

Television outside broadcasting services

1980–2110 MHz and 2170–2300 MHz

Radiocommunications Assignment and Licensing Instruction

RALI: FX 21

DATE OF EFFECT: 12 AUGUST 2022

Amendment history

Date	Comments
July 2012	Initial draft covering the bands 1980-2010 MHz and 2170-2200 MHz, considering responses to IFC 11/2012 (Introduction of television outside broadcast services into the bands 1980-2110 MHz and 2170-2300 MHz)
September 2013	Revised to include channel arrangements for the bands 2010-2110 MHz and 2200-2300 MHz
December 2013	Revised to include earth station, Fixed point-to-point and spectrum licence coordination arrangements
February 2014	Revised to separate coordination of TOB transmitters and TOB receivers and improve readability of document (IFC 7/2014) Draft revision to RALI FX21
May 2014	Incorporated changes after IFC 7/2014 consultation and finalised RALI
July 2015	Incorporated changes after IFC 11/2015 (Proposed updates to several RALIs) consultation
December 2015	Incorporated changes after IFC 27/2015 (Coordination arrangements with ESA New Norcia earth station) consultation which included reference to Coordination Arrangements document
December 2018	Updated to remove redundant sections due to passage of time, including removal of channel arrangements that ceased on 31 January 2016 and reference to Landsdale. Coordinates were updated from GDA66 to GDA94.
September 2019	Section 2.1, correction to error in Figure 1, with transitional use changed to STV to align with section text.
February 2021	Updated after IFC 23/2020 Replanning options for 2 GHz band consultation
April 2021	Updated after IFC 37/2020 Replanning options for 2.3 GHz band consultation (change to Section 4.5 2200-2300 MHz band and Table 3.)
August 2022	<p>Updates reflecting outcomes of IFC 45/2021 Replanning the 2 GHz band: Review of the 2 GHz Television Outside Broadcast Frequency Band Plan and IFC 46/2021 Proposed licensing arrangements for 2 GHz narrowband mobile-satellite services and 28 GHz fixed-satellite services. Changes include:</p> <ul style="list-style-type: none"> • revisions to background section and inclusion of TOB transitional arrangements with consequential edits throughout the document. • In section 2.1 (Channel arrangements) reference to TOB transition • In section 4 (Coordination of TOB receivers) clarified protection of TOB receivers with respect to services not supported under current planning arrangements. • A small number of minor (editorial) changes made (for example updated hyperlinks)

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1 Introduction

1.1 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide information on frequency coordination and licensing arrangements for television outside broadcast (TOB) services in the bands 1980-2110 MHz and 2170-2300 MHz.

The information in this document reflects the ACMA's statement of current policy in relation to TOB services operating in the bands 1980-2110 MHz and 2170-2300 MHz. 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:

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1.2 Background

When this RALI was first developed its purposes were to support the introduction of TOB services into the frequency bands 1980-2110 MHz and 2170-2300 MHz, an outcome of the 2010 review of the 2.5 GHz band (2500-2690 MHz), and long-term arrangements for electronic news gathering (ENG).¹ The operation of TOB services in the bands 1980-2110 MHz and 2170-2300 MHz was supported by the *Television Outside Broadcast Service (1980-2110 MHz and 2170-2300 MHz) Frequency Band Plan 2012* (the TOB Band Plan).²

In 2021 the ACMA completed a review of the bands 1980-2010 MHz and 2170-2200 MHz and made a decision to support the introduction of MSS services with TOB services to be cleared from the band. As part of work implementing that decision in June 2022 the [Television Outside Broadcast \(1980–2110 MHz and 2170–2300 MHz\) Frequency Band Plan 2012](#) was revoked, and the following new frequency band plans were made:

- the Radiocommunications (Mobile-Satellite Service) (1980–2010 MHz and 2170–2200 MHz) Frequency Band Plan 2022 (the MSS Band Plan)³
- the Radiocommunications (Television Outside Broadcasting) (2010–2110 MHz and 2200–2300 MHz) Frequency Band Plan 2022 (the 2022 TOB Band Plan).⁴

The 2022 TOB band plan gives effect to the same arrangements in 2010–2110 and 2200–2300 MHz as specified in the 2012 TOB band plan. That is, there are no changes to arrangements in this RALI in those bands (beyond reference updates).

¹ See <http://www.acma.gov.au/Industry/Spectrum/Digital-Dividend-700MHz-and-25Gz-Auction/Restack/longterm-arrangements-for-eng-digital-dividend-acma>

² See <http://www.comlaw.gov.au/Details/F2012L00731>

³ See <https://www.legislation.gov.au/Details/F2022L00843>

⁴ See <https://www.legislation.gov.au/Series/F2022L00842>

To support introduction of mobile-satellite services in the bands 1980-2010 MHz and 2170-2200 MHz, as detailed in the MSS Band Plan existing TOB services are required to cease operation in these bands by the following dates:

- 1 March 2026 in metropolitan areas and designated areas as defined in the MSS Band Plan
- 1 March 2024 elsewhere.

During the transition, TOB services in the bands 1980-2010 MHz and 2170-2200 MHz will continue to be protected. There is no change to arrangements for TOB services in the bands 2010-2110 MHz and 2200-2300 MHz from the introduction of MSS service. MSS services are required to protect and not cause interference to TOB services in the bands 2010-2110 MHz and 2200-2300 MHz.

Note that under the Radiocommunications Act 1992 (the Act) operation of a radiocommunications transmitter is not authorised by a transmitter licence if it is not in accordance with the conditions of the licence (subsection 97(4) of the Act). Paragraph 108(2)(a) of the Act makes it a condition of each transmitter licence that the licensee, and any person authorised to operate a radiocommunications transmitter under the licence, must not operate, or permit the operation, of the transmitter for a purpose that is inconsistent with a purpose of a kind specified in the appropriate frequency band plan (if any).⁵ The MSS Band Plan is relevant in this regard.

1.3 Scope

This RALI provides the coordination and licensing arrangements for TOB services operating in the bands 1980-2110 MHz and 2170-2300 MHz. All TOB transmitters are to be licensed and the licensing of TOB receivers is optional.

Coordination, licensing and interference protection status for TOB transmitters and receivers varies depending on frequency and area of operation.

1.3.1 1980-2010 MHz and 2170-2200 MHz

The bands 1980-2010 MHz and 2170-2200 MHz are available for use by low power TOB transmitters. Licences for TOB are not to authorise the operation of television outside broadcast services beyond the transition dates of the MSS Band Plan.

TOB licensees are required to coordinate usage with other TOB licensees.

Fixed TOB receivers may be licensed to assist coordination with other TOB licensees, however no protection is provided to these receivers from TOB services, existing fixed point-to-point links or adjacent band spectrum licensed services or apparatus licensed PTS services. Channelling arrangements are specified, these are nominal only and other arrangements can be used provided the requirements of this RALI are met.

1.3.2 2010-2110 MHz and 2200-2300 MHz

The use of the bands 2010-2110 MHz and 2200-2300 MHz are limited to ABC, Channel Seven, Nine Network, Network Ten and FOX Sports on behalf of subscription television. The channel arrangements for TOB use of the band are outlined in Section 2 of this RALI. Authorisation of TOB transmitters for ABC, Channel Seven, Nine Network, Network Ten and

⁵ [Radiocommunications \(Mobile-Satellite Service\) \(1980–2010 MHz and 2170–2200 MHz\) Frequency Band Plan 2022 – Explanatory Statement](#)

subscription television will be via Australia wide licences with licensees required to operate in accordance with the requirements in this RALI. The licensing of fixed TOB receivers in the band is optional.

TOB licensees are to self-coordinate adjacent channel use with other TOB licensees.

Coordination between TOB transmitters and fixed point-to-point receivers, earth station receivers and adjacent apparatus licence and spectrum licence receivers is required.

Coordination is also required between fixed TOB receivers and fixed point-to-point, adjacent apparatus licence and spectrum licensees. Coordination between earth stations and fixed TOB receivers is not required.

In a majority of cases minimal coordination will be required for TOB service operations around Australian capital cities (Perth and Canberra being notable exceptions).

2 Channel arrangements

Channel arrangements specified for TOB services in the frequency bands 1980-2010 MHz and 2170-2200 MHz are nominal only and other arrangements can be used provided the requirements of this RALI are met.

The bands in which TOB services can operate in the Perth area are limited by the Treaty between the Government of Australian and the European Space Agency. ESA operations are limited to the bands 2044-2054 MHz, 2110-2120 MHz, 2215-2230 MHz and 2290-2300 MHz in the Perth area, in which TOB will not be permitted to operate. A graphical representation of the channel arrangements is outlined in Figure 2b.

The use of all TOB channels is under the requirement that the sharing and coordination requirements between existing services and TOB, outlined in this RALI, are met.

2.1 Channel arrangements

Channel arrangements are as follows:

- The bands 2010-2110 MHz and 2200-2268 MHz is available for use by ABC, Seven Network, Nine Network Australia and Network Ten.
- The bands 2268-2300 MHz is available for use by FOX Sports who will coordinate the subscription television (STV) use of this band.
- The bands 1980-2010 MHz and 2170-2200 MHz are available for use by TOB services during the transition period (outlined in MSS Band Plan) on a shared, non-exclusive basis. Following the transition period, TOB use of these bands will be restricted. TOB licensees will be required to self-coordinate use. *Please note that channelisations shown in these bands are illustrative and not prescriptive.*

These arrangements are illustrated in Figure 1 below with arrangements around the Perth Area illustrated in Figure 2.

Figure 1 TOB channelling arrangements

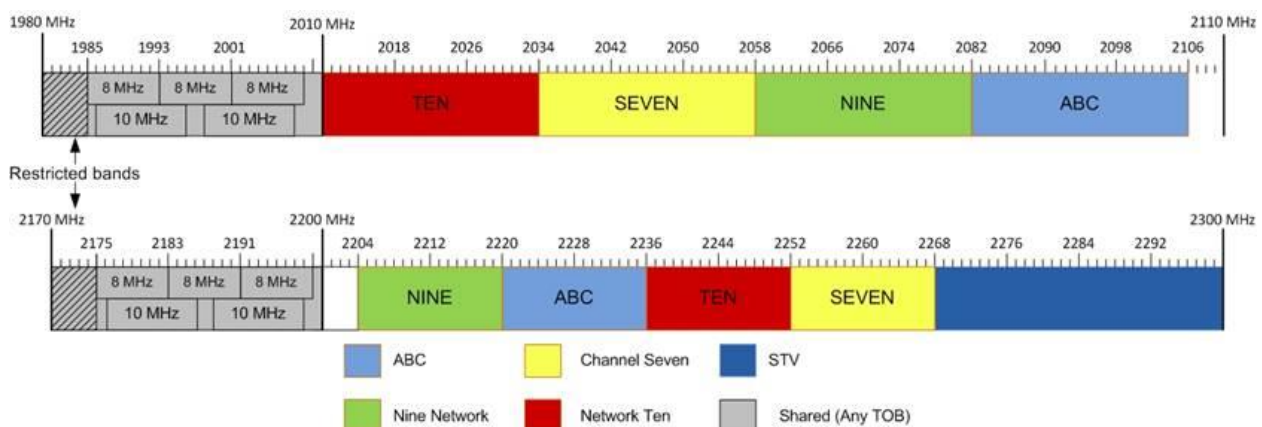
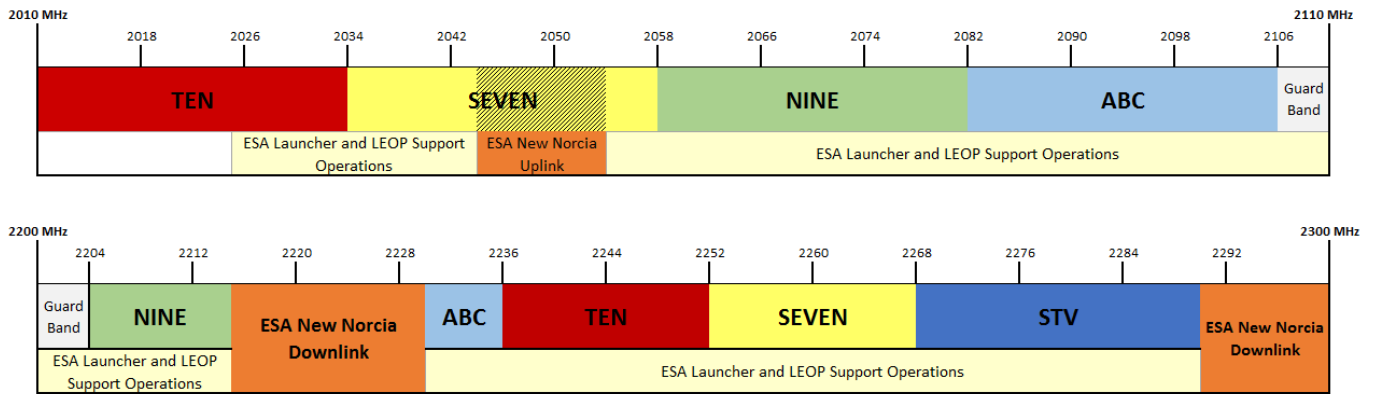


Figure 2 TOB channelling arrangements in 2010-2110 MHz and 2200-2300 MHz⁶ in the Perth Area



⁶ Note TOB arrangements in 1980-2010 MHz and 2170-2200 MHz remain unchanged as per Figure 2.

3 Coordination of TOB transmitters

Coordination arrangements for TOB transmitters in the bands 1980-2110 MHz and 2170-2300 MHz are detailed below. Coordination arrangements in the bands 1980-2110 MHz and 2170-2300 MHz are also summarised in Appendix A.

3.1 Overview

3.1.1 1980-2010 and 2170-2200 MHz

Frequency ranges currently available for use by TOB are the 1985-2010 MHz and 2175-2200 MHz band. TOB licensees are required to coordinate usage with other TOB licensees.

Due to coordination requirements with adjacent band services, TOB transmitters are not to operate in the 1980-1985 MHz and 2170-2175 MHz frequency ranges and the maximum power spectral density at the 1980 MHz and 2170 MHz frequency boundaries is -30 dBm/MHz.

The maximum TOB transmitter radiated power is limited to 23 dBm/8 MHz equivalent isotropically radiated power (EIRP).

Airborne TOB transmitters (e.g. helicopters), are not permitted in the bands 1980-2010 MHz and 2170-2200 MHz.

Fixed TOB receiver may be licensed to assist coordination with other TOB licensees, however no protection is provided to these receivers from TOB services, existing fixed point-to-point links or adjacent band spectrum licensed services or apparatus licensed PTS services.

In most of Australia, conditions of this RALI are met by compliance with requirements for radiated power, out-of-band emission, frequency range of operation and restrictions on use of airborne transmitters.

Details of this the coordination requirements for TOB transmitters can be found in the sections below and are summaries in Appendix A.

3.1.2 2010-2110 and 2200-2300 MHz

The frequency ranges 2010-2110 MHz and 2200-2300 MHz are available for use by TOB transmitters provided they meet the coordination criteria outlined in this RALI.

TOB transmitters will need to coordinate use with earth station receivers, fixed link receivers, and adjacent channel spectrum licence and PTS receivers.

Airborne TOB transmitters (e.g. aboard helicopters), are not permitted to operate in the band 2200-2300 MHz.

Details of this coordination arrangement can be found in the sections below and summarised in Appendix A.

3.2 TOB transmitters to TOB receivers

3.2.1 1980-2010 and 2170-2200 MHz

No frequency coordination within the bands 1980-2010 MHz and 2170-2200 MHz between TOB services is required for TOB assignments. TOB licensees are required to self-coordinate usage within the bands with other TOB licensees. To assist coordination with other licensees a TOB operator may wish to identify the location of TOB receiver locations by applying to licence TOB fixed receive locations under a fixed receive licence. While no protection is afforded to such receivers from TOB transmitters, TOB operators are encouraged to consider the location of such receivers when operating.

TOB transmitters can be operated under an area wide or location specific licence. TOB licensees should consider which approach best suits their operations and provides sufficient information to identify operating locations to assist coordination with other licensees. Irrespective of the licensing option or when a licence is issued, TOB licensees are required to coordinate usage with other TOB licensees.

3.2.2 2010-2110 and 2200-2300 MHz

No frequency coordination within the bands 2010-2110 MHz and 2200-2300 MHz between TOB services is required for TOB assignments.

TOB transmitters should be assigned in accordance with this RALI.

3.3 Fixed Point-to-Point link receivers

3.3.1 1980-2010 and 2170-2200 MHz

A small number of existing apparatus licensed fixed point-to-point links (in remote Queensland) operate in the bands 1980-2010 MHz and 2170-2200 MHz. Under the 2022 TOB Band Plan no new fixed point-to-point links may be operated in these bands.

The ACMA assessment is that low power handheld TOB transmitters (wireless cameras) are unlikely to cause interference to existing fixed point-to-point link operating in these bands unless directly located along the fixed link path. No coordination with fixed point-to-point links is required outside of the fixed link path⁷. The procedures outlined in Appendix D are to be followed when coordinating TOB transmitters with fixed point-to-point link receivers. TOB licensees should be aware of fixed link paths within their areas of TOB operations.

3.3.2 2010-2110 and 2200-2300 MHz

Due to the introduction of TOB in the bands 2010-2110 MHz and 2200-2300 MHz the clearance of fixed point-to-point links was necessary in areas of high TOB activity. The clearance areas for the 2010-2110 MHz and 2200-2300 MHz bands are defined in the [Television Outside Broadcast Service \(1980–2110 MHz and 2170–2300 MHz\) Frequency Band Plan 2012](#) and shown in Figure 3 and Figure 4. Under the 2022 TOB Band Plan no new fixed services are allowed in those areas.

⁷ The fixed link path is defined as the area contained between the two fixed point-to-point link stations within 2 degrees either side of the straight line path between them from the fixed link receive station.

Figure 3 Fixed point-to-point clearance areas for the 2010-2110 MHz band

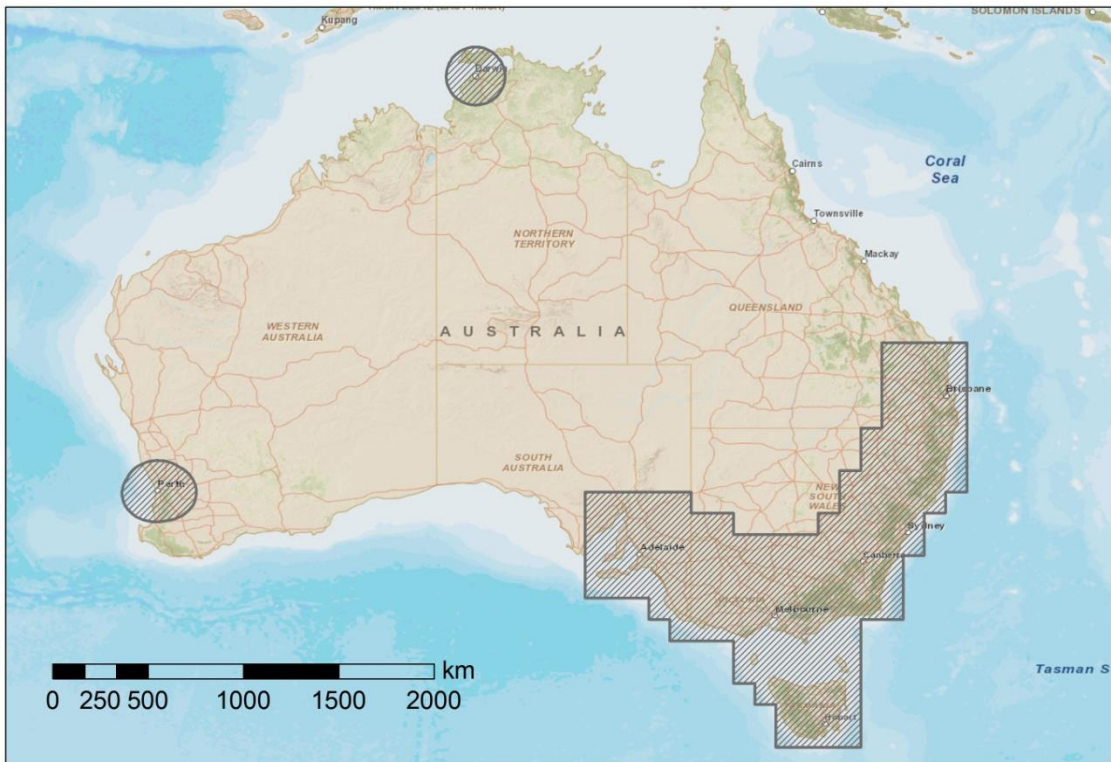
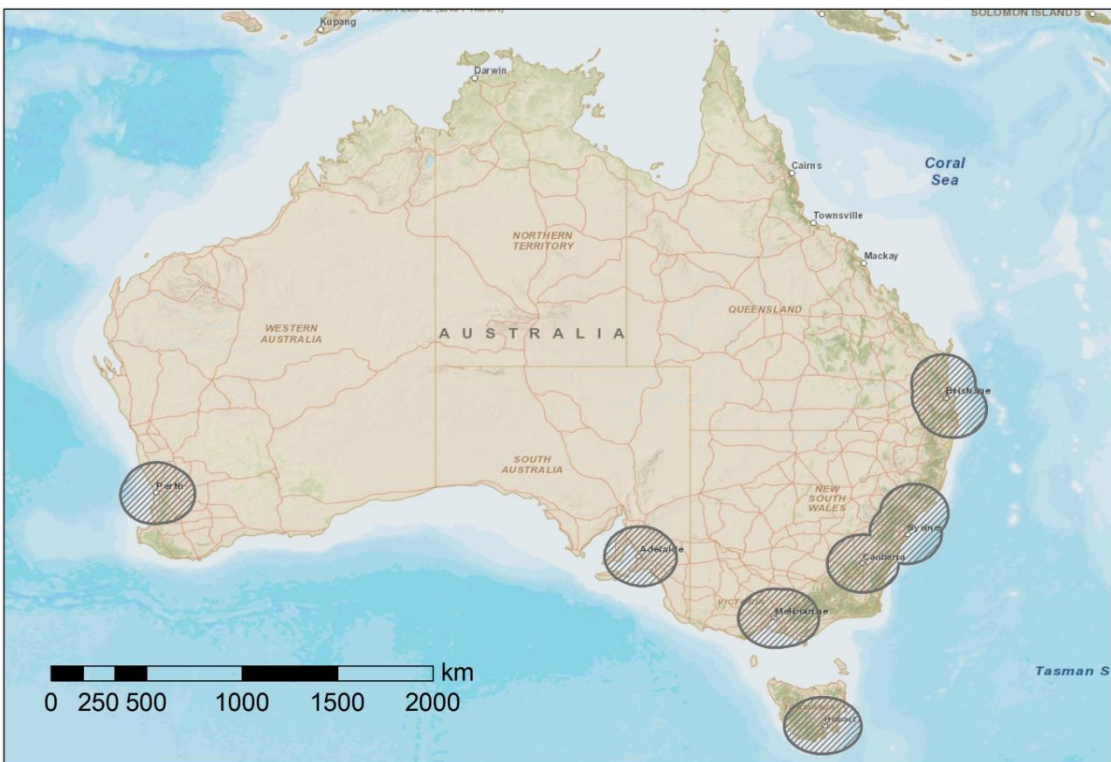


Figure 4 Fixed point-to-point clearance areas for the 2200-2300 MHz band



Coordination procedures between TOB transmitters and fixed link receivers vary depending on whether the TOB transmitter is in a fixed link clearance area and on the TOB transmitter power and TOB antenna height.

No coordination is required between TOB transmitters and fixed links receivers within the fixed link clearance areas.

Coordination is required between TOB transmitters and fixed link receivers outside the fixed link clearance zones. TOB licensees should be aware of fixed link paths outside the clearance zones which may be within their areas of TOB operations.

Detailed coordination procedures are outlined in the following subsections.

Note: Fixed TOB receivers operating in the bands 2010-2110 and 2200-2300 MHz will need to be licensed to obtain protection from future fixed point-to-point transmitters that may operate outside of the clearance areas.

3.3.3 Low power handheld TOB transmitters (wireless cameras⁸)

The ACMA assessment is that low power (EIRP \leq 26 dBm/8 MHz, height \leq 2m) handheld TOB transmitters (wireless cameras) are unlikely to cause interference to existing fixed point-to-point link operating in the bands 2010-2110 MHz and 2200-2300 MHz, unless directly located in the fixed link path. No coordination with fixed point-to-point links is required if operating outside the fixed link path⁹. The procedures outlined in Appendix D are to be followed when coordinating TOB transmitters with fixed point-to-point link receivers. TOB licensees should be aware of fixed link paths within their areas of TOB operations.

3.3.4 High power TOB transmitters (ENG vans¹⁰)

The operation of a high power TOB transmitter (EIRP $>$ 26 dBm/8 MHz, height $>$ 2m) in the bands 2010-2110 MHz and 2200-2300 MHz outside of the fixed link clearance area is unlikely given that there are typically no collection stations for them to transmit to.

TOB transmitters operating inside the fixed link clearance zone boundary¹¹

High power TOB transmitters do not need to coordinate with fixed links in the bands 2010-2110 MHz and 2200-2300 MHz inside of the fixed link clearance area.

This is because high powered TOB transmitters operate with collection stations located in capital cities. This makes the potential for high power TOB transmitters to interfere with fixed point-to-point links in the bands 2010-2110 MHz and 2200-2300 MHz very low. TOB transmitters will in most cases be pointing towards the TOB collection stations and away from areas of fixed link operation and therefore no coordination is required.

⁸ Typical wireless camera specifications are described in Appendix B of this RALI.

⁹ The fixed link path is defined as the area contained between the two fixed point-to-point link stations within 2 degrees either side of the straight line path between them from the fixed link receive station.

¹⁰ Typical ENG van specifications are described in Appendix B of this RALI.

¹¹ TOB services operating within 30 km of the fixed link (licence no. 1401371) located in Southwood, QLD must follow the coordination procedure outlined in Appendix D.

TOB transmitters operating outside of the fixed link clearance zones

Where a high power TOB transmitter (EIRP > 26 dBm/8 MHz, height > 2m) wishes to operate outside of the clearance zone they must do so using the procedure set out in section 4 of RALI FX 3 and summarised in Appendix D of this RALI.

3.3.5 Airborne TOB transmitters (helicopters)

Under the 2022 TOB Band Plan airborne transmitters are not permitted to operate in the band 2200-2300 MHz.

3.4 Mobile-satellite service

The bands 1980-2010 MHz and 2170-2200 MHz are also allocated to the mobile-satellite service. During the transition periods in the MSS Band Plan, no coordination with mobile-satellite services is required. The MSS earth stations must not cause harmful interference to, nor claim protection from, TOB stations licensed in accordance with the MSS Band Plan.

3.5 Earth station receivers

The band 2025-2110 MHz and 2200-2300 MHz are allocated on a primary basis to the Space Operation, Earth Exploration Satellite and Space Research services. This section outlines coordination requirements for TOB transmitters with earth station receivers at:

- Tidbinbilla in the ACT
- New Norcia in WA
- Mingenew in WA
- HMAS Cerberus in VIC
- Alice Springs in the NT.

Geographical coordinates of the earth stations are provided in Table 1 below.

Table 1 Geographical coordinates of earth stations operating in the bands 2025-2110 MHz and 2200-2300 MHz

Earth Station	Geographical coordinates (latitude, longitude) ¹²
Tidbinbilla earth station (CDSCC)	-35.400941°, 148.982603°
New Norcia earth station	-31.048230°, 116.191461°
Mingenew earth station	-29.045757°, 115.348614°
HMAS Cerberus earth station	-38.363780°, 145.174351°
CSIRO earth station Alice Springs	-23.759900°, 133.882340°

The operation of TOB in the Perth area¹³ is limited by the treaty between the Government of Australian and the European Space Agency. To satisfy the treaty, TOB licensees wishing to operate in the band 2200-2300 MHz are no longer permitted within 300km of the New Norcia

¹² All coordinates use the GDA94 geodetic systems

¹³ The Perth area is defined in Table B in the Schedule to the 2.5 GHz re-allocation declaration, see <http://www.comlaw.gov.au/Details/F2011L02181> (see Appendix F)

earth stations. Since 1 January 2016 ESA operations have been limited to the bands 2215-2230 MHz and 2290-2300 MHz in the Perth area, in which TOB will not be permitted to operate.

The European Space Agency may occasionally request access to the remainder of these bands for short duration activities, such as launcher tracking and Launch and Early Orbit Phase (LEOP) support¹⁴. Spectrum coordination arrangements for such accesses and the procedures by which such request are to be made are contained in the document “Spectrum coordination arrangements” which is available on the ACMA website at the [RALI FX21 page](#). All licensing, to support Launcher and LEOP activities will be in accordance with this agreement. TOB licensees are encouraged to consider such coordination requests and support where possible.

3.5.1 TOB operating in 2010-2110 MHz

Due to the CSIRO Earth Station in Alice Springs receiving in this band, high power TOB transmitters (that is, TOB vans) (e.i.r.p > 26 dBm/8 MHz, height > 2m) must not operate within 150 km of the earth station in the band 2103.406-2109.406 MHz. Low power TOB (that is, wireless cameras) (e.i.r.p ≤ 26 dBm/8 MHz, height ≤ 2m) must not operate within 50 km of the Alice Springs earth station in the band 2103.406-2109.406 MHz.

3.5.2 TOB operating in 2170-2200 MHz

Due to the sensitivity of Space Research (space-to-Earth) service, Space Operation (space-to-Earth) and Earth Exploration-Satellite (space-to-Earth), earth stations operating in the adjacent band 2200-2300 MHz a minimum separation distance of 100 km is required between TOB transmitters operating in the band 2175-2200 MHz and New Norcia, Mingenew and Tidbinbilla Space Research (space-to-Earth) and Space Operation (space-to-Earth) earth stations operating in the band 2200-2300 MHz.

After 1 January 2016 this requirement will be limited to Mingenew, New Norcia and Tidbinbilla earth stations only.

3.5.3 Operation of TOB in the band 2200-2300 MHz (space-to-Earth)

The 2200-2300 MHz¹⁵ band is allocated to the Space Research (space-to-Earth), Space Operation (space-to-Earth) and Earth Exploration-Satellite (space-to-Earth) services on a Primary basis. TOB operations in this band shall not cause interference into earth station receivers.

TOB transmitters wishing to operate in the band 2200-2300 MHz must consult the relevant section(s) of Appendix C of this RALI. If the operation of a TOB transmitter falls outside of the areas described in Appendix C of this RALI, coordination with Space Research (space-to-Earth), Space Operation (space-to-Earth) and Earth Exploration-Satellite (space-to-Earth) service earth stations is not required.

¹⁴ A requirement included in the implementation arrangement to support the Treaty between the Government of Australian and the European Space Agency

¹⁵ 2200-2290 MHz is used for near Earth operations while 2290-2300 MHz is used for Deep Space operations

3.6 Mid-West Radio Quiet Zone

TOB transmitters must not operate within 150 km of the Mid-West Radio Quiet Zone (RQZ) as defined by the *Radiocommunications (Mid-West Radio Quiet Zone) Frequency Band Plan 2011*¹⁶.

¹⁶ See <http://www.comlaw.gov.au/Details/F2011L01520>

3.7 Radio astronomy

The ACMA has established "Radio Sensitive Zones" around key Australian radio astronomy facilities, to provide the operators of the facilities the opportunity to seek better outcomes for radio astronomy when new radio transmitters are planned to be installed near these facilities.

These radio sensitive zones and notification procedures are defined in RALI MS31 [Notification Zones for Apparatus Licensed Services Around Radio Astronomy Facilities](#) and cover the frequency band 2200-2300 MHz.

While RALI MS31 does not apply to radiocommunications systems that operate in an itinerant fashion (such as TOB transmitters operating under area wide licenses), when operation in the areas around Radio Astronomy sites (radio sensitive zones) is planned the ACMA encourages TOB licensees to first notify the relevant Observatory. TOB licensees should be aware of Radio Astronomy sites within their areas of TOB operations.

3.8 Adjacent 2 GHz, 2.3 GHz spectrum licensing and PTS receivers

Coordination information for spectrum licensed (SL) services operating in adjacent bands to the new TOB bands can be found in technical frameworks for the spectrum licenses.

The 2 GHz SL band is defined as the frequency bands: 1920-1980 MHz and 2110-2170 MHz in capital city areas and 1960-1980 MHz and 2150-2170 MHz in regional areas. The geographic areas of the 2 GHz spectrum licence are provided in Appendix E.

2.3 GHz SL band is defined as the frequency range of 2302 MHz to 2400 MHz. The band is designated for spectrum licensing throughout Australia.

Apparatus licensed - public telecommunication services (PTS) are authorized to operate in the 1920-1980 MHz and 2110-2170 MHz bands in remote areas outside of those areas specified by the 2 GHz Spectrum Marketing Plan and depicted in Appendix E.

Coordination between TOB transmitters and these adjacent band services are outlined in the sections below.

3.8.1 1980-2010 and 2170-2200 MHz

Coordination between TOB transmitters and spectrum licence and PTS services is achieved through the general requirements that:

- Available frequency range is 1985-2010 MHz and 2175-2200 MHz;
- The radiated power of a TOB transmitter shall not exceed 23 dBm/8 MHz EIRP;
- They not exceed a maximum power spectral density at the 1980 MHz and 2170 MHz frequency boundaries of -30 dBm/MHz; and
- Airborne TOB transmitters are not permitted in these bands.

3.8.2 2010-2110 and 2200-2300 MHz

Coordination of TOB transmitters with spectrum license, PTS and TOB services is achieved through the coordination requirements of:

- TOB transmitters operating at a power greater than 23 dBm/8 MHz EIRP and an antenna height greater than 2m being restricted to the frequency range 2010-2105 MHz; and
- A maximum power spectral density at the 2110 MHz and 2300 MHz boundaries of -30 dBm/MHz.

4 Coordination of TOB receivers

The licensing of TOB receivers is optional in the bands 1980-2110 MHz and 2170-2300 MHz. TOB receivers, such as TOB collection stations¹⁷, cannot claim protection from new services unless licensed. Note this does not include services for which ACMA planning arrangements do not currently support. For example, beyond earth stations identified in this RALI, spectrum Embargo 23 does not support new earth stations in the in the frequency range 2025-2110 MHz and 2200-2300 MHz except in the Mingenew earth station protection zone. Outside of Mingenew, requests are considered on a case-by-case basis by the Manager Spectrum Planning Section and as part of the process the views of TOB licencees are sought.

Mobile TOB receivers (such as ENG vans and wireless cameras) and unlicensed fixed TOB receivers will not be afforded protection, though some inherent protection is provided by the procedures set out in this RALI.

The following subsections outline the process of assessing the likelihood of interference from existing service.

4.1 Television outside broadcasting

No frequency coordination within the bands 2010-2110 MHz and 2200-2300 MHz between TOB services is required for TOB assignments. TOB fixed services operate on a shared unprotected basis. TOB licensees are required to coordinate usage within the bands with other TOB licensees.

4.2 Fixed point-to-point links transmitters

It is anticipated that most fixed TOB collection stations will typically be located within the fixed link clearance zones and will not be impacted by fixed links. Outside these fixed link clearance areas new TOB fixed receiver stations may be licensed with coordination with existing fixed links.

To assess whether a fixed TOB receiving station will be exposed to unacceptable levels of interference, the level of interfering signal at the TOB fixed receiver can be calculated using the methods described in RALI FX3 using the propagation model ITU-R P.526 (with $k=1.33$) and protection requirements outlined in Appendix B.

New fixed links will be required to coordinate with all licensed fixed TOB collection stations.

4.3 Earth station transmitters

The 2025-2110 MHz band is allocated to the Space Research (Earth-to-space) service, Space Operation (Earth-to-space) and Earth Exploration-Satellite (space-to-Earth) services on a Primary basis. TOB receivers will not be afforded protection from interference from earth station transmitters described in this RALI. For location of earth stations please see

¹⁷Typical ENG collection station specifications are described in Appendix B of this RALI.

Section 3.5. Earth station transmitters at Mingenew and Tidbinbilla have access to the entire band. Specific operational characteristics of other earth station are described below.

4.3.1 Alice Springs

Alice Springs Earth Station transmits in the both the 2025-2110 MHz and 2200-2300 MHz bands. TOB services that operate fully or partly in the bands 2101.5-2101.7 MHz and 2284.5-2290.5 MHz will not be afforded protection from the earth station.

4.3.2 HMAS Cerberus

The Bureau of Meteorology (BOM) operates in the bands 2031.7-2032.7 MHz and 2046-2047 MHz. TOB receivers operating partially or fully in these bands cannot claim interference from the BOM HMAS Cerberus earth station.

4.3.3 New Norcia

New Norcia earth station operates in the bands 2044-2054 MHz and 2110-2120 MHz. The European Space Agency may occasionally request access to the remainder of the band for short duration activities, such as launcher tracking and Launch and Early Orbit Phase (LEOP) support¹⁸. Spectrum coordination arrangements for such accesses and the procedures by which such request are to be made are contained in the document "Spectrum coordination arrangements" which is available on the ACMA website ([RALI FX21](#)). All licensing, to support Launcher and LEOP activities will be in accordance with this agreement. TOB licensees are encouraged to consider such coordination requests and support where possible.

4.4 Airborne mobile telemetry transmitters

The Department of Defence operates airborne mobile telemetry (AMT) in the band 2200-2300 MHz. These services are authorised via Fixed Receive and Aeronautical Assigned System apparatus licences. TOB operators are to receive from Department of Defence the following notifications through a single point of contact:¹⁹

- For repeatable, regular use in Defence training/operating areas, Defence, will provide standing advice to TOB operators describing the broad technical and geographic characteristics of ongoing AMT activities.
- For irregular, short duration and location specific AMT activities, Defence will notify their usage of the band on an as needed basis. This will include, where appropriate, time and area of operation and TOB channels affected

4.5 Adjacent 2 GHz, 2.3 GHz spectrum licensing and PTS

The following subsection details the interference analysis that will be required for any fixed TOB receiver wishing to operate in the outlined bands below.

1980-2010 MHz band. This band is adjacent to the 2 GHz spectrum licence and PTS apparatus licence base station receive band. Fixed TOB receivers cannot claim protection from mobile transmitters conforming to their licence requirements in the adjacent band.

¹⁸ A requirement included in the implementation arrangement to support the Treaty between the Government of Australian and the European Space Agency

¹⁹ Contact the ACMA for specific contact details at freqplan@acma.gov.au

2170-2200 MHz band. This band is adjacent to the 2 GHz spectrum licence and PTS apparatus base station transmit band. Due to the high density of existing 2 GHz spectrum licence and PTS apparatus licence base station transmitters in and around capital cities it is unlikely that a Fixed TOB receivers located in those areas can be operated successfully adjacent to the 2170 MHz band edge.

4.5.1 Coordination procedure

To assess whether a fixed TOB receiver station will potentially be exposed to unacceptable interference from existing adjacent band 2 GHz spectrum licence and PTS apparatus licence base station transmitters, all transmitters within 20 MHz of the TOB receive channel edge and within 100 km of the proposed fixed TOB receiver site should be assessed using the criteria outlined below.

Assessment between fixed TOB receivers and adjacent band base stations will be deemed acceptable if:

$$P_{rx} < -147.3 \quad (4.5-1)$$

Where:

P_{rx}: Power received from an adjacent channel base station (dBW/MHz)

The power received from an adjacent channel base station should be calculated using the following formula:

$$P_{rx} = P_{ob} - L_p + G_{rx} \quad (4.5-2)$$

Where:

P_{rx}: Power received from an adjacent channel base station (dBW/MHz)

P_{ob}: Out of band e.i.r.p from SL or PTS service dependant on frequency offsets from band edge (see Table 2 and Table 3).

L_p: Path loss calculated using Recommendation ITU-R P.526 (dB)

G_{rx}: Gain of the receive antenna (dBi)

Table 2 EIRP emission limits for 2 GHz spectrum licence and PTS apparatus licence services

Offset	Out of band power at frequency offset from band edge (dBm/MHz)			
	0.0 - 0.75 MHz	0.75 - 1 MHz	1.0 - 5.0 MHz	5.0 - 20.0 MHz ²⁰
	27.22	17.22	6.22	-0.78

²⁰ The ACMA recommends that a minimum of 5 MHz offset is used.

2010-2110 MHz band. The band is adjacent to the 2 GHz spectrum licence and PTS apparatus licence base station transmit band above 2110 MHz. Due to the high density of existing 2 GHz spectrum license and PTS apparatus license base station transmitters in and around capital cities it is unlikely that a Fixed TOB receiver located in those areas can be operated successfully adjacent to the 2110 MHz band edge.

Protection of fixed TOB receivers from adjacent band 2 GHz spectrum licensed and apparatus licensed PTS services will be afforded on a first in time basis. This means no protection will be given to a fixed TOB receiver from adjacent service fixed stations existing in the RRL at the time of licensing of the fixed TOB receiver.

To assess whether a fixed TOB receiver station will potentially be exposed to unacceptable interference from existing adjacent band 2 GHz spectrum licence and PTS apparatus licence base station transmitters, all transmitters within 20 MHz of the TOB receive channel edge and within 100 km of the proposed fixed TOB receiver site in the RRL should be assessed using the criteria outlined in section 4.5.

2200-2300 MHz band. The band is adjacent to the 2.3 GHz spectrum licence band. This band is a TTD band and base stations may be operating adjacent to the 2300 MHz boundary. Assessment of the interference to fixed TOB receivers from adjacent band base stations can be determined using equations 6.5-1 and 6.5-2. To determine the out of band EIRP from a 2.3 GHz spectrum licence, the Total Radiated Power limits in Table 3 plus the antenna gain of individual devices operating under 2.3 GHz spectrum licences (as recorded on the RRL) can be used.

Table 3 TRP emission limits for 2.3 GHz spectrum licence services below 2300 MHz

Out of band Total Radiated Power at Frequency Offset from band edge			
Offset	$0 \text{ MHz} \leq f_{\text{offset}} < 5 \text{ MHz}$	$5 \text{ MHz} \leq f_{\text{offset}} < 10 \text{ MHz}$	$10 \text{ MHz} \leq f_{\text{offset}}$
	$-7 - (7/5) \times (f_{\text{offset}})$ (dBm/100 kHz)	$-6 - (17/5) \times (f_{\text{offset}})$ (dBm/100 kHz)	-30 (dBm/MHz)

Mobile TOB receivers (such as ENG vans and wireless cameras) and unlicensed fixed TOB receivers will not be afforded protection from adjacent channel services.

5 Licensing

5.1 General

Information on conditions, fees and other licensing requirements can be found in the apparatus licence information papers on the ACMA website. For television outside broadcast stations see the fixed information paper²¹ and for receive station see the fixed receive information paper²².

5.1.1 1980-2010 MHz and 2170-2200 MHz

Television outside broadcasting transmitters operating in the bands 1980-2010 MHz and 2170-2200 MHz are to be licensed under a fixed service apparatus licence that authorises the operation of a TOB station. The licence period will be limited in accordance with the relevant date of the transitional arrangements in the MSS Band Plan.

The optional licensing of fixed TOB receive stations operating in the bands 1980-2010 MHz and 2170-2200 MHz is to be under a fixed receive apparatus licence. The licence period will be limited to 1 year and is not to exceed the relevant date of the transitional arrangements in the MSS Band Plan.

5.1.2 2010-2110 MHz and 2200-2300 MHz

The licensing of transmitter in the bands 2010-2110 MHz and 2200-2300 MHz for ABC, Channel 7, Network 9, Channel 10 and STV will be under an apparatus licence for a maximum period of 5 years.

The optional licensing of fixed TOB receive stations operating in the bands 2010-2110 MHz and 2200-2300 MHz is to be under a fixed receive apparatus licence. The licence period will be a maximum of 5 years.

5.2 Licence conditions

All TOB transmitters in the bands 2010-2110 MHz and 2200-2300 MHz operate on the basis that they do not cause interference to other services (see Fixed LCD). The coordination criteria outlined in this RALI will be used in the consideration of any interference.

The operation of TOB in the Perth area is limited by the treaty between the Government of Australian and the European Space Agency. To satisfy this treaty TOB wishing to operate in the bands 2044-2054 MHz, 2215-2230 MHz and 2290-2300 MHz will not be permitted within 300km of the New Norcia earth station.

All licensing, to support Launcher and LEOP activities at the New Norcia earth station in the bands 2025-2044 MHz, 2054-2110 MHz, 2200-2215 MHz and 2230-2300 MHz will be in accordance with the document "Spectrum coordination arrangements" which is available on the ACMA website ([RALI FX21](#)).

²¹ Fixed apparatus licence information paper at <http://www.acma.gov.au/Industry/Broadcast/Television/Licence-fees-and-charges/fixed-licence-overview>.

²² Fixed receive apparatus information paper at <http://www.acma.gov.au/theACMA/fixed-receive-licences-guidelines>.

6 RALI authorisation

Approved [12 August 2022]

Chris Worley
Manager
Spectrum Planning Section
Spectrum Planning Engineering Branch
Australian Communications and Media Authority

Appendix A: Summary of coordination arrangements

General

The assignment requirements below for new TOB systems have been developed to minimise the need to carry out detailed coordination with existing services.

Assignment requirements for TOB stations in the band 1980-2010 MHz and 2170-2200 MHz

Specifically the radiated power limit, the frequency band limits for wanted emissions and the restriction preventing the use of airborne transmitters have been chosen to eliminate the need to coordinate with adjacent band services. For TOB operations in these bands the following criteria are to apply:

1. Available frequency range is 1985-2010 MHz and 2175-2200 MHz.
2. Within the band 2175-2200 MHz TOB transmitters are not to be operated within 100 km of an earth station receiver operating within the band 2200-2300 MHz.
3. The radiated power of a transmitter shall not exceed 23 dBm/8 MHz EIRP.
4. Airborne transmitters are not permitted.
5. Not to be operated within 150 km of the Mid-West Radio Quiet Zone (RQZ).
6. Operation is on the condition that no interference is caused to other radiocommunications services.
7. Operation of TOB is to be consistent with the transitional arrangements of the MSS Band Plan.

Assignment requirements for TOB stations in the band 2010-2110 MHz and 2200-2300 MHz

The following criteria is to apply to TOB assignments in the bands 2010-2110 MHz and 2200-2300 MHz:

1. Coordination is not required between TOB licensees operating to the channel plans.
2. Fixed point-to-point link coordination is not required in the link clearance areas. Outside those areas see Section 5.3.
3. Earth station coordination in the band is not required in the 2010-2110 MHz band except around the Alice Springs earth station, see Section 5.5.1. However interference must be accepted.
4. Airborne TOB transmitters are not permitted in the band 2200-2300 MHz.
5. Earth station coordination areas in the band 2200-2300 MHz are identified in Appendix C. Requirements inside those areas are given in Appendix C. Restricted operation in the Perth area due to the treaty between the Government of Australia and ESA, section 5.5.
6. Not to be operated within 150 km of the Mid-West Radio Quiet Zone (RQZ).
7. When planning TOB station operation in the band 2200-2300 MHz in the vicinity of radio-astronomy sites licensees are encouraged to give notification to the site operator. See RALI MS31 for details.
8. Airborne Mobile Telemetry to notify point-of-contact - Section 5.8 for details.
9. Coordination with Adjacent band 2 and 2.3 GHz SL and PTS services is required.

10. Operation is on the condition that no interference is caused to other radiocommunications services.

Appendix B: Typical characteristics for TOB services operating in the bands 2010-2110 MHz and 2200-2300 MHz

Fixed TOB receiving station parameters (collection station parameters)*		
Maximum antenna gain (dBi)	27	
Effective antenna pattern	Omnidirectional ²³	
Antenna height (m)	60-150	
Receiving band (MHz)	1980-2110 MHz 2170-2300 MHz	
Minimum wanted signal level (dBW)	-112.3	
Protection Ratio (dB)	Frequency Separation (MHz)	Wanted/Unwanted Protection Ratio (dB)
	Co-channel	26
	0 – 8	-30
	8 and above	-40
High site/high power TOB transmitter parameters (ENG van)*		
Transmitter's antenna gain (dBi)	25	
Antenna height (m)	10	
EIRP (dBm/8 MHz)	62.5	
Antenna Type	Parabolic	
DVB-T transmission mode	8K	
Spectrum Mask	ETSI EN 300 744	
Low power TOB transmitter parameters (Wireless camera)*		
Transmitter's antenna gain (dBi)	3	
Antenna height (m)	2	

²³ Achieved by a combination of multiple antennas and/or rotating antennas

Effective antenna pattern	Omni-directional
EIRP (dBm/8 MHz)	26

* For more detailed information on typical TOB systems parameters please refer to recommendation [ITU-R F.1777](#)

Appendix C: Coordination between a TOB Station and Earth Stations in the band 2200-2300 MHz

This appendix outlines the coordination or restricted areas for TOB operation around earth stations identified in section 5.5 of this RALI.

The following coordination and restriction areas have been developed using typical TOB receiver and transmitter characteristics as outlined in Appendix B. Any services wishing to operate outside of these characteristics must coordinate with the earth station using the procedure set out in Appendix 7 of the Radio Regulations of the International Telecommunication Union (ITU).

C1.0 Coordination around Tidbinbilla earth station

TOB services operating near the Tidbinbilla earth station must determine if their operation falls within the coordination area illustrated in Figure 5. The blue area in Figure 5 indicates the coordination area for TOB news vans and the hashed area where TOB wireless cameras need coordination.

The coordination area for TOB wireless cameras is based on the power and height restrictions of 23dBm/8MHz and 2m respectively. The coordination area for TOB news vans is based on the power and height restrictions of 56 dBm/8MHz and 10m respectively.

If a TOB operation falls outside of their respective coordination areas and are operating at or below the afore mentioned power and height levels then no coordination with the Tidbinbilla earth station is required.

If a TOB transmitter operates above these power and height levels they will need to coordinate usage with the Tidbinbilla earth station.

TOB services wishing to operate inside the coordination areas surrounding Tidbinbilla earth station must coordinate their use by using the procedure set out in Appendix 7 of the Radio Regulations of the ITU.

Assessment is based on the following method of determining the signal level from the proposed transmitter arriving at the location of the earth station:

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

Where:

PSD_{tx} - TOB 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 4 (*over*)

G_t - transmit antenna gain in the direction of the interference path (dBi)

G_r - (maximum) receive antenna gain in the direction of the interference path (dBi, see);

Interference Threshold Level - maximum permissible unwanted signal PSD (dBW/Hz); see Table 4.

Coordination calculations are to use propagation model ITU Recommendation P.452 with the values set out in Table 4. In particular the new TOB service should not exceed an interference threshold of -222 dBW/Hz (-153 dBW/8MHz) for 0.001% of time for services operating in 2290-2300 MHz.⁶³

TOB service must not operate in cases where the potential signal level reaching the location of the Tidbinbilla earth station is above the interference threshold level.

There are 5 small areas in Canberra (within the hashed area of Figure 5) where coordination has been pre-determined for 100mW and 400mW wireless camera operations. This includes the precincts of Canberra Airport, Manuka Oval and Bruce Stadium. Detailed information on these areas and other pre-determined areas is available from TOB licensees or the CSIRO who manages the Tidbinbilla earth station. Operation outside these pre-determined areas needs specific coordination with the Tidbinbilla earth station using the criteria outlined in this Appendix.

Figure 5 Tidbinbilla earth station coordination area for TOB vans and wireless cameras in the band 2200-2300 MHz

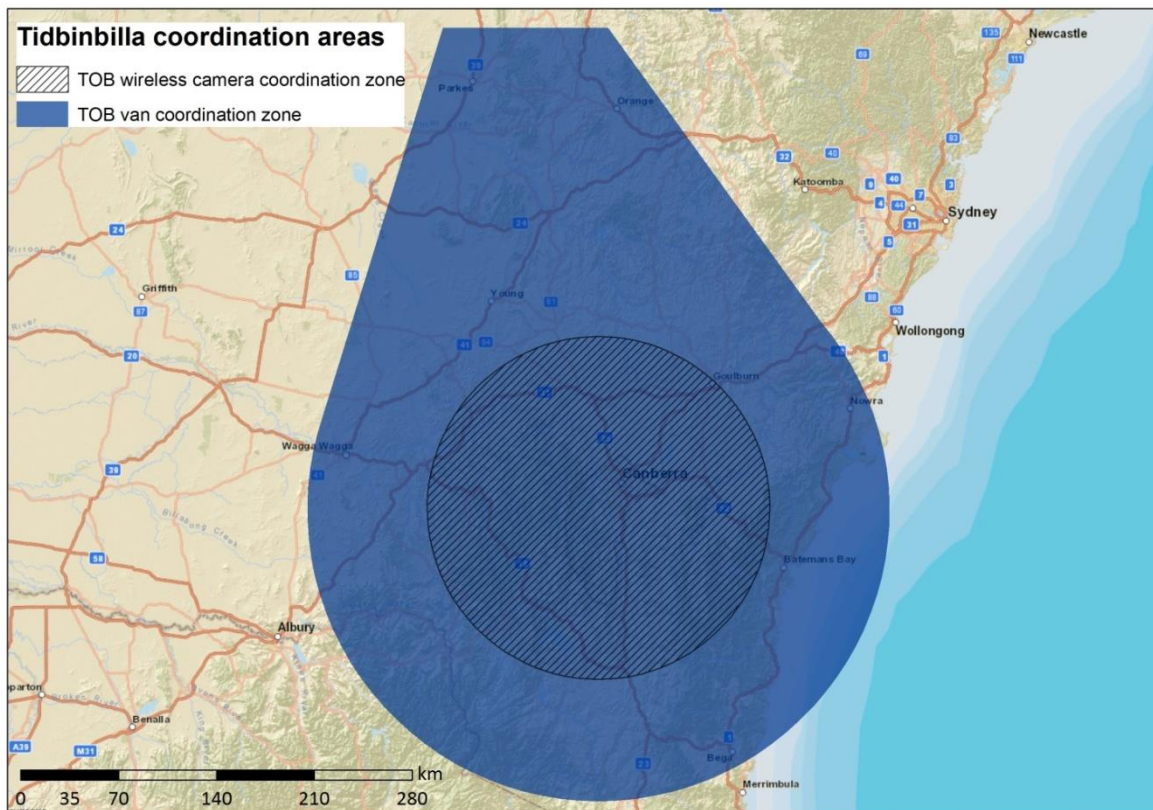


Table 4 Parameters used for coordination calculations around Tidbinbilla earth station

Earth Station Parameters	Value
Interference threshold (I_{th}):	
(2200-2290 MHz)	-216 dBW/Hz (-147 dBW/8MHz)
(2290-2300 MHz)	-222 dBW/Hz (-153 dBW/8MHz)
Receive antenna gain (G_{rx}):	
(2200-2290 MHz)	63.3 dBi (14.5dBi towards horizon @ 5° minimum antenna elevation)
(2290-2300 MHz)	63.3 dBi (7dBi towards horizon @ 10° minimum antenna elevation)
Receive antenna height (h_{rx})	37m (a.g.l)
Antenna pattern:	
<i>Horizontal</i>	Omni directional
<i>Vertical</i>	ITU-R S.465 (min -10 dBi off-axis)
Propagation model	ITU-R P.452 (without ducting ²⁴)
Percentage of time $p(\%)$:	
(2200-2300 MHz)	0.001
Digital elevation model	3-second

²⁴ Note that surface ducting, a short time interference mechanism over water in flat coastal areas, is not considered applicable for the geographic area surrounding Tidbinbilla earth station.

C2.0 Restricted area around New Norcia earth station

New Norcia earth station receivers operate in the bands 2215-2230 MHz and 2290-2300 MHz. Any TOB channel that is fully or partially within this band must not operate within 300 km of the earth station.

The European Space Agency may occasionally request access to the remainder of the band for short duration activities, such as launcher tracking and Launch and Early Orbit Phase (LEOP) support²⁵. Spectrum coordination arrangements for such accesses and the procedures by which such request are to be made are contained in the document “Spectrum coordination arrangements” which is available on the ACMA website ([RALI FX21](#)). All licensing, to support Launcher and LEOP activities will be in accordance with this agreement. TOB licensees are encouraged to consider such coordination requests and support where possible.

C4.0 Restricted areas around Mingenew earth station

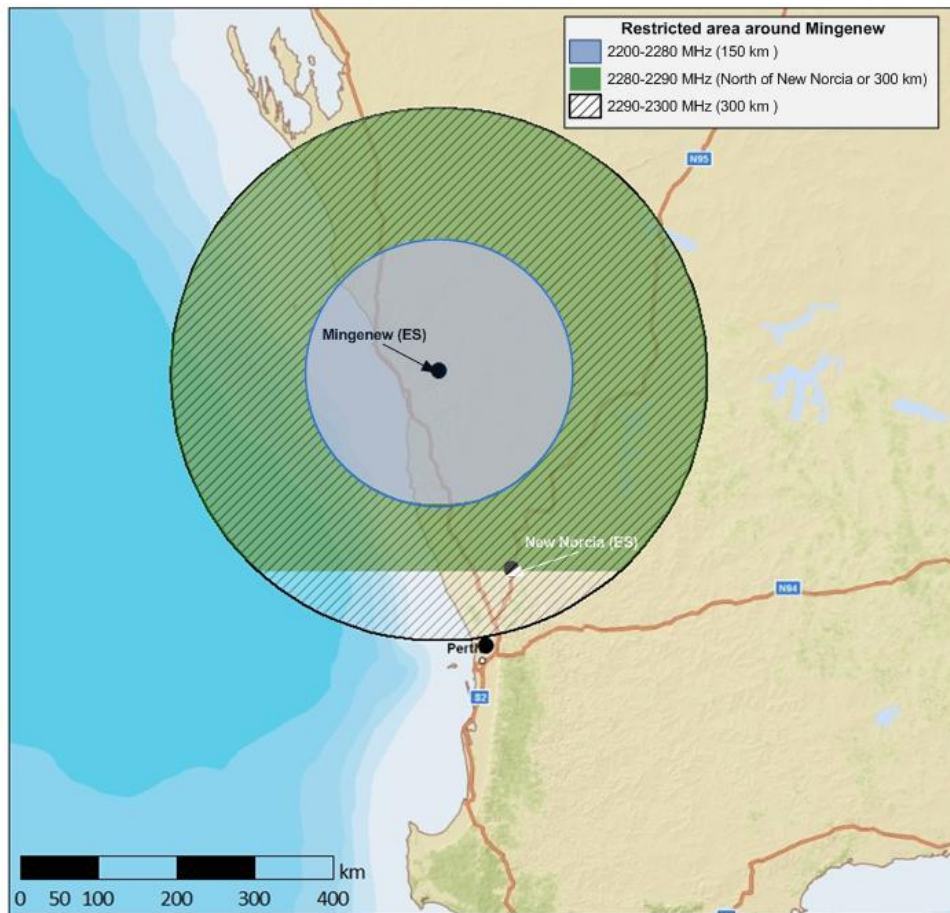
TOB transmitters are restricted around the Mingenew earth station. The distances at which TOB transmitters are restricted are frequency dependant. TOB transmitters must not operate in the restricted areas listed in Table 5 and shown in Figure 6.

Table 5 Restricted distances around Mingenew earth station for different frequency ranges

Frequency Range (MHz)	Restricted distance
2200-2280	150 km
2280-2290	North of the New Norcia earth station and within 300 km
2290-2300	300 km

²⁵ A requirement included in the implementation arrangement to support the Treaty between the Government of Australian and the European Space Agency

Figure 6 Restricted TOB areas around Mingenew earth station



C5.0 Restricted area around Alice Springs earth station

TOB services around the Alice Springs earth station must not operate in the bands 2281.2-2283.4 MHz and 2286.5-2288.5 MHz within 150 km radius of the Alice Springs earth station.

Alice Springs Earth Station also transmits in the band 2200-2300 MHz. TOB services that operate fully or partly in the band 2284.5-2290.5 MHz will not be afforded protection from the earth station.

C6.0 Cerberus earth station

The Cerberus earth station does not operate in the band 2200-2300 MHz. TOB may operate in this band without the need to coordinate use with the Cerberus earth station.

Appendix D: Coordination between a high power TOB Station and Fixed Point-to-Point links in the bands 2010-2110 MHz and 2200-2300 MHz

All high power TOB transmitters outside the fixed link clearance areas need to coordinate their usage with existing fixed links. The coordination procedure is detailed in Section 4 of RALI FX3 (<http://www.acma.gov.au/theACMA/rali-fx3>) and is summarised below.

Each TOB service must follow the four step procedure set out below before commencing operation outside of the fixed point-to-point clearance area boundary or in scenarios outlined in section 5.3.2 which require detailed coordination.

1. Identify potentially affected services in the Register of Radiocommunication Licenses²⁶ within a distance of 200 km from the proposed TOB service. This should include all services ± 29 MHz from the proposed new frequency. This can potentially mean fixed point-to-point links in the 2.1 GHz and 2.2 GHz bands.

2. Calculate received signal levels of the wanted (W) and unwanted (U) using the formula:

$$P_r = P_t + G_t - L_t - L_p + G_r - L_r$$

where :

P_r	RF signal power at the input to the receiver (dBm)
P_t	RF signal power at the output of the transmitter (dBm)
G_t	gain of the transmitting antenna in the azimuth of the receiver (dBi)
L_t	feeder and branching losses associated with the transmitter (dB)
L_p	total path loss between the transmit and receive antennas (dB)
G_r	gain of the receiving antenna in the azimuth of the transmitter (dBi)
L_r	feeder and branching losses associated with the receiver (dB)

L_p should be calculated via the methods described in RALI FX3 however it is recommended that propagation model ITU-R P.526 (with $k=1.33$) should be used.

3. Assess received signal levels (wanted and unwanted) against interference management criteria.

²⁶ http://web.acma.gov.au/pls/radcom/register_search.main_page

For a successful coordination the ratio of wanted to unwanted signal must be greater than or equal to the protection ratio for a given fixed point-to-point link in accordance with RALI FX3.

$$W-U \geq PR + CF(P_L=20)$$

where :

W - Wanted signal level in dBm

U - Unwanted signal level in dBm

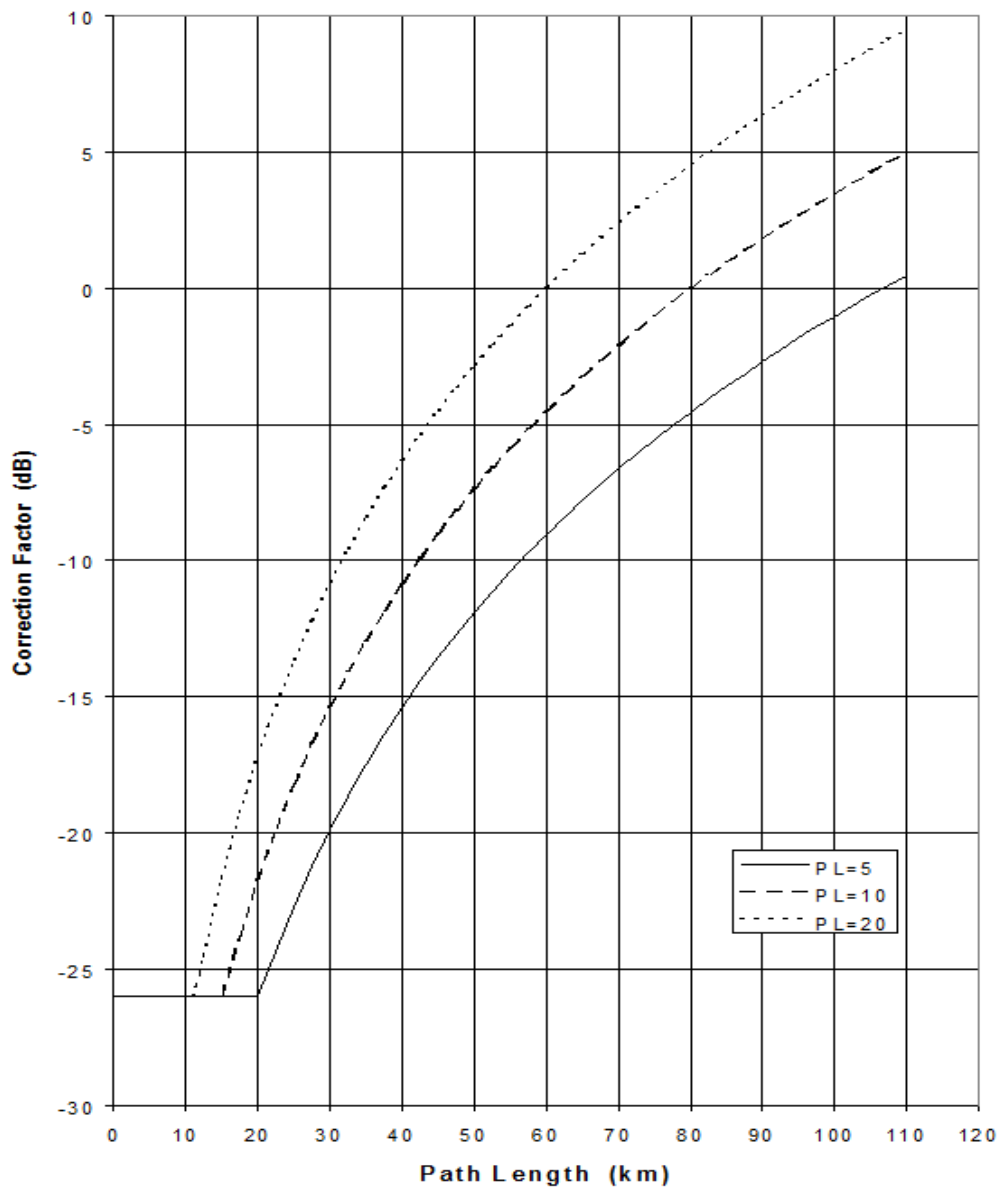
PR - Protection ratio: minimum ratio of the relative levels of wanted and unwanted signals at the input of the (potential) victim receiver (see Table 6)

CF - Path length correction factor based on a $P_L=20$ (see Figure 7)

Table 6 Protection ratio for fixed point-to-point links (P_L : 20, path length 60 km)

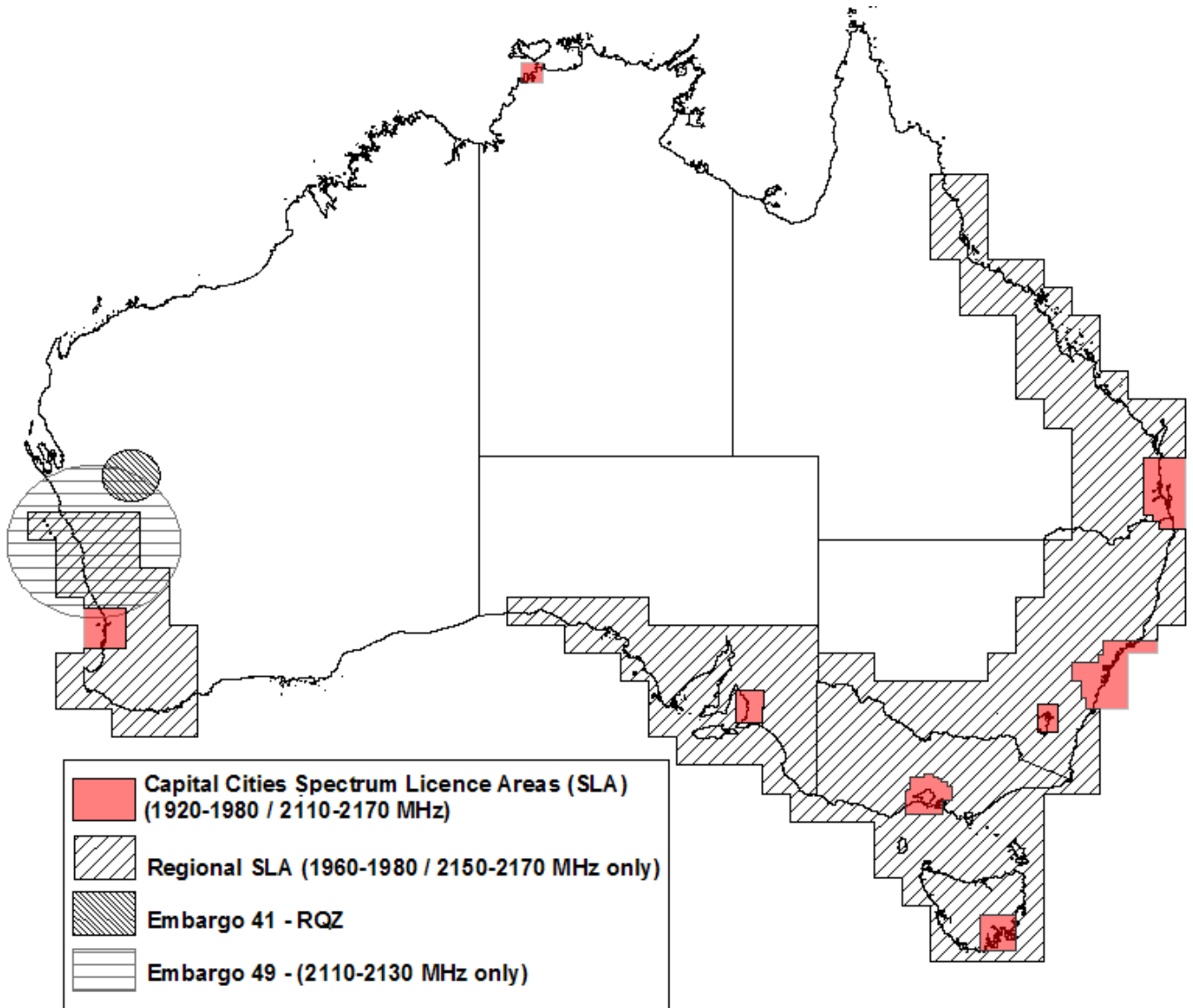
Frequency Offset from closest channel edge to channel edge	REQUIRED PROTECTION RATIO (dB) Digital Interferer Tx → Digital Victim Rx
Co-channel or overlapping	60
1 Hz - 29 MHz	30
29 -58 MHz	0
>58 MHz	

Figure 7 Multipath Correction Factor (CF)



P_L : Percentage of time that the average refractivity gradient in the lowest 100 m of the atmosphere is less than or equal to -100 N units/km. For further details refer to Annex A to Appendix 1 of RALI FX-3.

Appendix E: Designated areas for the 2.0 GHz spectrum licence



Appendix F: Perth Area (Radiocommunications Spectrum Re-allocation Declaration No. 2 of 2011)

