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Radiocommunications Assignment and Licensing Instruction

COORDINATION

OF SPECTRUM-LICENSED DEVICES OPERATING IN THE 2.3 GHz BAND WITH

SRS EARTH STATIONS

IN THE 2290–2300 MHz BAND

AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY
SPECTRUM PLANNING AND ENGINEERING BRANCH

RADIOCOMMUNICATIONS ASSIGNMENT AND LICENSING INSTRUCTIONS

DISCLAIMER

The Australian Communications and Media Authority (ACMA) advises that these instructions reflect the current policies of the ACMA.

Prospective applicants for licences should take all necessary steps to ensure that they have access to appropriate technical and other specialist advice independently of ACMA concerning their applications, the operation of radiocommunications equipment and services, and any other matters relevant to the operation of transmitters and services under the licences in question.

The policies of ACMA and the laws of the Commonwealth may change from time to time, and prospective licensees should ensure that they have informed themselves of the current policies of ACMA and of any relevant legislation (including subordinate instruments). Prospective applicants for licences should not rely on statements made in these instructions about the policies that may be followed by other government authorities or entities, nor about the effect of legislation. These instructions are not a substitute for independent advice (legal or otherwise) tailored to the circumstances of individual applicants.

Radiocommunications Assignment and Licensing Instructions are subject to periodic review and are amended as ACMA considers necessary. To keep abreast of developments, it is important that users ensure that they are in possession of the latest edition.

No liability is or will be accepted by the Minister or the Department of Broadband, Communications and the Digital Economy, ACMA, the Commonwealth of Australia, or its officers, servants or agents for any loss suffered, whether arising directly or indirectly, due to reliance on the accuracy or contents of these instructions.

Suggestions for improvements to Radiocommunications Assignment and Licensing Instructions may be addressed to The Manager, Spectrum Engineering, ACMA at PO Box 78, Belconnen, ACT, 2616, or by email to freqplan@acma.gov.au. It would be appreciated if notification to ACMA of any inaccuracy or ambiguity found be made without delay in order that the matter may be investigated and appropriate action taken.

Amendment History

Date	Comments
14 October 2013	First release of RALI

Table of Contents

COORDINATION OF SPECTRUM-LICENSED DEVICES OPERATING IN THE 2.3 GHZ BAND WITH SRS EARTH STATIONS IN THE 2290–2300 MHZ BAND

1 Introduction

1.1 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide processes for out-of-band coordination between:

- earth stations of the space research service (SRS) operating in the band 2290–2300 MHz for deep space communications; and
- devices operating under spectrum licences in the 2.3 GHz.

The information in this document reflects the Australian Communications and Media Authority's statement of current policy in relation to the frequency coordination of SRS Earth stations. Users of this RALI are advised that, recognising that the ITU-R continues to study and make recommendations regarding radiocommunications and associated regulatory and spectrum management issues, this document is subject to ongoing revision.

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 Engineering Section, PO Box 78, Belconnen, ACT, 2616, or by email to freqplan@acma.gov.au.

1.2 Scope

This RALI applies only to the out-of-band coordination of SRS Earth Stations with devices proposed for operation under a 2.3 GHz band spectrum licence.

Deep-space communications at Lansdale, though currently operational, will cease to operate by 31 December 2015[1]. As a result, specific protection requirements for the SRS (deep space) in 2290–2300 MHz are not specified in this RALI.

Protection from out-of-band interference into LNA's operating at the Canberra Deep Space Communications Complex (CDSCC) is already in place through the implementation of geographic area and frequency guard bands in the 2300-2330 MHz band.

For all other interference management requirements that may apply to a device operating under a 2.3 GHz spectrum licence please refer to the conditions on the licence and the relevant technical framework.

[1] One means to enforce the non-operational status of the facility is provided in section 11 of the Television Outside Broadcast (1980-2110 MHz and 2170-2300 MHz) Frequency Band Plan 2012 available at: http://www.comlaw.gov.au/Details/F2012L00731

2 Procedures

2.1 Restricted Zones

The ACMA has defined restricted zones in Table 1 around each of the SRS earth station sites defined in Table 2 of this RALI. Within the restricted zones, unless agreement is reached with the earth station licensee or the ACMA, the following applies:

- no new devices are to be registered under 2.3 GHz spectrum licences;
- no new licence-exempt devices are to be operated in 2.3 GHz band;
- existing devices operating under spectrum licences may continue to operate; and
- the transmission parameters of existing devices operating under spectrum licences shall not be modified in a way such that their potential to cause interference would increase.

Table 1: Restricted Zone Radii for SRS earth stations.

	New Norcia	**Mingenew**
Centre Point Latitude (°)	-31.0482	-29.0462
Centre Point Longitude (°)	116.1915	115.3489
Frequency Range (MHz)[2]	**Restricted Zone ***	
2300–2310	Area 1, Annex 1	90 km
2310–2320	Area 1, Annex 1	75 km
2320–2330	Area 1, Annex 1	45 km
> 2330	7 km	20 km

* The restricted zone is either the relevant area defined in Annex 1 or a circle where the centre is the coordinates specified for each site and the radius as specified in Table 1.

[2] Lower limit exclusive, upper limit inclusive.

2.2 Coordination Requirements

2.2.1 Out-of-band coordination requirements

Outside of the restricted zones, an assessment must be made as to whether the proposed transmitter will exceed the overload threshold of an SRS earth station as defined in Table 3. Assessment is based on the following method of determining the signal level from the proposed transmitter arriving at the location of the SRS earth station:

$$PSD_{tx} + G_t - PL(p) + G_r \geq \text{Overload Threshold Level}$$

Where:

PSD_{tx} = transmitter power spectral density within the transmitter's occupied bandwidth (dBW/Hz)

PL(p) = propagation path loss (dB) along the interference path not exceeded for p% time, where p is defined in Table 2

G_t = transmit antenna gain in the direction of the interference path[3] (dBi)
G_r = (maximum) receive antenna gain in the direction of the interference path (dBi, see Table 2);

Overload Threshold level = maximum permissible unwanted signal PSD (dBW/Hz); see Table 3.

For calculation of the transmitter power spectral density (PSDtx) a relatively uniform emission level is assumed within the occupied bandwidth of the device. PSDtx in the direction of the interference path is determined by:

$$PSD_{tx} = P_{tx} - 10*\log_{10}(B)$$

Where:

P_{tx} = true mean transmitter power into the antenna;

B = bandwidth (Hz)

Only emission within the transmitter's occupied bandwidth are considered for the purposes of assessing whether a transmitter exceeds the overload threshold defined in table 3.

Propagation path loss is to be calculated according to Recommendation ITU-R P.452-14.

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[3] If elevation-plane discrimination is to be considered, then the elevation angle of the interference path, ε_p, along the azimuth of the interference path must be taken into account. The elevation angle of the interference path is the maximum of:

a) the angle subtended by the highest terrain obstruction along the interference path (trans-horizon path); and

b) the angle subtended by the victim earth station antenna (LOS path).

and is taken relative to the horizontal plane (i.e. $\varepsilon_p > 0$ above the horizontal, $\varepsilon_p < 0$ below it).

The off-axis angle (of the interference path relative to the antenna main beam, in the elevation plane) is therefore $\varepsilon_p - \varepsilon_{ant}$, where ε_{ant} is the elevation angle of the antenna main beam.

Ducting does not need to be taken into consideration as the earth station sites are located inland and away from large bodies of water. Therefore Sections 4.4 of Annex 1 to Recommendation ITU-R P.452-14 need not be implemented.

A 9 second digital elevation model (such as RadDEM) or better should be used.

Table 2: Coordination Parameters.

	New Norcia	Mingenew
Centre Point Latitude (°)	-31.0482	-29.0462
Centre Point Longitude (°)	116.1915	115.3489
***p*% time interference can be exceeded**	1%	1%
Minimum Elevation Angle	10º	
Max. receive antenna gain along the interference path, G_r (dBi)	Determined from the antenna pattern defined in Annex 2 of this RALI $\varphi = \max((10º - \varepsilon_h(\alpha)), 0)$ [Notes 1]	
	G_{amax} = 56 dB D/λ = 270 [Note 2]	G_{amax} = 46 dB D/λ = 100 [Note 2]
Antenna height (m)	22.5	

Note 1: Minimum earth station antenna elevation angle is 10º for the space research service (deep space) according to Article 21.15 of the ITU-R Radio Regulations.

Note 2: These values are based on antenna gain and size as recorded in the ACMA's Register of Radiocommunications Licences for earth stations at New Norcia and Mingenew.

Table 3: Receiver overload threshold for SRS earth stations at various frequency offsets

Frequency Range (MHz)[4]	Overload Threshold (dBW/Hz)	
	New Norcia	Mingenew
2300–2310	-222	-222
2310–2320	-217	-217
2320–2330	-201.6	-201.6
2330–2340	-180.4	-180.4
2340–2350	-163.2	-163.2
2350–2360	-147	-147
2360–2370*	-130.8	-130.8
2370–2380*	-115.6	-115.6
2380–2390*	-101.4	-101.4
2390–2400*	-88.2	-88.2

* The restricted zone is considered to provide sufficient protection to space research services at frequencies > 2360 MHz.

If the calculated signal level is above the threshold level, then coordination is deemed to fail and the device cannot be registered.

In such cases the spectrum licensee will require agreement by the users of the SRS deep space earth station before the device is registered by the ACMA.

If no agreement can be made then ACMA will make the final decision taking into account the requirements of and information provided by all stakeholders. Documents describing the reasons why agreement could not be reached must be forwarded to the Manager, Spectrum Engineering Section, ACMA[5].

2.2.2 In-band coordination requirements

Spectrum licensees must also comply with the requirements specified in Annex 7 of Appendix 7 of the Radio Regulations. This relates to the levels of interference protection to be afforded to deep space facilities from out-of-band emissions that fall within the band 2290–2300 MHz.

The requirements of Appendix 7 of the Radio Regulations are deemed to be satisfied if the coordination procedure of Section 2.2 is carried out, but with:

PSDtx = transmitter's out-of-band power spectral density in any 1 Hz within the band 2290-2300 MHz (dBW/Hz)

[4] Lower limit exclusive, upper limit inclusive.

[5] Manager, Spectrum Engineering Section, ACMA, PO Box 78 Belconnen ACT 2616.

p = 0.001% (as per Table 8b of Annex 7 to Appendix 7 of the Radio Regulations)

Interference Threshold level = –222 dBW/Hz (as per Table 8b of Annex 7 to Appendix 7 of the Radio Regulations)

2.3 Exceptions

Exceptions to the requirements of this RALI for prospective assignments require case-by-case consideration by the Manager, Spectrum Engineering Section[6].

A request for exemption from the requirements of this RALI that is accompanied with evidence of support from the relevant SRS earth station licensee would normally be approved by the ACMA.

3 RALI Authorisation

[signed] 14/10/2013

Mark Arkell
Manager, Spectrum Engineering Section
Spectrum Planning and Engineering Branch
Australian Communications and Media Authority

[6] Manager, Spectrum Engineering Section, ACMA, PO Box 78 Belconnen ACT 2616.

Annex 1: Restricted Zone Coordinates

For the purposes of table 1 of section 2.1 of this RALI, Area 1 is described as the geographical area whose boundaries are described by the coordinates in the table below. Each successive set of coordinate in the table are joined by a line of longitude or latitude.

The datum used for all geographic coordinates in this attachment is the Geocentric Datum of Australia 1994 (GDA94).

Longitude	Latitude
116.550	-30.680
116.550	-31.220
116.030	-31.220
116.030	-30.680
116.550	-30.680

Annex 2: Antenna Pattern for New Norcia and Mingenew

The pattern of the ESA deep space antenna at the New Norcia facility is defined by Annex 3 to Appendix 7 of the ITU-R Radio Regulations, modified such that:

$$G(\varphi) = G_{max} - 2.5 \cdot 10^{-3} \cdot (\varphi \cdot D/\lambda)^2 \quad \text{for} \quad 0 < \varphi < \varphi_m$$

$$G(\varphi) = G_1 \quad \text{for} \quad \varphi_m < \varphi < \varphi_r$$

$$G(\varphi) = 29 - 25 \cdot \log_{10}(\varphi) \quad \text{for} \quad \varphi_r < \varphi < 48°$$

$$G(\varphi) = -13 \quad \text{for} \quad 48° < \varphi < 180°$$

with:

$$G_1 = 15 \cdot \log_{10}(D/\lambda) - 1$$

$$\varphi_m = 20 \cdot (\lambda/D) \cdot (G_{max} - G_1)^{0.5}$$

$$\varphi_r = 15.85 \cdot (D/\lambda)^{-0.6}$$

where:

$G(\varphi)$: maximum gain (dBi);

φ: off-axis angle (deg);

D: antenna diameter (m);

λ: wavelength (m);

G_{max}: 56 dBi