Radiocommunications (Unacceptable Levels of Interference — 2.3 GHz Band) Determination 2009[1]

Radiocommunications Act 1992

The AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY makes this Determination under subsection 145 (4) of the *Radiocommunications Act 1992*.

Dated 3rd February 2009

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Member

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Australian Communications and Media Authority

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1 Name of Determination

This Determination is the *Radiocommunications (Unacceptable Levels of Interference — 2.3 GHz Band) Determination 2009*.

2 Commencement

This Determination commences on the day after it is registered.

3 Purpose of Determination

This Determination sets out what is an unacceptable level of interference caused by a transmitter operating under a spectrum licence issued in the 2.3 GHz band. This Determination ensures that high levels of emission from transmitters operated under a licence are kept within the geographic area and frequency band of the licence.

Note 1 ACMA may refuse to register a transmitter if the operation of the transmitter could cause an unacceptable level of interference to the operation of other radiocommunications devices — see section 145 of the Act.

Note 2 ACMA may register a transmitter whose operation could cause an unacceptable level of interference to the operation of other radiocommunications devices when guard space, provided either within a single licence or within a number of shared licences, is used to achieve the levels of isolation for emissions transmitted between spectrum spaces to the same extent as provided by this Determination. ACMA has issued written advisory guidelines under section 262 of the Act about the registration and operation of transmitters that could cause an unacceptable level of interference to the operation of other radiocommunications devices titled *Radiocommunications Advisory Guidelines (Registration of Transmitters without an Interference Impact Certificate) 1998*. Copies are available from ACMA.

Note 3 ACMA has issued written advisory guidelines under section 262 of the Act about compatibility requirements in relation to the assignment of transmitters operated under apparatus licences and the operation of transmitters under spectrum licences. ACMA will take these guidelines into account during the settlement of interference disputes. Each case will be assessed on its merits. The guidelines do not prevent a licensee negotiating other compatibility requirements with another licensee. The guidelines are:

(a) *Radiocommunications Advisory Guidelines (Managing Interference from Transmitters — 2.3 GHz Band) 2009*; and

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

Copies are available from ACMA.

4 Interpretation

(1) In this Determination:

2.3 GHz band means the frequency band from 2302 MHz to 2400 MHz.

ACMA means the Australian Communications and Media Authority.

Act means the *Radiocommunications Act 1992*.

centre location, in relation to a transmitter, means the centre location of the transmitter calculated in accordance with Schedule 1.

device boundary, in relation to a transmitter or a group of transmitters operated under a spectrum licence, means the device boundary established in accordance with Part 1 of Schedule 2.

device boundary criterion (2302–2400 MHz) means the value of the mathematical expression calculated in accordance with Part 2 of Schedule 2.

effective antenna height means the effective height of an antenna worked out in accordance with Schedule 3.

effective occupied bandwidth, for a transmitter, means the minimum width of a frequency band having fixed upper and lower limits that is necessary to contain not less than 99% of the true mean power of the transmitter's emission at any time.

effective radius, for a centre location, means the value in kilometres of the effective radius for the centre location, calculated in accordance with Schedule 1.

emission centre frequency, for a transmitter, means the frequency midway between the lower and upper frequency limits of the transmitter's effective occupied bandwidth.

emission designator has the meaning given by section 8.

error means the uncertainty, relating to the measured value of a parameter, that results in a 95% level of confidence that the true value of the parameter is within the range:

(a) measured value minus the uncertainty; to

(b) measured value plus the uncertainty.

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

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

geographic area, in relation to a spectrum licence, means the area within which operation of a device is authorised under the licence.

group of receivers has the meaning given by section 6.

group of transmitters has the meaning given by section 5.

horizontally radiated power, for a radiocommunications device, means the product of:

(a) the maximum true mean power within the frequency band of the licence authorising the operation of the device, measured in units of dBm per 30 kHz at the antenna connector; and

(b) the antenna gain relative to an isotropic antenna in a specified direction reference from, and in the horizontal plane containing, the phase centre of the antenna used with the device.

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.

indoor, in relation to a fixed transmitter, means a transmitter having an antenna:

(a) located within an enclosed space; and

(b) illuminating the enclosed space within its half-power beamwidth.

maximum true mean power means the true mean power measured in a 30 kHz rectangular bandwidth that is located within a specified frequency band such that the true mean power is the maximum of true mean powers produced.

Note The power within a 30 kHz rectangular bandwidth is normally established by taking measurements using either an adjacent channel power meter or a spectrum analyser. 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.

mean power means the average power measured during an interval of time that is at least 10 times the period of the lowest modulation frequency.

mobile transmitter means a transmitter established for use while in motion or during halts at unspecified points on land or sea.

outdoor transmitter in relation to a fixed transmitter, means a transmitter that is not an indoor fixed transmitter.

publish includes publish electronically.

RadDEM means the digital elevation model developed by ACMA for radiocommunications purposes that contains modelled terrain height information for Australia in cells of a size of 9 seconds of arc, published by ACMA, copies of which are available from ACMA.

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

true mean power means:

(a) if an unmodulated carrier is present — the mean power measured while the unmodulated carrier is present; and

(b) if an unmodulated carrier is not present — the mean power measured while transmitted information is present.

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

(3) In this Determination, radiated power values are to be estimated with a level of confidence not less than 95% that the true value of the radiated power remains below the estimated relevant radiated power value plus 2 dB.

Note The following terms used in this Determination have the meaning defined in the Act:

- core condition
- frequency band
- interference
- spectrum licence
- transmitter.

5 Group of transmitters

(1) In this Determination, 2 or more fixed transmitters are a ***group of transmitters*** if:

(a) the transmitters have the same:

(i) emission centre frequency; and

(ii) emission designator; and

(b) the transmitters are operated for the purpose of communicating with the same receiver or same group of receivers; and

(c) ACMA has assigned the same identification number to each antenna that is used with the transmitters.

(2) A transmitter may belong to more than 1 group of transmitters.

6 Group of receivers

(1) In this Determination, 2 or more fixed receivers are a ***group of receivers*** if:

(a) the receivers are operated for the purpose of communicating with the same transmitter or the same group of transmitters; and

(b) ACMA has assigned the same identification number to each antenna that is used with the receivers.

(2) A receiver may belong to more than 1 group of receivers.

7 Unacceptable level of interference

(1) This section sets out what are unacceptable levels of interference for section 145 of the Act.

Note Under section 145, ACMA may refuse to register a transmitter if the operation of the transmitter could cause an unacceptable level of interference to the operation of other radiocommunications devices.

(2) A level of interference caused by a transmitter operated under a spectrum licence issued for the 2.3 GHz band is unacceptable if the operation results in a breach of a core condition of the licence relating to the maximum permitted level of radio emission from the transmitter:

(a) outside the parts of the spectrum, the use of which is authorised by the licence but excluding maximum permitted levels which have been negotiated between licensees of frequency-adjacent licences; or

(b) outside the geographic area of the licence.

Note Subsection 66 (1) of the Act provides that a spectrum licence must include core conditions specifying the maximum permitted levels of radio emissions that may be caused by the operation of radiocommunications devices under the licence — see paragraphs 66 (1) (b) and (d) of the Act.

(3) A level of interference caused by a transmitter operated under a spectrum licence (the ***first licence***) issued for the 2.3 GHz band is unacceptable if any part of the device boundary of the transmitter lies outside:

(a) the geographic area of the first licence; and

(b) the geographic area of:

(i) a second licence, if the licensee of the first licence has an agreement with the licensee of the second licence for the purpose of core condition 7 of the first licence; or

(ii) an adjacent licence, if the licensee of the first licence is also the licensee under the adjacent licence.

(4) If a device boundary of a fixed transmitter cannot be calculated in accordance with Schedule 2, the transmitter is taken to cause an unacceptable level of interference.

(5) A mobile transmitter or an indoor fixed transmitter that operates in the 2.3 GHz band with a horizontally radiated power always less than or equal to 21 dBm EIRP per 30 kHz is taken not to cause unacceptable interference.

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.

(6) A transmitter operated under a spectrum licence issued for the 2.3 GHz band, and located on an airship or on a balloon, is taken to cause unacceptable interference.

8 Emission designator

For the purpose of working out the designation of a transmitter, the references in Appendix 1 of the Radio Regulations, published by the International Telecommunications Union, to necessary bandwidth for a given class of emission are taken to be references to the effective occupied bandwidth of the transmitter.

9 Revocation

The *Radiocommunications (Unacceptable Levels of Interference — 2302-2400 MHz Band) Determination 2000* is revoked.

Schedule 1 Centre location and effective radius of a fixed transmitter

(subsection 4 (1), definition of ***centre location***)

Note A model for the location of a group of transmitters (the ***effective location***) is the circumference of the circle defined by the centre location and the effective radius.

1 General

The centre location of a transmitter is the centre of a circle l_c with an effective radius r_e. This Schedule sets out the l_c and r_e of particular transmitters.

2 Single fixed transmitter

For a fixed transmitter, l_c is the location (specified as a latitude and longitude with reference to the Australian National Spheroid) of the phase centre of the transmitter's antenna and r_e is zero.

Note ACMA's Business Operating Procedure titled *Radiocommunications Site Data Requirements*, sets out the acceptable level of error and other information relevant to the determination of the coordinates of the location l_c. Copies are available from the ACMA website.

3 Group of fixed transmitters located near a central point

For a group of fixed transmitters:

(a) supported by the same structure; and

(b) having the phase centre of each transmitter's antenna located within 10 metres of the same central point;

l_c is the central point and r_e is zero.

4 Group of fixed transmitters not covered by clause 3

For a group of fixed transmitters to which clause 3 does not apply:

(a) where operating to a receiver located within the geographic area of the group, l_c is the location of that receiver; and

(b) in any other case, l_c is the centre point of the straight line joining the 2 transmitters with the greatest separation distance within the group; and

(c) r_e is the distance from the l_c to the most distant transmitter of the group.

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Schedule 2 Device boundaries and device boundary criteria

(subsection 4 (1), definitions of ***device boundary*** and ***device boundary criterion (2302–2400 MHz)***)

Part 1 Device boundary of a transmitter or a group of transmitters

Note It is not necessary to calculate a device boundary for certain types of mobile and fixed transmitters as ACMA does not intend to require these to be registered — see subsection 69 (2) of the Act and the registration conditions of spectrum licences.

1. The device boundary of a transmitter is established as follows:

Step 1 Calculate the device boundary criterion (2302–2400 MHz) for each increment (m·5) minutes in distance by reference to the Australian National Spheroid, where ***m*** is any integer beginning 1 to 30, along each of 144 radials.

All increments m = 1 to 30 begin at the common central point of the radials.

The common central point is the centre location of the transmitter.

The 144 radials have bearings taken clockwise and given by the sequence ϕ_0, ϕ_1, ϕ_2,... ϕ_{142}, ϕ_{143}, (ϕ_n) according to the sequence rule $\phi_n = ((n \cdot {}^5/_2) + {}^5/_4)$ degrees referenced to true north.

Note In the expression ***m·5***, and similar expressions, the symbol ‘ · ’ represents the operation of multiplication.

Step 2 Calculate an end point for each radial as the point corresponding to the sum of:

(a) the distance in kilometres along the radial equal to the length corresponding to the number of 5 minute increments from the centre location of the transmitter that corresponds to the calculated value of the device boundary criterion (2302–2400 MHz) being zero or negative when either all the previous values calculated for that radial are positive, or the number of the increment is equal to 1; and

(b) the effective radius of the centre location.

Note 1 The value of ***m*** for each increment is the same as the value of ***m*** for the segment referred to in paragraph 2 (1) (c) of Schedule 3.

Note 2 The actual distance in kilometres for a 5 minute increment in distance varies according to the direction and location of the radial by reference to the Australian National Spheroid. Distances measured in minutes are accepted usage in mapping.

Step 3 Identify the location of each end point by reference to the spectrum map grid.

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Step 4 Connect the end point of each radial consecutively to draw a polygon in relation to the spectrum map grid cells.

Step 5 Aggregate the spectrum map grid cells that either fall within or are intersected by the polygon. The boundary of this aggregated area is the device boundary of the transmitter.

2. For a group of fixed transmitters:
   (a) the device boundary of the group is to be calculated as if for a single transmitter; and
   (b) when calculating the device boundary criterion (2302–2400 MHz), the horizontally radiated power is calculated in accordance with clause 3.

3. The horizontally radiated power is taken:
   (a) to be equal for each bearing ϕ_n; and
   (b) to have a value that is equal to the maximum horizontally radiated power, in any direction, of any transmitter in the group.

Part 2 Device boundary criterion (2302–2400 MHz)

1. The device boundary criterion (2302–2400 MHz) is the value of the mathematical expression:

HRP - MP

where:

HRP is the horizontally radiated power (dBm EIRP per 30kHz) for each bearing ϕ_n, estimated with a level of confidence not less than 95% that the true value of the horizontal radiated power remains below this horizontal radiated power value plus 2 dB.

MP is the Maximum Power, calculated as set out below, being a function of $he_m(\phi_n)$ and $d_m(\phi_n)$ and measured in units of dB, and where:

$he_m(\phi_n)$ is the effective antenna height of the transmitter measured in metres for segment m (m being any integer from 1 to 30) for each bearing ϕ_n; and

$d_m(\phi_n)$ is the distance m·5 minutes with reference to the Australian National Spheroid, calculated for segment m and measured in kilometres with an error of less than ± 0.1 km, for each bearing ϕ_n.

2. (1) In calculating **MP**, for simplification:

(a) let $dm(\phi_n) = d$; and

(b) let $he_m(\phi_n) = he$; and

(c) if $he < 1.0$, then let $he = 1.0$; and

(d) if $he > 800$, then let $he = 800$.

(2) For $1 < d < 20$ km, *MP* equals:

max [158.91 – 13.82 * log(max[30;*he*]) - min([0;20 * log(*he* / 30)]) – 25.62 + {44.9 – 6.55 * log(max[30;*he*])} * log(d);99.87 + 20 * log(*d*)] – 105

(3) For $d > 20$ km and $he < 200$ m, *MP* equals:

158.91 – 13.82 * log(max[30;*he*]) – min([0;20 * log(*he* / 30)]) – 25.62 + {44.9 – 6.55 * log(max[30;*he*])} * $\log(d)^{\alpha}$ – 105

where:

$\alpha = 1 + (0.58 + 0.00107 * he) * (\log[(d) / 20])^{0.8}$

(4) For $d > 20$ km and $he > 200$ m, *MP* equals:

$103 + 51.5 * \log(d) + 0.044 * he - 2.74 * (he)^{1/2} – 105$

Schedule 3 Effective antenna height

(subsection 4 (1), definition of ***effective antenna height***)

1 General

The effective height of an antenna is determined in accordance with its transmitter, as set out in this Schedule.

Note ACMA publishes software tools that may be used to calculate tables of effective antenna heights for any location in Australia.

2 Effective antenna height of an outdoor fixed transmitter (see Diagram 1 below)

(1) Subclause (2) applies if:

(a) *hg* is the vertical height in metres of the phase centre of the fixed transmitter's antenna measured with an error of less than 5 parts in 100 and relative to the point:

(i) located on the line of intersection between the external surface of the structure supporting the antenna and the surface of the ground or sea; and

(ii) having the lowest elevation on that line; and

(b) *hs* is the sum of:

(i) the elevation attribute of the RadDEM cell containing the location of the phase centre of a fixed transmitter's antenna; and

(ii) *hg*; and

(c) $hag_m(\phi_n)$ is average ground height, as described below, for each of the segments 'm' of a sector of 2.5 degrees arc centred along each of the bearings 'ϕ_n', calculated by taking the average of the elevation attributes for all of the cells that have either half (with an error of less than 1 part in 64) or more than half their area within each segment 'm'; and

(d) each sector is divided into 30 segments (*m*) (as illustrated in Diagram 2 below) with:

(i) any 2 consecutively numbered segments 1 to 30 being contiguous; and

(ii) each segment being a 5 minute increment in radial distance; and

(iii) segment 1 beginning at the centre location.

(2) For an outdoor fixed transmitter operating in the 2.3 GHz band:

(a) the effective antenna height for segment 1, $he_1(\phi_n)$, is *hg* for that centre location, except when ($hs - hg - hag_1(\phi_n)$) is > 0, in which case $he_1(\phi_n)$ is ($hs - hag_1(\phi_n)$) for that centre location; and

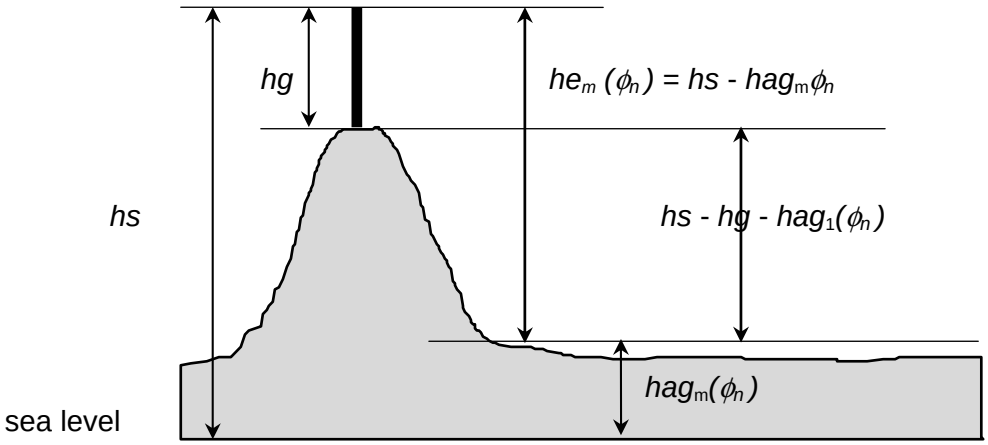
(b) the effective antenna height for segments 2 to 30, $he_m(\phi_n)$, where m is any integer in the range 2 to 30, is ($hs - hag_m(\phi_n)$) for that centre location, except when ($hs - hag_m(\phi_n)$) is < *hg*, in which case $he_m(\phi_n)$ is *hg* for that centre location.

Note 1 A RadDEM cell is represented as raster data such that the western and southerly boundary of the cell is part of the cell but the northerly and easterly boundary is part of the adjacent cells. This is an important consideration when a location falls on a cell boundary.

Note 2 A RadDEM cell is considered to be half within a sector/segment with an error of less than 1 part in 64 when the centre locations of 64 sub-cells that compose the cell are within the sector/segment.

3 Diagram 1

Calculating effective antenna height



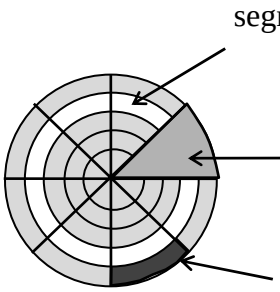
hg : antenna height
hs : antenna height above sea level
$hag_m(\phi_n)$: average ground height above sea level in segment 'm' of sector 'n'
$he_m(\phi_n)$: effective antenna height for segment 'm' of sector 'n'

(note: for this case $hs - hg - hag_1(\phi_n) > 0$)

4 Diagram 2

Segments and sectors

(not to scale)



5 Effective antenna height of an indoor fixed transmitter

The effective antenna height of an indoor fixed transmitter for any segment m =1 to 30 and any bearing (ϕ_n), $he_m(\phi_n)$ is *hg* metres, where:

hg is the smallest distance, measured vertically, between the phase centre of the transmitter's antenna and any surface in the building where the transmitter is located and on which mobile transmitters are supported.

6 Effective antenna height of a group of transmitters

For a group of transmitters where the antenna height above ground of the highest transmitter (hg_{max}), calculated in accordance with paragraph 2 (1) (a), is equal to or less than 20 metres, then the effective antenna height of the group $he_m(\phi_n)$, is hg_{max} for any segment m = 1 to 30, and any bearing (ϕ_n).

7 Effective antenna height of a group of fixed transmitters located near a central point

For a group of transmitters:

(a) that are fixed transmitters; and

(b) that are all supported by the 1 structure; and

(c) for which the phase centre of each transmitter's antenna is located within 10 metres of the same central point;

the effective antenna height of the group is calculated as if it were a single fixed transmitter located at the central point and with an *hg*, calculated in accordance with paragraph 2 (1) (a), equal to that calculated for the antenna with the largest *hg*.

Note

1. 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.