



Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria – 1800 MHz Lower Band) 2012

Radiocommunications Act 1992

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

Dated 26 September 2012

Chris Chapman
[signed]
Member

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[signed]
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Australian Communications and Media Authority

1 Name of Advisory Guidelines

These Advisory Guidelines are the *Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria - 1800 MHz Lower Band) 2012*.

2 Commencement

These guidelines commence on 18 June 2013.

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>.

3 Revocation

The *Radiocommunications Advisory Guidelines (Protection of Mobile Base Receivers – 1800 MHz Lower Band) 1999* are revoked.

4 Purpose and application

- (1) The purpose of these guidelines is to provide guidance for the protection of radiocommunications receivers operated under spectrum licences in the 1800 MHz Lower band from high sited radiocommunications transmitters operating under either a spectrum licence or an apparatus licence which is issued on or after 18 June 2013.
- (2) The ACMA will take these guidelines into account in determining whether high sited transmitters operating in the 1800 MHz Lower band are causing in-band interference to receivers operating under adjacent area spectrum or apparatus licences.

5 Interpretation

- (1) In these guidelines, unless the contrary intention appears:

1800 MHz band means the following frequency bands:

- (a) 1710 MHz – 1785 MHz (the **1800 MHz Lower band**); and
- (b) 1805 MHz – 1880 MHz (the **1800 MHz Upper band**).

Act means the *Radiocommunications Act 1992*.

additional device boundary criterion means the device boundary criterion worked out in accordance with Schedule 1.

areas of high mobile use means the areas described in Schedule 4 of the section 145 Determination.

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 in which operation of those radiocommunications devices is authorised under the licence; 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 specified in the licence.

ITU means the International Telecommunication Union.

ITU-R means the ITU Radiocommunications sector.

ITU-R Recommendation means a Recommendation made by the ITU-R as in force from time to time.

out-of-band means:

- (a) for a radiocommunications transmitter or radiocommunications receiver operated under a spectrum licence, the frequencies outside the frequency band in which operation of those radiocommunications devices is authorised under the licence; 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 specified in the licence.

section 145 Determination means the *Radiocommunications (Unacceptable Levels of Interference - 1800 MHz Band) Determination 2012*.

- (2) When a radiocommunications transmitter or radiocommunications receiver is described as **high sited**, this means its effective antenna height for any increment 1, $he_1(\phi_n)$ is greater than 10 metres.
- (3) When a radiocommunications transmitter or radiocommunications receiver is described as **low sited**, this means its effective antenna height for each increment 1, $he_1(\phi_n)$ is less than or equal to 10 metres.

Note The effective antenna height ($he_1(\phi_n)$) is calculated in accordance with the formula specified in the section 145 Determination.

- (4) In these guidelines, the range of numbers that identifies a frequency band includes the higher, but not the lower, number.
- (5) A number of terms used in these guidelines are defined in the section 145 Determination and, unless the contrary intention appears, have the same meaning as in that determination.

Note 1 The following terms are defined in the section 145 Determination:

- DEM-9S
- DEM-9S cell
- effective antenna height
- fixed transmitter
- geographic area
- horizontally radiated power
- occupied bandwidth.

Note 2 The following terms used in these guidelines, are defined in the Act and unless the contrary intention appears, have the meaning given to them by the Act:

- ACMA
- core condition
- frequency band
- interference
- radiocommunications receiver
- radiocommunication transmitter
- Register
- spectrum licence.

Part 1 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 provisions of the Act. These include:

- the core conditions that all spectrum licences are subject to (see section 66 of the Act), about emission limits outside the area and emission limits outside the band;
- the applicable determination under subsection 145 (4) of the Act relating to unacceptable levels of interference; and
- advisory guidelines made under section 262 of the Act, about managing interference in specific circumstances.

These guidelines are intended to assist in the management of interference to radiocommunications receivers operating in the 1800 MHz Lower band.

Part 2 Coexistence arrangements in the 1800 MHz Lower band

- (1) The emission buffer zones along the geographic boundaries of 1800 MHz spectrum licences are created by calculating the device boundary criteria set out in the section 145 Determination. The device boundary criteria in the section 145 Determination are based on a high site to low site propagation model which is generally representative of path loss for frequency division duplex (FDD) mobile services. This facilitates the deployment of services with high sited radiocommunications transmitters in the 1800 MHz Upper band and high sited radiocommunications receivers in the 1800 MHz Lower band.
- (2) In order to increase flexibility in the use of spectrum, the section 145 Determination allows high sited radiocommunications transmitters to be operated in the 1800 MHz Lower band. This can result in situations where both high sited radiocommunications transmitters and high sited radiocommunications receivers operate in the 1800 MHz Lower band. As a result, there is an increased risk of interference occurring. In looking to accommodate a mix of services while managing the potential for interference, a compromise has been necessary to allow these services to co-exist in the 1800 MHz Lower band.
- (3) The compromise made is to give precedence to FDD mobile services in areas of high mobile use and only allow high sited radiocommunications transmitters to be operated in the 1800 MHz Lower band outside these areas. To achieve this, in areas of high mobile use, radiocommunications transmitters are restricted to low sites when operating in the 1800 MHz Lower band by the section 145 Determination. Outside areas of high mobile use, the section 145 Determination allows radiocommunications transmitters to operate at any height in both the 1800 MHz Upper and Lower bands.
- (4) Licensees are advised that due to this deployment flexibility, there is potential for loss of spectrum utility in areas where both high sited radiocommunications transmitters and high sited radiocommunications receivers operate.

Part 3 Managing interference inside areas of high mobile use

Out-of-band interference - antenna height

- (1) The technical framework is designed to favour FDD mobile services in areas of high mobile use. Within those areas, the section 145 Determination does not allow high sited radiocommunications transmitters to operate in the 1800 MHz Lower band by providing that such operation will result in an unacceptable level of interference. This constraint is in force to help manage out-of-band interference in radiocommunications receivers for mobile systems used at high sites by maintaining a high site to low site interference path.

Note In urban areas, mobile service base stations are typically spread in a homogeneous fashion throughout a service area, sometimes as close as a few hundred metres to each other. Out-of-band compatibility would be very difficult to achieve under these circumstances if the radiocommunications transmitter's effective antenna height was not limited in the frequency band used for base radiocommunications receivers.

In-band interference - additional device boundary

- (2) Under the device boundary criteria in the section 145 Determination, which is based on a high site to low site propagation model, high sited radiocommunications receivers operating in the 1800 MHz Lower band would normally need to be placed well within the geographical boundary to achieve a reasonable level of protection from high sited radiocommunications transmitters operating in the 1800 MHz Lower band. In order to allow high sited radiocommunications receivers in the 1800 MHz Lower band to operate close to the boundary and still achieve a high level of protection, additional emission buffer zones are required for high sited radiocommunications transmitters operating in the 1800 MHz Lower band. These additional emission buffer zones are created by an additional device boundary requirement (that is, in addition to that described in the section 145 Determination) for both spectrum licensed and apparatus licensed high sited radiocommunications transmitters operating outside areas of high mobile use.
- (3) The additional device boundary requirement set out in Schedule 1 is based on:
 - (a) selection of an appropriate high site to high site propagation loss model; and
 - (b) notional base radiocommunications receiver parameters.

Part 4 Managing interference outside areas of high mobile use

- (1) Outside areas of high mobile use, radiocommunications transmitters may be sited at any height in both the 1800 MHz Upper and Lower bands. This has certain consequences for spectrum licensees.
- (2) High sited radiocommunications receivers operating in the 1800 MHz Lower band in all spectrum licensed areas that are registered in the Register are afforded out-of-band protection in accordance with the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 1800 MHz Band) 2012*. However, as this is on a first-in-time basis, a spectrum licensee who wants to operate a high sited radiocommunications receiver in the 1800 MHz Lower band where there are existing high sited radiocommunications transmitters operating in adjacent frequency bands, may have to either:
 - (a) provide guard bands and/or high performance filters at the edges of the band within which the receiver operates; or
 - (b) negotiate with the adjacent licensee to:
 - (i) employ transmit filtering; or
 - (ii) not place high sited radiocommunications transmitters at a particular location which is near the frequency boundary of the spectrum licence under which the receiver operates
- (3) In regional areas, base stations are usually located at the best vantage point for serving a country town. As a result there is an increased likelihood that high sited radiocommunications transmitters and high sited radiocommunications receivers will be operated in close proximity to each other. Therefore, in locations where both high sited radiocommunications transmitters and high sited radiocommunications receivers are deployed, it is likely that negotiation would need to occur between licensees to manage potential interference issues.

Part 5 Application of the Additional Device Boundary Criteria

Fixed transmitters operating under a spectrum licence

- (1) The additional device boundary criterion applies to a fixed transmitter operated under an 1800 MHz band spectrum licence if the fixed transmitter is:
 - (a) a high sited radiocommunications transmitter;
 - (b) operated in the 1800 MHz Lower band; and
 - (c) located outside an area of high mobile use and within 200 km of the geographical boundary of the 1800 MHz band spectrum licence it operates under.

- (2) If any part of the device boundary for a fixed transmitter described in section (1), determined using the additional device boundary criterion, lies outside the geographic area of the spectrum licence under which it is operated, it is deemed to cause unacceptable levels of interference under the section 145 Determination.

Note The additional device boundary criterion is also used to protect high sited radiocommunications receivers in the 1800 MHz Lower band operating under apparatus licences.

Fixed transmitters operating under an apparatus licence

- (3) The additional device boundary criterion applies to a fixed transmitter if the fixed transmitter is a high sited radiocommunications transmitter that:
 - (a) is operated under an apparatus licence issued on or after 18 June 2013;
 - (b) is located within 200 km of an adjacent area 1800 MHz band spectrum licence geographical boundary; and
 - (c) has an occupied bandwidth wholly or partially contained within the frequency band of an adjacent area 1800 MHz band spectrum licence.

- (4) If any part of the device boundary for a fixed transmitter described in section (3), determined using the additional device boundary criterion, lies inside the geographic area of an 1800 MHz band spectrum licence, the fixed transmitter will be taken to not comply with the additional device boundary criteria.

Circumstances when compliance is not required

- (5) A licensee of a fixed transmitter described in section (1) or (3) is not required to comply with the additional device boundary criterion if:
- (a) the device boundary of the transmitter is wholly within the geographic area of one or more spectrum licences other than the licence under which the transmitter operates (the *other spectrum licences*);
 - (b) the occupied bandwidth of the transmitter is wholly or partially contained within the frequency band within which the other spectrum licences operate; and
 - (c) the licensee:
 - (i) is the holder of the other spectrum licences; or
 - (ii) has written agreements with the holders of the other spectrum licences permitting it to exceed the additional device boundary criterion for the transmitter.

Schedule 1 Additional device boundary criterion

- (1) The additional device boundary is calculated according to the distance that is necessary to satisfy the following equation:

$$(HRP - Lb - CR) \leq 0;$$

Where HRP = Horizontally Radiated Power;

Lb = Propagation Loss; and

CR = Compatibility Requirement for a notional radiocommunications receiver.

- (2) Calculations are performed every 500 metres along radials with a maximum length of 200 kilometres at every 1 degree of arc (beginning at True North) and centred on the location of the radiocommunications transmitter.
- (3) The location of the point where the additional device boundary criterion is satisfied along each radial should be determined. These points form the device boundary of the radiocommunications transmitter.

Calculation of Horizontally Radiated Power (HRP)

- (4) HRP (dBm EIRP per 30 kHz) is the horizontally radiated power along each radial. It should be noted that the out-of-area core condition (imposed under section 66 of the Act) applicable to all 1800 MHz spectrum licences limits the HRP to 54.5 dBm EIRP per 30 kHz.

High Site-High Site Propagation Loss (Lb)

- (5) The propagation loss for a high site to high site transmit-receive path (Lb) may be worked out in accordance with the general method for estimating diffraction loss described in ITU-R Recommendation P.526: *Propagation by diffraction* using a path profile (from the radiocommunications transmitter site to each 500 metre increment along each radial) derived from DEM-9S and an effective earth radius factor of $4/3$.

Note The ITU-R Recommendation P.526 is available from the ITU website at <http://www.itu.int>.

- (6) The notional radiocommunications receiver antenna height above ground is 30 metres.
- (7) The procedure specified in ITU-R Recommendation P.526 for calculating propagation loss is complex and spectrum licensees should exercise particular care when establishing whether a particular service might meet the compatibility requirements under these guidelines.

Compatibility Requirement (CR)

- (8) The compatibility requirement (CR), specified in clause (1), to be satisfied is -136.5 dBm/30 kHz. This CR is based on providing the necessary level of protection (as calculated in accordance with clause (9)) for a notional radiocommunications receiver located at least 3 km from the geographic boundary of a spectrum licence operating in the 1800 MHz band.

Note 1 The CR of -136.5 dBm/30 kHz is to be met at the geographical boundary of an 1800 MHz spectrum licence, and aims to provide the necessary protection for a notional receiver located 3 km from the boundary. Therefore, the CR is a higher level of protection than the level of protection required by the notional receiver (as calculated in clause (9) below). The difference between the CR and the receiver level of protection is due to the additional signal propagation loss from the area boundary to the notional receiver location 3km from the boundary.

Note 2 Due to the device boundary criterion in the section 145 Determination it is expected that base station receivers will not be located closer than 3 km to a geographical boundary of an 1800 MHz spectrum licence.

- (9) The CR assumes a notional receiver level of protection of -139.5 dBm/30 kHz at the input of the receive antenna, which is located 3 km from the geographical boundary of an 1800 MHz spectrum licence.

This level of protection is based on:

- (a) a maximum unwanted level at the receiver input of -123.5 dBm/30kHz;
- (b) an antenna gain of 18 dBi; and
- (c) a feeder loss of 2 dB.

Note The maximum unwanted level at the receiver input set out in paragraph (a) is equal to the value of the CR specified in the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 1800 MHz Band) 2012*.