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**Radiocommunications Assignment and Licensing Instruction**

## **CO-ORDINATION OF MICROWAVE FIXED SERVICES WITH EARTH STATIONS**

**IF YOU HAVE CONCERNS ABOUT THE CURRENCY OF PARTICULAR SECTIONS IN THIS RALI , PLEASE CONTACT ERIK LENSSON, A/g MANAGER, SPECTRUM PLANNING & ENGINEERING (02) 6219 5254 OR email: [erik.lensson@acma.gov.au](mailto:erik.lensson@acma.gov.au)**

**Note: All reference to the Spectrum Management Agency, should be read as references to the Australian Communications and Media Authority. Similarly, all references to the SMA should be read as references to ACMA.**

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**AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY  
RADIOFREQUENCY PLANNING BRANCH**

# **RADIOCOMMUNICATIONS ASSIGNMENT AND LICENSING INSTRUCTIONS**

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The Spectrum Management Agency (SMA) advises that these instructions reflect the current policies of the SMA.

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

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Suggestions for improvements to Radiocommunications Assignment and Licensing Instructions may be addressed to the SMA at PO Box 78, Belconnen, ACT, 2616. It would be appreciated if notification to the SMA of any inaccuracy or ambiguity found, be made without delay in order that the matter may be investigated and appropriate action taken.

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# Co-ordination of Microwave Fixed Services with Earth Stations

## 1.0 Introduction

Microwave fixed services may require co-ordination with earth stations that operate in the same or adjacent spectrum as these services.

This Radiocommunications Assignment and Licensing Instruction (RALI) replaces MS 26, sequence number 70, dated 19 April 1996.

Co-ordination requirements between these dissimilar services are described in a number of International Telecommunication Union (ITU) Radio Regulations and Recommendations. Those documents provide information on appropriate co-ordination distances, propagation models, threshold interference levels, and earth station transmitter, receiver and antenna characteristics. As there are many types of earth stations and operating environments, this data varies widely between the different systems in use.

## 2.0 Purpose

The purpose of this RALI is to provide a consolidated reference on the ITU requirements for co-ordinating microwave fixed services with earth stations to aid the co-ordination process, and a suggested methodology to apply.

The information in this RALI reflects the Spectrum Management Agency's statement of policy in relation to the requirements for co-ordinating microwave fixed services with earth stations. In making decisions, Spectrum Management Agency (SMA) officers should take all relevant factors into account and decide each case on its merits. If an issue related to this document appears to fall outside the enunciated policy, please consult the Manager, Compliance and Licensing Directions Team, Business Directions Group, Canberra.

## 3.0 Co-ordination Requirements

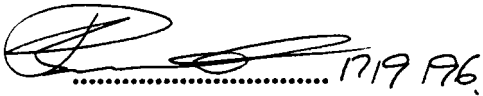
Frequency co-ordination between microwave fixed services and earth stations should be done in accordance with the relevant co-ordination requirements in the ITU Radio Regulations and Recommendations and RALI FX 3. To assist this task, Appendix A lists the ITU literature relevant to co-ordination with earth stations of various types of space services, and suggests a suitable co-ordination methodology to apply.

## 4.0 Source Documents

This RALI is based on the information contained in:

- ITU Radio Regulations and Recommendations;
- the *Australian Radiofrequency Spectrum Plan*; and
- the RALI entitled 'Microwave Fixed Services: Frequency Co-ordination' (FX 3).

## RALI Authorisation

A handwritten signature in black ink, appearing to read 'Roger Smith', with the date '17/9 96' written to the right. Below the signature is a dotted line.

**Roger Smith**  
**Executive Manager**  
**Business Directions Group**  
**Spectrum Management Agency**

## Appendix A - Co-ordination of Fixed Services with Earth Stations

This Appendix lists the Relevant International Telecommunication Union (ITU) Radio Regulations and Recommendations for use in co-ordinating fixed services with earth stations. It also suggests a co-ordination methodology for use with these Regulations and Recommendations and identifies, for each fixed services band, services that may require co-ordination and the location of technical information relevant to such co-ordination.

### 1. Relevant ITU Radio Regulations and Recommendations

The following is a list of relevant ITU Radio Regulations and Recommendations. It reflects the provisions of the ITU Radio Regulations, Edition of 1990, Revised in 1994, Geneva 1994, and the Recommendations contained in the 1994 edition of the ITU-R Recommendations Series. Future relevant changes to that material will be reflected in this list, in the case of new ITU Regulations when they come into effect, and in the case of new ITU Recommendations after the next edition of the ITU-R Recommendation Series is published. Information on recent changes to ITU documentation that may be relevant can be obtained in advance of this RALI being updated through the ITU Telecom Information Exchange Services (TIES) electronic facilities.

#### *ITU Radio Regulations:*

Article 27: *Terrestrial Radiocommunications Services Sharing Frequency Bands with Space Radiocommunication Services above 1 GHz.*

Appendix 28: *Method for the Determination of the Co-ordination Area Around an Earth Station in Frequency Bands Between 1 GHz and 40 GHz Shared Between Space and Terrestrial Radiocommunications Services.*

#### *ITU-R Recommendations:*

- BO Series Recommendations
- IS Series Recommendations, particularly:
  - IS.847: *Determination of the co-ordination area of an earth station operating with a geostationary space station and using the same frequency band as a system in a terrestrial service.*
  - IS.849: *Determination of the co-ordination area for earth stations operating with non-geostationary spacecraft in bands shared with terrestrial services.*
  - IS.850: *Co-ordination areas using predetermined co-ordination distances.*

- M Series Recommendations - Part 6
- PN Series Recommendations, particularly:
  - PN.452: *Prediction procedure for the evaluation of microwave interference between stations on the surface of the Earth at frequencies above about 0.7 GHz.*
- RA Series Recommendations
- S Series Recommendations
- SA Series Recommendations
- SF Series Recommendations

## 2. Co-ordination Methodology

A methodology<sup>1</sup> for co-ordinating fixed services with earth stations is given below:

1. Identify the type of earth station with which co-ordination may need to be done, based on spectrum allocations (eg, Space Research or Fixed-Satellite earth station, transmitting or receiving earth station or both). Identification can be assisted by reference to the relevant frequency band in the Australian Radiofrequency Spectrum Plan Including General Information April 1995 (the Spectrum Plan).
2. Determine if there are any earth station assignments for the above allocations in Australia and neighbouring countries.
3. If there are assignments, then determine the maximum co-ordination distance using the relevant ITU documentation. Using this distance determine the co-ordination contour that encompasses the co-ordination area. If there are any earth stations within this area, then determine the protection criteria and other relevant technical characteristics of both the fixed and earth stations being co-ordinated (either values will be found in the ITU documentation, or a list of parameters required to calculate those values will be provided (see 2.1) for the Australian fixed or earth station). Use this data and other mitigating factors identified in the ITU documentation to minimise the co-ordination area and consequently the number of stations that will require detailed co-ordination.
4. Using an appropriate propagation model, for each station within the co-ordination area calculate the propagation loss and hence received signal levels for either or both directions, as appropriate. Note that the ITU has developed recommendation ITU-R PN.452 (propagation modelling) specifically for this purpose.
5. Compare the values calculated at 4 against the relevant protection criteria. If the protection criteria are met or exceeded then it has been demonstrated that unacceptable interference between the proposed and existing stations is not likely to occur.

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<sup>1</sup> This methodology assumes that the proposed fixed link has been confirmed to meet the provisions of Article 27 (protection of geostationary satellites), if relevant.

### ***2.1 Notes on the Application of the Methodology***

Steps 1-3 of this methodology may be completed more readily by the application of Table 1 in this Appendix. Specifically, this table lists by fixed services band (as defined in RALI FX3):

- services which may have earth stations requiring co-ordination;
- references to ITU Recommendations specifying how to calculate co-ordination distances;
- references to ITU Recommendations specifying relevant protection criteria; and
- references to ITU Recommendations specifying station characteristics for the services being co-ordinated.

The identification of earth stations in neighbouring countries in Step 2 may be determined by reference to the ITU-R Space Radiocommunications Stations on CD-ROM which is available from the ITU on a subscription basis. The CD-ROM can be combined with the latest Weekly Circular on Diskette to provide the latest update.

Enquiries regarding technical parameters not specified by the ITU and the application of the methodology should be referred to the Spectrum Planning Team, Business Directions Group.

#### ***Notes on Table 1***

- Table 1 reflects the arrangements on use of the radiofrequency spectrum contained in the Spectrum Plan. Services listed in the column "Possible Services to Co-ordinate" of Table 1 are those services referred to in Section 2, Part 2, Column 2: Australia Table of Allocations in the Spectrum Plan including the footnotes to that column that may have earth stations requiring co-ordination with microwave fixed services. The Spectrum Plan should be referred to for information on the interference management framework associated with the services listed in Table 1 and their co-ordination with fixed services.
- The Spectrum Plan is reviewed on a regular basis to ensure that it reflects the frequency allocations of the most recent ITU World Radiocommunication Conference (WRC). WRC 1995 was the most recent WRC; allocations agreed at that Conference come into effect on 1 January 1997. Table 1 will be revised as required to reflect these allocations after this date. Information on these allocations is contained in the Final Acts of WRC 1995 which may be obtained through the ITU TIES electronic facilities.
- Protection criteria for the Fixed-Satellite service require the calculation of a threshold interference level. This calculation requires knowledge of the earth station thermal noise temperature. This data is not recorded on the SMA database. Please contact the Spectrum Planning Team, Business Directions Group, regarding the thermal noise temperatures of particular earth stations in this service.
- The Radioastronomy service conducts observations in a number of the bands listed in the table; refer to footnote AUS 87 in the Spectrum Plan for more details.
- IS-847, IS-849 and IS-850 should be applied in conjunction with Appendix 28 of the ITU Radio Regulations.

***Key to Symbols Used in Table 1***

- ↑ Earth-to-space
- ↓ space-to-Earth
- s-s space-space
- \* This service extends into an adjacent band, services in that band may need to be considered.
- \*\* There are services in the band adjacent to the fixed band that may need to be considered.
- # Information not known at this point in time.



**Appendix A - Table 1 - Information to Complete Steps 1 - 3 of the Co-ordination Methodology**

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
1.5 GHz (1427-1535 MHz) 1.5 GHz DRCS (1427-1535 MHz)	1427-1429 **			
	Space Operations ↑	IS-847	IS-847	IS-847
	1452-1492 Broadcasting-Satellite	#	#	#
	1525-1530			
	Space Operations ↓	IS-847/849	IS-847/849	IS-847/849
	Mobile-Satellite ↓	IS-850	#	#
	Earth Exploration-Satellite	#	#	#
	1530-1535 **			
	Space Operations ↓	IS-847/849	IS-847/849	IS-847/849
	Mobile-Satellite ↓*	#	#	#
Earth Exploration-Satellite	#	#	#	
1.8 GHz (1700-1900 MHz)	1700-1710 **			
	Meteorological-Satellite ↓*	IS-847/849	IS-847/849	IS-847/849
	1718.8-1722.2 Radio Astronomy	#	#	#
	1750-1850			
	Space Operations ↑	#	#	#
Space Research ↑	#	#	#	

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
2.1 GHz (1900-2300 MHz)	1980-2010 Mobile-Satellite ↑	IS-850	IS-847	IS-847
	2025-2110			
	Space Research ↑ s-s	IS-847	IS-847	IS-847
	Space Operations ↑ s-s	IS-847	IS-847	IS-847
	Earth Exploration-Satellite ↑ s-s	IS-847	IS-847	IS-847
	2110-2120 Space Research ↑ deep space	IS-847	IS-847	IS-847
	2170-2200 Mobile-Satellite ↓	IS-850	#	#
	2200-2290			
	Space Research ↓ s-s	IS-847/849	IS-847/849	IS-847/849
	Space Operations ↓ s-s	IS-847/849	IS-847/849	IS-847/849
	Earth Exploration-Satellite ↓ s-s	IS-847	IS-847	IS-847
	2290-2300 Space Research ↓ deep space	IS-847/849	IS-847/849	IS-847/849

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
2.5 GHz ENG (2450-2690 MHz)	2483.5-2500			
	Mobile Satellite ↓	IS-850	847	847
	Radiodetermination-Satellite ↓	IS-850	#	#
	2500-2520			
	Fixed Satellite ↓	IS-847	IS-847	IS-847
	Mobile Satellite ↓	IS-850	847	847
	2520-2535			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Broadcasting-Satellite	#	#	#
	Mobile Satellite ↓	#	#	#
	2535-2640 Broadcasting-Satellite	#	#	#
	2640-2655			
	Broadcasting-Satellite	#	#	#
	Space Research (passive)	#	#	#
	2655-2670			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
	Broadcasting-Satellite	#	#	#
	Mobile Satellite ↑	IS-847	IS-847	IS-847
	Radio Astronomy (passive)	#	#	#
	Space Research (passive)	#	#	#
	2670-2690 **			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
	Mobile-Satellite ↑	IS-847	IS-847	IS-847
Radio Astronomy (passive) *	#	#	#	
Space Research (passive) *	#	#	#	

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
3.8 GHz (3580-4200 MHz)	3580-4200 Fixed-Satellite ↓*	IS-847	IS-847	IS-847
4 GHz (3770-4200 MHz)	3770-4200 Fixed-Satellite ↓*	IS-847	IS-847	IS-847
5 GHz (4400-5000 MHz)	4500-4800 Fixed-Satellite ↓	IS-847	IS-847	IS-847
	4800-4950 Radio Astronomy	#	#	#
	4950-4990			
	Radio Astronomy	#	#	#
	Space Research (passive)	#	#	#
	4990-5000 **			
	Radio Astronomy	#	#	#
6 GHz (5925-6425 MHz)	5925-6425 ** Fixed-Satellite ↑*	IS-847	IS-847	IS-847
6.7 GHz (6425-7110 MHz)	6425-6429			
	Fixed-Satellite ↑*	IS-847	IS-847	IS-847
	Standard Frequency and Time Signal Satellite Service	#	#	#
	6429-7075 Fixed-Satellite ↑*	IS-847	IS-847	IS-847

<b>Fixed Services Band</b>	<b>Possible Services to Co-ordinate</b>	<b>Co-ordination Distances</b>	<b>Protection Criteria</b>	<b>Station Characteristics</b>
7.2 GHz (TOB) (7100-7425 MHz)	7145-7235 Space Research ↑	IS-847	IS-847	IS-847
	7250-7375			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Mobile-Satellite ↓	IS-850	#	#
	7375-7425 Fixed-Satellite ↓*	IS-847	IS-847	IS-847
7.5 GHz (7425-7725 MHz)	7425-7450 Fixed-Satellite ↓*	IS-847	IS-847	IS-847
	7450-7550			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Meteorological-Satellite ↓	IS-847/849	IS-847/849	IS-847/849
	7550-7725 Fixed-Satellite ↓*	IS-847	IS-847	IS-847

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
8 GHz (7725-8275 MHz)	7725-7750 Fixed-Satellite ↓*	IS-847	IS-847	IS-847
	7900-8025			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
	Mobile-Satellite ↑	IS-850	IS-847	IS-847
	8025-8175			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
	Earth Exploration-Satellite ↓	IS-847	IS-847	IS-847
	8175-8215			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
	Meteorological-Satellite ↑	IS-847	IS-847	IS-847
	Earth Exploration-Satellite ↓	IS-847/849	IS-847/849	IS-847/849
	8215-8275 **			
	Fixed-Satellite ↑ *	IS-847	IS-847	IS-847
Earth Exploration-Satellite ↓ *	IS-847/849	IS-847/849	IS-847/849	
8.3 GHz (TOB) (8275-8400 MHz)	8275-8400 **			
	Fixed-Satellite ↑ *	IS-847	IS-847	IS-847
	Earth Exploration-Satellite ↓ *	IS-847/849	IS-847/849	IS-847/849
	8400-8500 **			
	Space Research ↓ deep space	IS-847	IS-847	IS-847
10.5 GHz (10.5-10.68 GHz)	10.6-10.68 **			
	Radio Astronomy*	#	#	#
	Space Research (passive)*	#	#	#

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
11 GHz (10.7-11.7 GHz)	10.68-10.7			
	Radio Astronomy*	#	#	#
	Space Research (passive)*	#	#	#
	10.7-11.7 **			
13 GHz (TOB +FX) (12.75-13.25 GHz)	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	12.75-13.25 **			
	Fixed-Satellite ↑	IS-847	IS-847	IS-847
15 GHz (14.5-15.35 GHz)	Space Research ↓ deep space	#	#	#
	14.5-14.8 **			
	Fixed-Satellite ↑*	IS-847	IS-847	IS-847
	Space Research	#	#	#
	14.8-15.2 Space Research (passive)	#	#	#
	15.2-15.35 **			
	Space Research (passive) *	#	#	#

Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
18 GHz (17.7-19.7 GHz)	17.7-18.1 **			
	Fixed-Satellite ↓↑*	IS-847	IS-847	IS-847
	18.1-18.3			
	Fixed-Satellite ↓↑	IS-847	IS-847	IS-847
	Meteorological-Satellite ↓	IS-847	IS-847	IS-847
	18.3-18.4 Fixed-Satellite ↓↑	IS-847	IS-847	IS-847
	18.4-18.6 Fixed-Satellite ↓	IS-847	IS-847	IS-847
	18.6-18.8			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Space Research (passive)	#	#	#
	18.8-19.7 **			
Fixed-Satellite ↓	IS-847	IS-847	IS-847	
22 GHz (21.2-23.6 GHz)	21.2-21.4 Space Research (passive)	#	#	#
	21.4-22 Broadcasting-Satellite	#	#	#
	22.21-22.5			
	Radio Astronomy	#	#	#
	Space Research (passive)	#	#	#
31 GHz (31-31.3 GHz)	31-31.3 **			
	Standard Time and Frequency Signal-Satellite ↓	#	#	#
	Space Research	#	#	#



Fixed Services Band	Possible Services to Co-ordinate	Co-ordination Distances	Protection Criteria	Station Characteristics
38 GHz (37-39.5 GHz)	37-37.5 Space Research ↓	#	#	#
	37.5-38			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Space Research ↓	#	#	#
	Earth Exploration-Satellite ↓	#	#	#
	38-39.5			
	Fixed-Satellite ↓	IS-847	IS-847	IS-847
	Earth Exploration-Satellite ↓	#	#	#
49 GHz (49.2-49.95 GHz)	47.2-50.2 Fixed-Satellite ↑*	IS-847	IS-847	IS-847
50 GHz (50.4-51.15 GHz)	50.4-51.4 **			
	Fixed-Satellite ↑*	IS-847	IS-847	IS-847
	Mobile-Satellite ↑*	#	#	#