

Frequency coordination requirements between microwave fixed point-to-point links and FSS earth stations

RALI: MS 45

DATE OF EFFECT: 12 SEPTEMBER 2022

Amendment history

Date	Comments
11 January 2019	IFC 1/2019 Consultation draft
2 August 2019	Initial release covering 6 GHz and 6.7 GHz finalised
22 July 2022	<p>Update released for public consultation (IFC 26/2022) to include coordination requirements between earth station transmitters communicating with geostationary satellites in the fixed satellite services and fixed point-to-point fixed link receivers in the frequency bands:</p> <ul style="list-style-type: none"> > 8 GHz (7725 – 8275 MHz) > 13 GHz (12.75 – 13.25 GHz) > 15 GHz (14.5 – 15.35 GHz) > 18 GHz (17.7 – 19.7 GHz) <p>Additional guidance on application of minimum earth station elevation angle requirement (section 4.1)</p> <p>Inclusion of Appendices B & C providing information on how distance culls are calculated</p>

Suggestions for improvements to Radiocommunications Assignment and Licensing Instruction MS 45 may be addressed to:

The Manager, Spectrum Planning Section
 Australian Communications and Media Authority
 PO Box 78
 Belconnen ACT 2616

or by email to: freqplan@acma.gov.au.

Please notify the ACMA of any inaccuracy or ambiguity found in this RALI so that it can be investigated and appropriate action taken.

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1 Introduction

1.1 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to describe procedures for the frequency coordination between earth stations operating in the fixed-satellite service (FSS) and microwave fixed point-to-point links operating in accordance with channel arrangements of RALI FX 3. The procedures are for use when considering new fixed point-to-point links or earth stations.

This RALI currently considers earth station transmitters communicating with geostationary satellites in the FSS and fixed point-to-point link receivers. The intention is to increase the scope in the future to include the coordination of fixed point-to-point transmitters with FSS earth station receivers if required.

This RALI covers coordination between earth station transmitters and fixed links operating in accordance with the following RALI FX 3 channel arrangements:

- > 6 GHz (5925 – 6425 MHz)
- > 6.7 GHz (6425 – 7110 MHz)
- > 8 GHz (7725 – 8275 MHz)
- > 13 GHz (12.75 – 13.25 GHz)
- > 15 GHz (14.5 – 15.35 GHz)
- > 18 GHz (17.7 – 19.7 GHz)

Note: Operation of FSS earth station transmitters in 7725-8275 MHz is restricted to Defence usage. Under the [Australian Radiofrequency Spectrum Plan](#) the frequency range 7975-8025 MHz is subject to Australian Footnote AUS 100 (This band is designated for use by the Australian Defence Force and Department of Defence. The Department of Defence is to be consulted in considering non-defence use of this band). FSS (Earth-to-space) in the frequency range is 7725-7750 MHz, 7900-7975 MHz and 8025-8400 MHz is subject to AUS100A (This service is designated for use by the Australian Defence Force and Department of Defence. The Department of Defence is to be consulted in considering non-defence use of this service).

The information in this document reflects the ACMA's statement of current policy in relation to the frequency coordination of FSS earth stations with fixed point-to-point links. In making decisions, accredited frequency assigners and the ACMA's officers should take all relevant factors into account and decide each case on its merits. Issues relating to this document that appear to fall outside the enunciated policy should be referred to:

The Manager, Spectrum Planning Section
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

or by email to: freqplan@acma.gov.au.

1.2 Scope

The scope of the RALI is limited to coordination between earth station transmitters communicating with geostationary satellites in the FSS and fixed link receivers operating in accordance with the RALI FX 3 channel arrangements in the frequency bands identified above.

This RALI does not cover all matters relevant to coordination and licensing for earth stations and fixed point-to-point links. It should be read in conjunction with other applicable documentation including earth station licensing procedures as outlined the ACMA Business Operating Procedure [Submission and processing of applications for earth and earth receive apparatus licences for fixed earth stations](#); and [RALI FX 3 Microwave fixed services frequency coordination](#).

In addition, ITU requirements to facilitate sharing between earth stations and microwave fixed point-to-point links are applicable. These include requirements from ITU RR Article **21** and earth station elevation restrictions.

Additional coordination requirements may apply if the coordination area, area cull under this RALI, affects the territory of neighbouring countries (mainly applicable for sites in northern Australia due to proximity to Papua New Guinea).

2 Frequency coordination procedures: earth station transmitters and fixed point-to-point receivers

2.1 Identification of potentially affected services

Stations in existing services within the following frequency and distance from the proposed station of the new service are to be considered.

2.1.1 Distance cull

Distance culls (distances beyond which detailed coordination is not normally required) are as outlined in Table 1. The methodology and assumptions used to derive the distance cull values are given in Appendix B. The distance cull values in Table 1 are applicable for services operating within the parameters described in Appendix B. Distances calculated using modelling are in Appendix C for a station at 33 degrees south latitude. Each calculation was rounded up to the nearest 25 km to derive the distance cull values. Distance cull values should be reassessed for transmitting earth stations or terrestrial receivers operating outside of the parameters used in this modelling. As an upper bound ITU Appendix 7 propagation mode 1 radio-climatic zones maximum coordination culls are 500 km for coastal land (zone A1) and 375 km for all other land (zone A2).

Proposed Station	Existing Station	Frequency Bands	Distance Cull
Earth station transmitter	Fixed link receiver	6 GHz (5925 – 6425 MHz) 6.7 GHz (6425 – 7110 MHz) 8 GHz (7725 – 8275 MHz)	250 km
Fixed link receiver	Earth station transmitter (Defence usage)		
Earth station transmitter	Fixed link receiver	13 GHz (12.75 – 13.25 GHz)	200 km
Fixed link receiver	Earth station transmitter		
Earth station transmitter	Fixed link receiver	15 GHz (14.5 – 15.35 GHz)	175 km
Fixed link receiver	Earth station transmitter		
Earth station transmitter	Fixed link receiver	18 GHz (17.7 – 19.7 GHz)	150 km

Fixed link receiver	Earth station transmitter		
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Table 1 Distance cull

2.1.2 Frequency cull

Frequency culls are outlined in Table 2.

Proposed station		Frequency Cull
Fixed link receiver	Earth station transmitter	
6 GHz (5925 – 6425 MHz)	5850 – 7075 MHz	5850 – 7110 MHz
6.7 GHz (6425 – 7110 MHz)		
8 GHz (7725 – 8275 MHz)	7900 – 8275 MHz	7725 – 8275 MHz
13 GHz (12.75 – 13.25 GHz)	12.75 – 13.25 GHz	12.75 – 13.25 GHz
15 GHz (14.5 – 15.35 GHz)	13.75 – 14.8 GHz	13.75 – 15.35 GHz
18 GHz (17.7 – 19.7 GHz)	17.3 – 18.4 GHz	17.3 – 19.7 GHz

Table 2 Frequency cull

These frequency culls can be refined depending on whether considering a new earth station transmitter or new fixed point-to-point link to identify co-channel, first adjacent channel and second adjacent channel services to consider all services within a frequency separation of:

$$\Delta f < [2 * \max(B_{ES}, B_{FS}) + (B_{ES} + B_{FS})/2]$$

where:

B_{FS} : is the channel bandwidth of the proposed new fixed service receiver or maximum channel bandwidth for the frequency band in accordance with the RALI FX 3 channel plan, as appropriate

When considering a new fixed link receiver or earth station transmitter Δf and B_{ES} become:

New earth station transmitter:

Δf : the absolute value of the difference between the centre frequencies of the proposed new earth station transmitter and existing fixed service receivers

B_{ES} : is the emission bandwidth of the proposed new earth station transmitter

New fixed link receiver:

Δf : the absolute value of the difference between the centre frequencies of the proposed new fixed point-to-point receiver and existing earth station transmitters

B_{ES} : is the maximum emission bandwidth of existing earth station transmitters within the distance cull specified in Table 1 and the frequency cull specified in Table 2 of the proposed new service

2.2 Protection criteria

Fixed service receivers are to be protected to a maximum interference level specified in Table 3¹ or protection ratios as specified in RALI FX 3:

RALI FX 3 Band	Maximum Interference Level
6 GHz	-146.0 dBW/MHz
6.7 GHz	-146.0 dBW/MHz
8 GHz	-146.0 dBW/MHz
13 GHz	-145.0 dBW/MHz
15 GHz	-145.0 dBW/MHz
18 GHz	-145.0 dBW/MHz

Table 3 Fixed link receiver maximum interference thresholds

The values of protection ratios for co-channel, first adjacent channel and second adjacent channel are those listed in RALI FX 3 for the fixed link channel bandwidth under consideration where:

Co-channel:²

$$0 \leq \Delta f < (B_{ES} + B_{FS})/2$$

First adjacent-channel:

$$(B_{ES} + B_{FS})/2 \leq \Delta f < [\max(B_{ES}, B_{FS}) + (B_{ES} + B_{FS})/2]$$

Second adjacent-channel:

$$[\max(B_{ES}, B_{FS}) + (B_{ES} + B_{FS})/2] \leq \Delta f < [2 \cdot \max(B_{ES}, B_{FS}) + (B_{ES} + B_{FS})/2]$$

¹ See consultation [IFC 1/2019](#) *Coordination between fixed-satellite service earth station transmitters and fixed point-to-point links in the 6 and 6.7 GHz bands – Rationale and consultation paper*

² That is where there is any frequency overlap of the licensed bandwidths of the proposed and existing service.

where:

Δf : is the frequency offset, the absolute value of the difference between the centre frequencies of the FSS earth station transmitter and the fixed service receiver being coordinated

B_{ES} : is the emission bandwidth of the earth station

B_{FS} : is the channel bandwidth of the fixed service receiver

The relevant protection ratios to use when coordinating with fixed links are defined in RALI FX 3 for each frequency band.

Note that protection ratio values have been normalised for a particular path length, rainfall rate and time percentage. Accordingly, appropriate corrections must be applied to the tabulated protection ratio values to account for the victim system's actual path length, geoclimatic zone and time availability in accordance with the relevant protection ratio correction factor detailed in RALI FX 3.

2.3 Propagation model

Earth station transmitter: [Recommendation ITU-R P.452](#) 'Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz' using 20% time percentage for calculating unwanted receive power.

Fixed link transmitter: [Recommendation ITU-R P.525](#) 'Calculation of free-space attenuation' for calculating the wanted receive power.

3 Default earth station characteristics for coordination

For coordination with existing earth station transmitters in cases where information is not available or not specified on the licence the following characteristics can be assumed:

3.1 Antenna radiation pattern

[Recommendation ITU-R S.465](#) 'Reference radiation pattern of earth station antennas in the fixed-satellite service for use in coordination and interference assessment in the frequency range from 2 to 31 GHz'.

3.2 Minimum earth station antenna elevation

Minimum earth station antenna elevation angles are to be:

- > geostationary orbit (GSO): 15° (based on typical look angle)
- > orbit unknown: as per ITU RR Nos. **21.14** and **21.15**, that is 3°, except for
 - Earth stations in the space research service (near Earth): 5°
 - Earth stations in the space research service (deep space): 10°.

4 Facilitating sharing between terrestrial and space services

The requirements listed below and in Appendix A are to be met by all new earth station transmitters and microwave fixed point-to-point links to facilitate spectrum sharing. In the main they reflect the requirements of Article 21 of the ITU Radio Regulations.

4.1 Minimum earth station elevation angle

The minimum angle is given in Table 4.

Earth Station	Antenna Minimum Angle
GSO earth station transmit	15°

Table 4 Antenna minimum angle

Note: For existing services technical details as per the licence including any special conditions are to be used. While the ACMA is open to considering requests for earth stations in the fixed satellite services with antenna angles below 15°, the ACMA would not be of a mind to support such requests in and around capital city areas. The ACMA preference is that earth stations requiring low antenna elevation angles be located in earth station protection zones and in low and remote density apparatus licence areas so as to avoid areas of high spectrum usage.

4.2 Earth station site shielding

It is beneficial to choose an earth station location that provides a degree of site shielding so as to provide additional diffraction propagation losses over the horizon. The ACMA does not support earth stations being site on elevated locations (for example at the top of a hill) as they increase spectrum denial. Coordination distances of this RALI assume an earth station distance to horizon of 500 m and an angle to the horizon of 5°.

Prospective earth station licensees are encouraged to apply good engineering practices and choose earth station locations that provide an equivalent or greater isolation.

4.3 Earth station pointing angles

While the ACMA preference is that antenna pointing information (azimuth, elevation/tilt) be recorded in the appropriate technical field on the station record, it is recognised that this is not always possible. With the caveat that the decision as to how many 'satellite networks' are recorded on one station record is made separately as part of the licensing processes (considering factors such ITU coordination status and whether the same satellite network operator applies in all cases), to ensure that earth station licence records contain accurate antenna pointing information it is proposed that in addition to the information recorded in the antenna fields (azimuth, tilt) that:

- > GSO – the orbit location should be recorded as a special condition. Where an earth station communicates with more than one GSO orbit location, all locations should be listed.

5 Relationship to RALI MS 44

RALI MS 44 'Frequency coordination procedures for the earth station protection zones' provides a framework for the management of interference to and from earth stations communicating with satellites (or space stations) in the fixed-satellite service (FSS) in specific defined areas known as protection zones. For terrestrial receivers the RALI provides notional criteria required for coordination between proposed receivers and FSS earth station transmitters in the protection zones.

When applying the procedures of RALI MS 44 in the context of new fixed point-to-point links or earth station transmitters (in the earth station protection zones) the following should be considered:

- > new fixed link receivers: interference into a fixed link receiver should be assessed using both the procedures of RALI MS 44 (using the test points) and this RALI
- > new earth station transmitters: only the procedures of this RALI need to be applied.

6 Exceptions

Exceptions to the requirements of this RALI for prospective assignments require case-by-case consideration by the Manager, Spectrum Planning Section.

A request for exemption from the requirements of this RALI would need to be accompanied by evidence to support the request.

All requests for exemptions should be submitted to freqplan@acma.gov.au.

7 RALI Authorisation

Approved 12 September 2022

Xavier Halliwell

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Appendix A: Extract from ITU RR

Article 21

The following requirements are an extract of relevant parts of Article 21 'Terrestrial and space services sharing frequency bands above 1 GHz' of the ITU Radio Regulations. Where redactions have been made from the original version '.....' will appear. For the full version please see the [ITU Radio Regulations](#).

Section I – Choice of sites and frequencies

.....

21.2 § 2 1) As far as practicable, sites for transmitting stations^{3,4}, in the fixed or mobile service, employing maximum values of equivalent isotropically radiated power (e.i.r.p.) exceeding the values given in Table **21-1** in the frequency bands indicated, should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit by at least the angle in degrees shown in the Table, taking into account the effect of atmospheric refraction⁵: (WRC-12)

Table 21-1:

Frequency band (GHz)	e.i.r.p. value (dBW) (see also Nos. 21.2 and 21.4)	Minimum separation angle with respect to geostationary-satellite orbit (degrees)
1-10	+35	2
10-15	+45	1.5
25.25-27.5	+24 (in any 1 MHz band)	1.5
Other bands above 15 GHz	+55	No limit

³ **21.2.1** For their own protection receiving stations in the fixed or mobile service operating in frequency bands shared with space radiocommunication services (space-to-Earth) should also avoid directing their antennas towards the geostationary-satellite orbit if their sensitivity is sufficiently high that interference from space station transmissions may be significant. In particular, in the frequency bands 13.4-13.65 GHz and 21.4-22 GHz, it is recommended to maintain a minimum separation angle of 1.5° with respect to the direction of the geostationary-satellite orbit. (WRC-15)

⁴ **21.2.4** For frequency bands above 15 GHz (except 25.25-27.5 GHz), there is no restriction on the angular separation for transmitting stations of the fixed or mobile service. This matter is being studied in ITU-R.

⁵ **21.2.2** Information on this subject is given in the most recent version of Recommendation ITU-R SF.765 (see Resolution **27 (Rev.WRC-03)**). * Note by the Secretariat: This Resolution was revised by WRC-07 and WRC-12.

21.2.3 Not used.

Section II – Power limits for terrestrial stations

21.3 § 3 1) The maximum equivalent isotropically radiated power (e.i.r.p.) of a station in the fixed or mobile service shall not exceed +55 dBW.

21.4 2) Where compliance with No. **21.2** for frequency bands between 1 GHz and 10 GHz is impracticable, the maximum equivalent isotropically radiated power (e.i.r.p.) of a station in the fixed or mobile service shall not exceed:

- +47 dBW in any direction within 0.5° of the geostationary-satellite orbit; or
- +47 dBW to +55 dBW, on a linear decibel scale (8 dB per degree), in any direction between 0.5° and 1.5° of the geostationary-satellite orbit, taking into account the effect of atmospheric refraction⁶

21.5 3) The power delivered by a transmitter to the antenna of a station in the fixed or mobile services shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz, or +10 dBW in frequency bands above 10 GHz, except as cited in No. **21.5A**. (WRC-2000)

21.5A As an exception to the power levels given in No. **21.5**, the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate in the band 18.6-18.8 GHz is defined by the following limitations on the operation of the fixed service: the power of each RF carrier frequency delivered to the input of each antenna of a station in the fixed service in the band 18.6-18.8 GHz shall not exceed -3 dBW. (WRC-2000)

21.6 4) The limits given in Nos. **21.2**, **21.3**, **21.4**, **21.5** and **21.5A** apply, where applicable, to the services and frequency bands indicated in Table **21-2** for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile services: (WRC-2000)

Table 21-2 (Rev. WRC-19):

Frequency band	Service	Limit as specified in Nos.
..... 5 850-7 075 MHz 7 900-8 400 MHz	Fixed-satellite	21.2, 21.3, 21.4 and 21.5
..... 12.75-13.25 GHz	Fixed-satellite	21.2, 21.3 and 21.5

⁶ **21.4.1** Information on this subject is given in the most recent version of Recommendation ITU-R SF.765 (see Resolution **27 (Rev.WRC-03)**). * Note by the Secretariat: This Resolution was revised by WRC-07 and WRC-12.

..... 14.5-14.8 GHz		
17.7-18.4 GHz 19.3-19.7 GHz	Fixed-satellite	21.2, 21.3, 21.5 and 21.5A

.....

Section III – Power limits for earth stations

21.8 § 4 1) The equivalent isotropically radiated power (e.i.r.p.) transmitted in any direction towards the horizon by an earth station shall not exceed the following limits except as provided in No. **21.10** or **21.11**:

- a) in frequency bands between 1 GHz and 15 GHz
+40 dBW in any 4 kHz band for $\theta \leq 0^\circ$
+40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$; and
- b) in frequency bands above 15 GHz
+64 dBW in any 1 MHz band for $\theta \leq 0^\circ$
+64 + 3 θ dBW in any 1 MHz band for $0^\circ < \theta \leq 5^\circ$,

where θ is the angle of elevation of the horizon viewed from the centre of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

21.9 2) For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power (e.i.r.p.) transmitted by an earth station towards the horizon.

21.10 3) As an exception to the limits given in No. **21.8**, the equivalent isotropically radiated power (e.i.r.p.) towards the horizon for an earth station in the space research service (deep space) shall not exceed +55 dBW in any 4 kHz band in frequency bands between 1 GHz and 15 GHz, or +79 dBW in any 1 MHz band in frequency bands above 15 GHz.

21.11 4) The limits given in Nos. **21.8** and **21.10**, as applicable, may be exceeded by not more than 10 dB. However, when the resulting coordination area extends into the territory of another country, such increase shall be subject to agreement by the administration of that country.

21.12 5) The limits given in No. **21.8** apply, where applicable, to the services and frequency bands indicated in Table 21-3 below for transmission by earth stations where the frequency bands are shared with equal rights with the fixed or mobile service:

Table 21-3 (Rev. WRC-19):

Frequency band	Service
.....
5 850-7 075 MHz	Fixed-satellite
7 190-7 250 MHz
7 900-8 400 MHz	
.....	
12.75-13.25 GHz	
.....	
14.4-14.8 GHz	
17.7-18.1 GHz	
.....	

.....

Appendix B: Distance cull derivation

Transmitting earth stations

The distance cull has been determined by use of International Telecommunication Union (ITU) Radio Regulations [Appendix 7](#) “Methods for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz” for propagation mode (1)⁷ and using typical parameters for earth station transmitters and fixed point-to-point links (outlined below).

Parameters used to determine the coordination distances are based on an analysis of current assignments and derivation of protection ratios published in [RALI FX 3](#).

Radio climate zone:

Zone A1: Coastal land/Zone A2: All land

Current aggregate land distance for Zone A1 and A2 is equal to the distance consideration ($d_t = d_i$ in equation (43)).

The minimum distance values were calculated using Appendix 7 for an auxiliary contour. The frequency used for calculations was the value given by the band name. RALI MS 44 specifies a transmitter gain of 58 dBi; however, in Appendix 7 the calculation of minimum distances are based on gain of the earth station antenna (dBi) towards the horizon⁸. As a conservative approach⁹ earth station antenna gain values have been calculated under an assumed antenna discrimination between earth station transmitter and fixed link receiver of at least 2 degrees for earth stations pointing at a GSO. At such antenna discrimination angles and using standard models, the earth station antenna gain is a fixed value, a rounded value for transmitter antenna gain of 30 dBi was used.

GSO earth station transmitter:

Transmitter power	39 dBW (normalised to 1 MHz bandwidth)
Antenna gain (towards the horizon)	30 dBi (antenna discrimination between earth station and fixed link of at least 2 degrees as earth station pointing at GSO)
Distance to the horizon	0.5 km (ITU Appendix 7 default when no information available)
Angle to the horizon	5°

⁷ Propagation mode 1: propagation phenomena in clear air (tropospheric scatter, ducting, layer reflection/refraction, gaseous absorption and site shielding). These phenomena are confined to propagation along the great-circle path.

⁸ Refer Appendix 7, section 3.1.1 definition of G_t : gain of the coordinating (transmitting) earth station antenna (dBi) towards the horizon at the horizon elevation angle and the azimuth under consideration

⁹ Conservative as for other calculation have assumed an earth angle to the horizon of 5 degrees

Distance to the coast	1 km
Maximum percentage of time for which the permissible interference power may be exceeded	20%

Fixed link receiver:

Permissible interference power	As per Table 3 for each band
Antenna gain	45 dBi
Latitude	33° S

Using the parameters above and the methods described in [Appendix 7](#) of the *ITU Radio Regulations*, the resulting distance culls for each band are given in Table 2. The distance cull values defined were calculated and rounded up to the nearest 25 km.

Note calculations are based on values given in [Appendix 7](#) of the *ITU Radio Regulations*; detailed modelling with system-specific information may result in values differing to those specified in Table 2.

The distance cull values in Table 2 are applicable for services operating within the parameters assumed above. Distance cull values should be reassessed for transmitting earth stations or terrestrial receivers operating outside of the above parameters.

Appendix C: Distance cull calculations

Transmitting earth stations

Taking the approximate latitudes from the top of the Australian mainland (10° S), the bottom of Tasmania (44° S) and the average latitude of 27° S through the Australian mainland, the distance cull values (d) in Table C1 were obtained for each frequency band (frequency band value used for simplicity). The approximate latitudes of the following north, south, east, west and central locations of Australia align with the latitudes used in the model:

- > Cape York (north): 10.7° S
- > Hobart (south): 42.9° S
- > Brisbane (east): 27.5° S
- > Perth (west): 32° S
- > Alice Springe (central): 23.7° S

The results for latitude 33° S were used to derive the distance cull values in Table 1, noting each calculation was rounded up to the nearest 25 km.

RALI FX 3 Band (GHz)	Latitude 10° d (km)	Latitude 24° d (km)	Latitude 27° d (km)	Latitude 33° d (km)	Latitude 44° d (km)
6	306	271	263	246	214
6.7	300	264	255	239	207
8	290	253	244	227	194
13	255	214	205	187	154
15	242	200	191	174	142
18	215	175	167	150	121

Table C1 Distance cull calculations

Generally speaking, Australia can be considered as being in ITU radio-climatic zones A1 (coastal land) and A2 all other land.

Under Appendix 7 maximum coordination culls for these zones are 500 km (A1) and 375 km (A2).