Radiocommunications (Unacceptable Levels of Interference — 3.4 GHz Band) Determination 2015

Radiocommunications Act 1992

made under subsection 145(4) of the

Radiocommunications Act 1992.

Compilation No. 3

Compilation date: 27 June 2023

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Prepared by the Australian Communications and Media Authority, Melbourne

Authorised Version F2023C00611 registered 19/07/2023

1 Name of Determination

This Determination is the *Radiocommunications (Unacceptable Levels of Interference — 3.4 GHz Band) Determination 2015*.

4 Purpose

This Determination is made for the purposes of section 145 of the Act and sets out what is an unacceptable level of interference caused by a radiocommunications transmitter operating under a spectrum licence issued in the 3.4 GHz band, so as to ensure that high levels of emission from radiocommunications transmitters operated under a spectrum licence are kept within the geographic area and frequency band of the licence.

Note 1 Under section 145 of the Act, the ACMA may refuse to register a radiocommunications transmitter if it is satisfied that the operation of the radiocommunications transmitter could cause an unacceptable level of interference to the operation of other radiocommunications devices under that or any other spectrum licence, or any other licence.

Note 2 The ACMA information paper, *Registration of radiocommunications devices under spectrum licences,* (available on the ACMA website: www.acma.gov.au), provides further information about the registration of radiocommunications transmitters under Part 3.5 of the Act.

Note 3 The ACMA has issued written advisory guidelines under section 262 of the Act about compatibility requirements in relation to the assignment of frequencies to radiocommunications transmitters operated under apparatus licences and the operation of radiocommunications transmitters under spectrum licences. The 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:

- *Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters — 3.4 GHz Band) 2015*; and
- *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 3.4 GHz Band) 2015.*

These instruments can be accessed on the ComLaw website: www.comlaw.gov.au.

5 Interpretation

(1) In this Determination, unless the contrary intention appears:

3.4 GHz band means the 3400 MHz to 3800 MHz frequency band.

Act means the *Radiocommunications Act 1992*.

active antenna system or ***AAS*** means a base station antenna system where the amplitude and/or phase between antenna elements is continually adjusted, resulting in an antenna pattern that varies in response to short term changes in the radio environment.

Australian Spectrum Map Grid (ASMG) means the *Australian Spectrum Map Grid 2012* published by the ACMA, as existing from time to time.

Note The ASMG can be accessed on the ACMA website: www.acma.gov.au.

Australian territorial sea baseline means the baseline from which the breadth of the territorial sea, or any part of the territorial sea, is to be measured under section 7 of the *Seas and Submerged Lands Act 1973*.

centre frequency, in relation to a radiocommunications transmitter, means the frequency midway between the lower and upper frequency limits of the transmitter's occupied bandwidth.

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DEM-3S means the dataset:

(a) with the citation "Gallant, J., Wilson, N., Tickle, P.K., Dowling, T., Read, A. 2009. 3 second SRTM Derived Digital Elevation Model (DEM) Version 1.0. Record 1.0. Geoscience Australia, Canberra."; and

(b) given the persistent identifier http://pid.geoscience.gov.au/dataset/ga/69888;

containing modelled terrain height information for Australia, published by Geoscience Australia.

Note Copies of DEM-3S can be obtained, free of charge, using the persistent identifier. More information about DEM-3S can be obtained from the Geoscience Australia website: www.ga.gov.au.

DEM-3S cell means an individual height element of the DEM-3S.

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

device boundary criterion means the value of the mathematical expression calculated in accordance with Part 2 of Schedule 2.

EIRP, in relation to a radiocommunications device, means the Effective Isotropic Radiated Power of the device.

emission designator means the designation of a radiocommunications transmitter's emission, determined in accordance with section 6.

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

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

Geocentric Datum of Australia 1994 means the geodetic datum designated as the 'Geocentric Datum of Australia (GDA94)' gazetted in the Commonwealth of Australia Gazette No. GN 35 on 6 September 1995.

Note The Geocentric Datum of Australia 1994 is a coordinate reference system. More information on the GDA94 can be obtained from the Geoscience Australia website: www.ga.gov.au.

geographic area, for a spectrum licence, means the area within which operation of a radiocommunications device is authorised under the licence.

group of radiocommunications receivers has the meaning given by section 8.

group of radiocommunications transmitters has the meaning given by section 7.

HCIS identifier means an identifier used to describe a geographic area in the HCIS.

hierarchical cell identification scheme or ***HCIS*** means the cell grouping hierarchy scheme used to describe areas in the Australian Spectrum Map Grid 2012 published by the ACMA on its website, as existing from time to time.

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

(a) the maximum true mean power, in dBm per specified rectangular bandwidth at the antenna connector that is located within the frequency band of the spectrum licence authorising the operation of the radiocommunications device; and

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

ITU means the International Telecommunication Union.

ITU-R means the International Telecommunication Union Radiocommunication Sector.

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location, in relation to a radiocommunications transmitter or group of radiocommunications transmitters, means the location of the transmitter or group of transmitters, as the case may be, calculated in accordance with Schedule 1.

maximum true mean power means the true mean power measured in a specified 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 specified 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 standard 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.

occupied bandwidth, in relation to a radiocommunications transmitter, means the width of a frequency band having upper and lower limits that are necessary to contain 99% of the true mean power of the transmitter's emission at any time.

Radio Regulations means the 'Radio Regulations' published by the ITU, as in force from time to time.

Note Copies of the Radio Regulations can be obtained from the ITU website: www.itu.int.

Recommendation ITU-R P.525-4 means the ITU-R Recommendation "P.525-4 Calculation of free-space attenuation", published by the ITU.

Note Copies of Recommendation ITU-R P.525-4 can be obtained, free of charge, from the ITU website: www.itu.int.

Recommendation ITU-R P.526-15 means the ITU-R Recommendation "P.526-15 Propagation by diffraction", published by the ITU.

Note Copies of Recommendation ITU-R P.526-15 can be obtained, free of charge, from the ITU website: www.itu.int.

Recommendation ITU-R P.2108-0 means the ITU-R Recommendation "P.2108-0 Prediction of clutter loss", published by the ITU.

Note Copies of Recommendation ITU-R P.2108-0 can be obtained, free of charge, from the ITU website: www.itu.int.

total radiated power, is defined as the integral of the power transmitted in different directions over the entire radiation sphere. It is measured considering the combination of all radiating elements on an antenna panel or individual device.

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, unless otherwise specified, the range of numbers that identifies a frequency band includes the higher, but not the lower, number.

Note A number of terms used in this Determination are defined in the Act and unless the contrary intention appears, have the meanings given to them by the Act. Those terms include:

- ACMA
- core condition
- frequency band
- interference
- radiocommunications device

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- radiocommunications receiver
- radiocommunications transmitter
- radio emission
- Register
- spectrum licence

5A References to other instruments

In this Determination, unless the contrary intention appears:

(a) a reference to any other legislative instrument is a reference to that other legislative instrument as in force from time to time; and

(b) a reference to any other kind of instrument or writing is a reference to that other instrument or writing as in force or in existence from time to time.

Note 1 For references to Commonwealth Acts, see section 10 of the *Acts Interpretation Act 1901*; and see also subsection 13(1) of the *Legislation Act 2003* for the application of the *Acts Interpretation Act 1901* to legislative instruments.

Note 2 All Commonwealth Acts and legislative instruments are registered on the Federal Register of Legislation.

Note 3 See section 314A of the Act.

6 Emission designator

(1) In this Determination, the designation of a radiocommunications transmitter's emission (***emission designator***) is determined using the methods specified in the Radio Regulations.

(2) For the purpose of determining the designation of a radiocommunications transmitter's emission using the methods specified in the Radio Regulations, the references to necessary bandwidth for a given class of emission are taken to be references to the occupied bandwidth of the transmitter.

Note At the date of the making of this Determination, Appendix 1 of the Radio Regulations made provision for determining the designation of a radiocommunications transmitter's emission.

7 Group of radiocommunications transmitters

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

(a) they have the same centre frequency and emission designator;

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

(c) each has an antenna of the same type, model and manufacturer;

(d) the antenna used with each fixed transmitter is located on the same structure and within 20 metres of the phase centre of all antennas within the group of radiocommunications transmitters; and

(e) the identification number assigned by the ACMA to the antenna used with each radiocommunications transmitter is the same.

(2) A radiocommunications transmitter must not belong to more than one group of radiocommunications transmitters.

(3) The location of a group of radiocommunications transmitters is calculated in accordance with Schedule 1.

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8 Group of radiocommunications receivers

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

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

(b) each has an antenna of the same type, model and manufacturer;

(c) the antenna used with each fixed receiver is located on the same structure and within 20 metres of the phase centre of all antennas within the group of radiocommunications receivers; and

(d) the identification number assigned by the ACMA to the antenna used with each radiocommunications receiver is the same.

(2) A radiocommunications receiver must not belong to more than one group of radiocommunications receivers.

(3) The location of a group of radiocommunications receivers is calculated in accordance with Schedule 1 as if the group of receivers were a group of radiocommunications transmitters.

9 Unacceptable level of interference

(1) A level of interference caused by a radiocommunications transmitter operated under a spectrum licence issued for the 3.4 GHz band is unacceptable if:

(a) the operation of the transmitter in the 3.4 GHz band results in a breach of a core condition of the licence relating to the maximum permitted level of radio emission from the transmitter:

(i) outside the parts of the spectrum the use of which is authorised under the licence; or

(ii) outside the geographic area of the licence; or

(b) subject to subsection (2), (3), (4) and (5) – any part of the device boundary of the transmitter lies outside of the geographic area of the licence; or

(c) the device boundary of the transmitter cannot be calculated in accordance with Part 1 of Schedule 2; or

(d) the transmitter operated in the 3.4 GHz band is located on an aircraft.

(2) A level of interference mentioned in paragraph 9(1)(b) is not unacceptable in relation to a part of the device boundary that:

(a) lies outside the boundary of the ASMG; and

(b) is connected to a radial that:

(i) is mentioned in Part 1 of Schedule 2; and

(ii) does not cross the geographic area of another spectrum licence in the 3.4 GHz band.

(3) A level of interference mentioned in paragraph 9(1)(b) is not unacceptable in relation to a part of the device boundary that:

(a) lies outside the geographic area of the licence; and

(b) lies inside an earth station protection zone specified in Schedule 4; and

(c) is connected to a radial that:

(i) is mentioned in Part 1 of Schedule 2; and

(ii) does not cross the geographic area of another spectrum licence in the 3.4 GHz band.

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(4) A level of interference mentioned in paragraph 9(1)(b) is not unacceptable in relation to a part of the device boundary that:

(a) lies outside the geographic area of the licence; and

(b) is connected to a radial that:

(i) is mentioned in Part 1 of Schedule 2; and

(ii) does not cross over land outside the geographical area of the licence that is permanently above the Australian territorial sea baseline;

(iii) does not cross into any of the following HCIS: IW3E, IW3I, IW3M, IW6A, IW6E, KX9, LX7, LX8, LX9.

(5) A level of interference mentioned in paragraph 9(1)(b) is not unacceptable in relation to a part of the device boundary that:

(a) lies outside the geographic area of the licence; and

(b) lies inside an urban area specified in Schedule 5; and

(c) relates to the operation of a radiocommunications transmitter with an occupied bandwidth contained within the 3400-3475 MHz frequency range; and

(d) is connected to a radial that is mentioned in Part 1 of Schedule 2.

(6) This section does not apply in relation to a radiocommunications transmitter to which section 11 applies.

Note Subsection 145(1) of the Act provides that the ACMA may refuse to include in the Register details of a radiocommunications transmitter if the ACMA is satisfied that operation of the transmitter could cause an unacceptable level of interference to the operation of other radiocommunications devices. However, some radiocommunications transmitters are exempt from the requirement to be registered in the Register under a 3.4 GHz band spectrum licence – see subsection 69(2) of the Act. Accordingly, these transmitters are not required to meet the device boundary criterion specified in this Determination.

10 Accuracy

Unless otherwise specified, the value of a parameter in Schedules 2 and 3 must be estimated with a level of confidence not less than 95 percent that the true value of the parameter will always remain below the requirement specified in this Determination.

11 Transition – radiocommunications transmitter registered before commencement of this section

(1) If a radiocommunications transmitter was included in the Register in relation to a spectrum licence in the 3.4 GHz band before the commencement of this section (***relevant transmitter***), this section applies in relation to that transmitter.

(2) Subject to subsection (3), for the purposes of subsection 145(4) of the Act, a level of interference caused by a relevant transmitter is unacceptable if it would have been unacceptable under this Determination as in force at the time the relevant transmitter was included in the Register.

Note This Determination, and previous versions of this Determination, can be obtained, free of charge, from the Federal Register of Legislation: www.legislation.gov.au.

(3) For the purposes of subsection 145(4) of the Act, if:

(a) after the commencement of this section, both:

(i) a detail of a relevant transmitter changes (***relevant change***); and

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(ii) the change to the detail is recorded in the Register; and

(b) the distance of the new device boundary of the relevant transmitter is, on each radial mentioned in Part 1 of Schedule 2, equal to or less than the distance of the old device boundary of the relevant transmitter on that radial; and

(c) but for the effect of this subsection, a level of interference caused by the relevant transmitter, immediately after the change time, would be unacceptable;

the level of interference caused by the relevant transmitter, immediately after the change time, is not unacceptable because of the relevant change.

(4) In subsection (3):

change time, for a relevant transmitter, means the time the relevant change is recorded in the Register.

new device boundary, of a relevant transmitter, means the device boundary of the transmitter established immediately after the change time, in accordance with this Determination as in force at the change time.

old device boundary, of a relevant transmitter, means the device boundary of the transmitter established immediately before the change time, in accordance with this Determination as in force at the registration time.

registration time, for a relevant transmitter, means the time the transmitter was included in the Register.

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Schedule 1 Location of a transmitter

(subsections 5(1), 7(3) and 8(3))

1. The location of a radiocommunications transmitter, (l_t, L_t) is the location (by latitude and longitude with reference to the Geocentric Datum of Australia 1994) of the phase centre of the radiocommunications transmitter's antenna.

2. The location of a group of radiocommunications transmitters, (l_t, L_t) is the location (by latitude and longitude with reference to the Geocentric Datum of Australia 1994) of the centre point between the phase centre of each radiocommunications transmitter antenna within the group.

3. In determining the location of a radiocommunications transmitter, or a group of radiocommunications transmitters, the measurement error should be less than 10 metres.

Note 1 The ACMA issues site identifiers for established radiocommunications locations available in the Register.

Note 2 The ACMA provides advice on its website at www.acma.gov.au to assist licensees in determining the location and measurement error of a transmitter site in the document *Business Operating Procedure (BOP) – Radiocommunications site data requirements.*

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Schedule 2 Device boundaries and device boundary criteria

(subsections 5(1), 9(1), 9(2), 9(3), 9(4) and 9(5), section 10, and subsection 11(3))

Part 1 Device boundary of a transmitter

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

Step 1: Calculate the device boundary criterion at each m×100 metre increment along each of the n-degree radials, where:

(a) m is the values 2 through 1010; and

(b) n is the values 0 (true north) through 359.

Step 2: For each radial, find the latitude and longitude of the first point on the radial, moving away from the location of the radiocommunications transmitter (that is, with the lowest value of m), where either:

(a) RP-MP is less than or equal to 0; or

(b) m is equal to 1010.

This point is the end point of the radial.

Step 3: The end point of each radial is the device boundary of the radiocommunications transmitter connected to that radial.

Note: RP-MP (device boundary criterion) is calculated under Part 2.

2. For a group of radiocommunications transmitters the device boundary is to be calculated as if for a single radiocommunications transmitter. The radiated power (RP) for groups of radiocommunications transmitters is taken:

(a) to be equal for each bearing σ_n; and

(b) to have a value that is the maximum horizontally radiated power, in any direction, of any radiocommunications transmitter in the group.

Note: σ_n is the bearing of the n^{th}-degree radial for the group of radiocommunications transmitters.

Part 2 Device boundary criterion

1. The device boundary criterion is the value of the mathematical expression:

RP – MP

where:

MP	is $PL(l_{mn},L_{mn}) + LOP - G_r$;
RP	is the horizontally radiated power, measured in dBm EIRP per MHz, for each bearing, σ_n;
Note	For a device with an active antenna system, the RP

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	at bearing σ_n is defined as the sum of the gain of the antenna towards the horizontal plane and towards azimuth σ_n (dB) and the total radiated power (dBm). This allowance is based on the assumption that beam pointing angles and/or power can be controlled dynamically to ensure RP is not exceeded.
LOP	is the level of protection. For radiocommunications transmitters with AAS, the *LOP* is -90 dBm per MHz. For radiocommunications transmitters without AAS, the *LOP* is –98 dBm per MHz;
G_r	is the nominal radiocommunications receiver antenna gain including feeder loss set to 0 dBi;
$PL(l_{mn},L_{mn})$	is the propagation loss (dB) set out in Part 3 of the m^{th} increment on the n^{th} radial.

Part 3 Calculation of propagation loss

1. Subject to this Part 3, the ***propagation loss*** (or $\boldsymbol{PL(l_{mn},L_{mn})}$), for a radiocommunications transmitter, of the m^{th} increment on the n^{th} radial is calculated using:
   (a) for a transmitter connected to an antenna which is located greater than 6 metres above ground level – the method and parameters defined in section 2.2 of Recommendation ITU-R P.525-4 and in section 4.5.2 of Recommendation ITU-R P.526-15; or
   (b) for a transmitter connected to an antenna which is located at or below 6 metres above ground level – the method and parameters defined in section 2.2 of Recommendation ITU-R P.525-4, in section 4.5.2 of Recommendation ITU-R P.526-15 and in section 3.2 of Recommendation ITU-R P.2108-0.

2. In implementing the method in section 4.5.2 of Recommendation ITU-R P.526-15, the height of the nominal receiver is 5 metres above ground level, the height of the transmitter above ground level is determined in Part 1 of Schedule 3, and the height of a profile point is determined in Part 2 of Schedule 3.

3. In implementing the method in section 4.5.2 of Recommendation ITU-R P.526-15, the path profile is developed by sampling the DEM-3S at 100 metre increments along each radial. At each increment along the path profile, the procedure for determining the average ground height described in Part 2 of Schedule 3 is implemented.

4. In implementing the method in section 3.2 of Recommendation ITU-R P.2108-0:
   (a) the percentage of locations is set at 0.08% and the correction is applied at only one end of the path; and
   (b) if the loss calculated using the method in section 3.2 of Recommendation ITU-R P.2108-0 is less than 0 dB, the calculated loss value is replaced with 0 dB; and
   (c) if the loss calculated using the method in section 3.2 of Recommendation ITU-R P.2108-0 is greater than 8 dB, the calculated loss value is replaced with 8 dB.

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Schedule 3 Antenna height and average ground height

(section 10, Schedule 2)

Part 1 Antenna height of a transmitter

1. The antenna height of a fixed transmitter, is the vertical height in metres of the phase centre of the transmitter's antenna measured with an error of less than 5 parts in 100 and relative to the point:
   (a) 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
   (b) having the lowest elevation on that line.

2. For a group of radiocommunications transmitters, the antenna height for the group is the greatest of the heights of each individual transmitter in the group, calculated in accordance with this Part.

Part 2 Average ground height

1. The average ground height for the m^{th} increment on the n^{th} radial is calculated as follows:

   Step 1: determine the associated latitude and longitude (l_{mn},L_{mn}) of the m^{th} increment on the n^{th} radial as calculated in Part 3.

   Step 2: identify the DEM-3S cell represented by the latitude and longitude of the m^{th} increment on the n^{th} radial.

   Step 3: bound the identified DEM-3S cell with the 8 adjacent DEM-3S cells in a 3x3 matrix and obtain each DEM-3S cell height attribute (as shown in Diagram 1).

   Step 4: determine the average value of height from the 3x3 matrix.

2. If the seconds component of (l_{mn},L_{mn}), plus 1.5, has a modulus of zero when divided by 3, then the corresponding DEM-3S cell, for the purposes Step 2 in item 1, is the adjacent DEM-3S cell with the minimum height.

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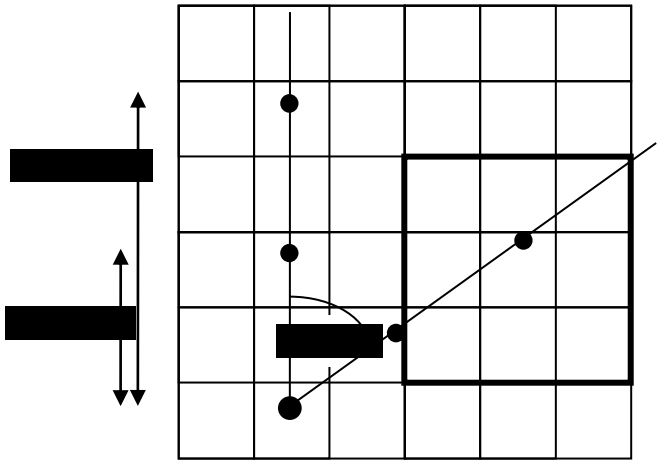
Diagram 1 Calculating average ground height



Part 3 Vincenty's Formulae

Note This implementation of Vincenty's Direct Formulae uses the parameters $\{a, f_l, b\}$ from the GRS80 ellipsoid as referenced by the Geocentric Datum of Australia 1994 (GDA94).

1. In calculating (l_{mn}, L_{mn}):

l_t : is the latitude of the fixed transmitter (decimal radians)

L_t : is the longitude of the fixed transmitter (decimal radians)

α : is the azimuth angle (decimal radians)

d : is the separation distance to required point (m×100 metres)

a : is the semi-major axis with value 6378137 metres

f_l : is the flattening of the value 1/298.25722210

b : is the semi-minor axis of $(a \times (1-f_l))$

$$e^2 = \left(a^2 - b^2\right)/b^2$$

$$U_1 = \arctan\left(\left(1 - f_l\right) \times \tan\left(l_t\right)\right)$$

$$\phi_1 = \arctan\left(\tan\left(U_1\right)/\cos\left(\alpha\right)\right)$$

$$\alpha_n = \arcsin\left(\cos\left(U_1\right) \times \sin\left(\alpha\right)\right)$$

$$u^2 = \cos^2\left(\alpha_n\right) \times e^2$$

$$A = 1 + \left(u^2/16384\right) \times \left(4096 + u^2 \times \left(-768 + u^2 \times \left(320 - 175 \times u^2\right)\right)\right)$$

$$B = \left(u^2/1024\right) \times \left(256 + u^2 \times \left(-128 + u^2 \times \left(74 - 47 \times u^2\right)\right)\right)$$

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2. Using an initial value $\phi = d/(b \times A)$, iterate the following three equations until the change in ϕ is less than 10^{-12}.

$$\phi_m = \frac{2 \times \phi_1 + \phi}{2}$$

$$\Delta\phi = B\sin(\phi) \times \left\{ \cos(2\phi_m) + \frac{B}{4} \times \left[\cos(\phi) \times \left(-1 + 2\cos^2(2\phi_m) \right) - \frac{B}{6} \cos(2\phi_m) \times \left(-3 + 4\sin^2(\phi) \right) \times \left(-3 + 4\cos^2(2\phi_m) \right) \right] \right\}$$

$$\phi = d/(b \times A) + \Delta\phi$$

3. Then:

$$l_{mn} = \arctan\left(\frac{\sin(U_1)\cos(\phi) + \cos(U_1)\sin(\phi)\cos(\alpha)}{(1 - f_l)\sqrt{\sin^2(\alpha_n) + (\sin(U_1)\sin(\phi) - \cos(U_1)\cos(\phi)\cos(\alpha))^2}} \right)$$

Note use the four-quadrant inverse tangent, *atan2*.

$$\lambda = \arctan\left(\frac{\sin(\phi)\sin(\alpha)}{\cos(U_1)\cos(\phi) - \sin(U_1)\sin(\phi)\cos(\alpha)} \right)$$

Note use the four-quadrant inverse tangent, *atan2*.

$$C = \frac{f_l}{16} cos^2(\alpha_n) \left[4 + f_l(4 - 3\, cos^2(\alpha_n)) \right]$$

$$L = \lambda - (1 - C) f_l\, sin(\alpha_n) \{ \varphi + C\, sin(\varphi) \left[cos(2\varphi_m) + C\, cos\, \varphi\, (-1 + 2\, cos^2(2\varphi_m)) \right] \}$$

$$L_{mn} = L_t + L$$

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Schedule 4 Earth station protection zones

(subsection 9(3))

Description of Area

1. The earth station protection zones are the areas named in Column 1 of the table below.
2. An earth station protection zone consists of the aggregation of block areas referenced by HCIS identifiers used to describe it which are specified in the corresponding Column 2 of the table below. (Refer to the ASMG for a complete description of the naming convention referred to as the HCIS.)

Column 1 Name	Column 2 HCIS Identifiers
Moree	MU5G, MU5H, MU5L, MU5C8, MU5C9, MU5D7, MU5D8, MU5D9, MU5K1, MU5K2, MU5K3, MU5K4, MU5K5, MU5K6, MU5K8, MU5K9, MU6A7, MU6E1, MU6E2, MU6E4, MU6E5, MU6E7, MU6E8, MU6I1, MU6I2, MU6I4, MU6I5, MU6I7
Quirindi	MV3G, MV3H, MV3K, MV3L, MV3C8, MV3C9, MV3D7, MV3F3, MV3F5, MV3F6, MV3F8, MV3F9, MV3J2, MV3J3, MV3J5, MV3J6, MV3J9, MV3O1, MV3O2, MV3O3, MV3P1
Roma	MT4H, MT4K, MT4L, MT4F9, MT4G2, MT4G3, MT4G4, MT4G5, MT4G6, MT4G7, MT4G8, MT4G9, MT4J3, MT4J6, MT4O1, MT4O2, MT4O3, MT4O6, MT4P1, MT4P2, MT4P3, MT4P4, MT4P5, MT5E4, MT5E7, MT5I1, MT5I2, MT5I4, MT5I5, MT5I7, MT5M1
Uralla	NU7K4

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Schedule 5 Urban areas

(subsection 9(5))

Description of urban areas

1. Urban areas are the areas named in Column 1 of the table below.
2. An urban area consists of the aggregation of block areas referenced by the HCIS identifiers used to describe it which are specified in the corresponding Column 2 of the table below.

Column 1 Name	Column 2 HCIS Identifiers
Adelaide	IW3N, IW3O4, IW3O5, IW3O7, IW3O8, IW6B1, IW6B2, IW6B3, IW6B5, IW6B6
Brisbane	NT9B, NT9C, NT9D, NT9E, NT9F, NT9G, NT9H, NT9K, NT9L, NT8H3, NT8L2, NT8L3, NT8L5, NT8L6, NT8L8, NT8L9, NT9A6, NT9A7, NT9A8, NT9A9, NT9I1, NT9I2, NT9I3, NT9I4, NT9I5, NT9I6, NT9J1, NT9J2, NT9J3, NT9J4, NT9J5, NT9J6, NT9J9, NT9N5, NT9N6, NT9N8, NT9N9, NT9O4, NT9O7, NU3B2, NU3B3, NU3C1, NU3C4
Canberra	MW4D, MW4H, MW5A, MW5B, MW5E, MW5F, MW2M5, MW2M6, MW2M7, MW2M8, MW2M9, MW2N4, MW2N5, MW2N7, MW2N8, MW2N9, MW4L1, MW4L2, MW4L3, MW4L5, MW4L6, MW5I1, MW5I2, MW5I3, MW5I4, MW5I5, MW5I6, MW5J1, MW5J2, MW5J4, MW5J5
Melbourne	KX3P, KX3L6, KX3L7, KX3L8, KX3L9, KX6D1, KX6D2, KX6D3, KX6D5, KX6D6, LX1M, LX1I7, LX1N4, LX4A1, LX4A2, LX4A3, LX4A4, LX4A5, LX4B1
Perth	BV1M, BV1N, BV1O, BV4A, BV4B, BV4C, BV1L5, BV1L8, BV1P1, BV1P2, BV1P4, BV1P5, BV1P7, BV1P8, BV4D1, BV4D2, BV4E1, BV4E2, BV4E3, BV4F1, BV4F2, BV4F3, BV4G1, BV4G2, BV1P9, BV4D3, BV4D4, BV4G3
Sydney	NV7G, NV7H, NV7J, NV7K, NV7L, NV7M, NV7N, NV7O, NV7P, NW1A, NW1B, NW1C, NW1D, NW1E, NW1F, NW1G, NW1H, MV9P2, MV9P3, MV9P5, MV9P6, MV9P7, MV9P8, MV9P9, MW3D1, MW3D2, MW3D3, MW3D5, MW3D6, MW3D8, MW3D9, MW3H2, MW3H3, MW3H5, MW3H6, MW3H9, MW3L2, MW3L3, NV4O7, NV4O8, NV4O9, NV4P7, NV7F6, NV7F8, NV7F9, NV7I6, NV7I8, NV7I9, NW1I1, NW1I2, NW1I3, NW1J1, NW1J2, NW1J3, NW1K1, NW1K2, NW1K3, NW1L1, NW1L2, NW1L3

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Endnotes

Endnote 1—About the endnotes

The endnotes provide information about this compilation and the compiled law.

The following endnotes are included in every compilation:

Endnote 1—About the endnotes

Endnote 2—Abbreviation key

Endnote 3—Legislation history

Endnote 4—Amendment history

Abbreviation key—Endnote 2

The abbreviation key sets out abbreviations that may be used in the endnotes.

Legislation history and amendment history—Endnotes 3 and 4

Amending laws are annotated in the legislation history and amendment history.

The legislation history in endnote 3 provides information about each law that has amended (or will amend) the compiled law. The information includes commencement details for amending laws and details of any application, saving or transitional provisions that are not included in this compilation.

The amendment history in endnote 4 provides information about amendments at the provision (generally section or equivalent) level. It also includes information about any provision of the compiled law that has been repealed in accordance with a provision of the law.

Misdescribed amendments

A misdescribed amendment is an amendment that does not accurately describe how an amendment is to be made. If, despite the misdescription, the amendment can be given effect as intended, then the misdescribed amendment can be incorporated through an editorial change made under section 15V of the *Legislation Act 2003*.

If a misdescribed amendment cannot be given effect as intended, the amendment is not incorporated and "(md not incorp)" is added to the amendment history.

Endnote 2—Abbreviation key

ad = added or inserted
am = amended
amdt = amendment
c = clause(s)
C[x] = Compilation No. x
Ch = Chapter(s)
def = definition(s)
Dict = Dictionary
disallowed = disallowed by Parliament
Div = Division(s)
exp = expires/expired or ceases/ceased to have effect
F = Federal Register of Legislation
gaz = gazette
LA = *Legislation Act 2003*
LIA = *Legislative Instruments Act 2003*
(md not incorp) = misdescribed amendment cannot be given effect
mod = modified/modification
No. = Number(s)
o = order(s)
Ord = Ordinance
orig = original
par = paragraph(s)/subparagraph(s) /sub-subparagraph(s)
pres = present
prev = previous
(prev…) = previously
Pt = Part(s)
r = regulation(s)/rule(s)
reloc = relocated
renum = renumbered
rep = repealed
rs = repealed and substituted
s = section(s)/subsection(s)
Sch = Schedule(s)
Sdiv = Subdivision(s)
SLI = Select Legislative Instrument
SR = Statutory Rules
Sub-Ch = Sub-Chapter(s)
SubPt = Subpart(s)
underlining = whole or part not commenced or to be commenced

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Endnote 3 – Legislation history

Title	Date of FRLI registration	Date of commencement	Application, saving or transitional provisions
Radiocommunications (Unacceptable Levels of Interference — 3.4 GHz Band) Determination 2015	25 May 2015 (see F2015L00727)	14 December 2015	
Radiocommunications – 3.4 GHz Band Omnibus Variation 2018 (No. 1)	27 July 2018 (*see* F2018L01063)	28 July 2018	-
Radiocommunications (Unacceptable Levels of Interference – 3.4 GHz Band) Amendment Determination 2021 (No.1)	10 Dec 2021 (see F2021L01753)	11 Dec 2021	
Radiocommunications (Unacceptable Levels of Interference – 3.4 GHz Band) Amendment Determination 2023 (No. 1)	26 June 2023 (see F2023L00857)	27 June 2023	

Endnote 4 – Amendment history

ad. = added or inserted am. = amended rep. = repealed rs. = repealed and substituted

Provision affected	How affected
s 2…….	rep. LA s 48D;
s 3…….	rep. LA s 48C;
s 5…….	am. 2018 No. 1;
s.5(1).....	am. 2021 No.1; am. 2023 No.1;
s.5A.....	ad. 2021 No.1;
s 9…….	am. 2018 No.1;
s.9(1).....	am. 2021 No.1;
s.9(4).....	am. 2021 No.1;
s.9(5).....	ad. 2021 No.1;
s.9(6).....	ad. 2021 No.1;
s.11	ad. 2021 No.1;
Sch 2, heading.....	am. 2021 No.1;
Sch 2 Pt 1…….	am. 2018 No.1; am. 2021 No.1; am. 2023 No.1;
Sch 2 Pt 2…….	am. 2018 No.1; am. 2021 No.1;
Sch 2 Pt 3…….	am. 2018 No.1; am. 2021 No.1;
Sch 3 Pt 2.....	am. 2021 No.1;
Sch 3 Pt 3…….	am. 2018 No.1; am. 2021 No.1;
Sch 4.....	ad. 2018 No.1;
Sch 5.....	ad. 2021 No.1;