



## **Radiocommunications (Interpretation – Technical Framework) Determination 2024**

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The Australian Communications and Media Authority makes the following determination under subsection 64(1) of the *Australian Communications and Media Authority Act 2005*.

Dated: 29 February 2024

Adam Suckling  
[signed]  
Member

Carolyn Lidgerwood  
[signed]  
Member/~~General Manager~~

Australian Communications and Media Authority

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## 1 Name

This is the *Radiocommunications (Interpretation – Technical Framework) Determination 2024*.

## 2 Commencement

This instrument commences on 31 March 2024.

## 3 Authority

This instrument is made under subsection 64(1) of the *Australian Communications and Media Authority Act 2005*.

## 4 Schedule 1–Dictionary

- (1) Subject to subsection (2), the Dictionary in Schedule 1 defines expressions used in the following instruments:
  - (a) this instrument;
  - (b) instruments made under subsection 145(4) of the Act;
  - (c) advisory guidelines made under subsection 262(1) of the Act.
- (2) If an instrument specified in paragraph (1)(b) or (c) defines an expression in the Dictionary, or an expression substantially similar to an expression in the Dictionary, the Dictionary does not define the expression for the purposes of that instrument.
- (3) In the Dictionary, expressions defined in the Act have the same meaning as in the Act.

Note: Expressions defined in the Act include:

- (a) apparatus licence;
- (b) class licence;
- (c) frequency band;
- (d) radiocommunications device;
- (e) radiocommunications receiver;
- (f) radiocommunications transmitter;
- (g) radio emission;
- (h) Register;
- (i) spectrum licence;
- (j) spectrum plan.

## 5 References to other instruments

In this instrument, 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 existing 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 65 of the *Australian Communications and Media Authority Act 2005*.

## **6 Accuracy**

Unless otherwise specified, the value of a parameter in Schedule 2 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 instrument.

## Schedule 1–Dictionary

(subsection 4(1))

### 1 Definitions

In each instrument for which this Dictionary defines expressions:

**AAS** (short for active antenna system) 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.

**Act** means the *Radiocommunications Act 1992*.

**ARQZWA** (short for Australian Radio Quiet Zone Western Australia) has the meaning given by the *Radiocommunications (Australian Radio Quiet Zone Western Australia) Frequency Band Plan 2023*, or any instrument made under section 32 of the Act as a replacement of that plan.

**Australian Spectrum Map Grid** means the Australian Spectrum Map Grid 2012, published by the ACMA.

Note: The Australian Spectrum Map Grid is available, free of charge, from the ACMA’s website at [www.acma.gov.au](http://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*.

**average ground height**: see item 2 of Schedule 2.

**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.

**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>; published by Geoscience Australia.

Note: DEM-3S is available, free of charge, from Geoscience Australia using the persistent identifier. More information about DEM-3S is available, free of charge, from the Geoscience Australia website at [www.ga.gov.au](http://www.ga.gov.au).

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

**effective antenna height**: see item 1 of Schedule 2.

**EIRP**, in relation to a radiocommunications device, means the equivalent isotropically radiated power of the device.

**emission buffer zone**, in relation to a spectrum licence, means a zone along the frequency boundary or geographic boundary specified in a spectrum licence where radio emissions of radiocommunications transmitters are modified to ensure that significant levels of those radio emissions stay within the geographic areas and frequencies of the licence.

**emission designator**: see item 2.

**fixed receiver** means a radiocommunications receiver:

- (a) located at a fixed point on land or sea; and
- (b) not designed or intended for use while in motion.

**fixed transmitter** means a radiocommunications transmitter:

- (a) located at a fixed point on land or sea; and
- (b) not designed or intended for use while in motion.

**GDA94** means the geodetic datum designated as the “Geocentric Datum of Australia (GDA)”, gazetted in the Commonwealth of Australia *Gazette* No. GN 35 on 6 September 1995, as existing on that date.

Note: *Gazette* No. GN 35 is available, free of charge, from the Federal Register of Legislation at [www.legislation.gov.au](http://www.legislation.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**: see item 4.

**group of radiocommunications transmitters**: see item 3.

**harmful interference** has the meaning given by the spectrum plan.

**HCIS** means the cell grouping hierarchy scheme used to describe areas in the Australian Spectrum Map Grid.

Note: HCIS stands for hierarchical cell identification scheme.

**HCIS identifier** means an identifier used to describe an area in the HCIS.

**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.

**in-band** means:

- (a) for a radiocommunications device operated under a spectrum licence – the part of the spectrum within which the operation of radiocommunications devices is authorised under the licence; or
- (b) for a radiocommunications device operated under an apparatus licence that specifies a frequency band – the frequencies within the lower frequency limit and the upper frequency limit specified in the licence; or
- (c) for a radiocommunications device operated under an apparatus licence that specifies a specific frequency and bandwidth – the frequencies within that bandwidth, when centred on the specific frequency.

**ITU-R Recommendation** means a recommendation made by the Radiocommunication Sector of the International Telecommunication Union.

Note: ITU-R Recommendations are available, free of charge, from the website of the International Telecommunication Union at [www.itu.int](http://www.itu.int).

**LIPD class licence** means:

- (a) the *Radiocommunications (Low Interference Potential Devices) Class Licence 2015*; or
- (b) if another instrument replaces that class licence – the other instrument.

**location**: see item 5.

**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 the true mean powers produced.

Note: The power within the specified rectangular bandwidth is normally established by taking measurements using either an adjacent channel power meter or a spectrum analyser. Estimation of the accuracy of the measuring equipment, the measurement protocol and any adjustments made to measurements to take account of practical filter shape factors should 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 device** means a radiocommunications device that is used:

- (a) while it is in motion on land, on water or in the air; or
- (b) in a stationary position at unspecified points on land, on water or in the air.

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

**out-of-band**, for a radiocommunications device, means a frequency other than an in-band frequency.

**Radio Regulations** means the document titled ‘Radio Regulations’, published by the International Telecommunication Union.

Note 1: The Radio Regulations are not regulations made by the Governor-General under the Act.

Note 2: The Radio Regulations are available, free of charge, from the International Telecommunication Union’s website at [www.itu.int](http://www.itu.int).

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

**true mean power** means:

- (a) if an unmodulated carrier is present – the mean power measured while the unmodulated carrier is present; or
- (b) if an unmodulated carrier is not present – the mean power measured while transmitted information is present.

**unwanted signal** means a radio emission from a radiocommunications transmitter that is not a wanted signal.

**Vincenty’s Direct Formulae** means the formulae set out in item 3 of Schedule 2.

**wanted signal** means a radio emission from a radiocommunications transmitter that is intended for reception by a radiocommunications receiver.

## 2 Emission designator

- (1) 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 emission designator of a radiocommunications transmitter using the methods specified in the Radio Regulations, references in the Radio Regulations to “necessary bandwidth” for a given class of emission are taken to be references to the occupied bandwidth of the transmitter.

Note: At the time the ACMA made this instrument, Appendix 1 of the Radio Regulations set out the method to be used for determining the designation of a radiocommunications transmitter’s emission.

### 3 Group of radiocommunications transmitters

- (1) Subject to subitem (2), two or more fixed transmitters are a ***group of radiocommunications transmitters*** if:
- (a) each transmitter has the same centre frequency and emission designator; and
  - (b) each transmitter is operated for the purpose of communicating with the same radiocommunications receiver or group of radiocommunications receivers; and
  - (c) each transmitter has an antenna of the same type, model and manufacture; and
  - (d) the antenna used with each transmitter is located on the same structure and within 20 metres of the phase centre of all antennas for the other transmitters 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.

Note: See section 144 of the Act, and any instrument made under that section, for the information that must be included in the Register about a spectrum licence and each radiocommunications device operated under a spectrum licence.

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

Note: If a radiocommunications transmitter is capable of belonging to more than one group of radiocommunications transmitters, the spectrum licensee or authorised third party may nominate one group for the transmitter.

### 4 Group of radiocommunications receivers

- (1) Subject to subitem (2), two or more fixed receivers are a ***group of radiocommunications receivers*** if:
- (a) each receiver is operated for the purpose of communicating with the same radiocommunications transmitter or group of radiocommunications transmitters; and
  - (b) each receiver has an antenna of the same type, model and manufacture; and
  - (c) the antenna used with each receiver is located on the same structure and within 20 metres of the phase centre of all antennas for the other receivers 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.

Note: See section 144 of the Act, and any instrument made under that section, for the information that must be included in the Register about a spectrum licence and each radiocommunications device operated under a spectrum licence.

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

Note: If a radiocommunications receiver is capable of belonging to more than one group of radiocommunications receivers, the spectrum licensee or authorised third party may nominate one group for the receiver.

## 5 Location

- (1) The **location** of a radiocommunications transmitter ( $l_t, L_t$ ) is the location (by latitude and longitude with reference to GDA94) 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 GDA94) of the centre point between the phase centre of each radiocommunications transmitter antenna within the group.
- (3) The **location** of a radiocommunications receiver ( $l_r, L_r$ ) is the location (by latitude and longitude with reference to GDA94) of the phase centre of the radiocommunications receiver's antenna.
- (4) The **location** of a group of radiocommunications receivers ( $l_r, L_r$ ) is the location (by latitude and longitude with reference to GDA94) of the centre point between the phase centre of each radiocommunications receiver antenna within the group.
- (5) In determining the location of a radiocommunications transmitter, a group of radiocommunications transmitters, a radiocommunications receiver, or a group of radiocommunications receivers, the measurement error must be less than 10 metres.

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

## Schedule 2—Effective antenna height, average ground height and Vincenty's Direct Formulae

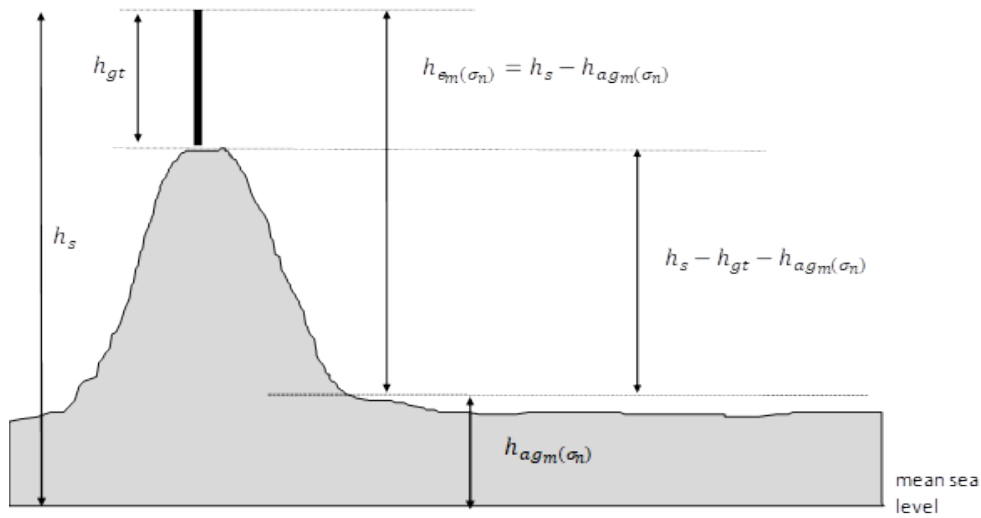
(section 6 and item 1 of Schedule 1)

### 1 Effective antenna height of a fixed transmitter

- (1) If:
- (a) subject to subitem (2),  $h_{gt}$  is the vertical height in metres of the phase centre of a 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) subject to subitem (3),  $h_s$  is the sum of:
    - (i) the DEM-3S cell height of the location of the fixed transmitter as defined in Schedule 1; and
    - (ii)  $h_{gt}$ ; and
  - (c)  $h_{agm}(\sigma_n)$  is the average ground height of the DEM-3S cell at each m-increment on each n-radial as calculated in accordance with item 2;

then the **effective antenna height**  $h_{em}(\sigma_n)$  of the fixed transmitter is:

- (d) except where paragraph (e) applies:  $h_s - h_{agm}(\sigma_n)$  (as shown in Diagram 1); or
  - (e) if  $h_s - h_{agm}(\sigma_n)$  is less than  $h_{gt} : h_{gt}$ .
- (2) For a group of radiocommunications transmitters,  $h_{gt}$  is the greatest of the  $h_{gt}$  for each individual transmitter in the group, calculated in accordance with this item.
- (3) If the seconds component of the latitude or longitude of the location of the fixed transmitter as defined in Schedule 1, plus 1.5, has a modulus of zero when divided by 3, then  $h_s$  is the sum of:
- (a)  $h_{gt}$ ; and
  - (b) the maximum height of the adjacent DEM-3S cells.

**Diagram 1 Calculating effective antenna height**

## 2 Average ground height

(1) The **average ground height** at the  $m^{th}$  increment on the  $n^{th}$  radial is calculated as follows:

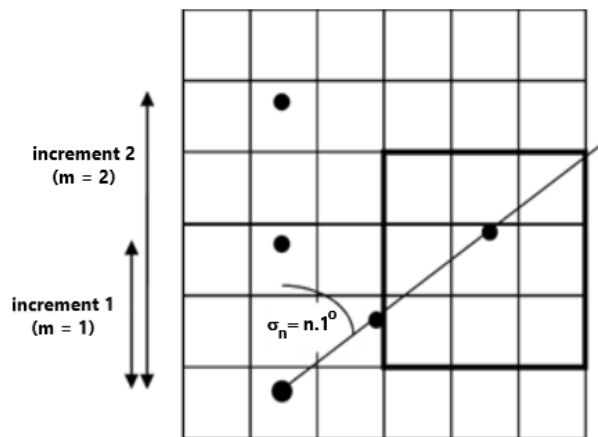
Step 1: Determine the associated latitude and longitude of the  $m^{th}$  increment on the  $n^{th}$  radial ( $l_{mn}, L_{mn}$ ) as calculated by using Vincenty’s Direct Formulae as set out in item 3.

Step 2: Identify the DEM-3S cell represented by ( $l_{mn}, L_{mn}$ ).

Note: See subitem (2) below for identifying the DEM-3S cell in a particular case.

Step 3: Bound the identified DEM-3S cell with the 8 adjacent DEM-3S cells in a 3 x 3 matrix and obtain each DEM-3S cell height attribute (as shown in Diagram 2).

Step 4: Determine the average value of the 9 DEM-3S cell heights for each cell in the 3 x 3 matrix.

**Diagram 2 Calculating average ground height**

(2) If the second 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 of Step 2 in subitem (1), is the adjacent DEM-3S cell with the minimum height.

Note Additional information for the case where (lmn, Lmn) corresponds to a DEM-3S cell boundary is provided in the document titled ‘Digital Elevation Model Interpretation’ available for free on the ACMA website: [www.acma.gov.au](http://www.acma.gov.au).

### 3 Vincenty’s Direct Formulae

Note: This implementation of Vincenty’s Direct Formulae uses the parameters  $\{a, f, b\}$  from the GRS80 ellipsoid as referenced by GDA94.

(1) In calculating  $(l_m, L_m)$ :

- $l_t$  is the latitude of the fixed transmitter (decimal radians)
- $L_t$  is the longitude of the fixed transmitter (decimal radians)
- $\alpha$  is the azimuth angle (decimal radians)
- $d$  is the separation distance to required point ( $m^{th}$  increment, metres)
- $a$  is the semi-major axis with value 6378137 metres
- $f$  is the flattening of the value 1/298.25722210
- $b$  is the semi-minor axis of  $(a \times (1-f))$

$$e^2 = (a^2 - b^2)/b^2$$

$$U_1 = \arctan((1 - f) \times \tan(l_t))$$

$$\varphi_1 = \arctan(\tan(U_1) / \cos(\alpha))$$

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

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

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

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

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

$$\varphi_m = \frac{2 \times \varphi_1 + \varphi}{2}$$

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

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

(3) Then:

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

Note: Use the four-quadrant inverse tangent, *atan2*.

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

Note: Use the four-quadrant inverse tangent, *atan2*.

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

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

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