Radiocommunications Advisory Guidelines (Managing Interference to Receivers – 2.5 GHz Band) 2012

Radiocommunications Act 1992

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

Dated *19th December* 2012

Chris Chapman
[signed]
Member

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Australian Communications and Media Authority

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Part 1 Preliminary

1.1 Name of Advisory Guidelines

These Advisory Guidelines are the *Radiocommunications Advisory Guidelines (Managing Interference to Receivers – 2.5 GHz Band) 2012*.

1.2 Commencement

These Advisory Guidelines commence on the day after they are registered.

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

1.3 Purpose

(1) The purpose of these Advisory Guidelines is to:

(a) manage in-band and out-of-band interference, by providing compatibility requirements for registered fixed receivers operating under spectrum licences issued for the 2.5 GHz band; and

(b) provide protection from interference caused by fixed transmitters operated under apparatus licenses, class licenses and spectrum licenses issued after the commencement of the *Radiocommunications Spectrum Marketing Plan (2.5 GHz Band) 2012.*

(2) These Advisory Guidelines should be used by operators of spectrum-licensed services and apparatus-licensed services in the planning of services and in the resolution of interference cases.

(3) These Advisory Guidelines do not prevent a licensee negotiating other protection requirements with another licensee.

1.4 Interpretation

(1) In these Advisory Guidelines, unless the contrary intention appears:

2.5 GHz band means the frequency bands:

(a) 2500 MHz to 2570 MHz (the ***2.5 GHz lower band***); and

(b) 2620 MHz to 2690 MHz (the ***2.5 GHz upper band***).

Act means the *Radiocommunications Act 1992*.

adjacent channel means a channel with a centre frequency offset on either side of the assigned channel frequency of the occupied channel by a specific frequency relation.

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

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

in-band means:

(a) for a radiocommunications transmitter or radiocommunications receiver operated under a spectrum licence, the frequencies within the frequency band to which the licence relates; and

(b) for a radiocommunications transmitter or radiocommunications receiver operating under an apparatus licence, the frequencies within the lower frequency limit and the upper frequency limit of its licence.

intermodulation response rejection has the meaning set out in subclause 4(1) of Schedule 1.

out-of-band means:

(a) for a radiocommunications transmitter or radiocommunications receiver operated under a spectrum licence, the frequencies outside the frequency band to which the licence relates; and

(b) for a radiocommunications transmitter or radiocommunications receiver operating under an apparatus licence, the frequencies outside the lower frequency limit and upper frequency limit of its licence.

receiver blocking has the meaning set out in subclause 5(1) of Schedule 1.

section 145 determination means the *Radiocommunications (Unacceptable Levels of Interference – 2.5 GHz Band) Determination 2012*.

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

spurious response immunity means a measure of the ability of the radiocommunications receiver to discriminate between the wanted signal and an unwanted signal at any frequency, outside the frequency band of the licence, to which the receiver responds.

wideband unwanted signal means an emission spread across a bandwidth greater than 4 MHz with 99 percent of its power contained within a bandwidth of 5 MHz.

(2) The following terms have the same meaning as in the section 145 determination:

(a) centre frequency;

(b) device boundary;

(c) device boundary criterion;

(d) effective antenna height;

(e) fixed receiver;

(f) fixed transmitter;

(g) geographic area;

(h) mobile transmitter.

Note A number of terms used in these Advisory Guidelines are defined in the Act and have the meanings given to them in the Act, including:

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

Part 2 Background

2.1 Interference

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.

2.2 Interference management

(1) 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 Act. These tools include:

(a) the core licence conditions that all spectrum licences are subject to (see section 66 of the Act), about:

(i) emission limits outside the geographic area; and

(ii) emission limits outside the frequency band;

(b) the determinations made under subsection 145(4) of the Act about what constitutes unacceptable levels of interference; and

(c) advisory guidelines made under section 262 of the Act, about managing interference in specific circumstances.

(2) These Advisory Guidelines have been made to provide recommendations on the management and settlement of interference to radiocommunications receivers operating under spectrum licences in the 2.5 GHz band and caused by radiocommunications transmitters operated under other licences.

Part 3 Managing interference from other services

3.1 In-band interference

(1) In-band interference caused in a radiocommunications receiver operating under a spectrum licence by a radiocommunications 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 radiocommunications receiver operating under a spectrum licence by a radiocommunications transmitter operating under an apparatus licence that is issued after the commencement date of the *Radiocommunications Spectrum Marketing Plan (2.5 GHz Band) 2012* is managed as if the transmitter is operated under a spectrum licence.

(3) The same device boundary criteria that apply to spectrum licensed radiocommunications transmitters also apply to apparatus licences issued after the commencement of the *Radiocommunications Spectrum Marketing Plan (2.5 GHz Band) 2012*. Therefore, spectrum licences are afforded the same level of in-band protection from new apparatus licensed radiocommunications transmitters as they are afforded from radiocommunications transmitters operated under adjacent spectrum licences.

(4) 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 multi-operator sites.

(5) The ACMA will not regard in-band interference to a radiocommunications 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 commencement date of the *Radiocommunications Spectrum Marketing Plan (2.5 GHz Band) 2012.*

3.2 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 radiocommunications transmitters and radiocommunications receivers. In addition, out-of-band interference:

(a) can extend for many megahertz either side of the frequency boundary of a spectrum licence;

(b) is dependent on the quality of the radiocommunications receiver as well as the levels of radiocommunications transmitter emission; and

(c) is difficult to accurately model.

(2) Because out-of-band interference from unwanted intermodulation products, harmonic and parasitic signals and other spurious signals may extend over a wide frequency range outside the licensed frequency band, it is possible for devices operating under non-adjacent spectrum licences to interfere with each other.

(3) 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 licence extend throughout the entire geographic area of the licence.

(4) Therefore, emission limits that manage out-of-band interference throughout the entire geographic area of a spectrum licence cannot be used because they would lead to a severe loss of utility of the spectrum on both sides of the frequency boundary

(5) 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 radiocommunications receivers. Because the performance level of receivers affects the level of interference and is likely to vary widely for receivers operating under spectrum licences, a minimum level of receiver performance is specified in conjunction with the compatibility requirement. The use of a minimum standard for receiver performance avoids placing an excessive mitigation burden on adjacent services that are coordinated with spectrum-licensed receivers when these receivers have poorly performing characteristics.

Note Spectrum licensees must accept any interference caused by apparatus licensed transmitters whose licences were issued before the commencement date of the *Radiocommunications Spectrum Marketing Plan (2.5 GHz Band) 2012.*

Part 4 Requirements for receiver protection

4.1 Recording radiocommunications receiver details in the Register

For a radiocommunications receiver to be afforded protection in accordance with these Advisory Guidelines, the details of the receiver must be recorded in the Register.

4.2 Mobile and nomadic devices

The compatibility requirement in Part 5 of these Advisory Guidelines does not apply to mobile or nomadic devices because the transient nature of their location prevents the use of this requirement as an interference management procedure. Mobile and nomadic radiocommunications receivers have, by their nature, the ability to avoid an interference source, unlike a fixed receiver.

4.3 Notional receiver performance

(1) The level of interference caused by out-of-band emissions depends on the interference susceptibility of the radiocommunications receiver and the level of the unwanted signal. Emission levels from radiocommunications transmitters should not have to be reduced below a point where the poor performance of the radiocommunications receiver is the main cause of the problem.

(2) It is necessary to establish a benchmark notional receiver performance level for the radiocommunications receiver when setting a compatibility requirement for radiocommunications receivers.

(3) The notional receiver performance level is set out in Schedule 1. A radiocommunications receiver must meet this level of performance to gain protection from interference from radiocommunications transmitters.

Note Schedule 1 specifies the anticipated receiver performance based on available information at the time that these Advisory Guidelines were made.

Part 5 Compatibility requirement

5.1 Compatibility

(1) The performance of a fixed radiocommunications receiver operated under a 2.5 GHz band spectrum licence meets the compatibility requirement if the receiver:

(a) has at least the notional level of receiver performance set out in Schedule 1; and

(b) meets the compatibility requirement of the minimum wanted signal level set out in section 5.2; and

(c) has its details included in the Register before the date that the radiocommunications transmitter with which compatibility is sought has its details recorded in the Register; and

(d) operates under a spectrum licence:

(i) in the 2.5 GHz lower band, with an effective antenna height (for any increment 1, $he_1(\phi_n)$) greater than 20 metres; or

(ii) in the 2.5 GHz upper band, with an effective antenna height (for any increment 1, $he_1(\phi_n)$) less than 10 metres.

Note 1 The effective antenna height (in each increment 1, $he_1(\phi_n)$) for a receiver is calculated in accordance with the formula specified in the section 145 determination, as if the receiver is a transmitter.

Note 2 The effective antenna height limit is chosen to be consistent with common deployment practice.

5.2 The minimum wanted signal level at the receiver

(1) For the purpose of assessing compatibility with other services, the performance of a fixed radiocommunications receiver operated under a 2.5 GHz band spectrum licence is a minimum wanted signal level at the antenna connector of -102.5 dBm/MHz for 90 percent of the time in any 1 hour period.

(2) The minimum wanted signal level is inclusive of a 1 dB increase in the receiver noise floor. Logarithmic scaling should be used to find the appropriate level in alternative bandwidths.

Schedule 1 Notional receiver performance level

(section 5.1)

1 Notional receiver performance level

(1) The notional receiver minimum performance level relates to:
   (a) adjacent channel selectivity;
   (b) intermodulation response rejection; and
   (c) receiver blocking.

(2) The notional receiver minimum level of performance is a product of duplex filtering from the antenna to the radiocommunications receiver and the performance of the radiocommunications receiver equipment. The minimum performance requirement is the combined performance measured at the antenna connector.

(3) In the case where the overall combined performance of duplex filtering and receiver equipment can be shown to be equal to or greater than the combination of the individual requirements specified below, the notional receiver minimum level of performance shall be considered as having been met.

2 Receiver performance reference points

The frequency offsets specified for the notional receiver performance are specified with respect to the edges of the spectrum licence under which the radiocommunications receiver operates. All levels are referenced to the antenna connector. The wanted signal level used for testing purposes (if required) should be a level equivalent to the minimum wanted signal level of the compatibility requirement in section 5.1. The notional antenna for a fixed receiver has a maximum gain of 17 dBi, including feeder losses.

3 Receiver adjacent channel selectivity

(1) The adjacent channel selectivity (***ACS***) can be expressed as either the ratio of the unwanted to wanted signal at a given frequency offset between the centre frequencies of the channels or as the unwanted signal power.

(2) The minimum notional receiver ACS shall be 43.5 dB, measured for a wideband unwanted signal operating between offsets of 0 and 5 MHz from the edge of the licence; and 85 dB, measured for a wideband unwanted signal operating at offsets greater than 5 MHz from the edge of the licence.

4 Receiver intermodulation response rejection

(1) ***Intermodulation response rejection*** means a measure of the ability of a radiocommunications receiver to receive a wanted signal in the presence of two or more unwanted signals with a specific amplitude and frequency relationship to the wanted signal frequency.

(2) The minimum notional receiver intermodulation response rejection level expressed as the minimum tolerable wideband unwanted signal level of the outer interfering signal with offset of 10 MHz or more is -12 dBm/MHz. The assumed inner unwanted signal is carrier wave signal of -52 dBm located at an offset of 7.5 MHz from the licence edge.

5 Receiver blocking

(1) ***Receiver blocking*** means a measure of the ability of a radiocommunications receiver to receive a wanted signal in the presence of a high level unwanted interferer on frequencies other than those of the adjacent channels.

(2) The minimum notional receiver blocking requirement, expressed as tolerance to a minimum unwanted signal level is:

(a) within the band 2480 to 2590 MHz, at frequency offsets greater than 10 MHz from the licence edge, for a wideband unwanted signal, a power spectral density of -18 dBm/MHz; and

(b) outside the band 2480 to 2590 MHz, for an unwanted signal, a total mean power of -15 dBm.

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.