limits that manage out-of-band interference for the entire geographic area of a spectrum licence (including communal sites) cannot be used because they would lead to a severe loss of use of the spectrum on both sides of the frequency boundary.
- (4) Instead of making large tracts of spectrum space unusable through the imposition of emission limits, the interference is managed through procedures based on a compatibility requirement for existing receivers. A minimum level of receiver performance has to be specified in conjunction with the compatibility requirement because the performance level of receivers:
  - (a) affects the level of interference; and
  - (b) varies widely for receivers operating under spectrum licences.

#### Part 3 Minimum level of receiver performance

#### 3.1 Recording receiver details in the Register

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

#### 3.2 Mobile devices

The compatibility requirement does not apply to mobile devices because the transient nature of mobile devices prevents the use of a practical interference management procedure.

*Note* ACMA does not intend to require the registration of low power mobile transmitters — see subsection 69 (2) of the Act and the registration conditions of spectrum licences.

#### 3.3 Receiver performance level

- (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 minimum receiver performance level when setting a compatibility requirement for receivers.
- (2) The receiver performance level is set out in Schedule 1. A receiver must meet this level of performance to gain protection.

*Note* Schedule 1 specifies the anticipated receiver performance based on available information at the time of making of this guideline. These performance requirements may be amended in the future, if it can be demonstrated that the parameters of typical equipment intended to be deployed in the band readily meet any proposed changes. Such changes would be introduced in consultation with licensees.

### Part 4 Compatibility requirement

#### 4.1 Acceptable unwanted signal level at the receiver

The performance of a fixed 2.3 GHz band spectrum licence receiver should be based on receiving a level of unwanted signal at the receiver of at least -105 dBm per 30 kHz to ensure compatibility with emissions from new and existing transmitters operating under other licences.

#### Schedule 1 **Receiver performance level**

(subsection 1.4 (1), definition of *compatibility requirement* and section 3.3)

#### Receiver minimum performance level

- 1.1 The minimum performance level for a receiver relates to:
  - (a) selectivity; and
  - (b) intermodulation immunity; and
  - (c) blocking.
- 1.2 Frequency offsets are specified with respect to the edge of the receiver necessary bandwidth. All levels are referenced to the antenna connector of the equipment. The notional antenna for a fixed receiver has a maximum gain of 21 dBi, including feeder losses.

Note For testing purposes (if required), a minimum wanted signal equivalent to the Receiver Sensitivity Level + 3dB should be used where possible.

#### **Receiver selectivity**

- 2.1 Receiver Selectivity is a measure of the ability of a receiver to receive a wanted signal without significant degradation due to the presence of an unwanted signal in adjacent spectrum. Receiver selectivity is principally determined by the intermediate frequency (IF) filter characteristic of the receiver. Receiver selectivity is typically specified either as a receiver IF characteristic or as the attenuation of the first adjacent channel.
- 2.2 There is no common channel structure for equipment operating under the 2.3 GHz band spectrum licence, so a minimum IF characteristic has been specified. The minimum IF attenuation requirement at the indicated frequency offset from the edge of the channel is set out in Table 1.

| I able 1               |                  |  |  |
|------------------------|------------------|--|--|
| Frequency offset (MHz) | Attenuation (dB) |  |  |
| 0                      | 0                |  |  |
| 0.35                   | 3                |  |  |
| 0.5                    | 10               |  |  |
| 1                      | 40               |  |  |
| 1.5                    | 50               |  |  |

Radiocommunications Advisory Guidelines (Managing Interference to Receivers - 2.3 GHz Band) 2009

#### **Receiver intermodulation response rejection**

3.1 Intermodulation response rejection means a measure of the capability of a receiver to receive a wanted signal in the presence of 2 or more unwanted interfering signals which have a specific frequency relationship to the wanted signal. The receiver intermodulation rejection is a function of the receiver front end linearity and the radiofrequency (RF) filter characteristic. The minimum RF filter attenuation requirement at the indicated frequency offset from the edge of the channel is set out in Table 2.

| Table 2          |                                         |  |
|------------------|-----------------------------------------|--|
| Attenuation (dB) |                                         |  |
| 0                |                                         |  |
| 3                |                                         |  |
| 10               |                                         |  |
| 20               |                                         |  |
| 40               |                                         |  |
|                  | Attenuation (dB)   0   3   10   20   40 |  |

3.2 The front end linearity requirement is given by the following minimum intermodulation conversion ratios set out in Table 3.

| Tab | le : | 3 |
|-----|------|---|
|-----|------|---|

| Intermodulation type                         | Conversion ratio (dB) |  |
|----------------------------------------------|-----------------------|--|
| Two-signal Third-order (2A <sup>±</sup> B)   | 11                    |  |
| Two-signal Fifth-order $(3A^{\pm}2B)$        | 28                    |  |
| Three-signal Third-order $(A^{\pm}B^{\pm}C)$ | 5                     |  |

#### **Receiver blocking**

4.1 Receiver blocking means a measure of the ability of a receiver to receive a wanted signal in the presence of a high level unwanted interferer on frequencies other than those of the adjacent channels. The minimum unwanted signal level to cause receiver blocking is a signal level of -45 dBm per 30 kHz with a frequency offset of 7 MHz or more.

*Note* The accuracy of measuring equipment, measurement procedure and any corrections to measurements necessary to take account of practical filter shape factors would normally be in accordance with good engineering practice.

#### Note

1. All legislative instruments and compilations are registered on the Federal Register of Legislative Instruments kept under the *Legislative Instruments Act 2003*. See <u>http://www.frli.gov.au</u>.