
Radiocommunications Assignment and Licensing Instruction

**Frequency Coordination and Licensing Procedures
for Apparatus Licensed
Public Telecommunications Services
in the
2 GHz Band**

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Suggestions for improvements to Radiocommunications Assignment and Licensing Instructions may be addressed to The Manager, Spectrum Planning Section, ACMA at PO Box 78, Belconnen, ACT, 2616, or by e-mail 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 of Effect	Sequence Number	Comments
25 March 2024	N/A	Updates to special conditions to account for sunsetting and remaking of the PTS LCD.
2 August 2019	N/A	Inclusion of rules surrounding underground PTS use. Correction to TOB protection criteria. Other editorial updates
08 July 2015	N/A	Addition of coordination procedure between PTS and TOB in the bands 1980-2110 MHz and 2170-2300 MHz as a result of the 2.5 GHz band review.
30 November 2012	192	Inclusion of coordination requirements and associate special conditions to allow low powered ubiquities deployments (e.g. femtocell, smart repeater). Inclusion of 10 MHz channelling arrangements to support LTE deployments
31 March 2011	185	Amendments to coordination requirements for earth station receiver near Alice Springs
28 February 2011	184	Coordination requirements for earth station receiver near Alice Springs
27 July 2010	183	Changes made to assignment priorities Reference to ITU-R Recommendations P.526 and P.452 updated to allow earlier version to be used. Minor editorial updates
19 March 2010	177	Initial release

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Frequency coordination and licensing procedures for apparatus licensed Public Telecommunications Services in the 2 GHz band

Part 1 Introduction

1.1. Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide information about, and describe the necessary steps for, the frequency coordination and licensing of public telecommunications services (PTS) in the paired, 1920-1980 MHz and 2110-2170 MHz frequency bands (the 2 GHz band).

The information in this document reflects the ACMA's statement of current policy in relation to frequency coordination and apparatus licensing of PTS systems in the 1920-1980 MHz and 2110-2170 MHz frequency ranges. In making decisions, both ACMA assigners and Accredited Persons should take all relevant matters into account and decide each case on its merits. Issues related to these procedures that appear to fall outside of the established policy should be brought to the attention of:

The Manager - Spectrum Planning Section
Spectrum Planning and Engineering Branch
Australian Communications and Media Authority
P.O. Box 78
Belconnen ACT 2616

A glossary of acronyms and abbreviations is provided at page 43.

1.2. Basic Principles

The basic principles for coordination and operation of PTS systems in the 1920-1980 MHz and 2110-2170 MHz bands are that:

- apparatus licences are able to be issued for PTS systems operating in the paired frequency ranges 1920-1980 MHz and 2110-2170 MHz in regional and remote areas that are outside of those areas specified for allocation by spectrum licensing¹, outside the Australian Radio Quiet Zone Western Australia (ARQZWA) exclusion area² and outside the area defined by Embargo 49³ (see diagram at Attachment 1);
- PTS base station transmitters must comply with the emission limits set out in Attachment 4 of this RALI;

¹ The 1920-1980 and 2110-2170 MHz band is not available for apparatus licensing in defined metropolitan (whole band) and regional areas (top 20 MHz of the band) as defined in RALI SM 26.

² At the time of release of this RALI the 70 MHz-25.25 GHz frequency range was subject to Embargo 41 of RALI MS03 and was not available for apparatus licensing within the defined area of the ARQZWA.

³ At the time of release of this RALI the 2100-2130 MHz band was subject to Embargo 49 of RALI MS03 and was not available for apparatus licensing within 300 km of Yarragadee in Western Australia.

- the operation of apparatus licensed PTS systems must not cause unacceptable interference to previously licensed PTS systems or other licensed co-primary services as defined in the *Australian Radiofrequency Spectrum Plan [1]*;
- low powered ubiquitous transmitters such as femtocells and smart repeaters are authorised to operate within 15 km of a base station registered on the RRL provided:
 - they meet the conditions specified in **Special Conditions C21 and C2** (see section 5.4); and
 - they meet coordination criteria specified in part 4 of this RALI.
- Uncoordinated underground services are authorised under a PMTS Class B licences provided they meet the conditions specified in **Special Condition C23**
- an ACMA assigner or Accredited Person will conduct the frequency coordination of PTS systems in accordance with this RALI. To satisfy themselves of the feasibility of the proposed PTS system, applicants may undertake coordination studies in accordance with the procedures in this RALI prior to submitting the application. The results of such studies may be included with the licence application.

1.3. Scope

This RALI details the steps necessary for frequency coordination and licensing of proposed PTS systems. It covers frequency coordination between proposed PTS systems and other previously licensed PTS systems; and between proposed PTS systems and other radiocommunications services identified in Table 1 that share the same or adjacent frequency bands.

This RALI aims to manage interference between systems to within limits defined at Attachment 2.

The RALI provides instructions that may be used by ACMA assigners and Accredited Persons when assessing whether proposed PTS systems will cause (or receive) unacceptable interference to (or from):

- existing PTS systems;
- point-to-point fixed links (fixed links);
- point-to-multipoint (BWA) systems;
- spectrum licensed space;
- the Australian Radio Quiet Zone Western Australia (ARQZWA);
- space services; and,
- Television Outside Broadcasting (TOB).

This RALI also identifies other services for which no specific coordination criteria have been developed due to the nature of the service and the potential for interference being low.

It is a requirement that coordination calculations should be performed to assess potential interference to and from PTS systems. In some cases the effect of PTS

mobile and low powered ubiquitous stations will need to be considered. Interference protection and requirements to protect other services are based upon the assumption that mobile station deployments conform to the deployment model described at Attachment 3.

1.4. Overview of Coordination Procedures

This RALI requires that coordination calculations should be performed to assess potential interference mainly to and from the PTS base station. In some cases, however, mobile stations will need to be considered in the coordination process.

Part 3 of this document describes a range of potential interference mechanisms that should be considered when making assessments of potential interference.

Part 4 provides details of a procedure for performing assessments of potential interference. Attachment 2 provides the applicable protection criteria to be used in performing the assessments.

A summary of potential interference scenarios and reference to the applicable coordination procedure in this document (or elsewhere) is given in Table 1 below.

Table 1: Summary of potential interference mechanisms

Interference mechanism	Coordination procedure
PTS → PTS (see section 3.1)	Part 4 of this RALI
PTS Tx → Point-to-point Rx (see section 3.2.1)	Part 4 of this RALI
Point-to-point Tx → PTS Rx (see section 3.2.2)	Part 4 of this RALI
PTS Tx → Spectrum licensed area (see section 3.3.1)	Part 4 of this RALI
Spectrum licensed area → PTS Rx (see section 3.3.2)	No procedure defined
PTS Tx → Adjacent spectrum licensed Rx (see section 3.3.3)	No procedure defined
Adjacent spectrum licensed Tx → PTS Rx (see section 3.3.3)	No procedure defined
BWA Tx → PTS (see section 3.4.1)	Part 4 of this RALI
PTS → BWA Rx (see section 3.4.2)	No procedure defined
PTS Tx → MSS uplink (space Rx) (see section 3.5.1)	Case does not currently exist – no procedure defined
MSS uplink Tx → PTS Rx (see section 3.5.2)	Case does not currently exist – no procedure defined
PTS Tx → Space services (see section 3.6.1)	Part 4 of this RALI
Space services → PTS Rx (see section 3.6.2)	Part 4 of this RALI
PTS Tx → ARQZWA (see section 3.7)	Part 3.7 of this RALI Procedure defined in RALI MS32
TOB Tx → PTS (see section 3.8)	No procedure defined
PTS → TOB Rx (see section 3.8)	Part 4 of this RALI

1.5. Licensing

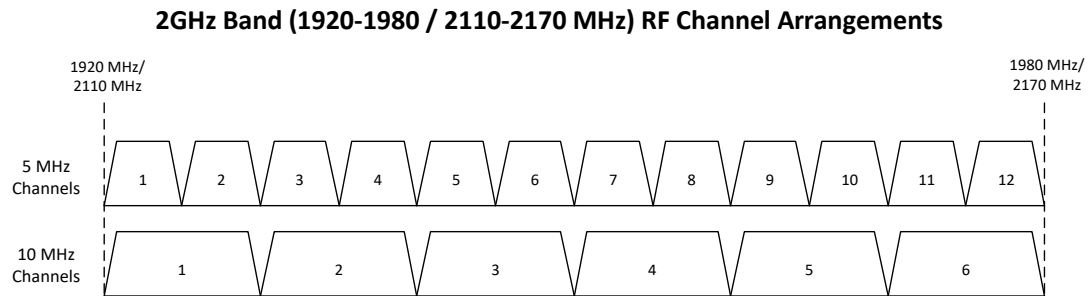
PTS apparatus licences are used to authorise the operation of PTS systems that comprises two or more land stations. The *Radiocommunications (Cellular Mobile Telecommunications Devices) Class Licence [2]* authorises mobile stations to communicate with the land stations authorised under the PTS apparatus licence, under a ‘no interference no protection’ basis.

PTS licences will only be issued for PTS systems in the paired 1920-1980 MHz and 2110-2170 MHz frequency bands in those areas of Australia that are outside the areas defined for allocation by spectrum licensing and other relevant embargo areas contained in *RALI MS03 - Spectrum Embargoes [3]*.

It should be noted that:

- in the 1920-1980 MHz and 2110-2170 MHz bands, channel allotment bandwidths of 5 MHz and 10 MHz apply as described below;
- no licensee may be assigned more than 20 MHz of spectrum (either two paired 5 MHz channels or one paired 10 MHz channel) in the same area⁴;

Additional information about the licensing arrangements is provided in Part 5 of this RALI.



⁴ The same area is the frequency reuse area of 45 km around a PTS base station.

Part 2 Background

2.1. Legislative/administrative arrangements

The *Australian Radiofrequency Spectrum Plan [1]* allocates the 1920-1980 MHz and 2110-2170 MHz frequency bands for Fixed and Mobile services⁵.

In addition to this, these frequency bands were subject to the *Radiocommunications (Spectrum Re-allocation) Declaration No.2 of 2000 [4]* (the Declaration). The Declaration defined geographic areas (that included major metropolitan and regional areas) that were allocated via the issue of spectrum licences. Although the Declaration is no longer in force, spectrum licences issued as a result of the Declaration are subject to the conditions specified in the relevant technical framework.

Apparatus licensing arrangements for PTS systems in the 1920-1980 MHz and 2110-2170 MHz frequency bands apply only in those areas that lie outside the areas specified in the Declaration and the embargoed areas defined in *RALI MS03: Spectrum Embargoes [3]*. A diagram of areas available for apparatus licensing is provided at Attachment 1.

The 1920 - 1980 MHz and 2110-2170 MHz spectrum has predominantly been used for fixed link services in regional and remote areas. The fixed link service band, detailed in the 2.1 GHz band channel arrangements of Appendix 1 of *RALI FX-3 - Microwave Fixed Services Frequency Co-ordination [5]*, overlaps these frequency ranges.

The 1920-1980 MHz band overlaps the first three main and interleaved channels of the 2.1 GHz fixed link channel arrangements. These relationships are illustrated in Figure 1 below.

The 2110-2170 MHz band overlaps the first two main channels and first three interleaved channels of the 2.1 GHz fixed link channel arrangements. These relationships are illustrated in Figure 2 below.

⁵ 2110-2120 MHz is also allocated to Space Research

Figure 1: Relationship between the 1920-1980 MHz band and other services

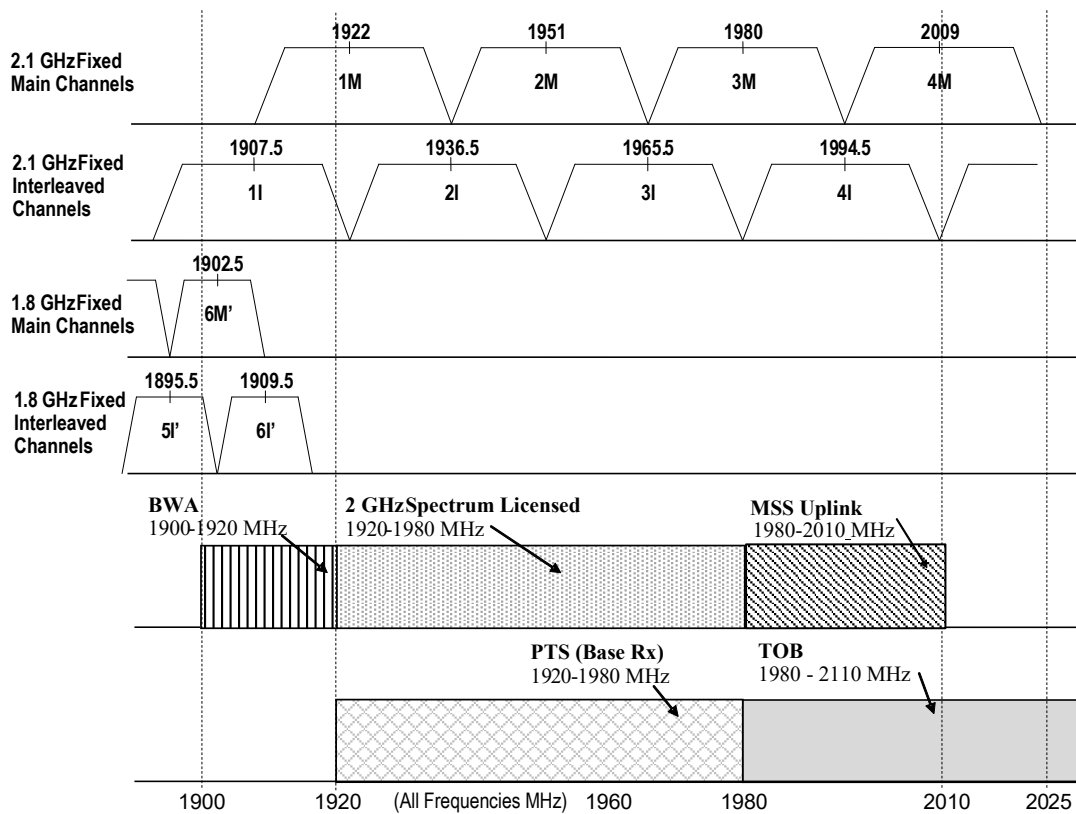
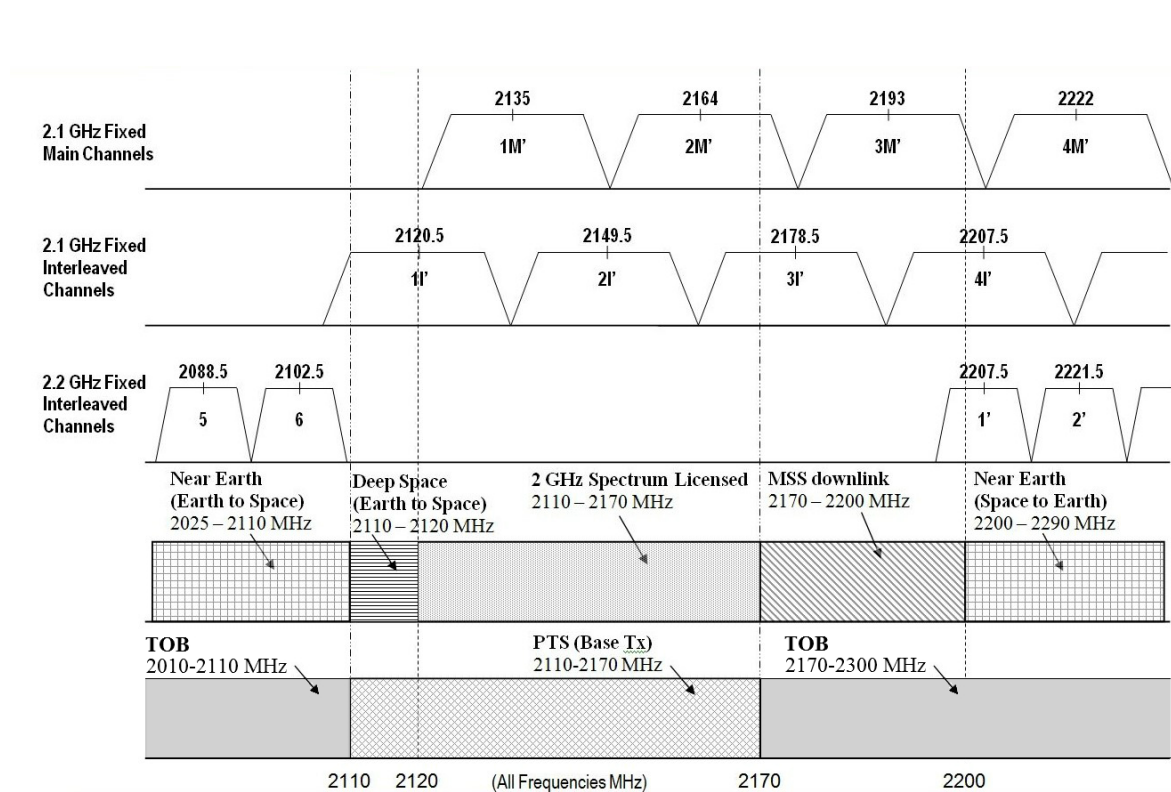


Figure 2: Relationship between the 2110-2170 MHz band and other services



Part 3 Potential interference mechanisms

This Part describes a range of potential co-channel and adjacent channel interference mechanisms that should be considered when making assessments of potential interference. While this section discusses the various services that have been considered, only the services that require specific coordination procedures are defined in Part 4. These services are (see also Table 1):

- PTS to PTS
- PTS transmitter to Fixed link receiver
- Fixed link transmitter to PTS receiver
- BWA transmitter to PTS receiver
- PTS transmitter to Spectrum Licensed Space
- Space Service Transmitter to PTS Receiver
- PTS transmitter to Space Service receiver
- PTS transmitter to the ARQZWA
- TOB transmitter to PTS receiver
- PTS transmitter to TOB receiver

3.1. PTS into PTS

3.1.1. Co-channel frequency coordination

Frequency coordination procedures for assessing whether a proposed new PTS system will cause (or suffer) unacceptable interference to (or from) previously licensed PTS systems are detailed in Part 4.7 of this document. These procedures only deal with the coordination of co-channel PTS systems.

The dominant interference mechanism is the PTS base station transmitter to mobile receiver. This situation will be catered for via the coordination procedure in Part 4.7. It is also believed that the coordination procedure defined in Part 4.7 will adequately account for the case of interference from a mobile transmitter to a PTS base station receiver.

3.1.2. Adjacent channel considerations

The coordination of adjacent channel PTS base stations is not required for the assignment of new PTS base stations. Due to the type of equipment that is expected to be deployed (as detailed at Attachment 3), paying particular attention to relevant standards, in addition to the expected area and type of deployment, it is anticipated that adjacent channel operation should be possible without any specific coordination required. Therefore, no coordination details have been provided in Part 4 of this RALI.

In addition to this, no specific coordination requirements have been developed to protect against out-of-band interference⁶, since this form of interference can be extremely difficult to predict and accurately model due to the various factors controlling it.

In order to account for any adjacent channel or out-of-band interference, **Special Condition FZ** will be applied to all PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz. The intention is to encourage licensees to cooperate and, where necessary, compromise to resolve interference if and when it occurs. However, in the event a practical solution cannot be found the license issued first in time will be deemed to have priority.

3.2. Fixed Links

3.2.1. PTS transmitter into fixed link receiver

As a consequence of the shared nature of the bands, PTS transmitters have the potential to cause interference to incumbent fixed link receivers. PTS base station transmitters will be the dominant interferer into fixed link receivers operating in or adjacent to the 2110-2170 MHz band, while mobile transmitters will be the dominant interferer into fixed link receivers operating in or adjacent to the 1920-1980 MHz band.

For both the 1920-1980 MHz and 2110-2170 MHz bands, interference between PTS transmitters and fixed link receivers in the 1.8 GHz, 2.1 GHz and 2.2 GHz band arrangements should be assessed.

Frequency coordination procedures outlined in Part 4.5 should be used for assessing whether:

- a proposed PTS transmitter will cause unacceptable interference to previously licensed fixed link receivers; and
- a proposed fixed link receiver will receive unacceptable interference from a previously licensed PTS transmitter.

In the event that calculations indicate that interference may occur, unless an agreement or other arrangements can be made between the applicant and the existing licensee, a licence will not be granted.

Note that any agreement or arrangements that are made may require one or both of the PTS or fixed link to be reassessed against the relevant coordination criteria.

3.2.2. Fixed link transmitter to PTS receiver

Interference from fixed link transmitters in the 1.8 GHz, 2.1 GHz and 2.2 GHz band arrangements needs to be assessed against both PTS base station receivers, in the 1920-1980 MHz band, and mobile receivers, in the 2110-2170 MHz band.

Frequency coordination procedures outlined in Part 4.6 should be used for assessing

⁶ Out-of-band interference refers to a number of non-linear types of interference that may occur across the frequency boundaries of a licence, for example: receiver intermodulation, receiver blocking and spurious emissions.

whether:

- a proposed fixed link transmitter will cause unacceptable interference to a previously licensed PTS receiver; and
- a proposed PTS system will receive unacceptable interference from previously licensed fixed link transmitters.

In the event that calculations indicate that interference may occur, unless an agreement or other arrangements can be made between the applicant and the existing licensee, a licence will not be granted.

Note that any agreement or arrangements that are made may require one or both of the PTS or fixed link to be reassessed against the relevant coordination criteria.

3.3. Spectrum Licensed Space

3.3.1. PTS transmitter into Spectrum Licensed area

A PTS base station transmitter located near a spectrum licence area boundary needs to coordinate with a “spectrum space” as opposed to the traditional method of coordination with a radiocommunications devices at a specific location. In order to do this spectrum licence coordination principles need to be applied. This means that the PTS transmitter should be treated as though it were a spectrum licence device.

Therefore, a proposed PTS transmitter will be considered to not interfere with the spectrum licence area if the device boundary (a polygon) of the PTS transmitter, as determined by procedure defined in the *2 GHz Spectrum Licence – Technical Framework – Section 145 Determination [6]*, does not intrude into the co-channel spectrum licensed area. The required coordination methodology is specified in section 4.8.

Note that only coordination of a PTS base station with a spectrum licensed area is required. It is believed that this will also adequately satisfy coordination requirements for any associated mobile stations, due to the significant difference in EIRP's and antenna heights of the stations.

3.3.2. Spectrum Licensed areas into PTS receiver

A PTS receiver located near a spectrum licence area boundary has the potential to receive interference from transmitters located within the spectrum licensed area. In most situations however, there will be a high level of reciprocity between the potential interference to a PTS receiver from transmitters located within the spectrum licensed area and the potential interference that a PTS transmitter may cause to receivers located within the spectrum licensed area. There are expected to be very few situations where a PTS transmitter could be licensed where the associated PTS receiver would suffer interference.

For this reason it is considered sufficient to formally assess potential interference from a PTS base station transmitter into the spectrum licensed area. Prospective licensees are of course free to undertake their own assessment of potential interference risk to PTS receivers.

Advisory Note FA will also be applied to all PTS licences located within 100 km of a spectrum licence boundary. This note informs licensees that if interference is caused by a registered spectrum licence device, the ACMA will consider that the spectrum licence device has priority over the PTS licence when settling the dispute.

3.3.3. Adjacent Band Spectrum Licence Devices

A PTS system operating in frequency adjacent spectrum to a registered spectrum licence device has the potential to cause or receive in-band or out-of-band interference.

In regards to in-band interference:

- PTS licensees must accept any in-band interference caused by a registered spectrum licence device operating in accordance with the stated core conditions of the licence and the *2 GHz Spectrum Licence – Technical Framework – Section 145 Determination [6]*.
- Spectrum licensees are afforded the same level of in-band protection from adjacent band PTS licence transmitters as they are afforded from transmitters operated by an adjacent band spectrum licensee. Therefore a registered spectrum licence device must accept any in-band interference caused by an adjacent band licensed PTS transmitter adhering to the emission limits specified in Attachment 4⁷ and operating in accordance with the requirements stated in this RALI.

In regards to out-of-band interference:

- Interference from apparatus licensed transmitters into devices operated under spectrum licences is managed by advisory guidelines. For the 2 GHz spectrum licensed band see the *2 GHz Spectrum Licence Technical Framework - Radiocommunications Advisory Guidelines [7]*. These guidelines specify compatibility requirements between spectrum licensed services and apparatus licensed services. The compatibility requirements are a model on the basis of which spectrum and apparatus licensees are expected to develop co-ordination procedures for the management of interference to each other's services, using good engineering practice. These guidelines should also be consulted by prospective licensees when co-siting systems with spectrum licensed devices (see also Part 4.13 of this RALI).
- Interference from devices registered for operation in a spectrum licensed space into apparatus licensed receivers is also managed by advisory guidelines. For the 2 GHz spectrum licensed band see the *2 GHz Spectrum Licence Technical Framework - Radiocommunications Advisory Guidelines [7]*.

Due to the type of equipment that is expected to be deployed (as detailed at Attachment 3), paying particular attention to relevant standards, in addition to the expected area and type of deployment, it is anticipated that in most circumstances adjacent band operation should be possible without any specific coordination required. Therefore, no coordination details have been provided in Part 4 of this RALI.

⁷ Attachment 4 emission limits are based on the limits defined in Schedule 6 of the 2 GHz Spectrum Licence - Marketing Plan

However, in the event that in-band or out-of-band interference does occur the ACMA encourages licensees to cooperate and, where necessary, compromise to find a resolution. The ACMA is prepared to consider any interference management arrangements agreed to between spectrum licensees and apparatus licensees. For the case of out-of-band interference, if agreement cannot be reached between affected parties or the interference cannot practically be resolved, then the ACMA will consider the system licensed/registered first in time has priority.

Additionally, although the technical standards developed for FDD equipment in the 2 GHz band provides an inherent level of protection from adjacent channel mobile devices, protection to registered spectrum licence receivers from harmful interference from PTS mobile transmitters cannot be guaranteed. In order to account for this, the *Radiocommunications (Cellular Mobile Telecommunications Devices) Class Licence [2]* requires that PTS mobile devices operate on a 'no interference no protection basis'. Therefore if harmful interference does occur it is the responsibility of the PTS licensee to resolve the problem.

3.4. BWA Services

3.4.1. BWA transmitter into PTS receiver

There is provision for the use of broadband wireless access (BWA) services, using Time Division Duplex (TDD) technologies, in defined regional and remote areas of Australia in the 1900-1920 MHz band.

A BWA base station transmitters operating in the 1900-1920 MHz band has the potential to cause interference to an adjacent channel PTS base station receiver operating in the 1920-1980 MHz band. This is due to the different duplex schemes utilised. Frequency coordination procedures for assessing whether a BWA base station transmitter will cause unacceptable interference to a PTS base station receiver are detailed in Part 4.8 of this document.

Other interference mechanisms related to BWA remote station transmitters and receivers as well as PTS mobile station transmitters are largely covered by the coordination of BWA and PTS base stations and the respective assignment planning models.

However, in the event that interference does occur the ACMA encourages licensees to cooperate and, where necessary, compromise to find a resolution. If the matter cannot be resolved between affected parties, it is noted that BWA remote stations and PTS mobile stations operate on a 'no interference no protection' basis. The BWA licensee will therefore be required to rectify any interference issues into PTS base station receivers caused by these devices.

3.4.2. PTS transmitter into BWA receiver

There are broadband wireless access (BWA) services, using Time Division Duplex (TDD) technologies, in defined regional and remote areas of Australia in the 1900-1920 MHz band.

A PTS mobile station transmitter operating in the 1920-1980 MHz band has the potential to cause interference to an adjacent channel BWA base station receiver. In most situations it is believed that this scenario will be adequately addressed through the coordination of the BWA base station transmitter and PTS base station receiver. Therefore, no coordination details have been provided in Part 4 of this RALI.

However, in the event that interference does occur the ACMA encourages licensees to cooperate and, where necessary, compromise to find a resolution. If the matter cannot be resolved between affected parties, it is noted that PTS mobile stations operate on a 'no interference no protection' basis. The PTS licensee will therefore be required to rectify any interference issues into BWA bases station receivers caused by these devices

3.5. MSS services

3.5.1. 1980-2010 MHz band MSS uplink services

As at March 2024, there are arrangements for narrowband MSS services in the 2005-2010 MHz band, and a framework for MSS services in 1980-2005 MHz is under development.

The Radiocommunications (Mobile-Satellite Service) (1980-2010 MHz and 2170-2200 MHz) Frequency Band Plan 2022 [8] enables the introduction of MSS services in the 1980-2010 MHz band, with some other services in this band being phased out over time.

There are potential out-of-band interference mechanisms to manage. At this stage procedures to manage potential out-of-band interference are under development for the 1980-2005 MHz band. These procedures will be implemented prior to allocating MSS licences in 1980-2005 MHz.

Further information on the development of arrangements in the 1980-2005 MHz frequency range can be found [here](#).

3.5.2. 2170-2200 MHz band MSS downlink services

At the time of release there are arrangements for narrowband MSS services in the 2195-2200 MHz band and a framework for MSS services in 1980-2005 MHz band is under development.

The Radiocommunications (Mobile-Satellite Service) (1980-2010 MHz and 2170-2200 MHz) Frequency Band Plan 2022 [8] enables the introduction of MSS services in the 2170-2200 MHz band, with some other services in this band being phased out over time.

There are potential interference mechanisms to manage. At this stage, procedures to manage potential out-of-band interference are under development for the 2170-2195 MHz band. These procedures will be implemented prior to allocating MSS licences in 2170-2195 MHz.

Further information on the development of arrangements in the 2170-2195 MHz frequency range can be found [here](#).

3.6. Space Services

3.6.1. 2025-2120 MHz band Space Services uplink

The 2025-2110 MHz band has allocations to the Space Research Service (Earth-to-space) and Space Operation Service. Currently, there are several space research or space operation facilities using these allocations across Australia⁸.

The 2110-2120 MHz band has an allocation to the Space Research Service (deep space, Earth-to-space). Currently there are few deep space research facilities using this allocation in Australia⁹.

There are four potential interference mechanisms between PTS systems and Space Service operating in the 2025-2120 MHz band:

- Adjacent channel interference from aggregations of PTS mobile transmitters in the 1920-1980 MHz band causing interference to space station receivers operating in the 2025-2110 MHz band;
- Adjacent channel interference from aggregations of PTS base station transmitters in the 2110-2170 MHz band causing interference to space station receivers operating in the 2025-2110 MHz band;
- Adjacent channel interference from ground-based near Earth transmitters operating in the 2025-2110 MHz band to PTS base station receivers operating in the 1920-1980 MHz band; and
- Co-channel and adjacent channel interference from ground-based deep space transmitters operating in the 2110-2120 MHz band to PTS mobile receivers operating in the 2110-2170 MHz band.

Space station receivers are protected in accordance with relevant ITU-R Recommendations and the ITU-R Radio Regulations. The ACMA has taken account of interference studies into these space services from PTS systems. Based on these studies, the risk of interference to these space services is low, and as such no coordination criteria has been developed.

PTS base station receivers operating in the 1920-1980 MHz band have a minimum 45 MHz separation from ground-based near Earth transmitters. Based on this frequency separation, the risk of interference to PTS base station receivers is considered to be low, as such no coordination criteria has been developed. Furthermore, the ACMA will not protect PTS base station receivers from out-of-band interference from ground-based near Earth station transmitters licensed first in time. It is expected that PTS licensees will use techniques such as filtering to manage such interference.

Transmitters used for the Space Research Service (deep space, Earth-to-space) are extremely high powered and have the potential to cause interference into both co-channel and adjacent channel services, in particular PTS mobile receivers. The relevant frequency coordination procedure for assessing the potential for interference between

⁸ As of the 1st August 2009 established space research or operations facilities in the 2025-2120 MHz band include the following locations: Mingenew, New Norcia, Tidbinbilla, Mount Stromlo, Alice Springs, HMAS Cerberus and Gngangara.

⁹ As of the 1st August 2009 established deep space research facility in the 2110-2120 MHz band include the following locations: Tidbinbilla and New Norcia

these services is specified in section 4.10. It is recommended that coordination be conducted in liaison with Earth station operators.

It should also be noted that, outside the coordination procedure specified in section 4.10, the ACMA will not protect PTS mobile receivers from interference caused by deep space Earth station transmitters. The relevant frequency coordination procedure for this scenario is specified in section 4.10.2.

PTS mobile receivers in the 2110-2170 MHz band operate in the adjacent band to the near-Earth Earth station transmitters in the 2025-2110 MHz band. While, there is the potential for PTS mobile receivers to receive interference within a few kilometres of a Near-Earth Earth station, The ACMA will not protect PTS mobile receivers from out-of-band interference from Near-Earth Earth station transmitters.

3.6.2. 2200-2300 MHz band Space Services downlink

The 2200-2290 MHz band has allocations to the Space Research Service (space-to-Earth, space-to-space) and Space Operation Service (space-to-Earth, space-to-space). There are several space research or space operation facilities using these allocations across Australia¹⁰.

The 2290-2300 MHz band has an allocation to the Space Research Service (deep space, space-to-Earth). Currently there are few deep space research facilities using this allocation in Australia¹¹.

There are two potential interference mechanisms:

- Adjacent channel interference from aggregations of PTS base station transmitters in the 2110-2170 MHz band causing interference to ground-borne receivers operating in the 2200-2290 MHz and 2290-2300 MHz bands;
- Adjacent channel interference from space transmitters operating in the 2200-2290 MHz band to PTS mobile receivers operating in the 2110-2170 MHz band.

PTS base station transmitters operating in the 2110-2170 MHz band have a minimum 30 MHz separation from near-Earth Earth station receivers in the 2200-2290 MHz band. While PTS licensees are required to protect these Earth station receivers in accordance with ITU-R Recommendations, based on the minimum 30 MHz of frequency separation, the risk of interference to Earth station receivers is considered to be low.

In order to adequately protect Earth station receivers (including deep space receivers) from interference, **Special Condition FA1** will be attached to all PTS licences issued in the 2 GHz band. This condition requires that transmitters operated under a PTS licence must not cause harmful interference to an Earth station receiver licensed first in time. Therefore if interference occurs it is the responsibility of the PTS licensee to rectify the issue. This may be best achieved through negotiations with the affected Earth station operator.

The 2290-2300 MHz band has an allocation to the Space Research Service (deep space,

¹⁰ As of the 1st August 2009 established space research or operations facilities in the 2200-2290 MHz band include, Mingenew, New Norcia, Tidbinbilla, Battery Point, Alice Springs and Gbangara

¹¹ As of the 1st August 2009 established deep space research facility in the 2290-2300 MHz band include the following locations: Tidbinbilla, Gbangara and New Norcia

space-to-Earth). While PTS licensees are required to protect these Earth station receivers in accordance with ITU-R Recommendations, based on the minimum 120 MHz of frequency separation, the risk of interference to Earth station receivers is considered to be low. The relevant coordination methodology is specified in section 4.11.

PTS mobile receivers operating in the 2110-2170 MHz band have a minimum 30 MHz separation from space station transmitters. Based on the minimum 30 MHz of frequency separation, the risk of interference to PTS mobile receivers is considered low. In addition to this, PTS mobile receivers operate in the band under a 'no interference no protection basis', as such no coordination criteria have been developed.

3.6.3. 2106 MHz Alice Springs

The CSIRO has an earth station located near Alice Springs that supports tracking and data relay satellites operating over Pacific and Indian oceans under a treaty with the United States of America. The earth station receiver operates on a carrier frequency of 2106.40625 MHz. The coordination methodology between the earth station receiver and PTS base station transmitters is specified in Section 4.12.

3.7. Australian Radio Quiet Zone Western Australia

The ACMA established Australia's first radio quiet zone on 11 April 2005. The radio quiet zone aims to maintain the current "radio-quietness" of a site in remote Western Australia (near Boolardy Station, around 200 km East of Meekatharra). The area has very low levels of radiofrequency energy because of its low population and lack of industrial development. The radio quiet zone is intended to facilitate the development and use of new radio astronomy technologies at that location, and support Australia's bid to host the Square Kilometre Array (SKA).

On 24 September 2006, the ACMA released a *RALI MS32 Coordination of Apparatus Licences within the Midwest Radio Quiet Zone*. RALI MS32 was updated in 2023 to account for the remaking of the *Radiocommunications (Australian Radio Quiet Zone Western Australia) Frequency Band Plan 2023*, and was renamed *RALI MS32 Coordination of Apparatus Licences within the Australian Radio Quiet Zone Western Australia [9]*.

The RALI defines the ARQZWA as inner restricted zones where new frequency assignments are not usually permitted (with exceptions assessed on a case by case basis), and outer coordination zones within which new frequency assignments require coordination. The frequency span of the ARQZWA is 70 MHz to 25.25 GHz. *RALI MS32 [9]* contains the relevant procedures and criteria required in order to coordinate with the ARQZWA.

A summary of the restricted and coordination zones for the frequency bands 1920-1980 MHz, 2110-2170 MHz is given table 2. No new assignments are to be made within the restricted zones. If a proposed assignment lies within a coordination zone then the coordination procedures outlined in *RALI MS32 [9]* must be followed.

Frequency Range (MHz)	Restricted Zone Radius	Coordination Zone
-----------------------	------------------------	-------------------

	(km)	Radius (km)
1920-1980	70	140
2110-2170	70	140

Table 2: ARQZWA Coordination and Exclusion zone radii. The ARQZWA is centred at latitude 26°42'15" South and longitude 116°39'32" East (GDA94 Datum).

3.8. Television Outside Broadcasting (TOB) Services

Television outside broadcasting (TOB) services have been established in the bands 1980-2110 MHz and 2170-2300 MHz as a primary service on a shared basis. The introduction of TOB services into these frequency bands is an outcome of the 2010 review of the 2.5 GHz band (2500-2690 MHz) and long term arrangements for electronic news gathering. These arrangements were amended in 2022 to implement planning outcomes of our review of the 2 GHz band.

The operation of TOB services in the bands 1980-2110 MHz and 2170-2300 MHz is supported by the *Radiocommunications (Television Outside Broadcasting) (2010–2110 MHz and 2200–2300 MHz) Frequency Band Plan 2022* [10] and (under certain circumstances) by *Radiocommunications (Mobile-Satellite Service) (1980-2010 MHz and 2170-2200 MHz) Frequency Band Plan 2022* [8] .

Coordination between TOB transmitters and PTS receivers is achieved through the general requirements for the operation of TOB transmitters in *RALI FX 21 Television Outside Broadcasting Services 1980-2110 MHz and 2170-2300 MHz* [11] and set out below.

TOB transmitter general requirements:

- must not operate in the guard bands 1980-1985 MHz and 2170-2175 MHz;
- maximum radiated power must not exceed 23 dBm/8 MHz in the bands 1985-2010 MHz and 2175-2200 MHz;
- out-of-band emissions are limited to a maximum power spectral density of -30 dBm/MHz at the 1980 MHz, 2170 MHz, 2110 MHz and 2300 MHz frequency boundaries;
- airborne TOB transmitters are not permitted to operate in the bands 1980-2010 MHz and 2170-2300 MHz; and
- antenna height is restricted to no greater than 2 m in the band 2105 -2110 MHz for transmitters with a maximum radiated power greater than 23 dBm/8 MHz EIRP.

Coordination between new fixed PTS transmitters and TOB fixed receivers see assessing interference PTS into TOB section 4.13. For further information see *RALI FX21 Television Outside Broadcasting Services in the Bands 1980-2110 MHz and 2170-2300 MHz* [11].

3.9. Underground PTS

PTS networks in underground locations such as mines are increasingly being sought by users. Due to the service being located underground, the potential for interference to

any coordinated above ground station is low. Thus, no formal coordination for or with these services is considered necessary provided **Special Condition C23** and advisory note BL are attached to any licence issued. There is also no limit on how much of the 2 GHz band can be used in an underground environment under these conditions. However, coordination among multiple underground PTS licensees is a site management issue and should be resolved by underground site manager. Moreover, the arrangements for underground PTS in this RALI do not apply in any 2GHz spectrum licensed space. **Special Condition C23** is applied to the licence in order to protect other services from interference. **Special Condition C23** limits the above ground emissions and requires that stations operate under a 'no interference and no protection basis'. Advisory Note BL indicates that the band is under review and that the licensed transmitter may be required to cease operation upon notice.

When applying for a licence, an above ground PTS transmitter position indicating the nominal location of the underground facility, must be used. This is intended to provide an indication of where the underground use is occurring. Multiple underground devices may be operated under any licence issued, without the requirement of registration, provided the requirements of **Special Condition C23** are not exceeded.

Other parameters that should be used on any licence applications are:

- EIRP: 10 μ W
- Antenna ID: 80219
- Antenna height: 1.5 m
- Antenna azimuth: omni directional

For an existing PTS licence that does not support underground communications (ie no **Special Condition C23**), the licensee may apply to vary their existing licence to support underground transmitters using the procedure as above.

Part 4 PTS Coordination Procedure

4.1. Overview of Coordination Procedure

This part provides an overview of the coordination procedure to be followed.

To perform the coordination, access to licence data for existing assignments is required. This data is available on the ACMA's Register of Radiocommunications Licences (RRL) that is available for purchase on CD-ROM.

The coordination procedure described here determines the compatibility of a proposed PTS with existing services operating in a particular frequency band in a given area. For typical coordination assessments the steps outlined below (or relevant parts thereof) need to be completed.

- Step 1. Identify potentially affected receivers;
- Step 2. Determine the wanted power at each receiver from its transmitter;
- Step 3. Determine the unwanted power at each receiver from the proposed transmitter;
- Step 4. Determine the required protection criteria for each identified victim receiver;
- Step 5. Compare the calculated unwanted level or wanted-to-unwanted ratio at each receiver against the applicable protection criteria.

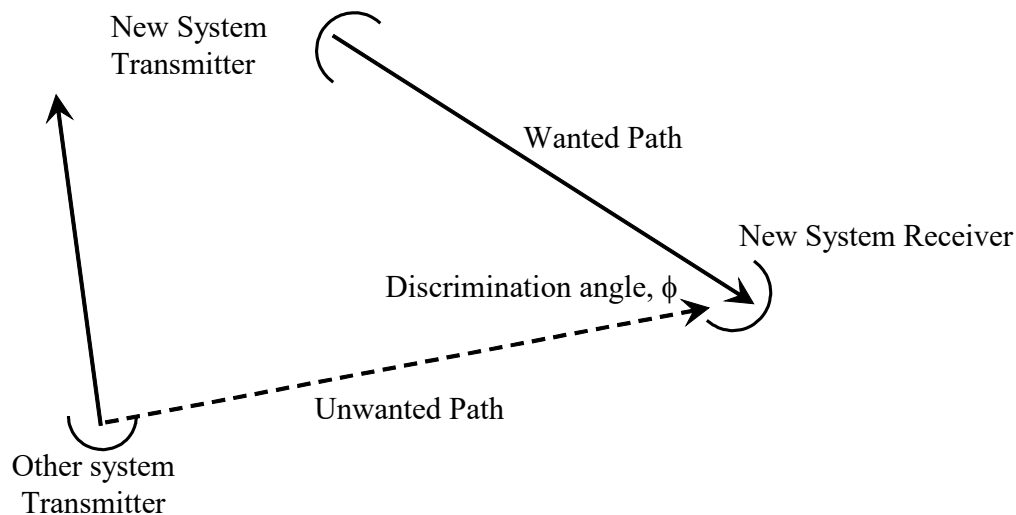
4.2. Detailed description of Coordination Procedure

Step 1: Identify potentially affected receivers or interfering transmitters

The first step is to identify all receivers that may be affected by the operation of the proposed system. Only those receivers operating within a frequency cull range and located within a distance cull radius need to be considered. If no potential victim receivers are identified within the frequency and distance cull ranges then no further coordination calculations are required.

To assess the effects of other systems into a proposed system it is necessary to identify all transmitters falling within specified frequency and distance cull limits. Figure 3 illustrates a wanted system being interfered with from an unwanted signal.

Figure 3. Illustration of wanted and an unwanted signals



Step 2: Determine wanted signal power at each receiver from its associated transmitter

Step 2 of the coordination procedure is to calculate the level of wanted power at each receiver identified in step 1. Note that this step is only relevant in the case of interference into fixed link receivers.

Step 3: Determine the unwanted power at each receiver from the proposed transmitter

Step 3 of the coordination procedure is to calculate the level of unwanted power at each receiver identified in step 1.

Step 4: Determine the required protection criteria for each identified victim receiver

Step 4 of the coordination procedure is to determine the applicable protection criteria for each victim receiver identified in step 1. To protect receivers from unacceptable interference, the unwanted power levels at a victim receiver must not exceed the required protection criteria for that receiver.

In this RALI a maximum allowable unwanted level criterion is used for protection of PTS receivers and protection ratios are used for protection of fixed link receivers.

When applying protection ratios for protection of fixed link receivers, the protection ratios should be adjusted to take account of actual path length and geoclimatic zone. Protection ratio correction factor graphs are provided in Attachment 2c.

Example of Protection Ratio correction factor adjustment

An example calculation of the protection ratio for a digital fixed link receiver with the following parameters is shown below:

Input data:

Centre Frequency	=	1.98 GHz
bandwidth	=	29 MHz
P_L	=	10
link path length	=	50 km

$$PR = \text{co-channel PR} + (\text{adjustment for } d=50 \text{ km and } P_L=10)^{12}$$

$$= 60 + (-7) \quad \text{dB}$$

$$= 53 \quad \text{dB}$$

Step 5: Comparison with protection criteria.

Step 5 of the coordination procedure compares the calculated levels from Step 2 and Step 3 with the protection values obtained from Step 4. Two cases are detailed below depending on which type of protection criteria is required.

Case one: Protection Ratio

The protection criterion is met for a particular victim receiver if the wanted-to-unwanted power ratio equals or exceeds the required protection ratio for that receiver. That is:

$$\text{Wanted Signal} - \text{Unwanted Signal} - \text{Protection ratio} \geq 0$$

¹² see Attachment 2c

If the wanted-to-unwanted power ratio equals or exceeds the protection ratio for each victim receiver then the protection criteria has been met and spectrum sharing is possible. However, if the wanted-to-unwanted power ratio is less than the protection ratio at any of the victim receivers then, for those receivers, the new transmitter is deemed to be causing unacceptable interference.

Case two: Maximum Unwanted Level

The unwanted signal level at the victim receiver is compared to a maximum unwanted level. This is generally expressed in dBm per bandwidth (e.g. dBm/5MHz).

If the unwanted signal level exceeds the maximum unwanted level for any victim receiver then the transmitter is deemed to be causing unacceptable interference. However, if the unwanted signal level is equal or less than the maximum unwanted level for each victim receiver then the protection criteria has been met and spectrum sharing is possible.

Note: Where Protection ratios and Protection Criteria are required for frequency offset values other than those shown in the tables at Attachment 2 the value applying to the lesser offset case should be used.

4.3. Propagation Models

Path losses between systems may arise through a range of propagation mechanisms, depending on the factors. Some of the main propagation mechanisms are: line of sight (free space loss), smooth earth diffraction and diffraction over obstacles and irregular terrain (knife-edge diffraction).

Information on how to determine propagation losses due to diffraction over obstacles and irregular terrain can be found in *ITU-R Recommendation P.526 [12]*, which also covers spherical Earth diffraction.

The interference protection criteria extracted from RALI FX-3 are applicable for interference levels exceeded for 20% of the time. Therefore, when drawing a path profile to calculate diffraction losses an Earth curvature factor of $k = 3$ should be used. This will give results corresponding to signal levels exceeded for 20% of the time. There is no need to apply a correction factor for location variability as the method yields results only appropriate to the one receiver location.

In performing frequency assignment work, the ACMA recommends the use of the propagation models defined in *ITU-R Recommendation P.452 [13]* under clear sky conditions for an annual time percentage of 20% or *ITU-R Recommendation P.526 [12]* using a k-factor of 3. However, assigners are free to choose an alternative propagation model to be applied for a particular path, provided it is justifiable.

4.4. Further Options if Coordination is not Successful

If the protection criteria are not met, then spectrum sharing is not possible unless further steps are taken by the applicant. If the proposal is to be pursued further, the applicant may consider the following options:

- modifying the configuration of the proposed system to meet the protection criteria (this may include modifying the equipment to limit operation to a smaller portion of the band, or changing the locations, antenna height, proposed EIRP, etc.);
- negotiating an agreement with the affected or affecting licensee(s) regarding changes to the system;
- applying for a licence to conduct test transmissions to assess the actual propagation loss.

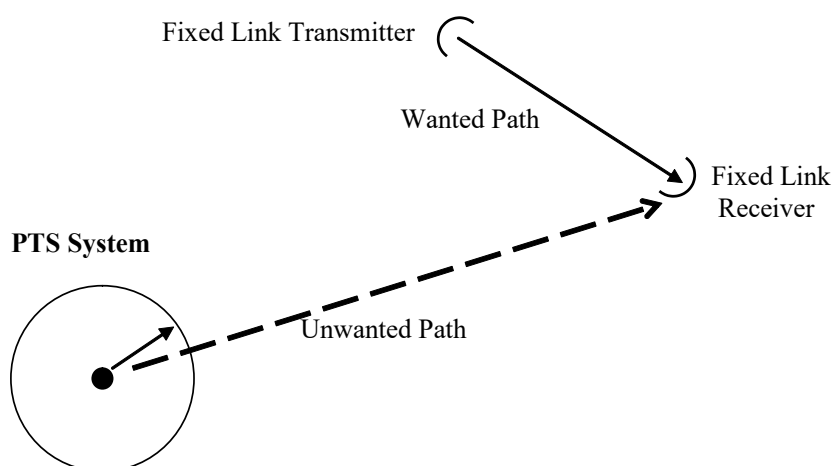
4.5. Assessing Interference: PTS into Fixed Links

Interference from a proposed PTS system transmitter into a fixed link receiver is assessed using the Steps described in section 4.2. Steps 1 to 5 in conjunction with the additional clarifications given below are to be followed. This procedure can also be used to assess potential interference into a proposed fixed link receiver from an existing PTS system transmitter.

The coordination process calculates a wanted-to-unwanted signal level ratio at the fixed link receiver input and compares it against the relevant protection ratio value(s) given in the tables at Attachment 2b.

Figure 4 illustrates the wanted and unwanted paths on the basis of the deployment model detailed at Attachment 3.

Figure 4. Interference scenario PTS into point-to-point fixed link



Specific Step Clarification

Step 1: To identify potentially affected fixed link receivers, a recommended minimum distance cull around the site of the proposed PTS base station transmitter of 200 km is required. Anything within this radius should be included in the following steps.

A frequency cull is then applied to further reduce the number of cases requiring more detailed coordination calculations. Noting that different situations apply with respect to sharing with other services in the two bands, the required frequency culls are:

PTS Band	Fixed Link Receiver Frequency Cull Range
1920 – 1980 MHz	1888.5 – 2038 MHz
2110 – 2170 MHz	2038 – 2236.5 MHz

Step 3: This step requires calculations to be made for all victim receivers identified in Step 1. This needs to take into account the appropriate interference scenarios for the frequency band being considered. Three separate cases exist:

Case 1 For the band 2110 – 2170 MHz (PTS base station transmit), calculate the unwanted power level on the basis of the licensed details (or application details) for the PTS base station transmitter using transmit power and antenna gain (with any discrimination taken into account), the licensed (or application) fixed point-to-point receiver gain (with any discrimination taken into account), and propagation loss from the appropriate propagation model.

Case 2 For the coordination of low powered ubiquitous transmitters¹³ in the band 2110 – 2170 MHz, if the ubiquitous transmitter occupies spectrum at or within the second adjacent channel of the fixed link receiver channel and the geographical location of the PTS base station (from case one) is within 15 km of the fixed link receiver, coordination is deemed to fail.

This case is only considered if low powered ubiquitous terminals are to be deployed.

Case 3 For the band 1920 – 1980 MHz (PTS mobile transmit), calculate the unwanted power level on the basis of the notional PTS mobile station details (provided at Attachment 3), the licensed (or applicant) fixed point-to-point receiver gain (with any discrimination taken into account), and propagation loss from the appropriate propagation model.

If the PTS mobile station occupies spectrum at or within the second

¹³ Low powered ubiquitous transmitters include devices such as femtocells and smart repeaters that adhere to **Special Condition C21** specified in section 5.4.

adjacent channel of the fixed link receiver channel and the geographical location of the PTS base station is within 15 km¹⁴ of the fixed link receiver, coordination is deemed to fail. Generally as a result a licence will not be granted unless it can be shown that the coverage area of the PTS system does not overlap the interference zone of the fixed link receiver where the interfering system has the notional PTS mobile transmitter characteristics (see Attachment 3).

If the PTS mobile station occupies spectrum at or within the second adjacent channel of the fixed link receiver's channel and the geographical location of the PTS base station is greater than 15 km from the fixed link receiver, the notional PTS mobile station should be considered to be at the same coordinates and height as the PTS base station antenna.

Step 5: A comparison of the calculated wanted-to-unwanted ratios from Steps 2 and 3 with the relevant protection ratio value(s) in the tables at Attachment 2b will determine if the protection criteria at the victim fixed link receiver is achieved.

Note:

1. Case 1 and Case 3 coordination always needs to be performed for interference from both PTS base station transmitters in the 2110-2170 MHz band and notional PTS mobile station transmitters in the 1920-1980 MHz band interfering into fixed link receivers.
2. Case 2 coordination need only be performed if low powered ubiquitous transmitters are to be deployed under the proposed assignment. If the frequency assignment criteria is met, then **Special Condition C21** (see section 5.4) must be attached to relevant spectrum accesses. If the assignment is within 15 km of the geographical boundary of a spectrum licence then **Special Condition C2** should also be attached.

4.6. Assessing Interference: Fixed Links into PTS

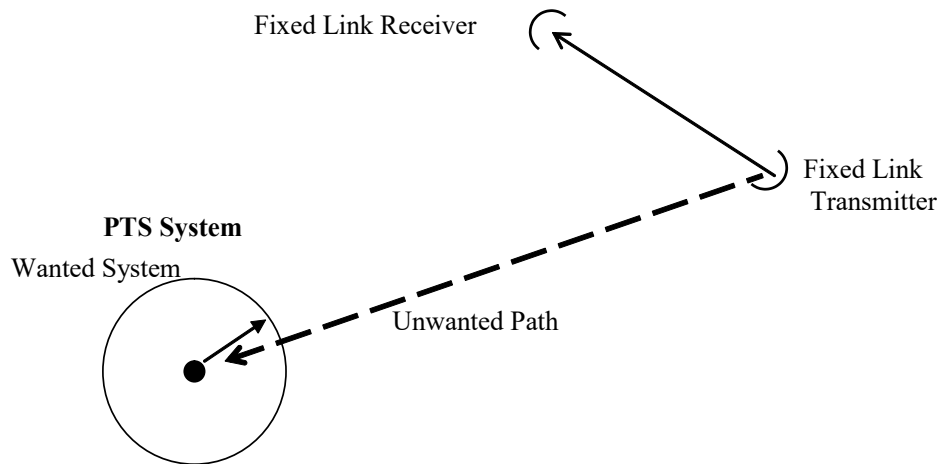
Interference from an existing fixed link transmitter into a proposed PTS system receiver is assessed using the Steps described in section 4.2. Steps 1 to 5 in conjunction with the additional clarifications given below are to be followed. This procedure can also be used to assess potential interference from a proposed fixed link transmitter into an existing PTS system.

The coordination process is to calculate the unwanted signal level at the PTS victim receiver and compare it against relevant protection criteria given in the tables at Attachment 2a.

¹⁴ The notional coverage area has been estimated at 15 km (based on a mobile transmitter EIRP of 30 dBm/5MHz, base station receiver sensitivity of -102 dBm/5MHz and notional system characteristics contained in Attachment 3).

Figure 5 illustrates the wanted and unwanted paths on the basis of the deployment model detailed at Attachment 3.

Figure 5. Interference scenario fixed link into PTS



Specific Step Clarification

Step 1: To identify potentially interfering fixed link transmitters, a recommended minimum distance cull around the site of the proposed PTS base station receiver of 200 km is required. Anything within this radius should be included in the following steps.

A frequency cull is then applied to further reduce the number of cases requiring more detailed coordination calculations. The recommended frequency culls are:

PTS Band	Fixed Link Transmitter Frequency Cull Range
1920 - 1980 MHz	1907.5 – 1994.5 MHz
2110 – 2170 MHz	2102.5 – 2178.5 MHz

Step 3: This step requires calculations to be made for all victim receivers identified in Step 1. This needs to take into account the appropriate interference scenarios for the frequency band being considered. Two separate cases exist:

Case 1 For the band of 1920 – 1980 MHz (PTS base station receive), calculate the unwanted power level at the PTS base station receiver, using the PTS base station licensed details (or application details) including antenna gain (with any discrimination taken into account), the fixed link transmitter power (EIRP) in the direction of the PTS base station receiver, and propagation loss from the appropriate propagation model.

Case 2 For the band of 2110 – 2170 MHz (PTS mobile receive), calculate the unwanted power level at a PTS mobile receiver using the notional PTS mobile receiver details (provided at Attachment 3), the fixed link

transmitter power (EIRP) in the direction of the notional PTS mobile receiver, and propagation loss from the appropriate propagation model.

If a fixed link transmitter occupies spectrum at or within the first adjacent channel of the PTS mobile station receiver's channel and its geographical location is within 15 km¹⁵ of the PTS base station, coordination is deemed to fail and a licence will not be granted.

If a fixed link transmitter occupies spectrum at or within the first adjacent channel of the PTS mobile station receiver's channel and its geographical location is greater than 15 km from the PTS base station, the notional PTS mobile station should be considered to be at the same coordinates and height as the PTS base station antenna.

Step 5: A comparison of the relevant values in the tables at Attachment 2a and the calculated unwanted signal levels (dBm/5 MHz) from Step 3 will determine if the level of interference into the PTS receiver is acceptable.

Note that this needs to be performed for interference from fixed link transmitters into both PTS base station receivers in the 1920-1980 MHz band and notional PTS mobile station receivers in the 2110-2170 MHz band.

4.7. Assessing Interference: PTS into PTS

Note: This process is not required between stations operated by the same licensee, as it is expected that the licensees will manage interference between their own stations.

Interference from a proposed PTS system transmitter into each potential victim PTS system receiver is assessed using the Steps described in section 4.2. Steps 1 to 5 in conjunction with the additional clarifications given below are to be followed.

Two scenarios are considered together in this section:

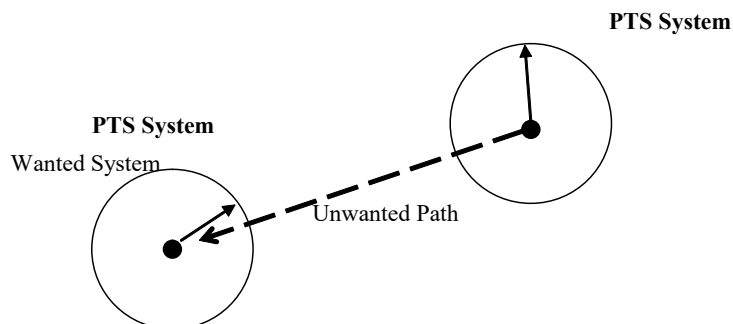
- interference from a proposed PTS transmitter to a licensed PTS receiver
- interference from a licensed PTS transmitter to a proposed PTS receiver

The coordination process is to calculate the unwanted signal level at the PTS victim receiver and compare it against relevant protection criteria given in the tables at Attachment 2a.

¹⁵ The notional coverage area has been estimated at 15 km (based on a mobile transmitter EIRP of 30 dBm/5MHz, base station receiver sensitivity of -102 dBm/5MHz and notional system characteristics contained in Attachment 3).

Figure 6 illustrates the wanted and unwanted paths on the basis of the deployment model detailed at Attachment 3.

Figure 6. Interference scenario PTS into PTS



Specific Step Clarification

Step 1: To identify potentially affected PTS receivers, a recommended minimum distance cull around the proposed PTS base station transmitter/receiver site of 100 km is required. Anything within this radius should be included in the following steps. A minimum co-channel reuse distance of 45 km will also be applied to PTS base stations operated by different licensees. Within the reuse distance of an existing PTS base station location, other co-channel PTS applications will not be considered. Beyond the reuse distance, co-channel coordination procedure detailed in the following steps should be followed.

A frequency cull is then applied to further reduce the number of cases requiring more detailed coordination calculations. Given that, in this case, the wanted and unwanted systems have the same bandwidth the frequency culls are made at ± 2.5 MHz from the centre frequency of the proposed channel (i.e. only co-channel coordination is required).

Step 3: Calculate the unwanted power level on the basis of the proposed details for the PTS base station transmitter using antenna gains (with any discrimination taken into account) and transmitter power, notional PTS mobile station parameters (provided at Attachment 3), and propagation loss from the appropriate propagation model.

A notional PTS mobile station is used as the victim receiver during coordination in this step. It should be considered to be at the same coordinates and height as the victim PTS base station antennas identified in step 1.

Step 5: A comparison of the values in the tables at Attachment 2a and the calculated unwanted signal levels (dBm/5 MHz) from Step 3 will determine if the level of interference into the PTS victim receiver is acceptable.

4.8. Assessing Interference: Spectrum Licensed Services

To best ensure compatibility, coordination of PTS licenses with existing Spectrum Licences will be subject to the same requirements as if devices were deployed under the 2 GHz spectrum licence technical framework.

This means that for all PTS base station transmitters located within 100 km of a spectrum licence boundary in the frequency range 2110-2170 MHz, device boundary requirements needs to be met. The device boundary requirements, including device boundary criteria and propagation model, are detailed in the *2GHz Spectrum Licence – Technical Framework – Section 145 Determination [6]*.

Prospective licensees should be aware that **Advisory Note FA** (see section 5.3) will also be attached to all PTS licences located within 100 km of a spectrum licence boundary. This note advises PTS licensees that within this distance, if interference into a PTS receiver occurs, the spectrum licensee has priority irrespective of date the spectrum licence device was first operated.

Prospective licensees wishing to deploy low powered ubiquitous terminals will also be required to attach **Special Condition C2** (see Section 5.4). This condition states that low powered ubiquitously deployed terminals may not be operated inside a spectrum licence space.

4.9. Assessing Interference: BWA into PTS

Interference from an existing adjacent channel BWA transmitter operating in the 1900-1920 MHz band into a PTS base station receiver is assessed using the Steps described in Section 4.2. Steps 1 to 5 in conjunction with the additional clarifications given below are to be followed. This procedure can also be used to assess potential interference from a proposed BWA transmitter in the 1900 -1920 MHz band into an existing PTS base station receiver.

The coordination process is to calculate the unwanted signal level at the PTS victim receiver and compare it against relevant protection criteria given in the tables at Attachment 2a.

Specific Step Clarification

Step 1: To identify potentially interfering BWA base station transmitters, a recommended minimum distance cull around the site of the proposed PTS base station receiver of 50 km is required. Anything within this radius should be considered.

A frequency cull is then applied to further reduce the number of cases requiring more detailed coordination calculations. The required frequency culls are:

PTS Band	BWA Transmitter Frequency Cull Range
1920 – 1937.5 MHz	1900 - 1920 MHz

Step 3: Calculate the unwanted power level at the PTS base station receiver, using the PTS base station application details (or licensed details) including antenna gain (with any discrimination taken into account), the BWA base station transmitter power (EIRP) in the direction of the PTS base station receiver, and propagation loss from the appropriate propagation model.

Any PTS base station receiver, identified in step 1, that requires coordination with¹⁶ and is within 20 km of a BWA base station operating in the 1900-1920 MHz band will be deemed to receive unacceptable interference. Therefore, a licence will not be granted.

Step 5: A comparison of the values in the tables at Attachment 2a and the calculated unwanted signal levels (dBm/5 MHz) from Step 3 will determine if the level of interference into the PTS victim receiver is acceptable.

4.10. Assessing Interference: Space Services into PTS

4.10.1. Near-Earth Earth Stations (2025-2110 MHz)

Interference from a Near-Earth Earth Station transmitter operating in the 2025-2110 MHz band (Earth station uplink band) into a PTS mobile receiver operating in the 2110-2170 MHz band is assessed using the methodology described in this section.

The coordination process is to determine whether a proposed PTS system is outside the specified minimum required separation distance.

Specific Step Clarification

Step 1: To identify potentially affected PTS system receivers, a minimum separation distance between a PTS system and a Near-Earth Earth Station transmitter operating in the 2025-2110 MHz band is employed. The required separation distance with respect to the operating frequency of a BWA system is given in the table below.

Any PTS systems located within these minimum separation distances will be deemed to receive unacceptable interference. Therefore, a licence will not be granted.

Operating Frequency (for PTS services)	Minimum required separation distance
2110-2115 MHz	20 km
2115-2170 MHz	N/A

¹⁶ Applications requiring coordination are identified in the tables under part 3 of Attachment 2a and differ depending on the bandwidth of the BWA base station in question.

4.10.2. Deep Space Earth Stations (2110-2120 MHz)

Interference from an Earth Station transmitter operating in the 2110-2120 MHz band (Deep Space Earth station uplink band) into a PTS mobile receiver operating in the 2110-2170 MHz band is assessed using the methodology described in this section.

The coordination process is to determine whether a proposed PTS system is outside the specified minimum required separation distance.

Specific Step Clarification

Step 1: To identify potentially affected PTS system receivers, a minimum separation distance between a PTS system and a deep space Earth station transmitter operating in the 2110-2120 MHz band is employed. The required separation distance with respect to the operating frequency of a BWA system is given in the table below.

Any PTS systems located within these minimum separation distances will be deemed to receive unacceptable interference. Therefore, the proposed service will not be registered.

Operating Frequency (for PTS services)	Minimum required separation distance
2110-2125 MHz	75 km
2125-2170 MHz	20 km

For PTS systems located in areas that fall outside the minimum required separation distance set out in the table above, the PTS operator must satisfy themselves that they will not be subject to interference through liaison with Earth Station operators, as the ACMA will not protect PTS mobile receivers from interference caused by Deep Space Earth Stations. This is in accordance with section 3.6.1.

4.11. Assessing Interference: PTS into Space Services

Interference from a proposed PTS system transmitter into each potential victim Earth Station receiver operating in the 2290-2300 MHz band (Deep Space Earth station downlink band), is assessed using the methodology described in this section.

Space Service protection requirements provided in this RALI have been determined from the protection requirements for Space Service station receivers as set out in the following ITU-R publications:

- *ITU-R Recommendation SA.1157: Protection criteria for deep-space research [14];*
- *ITU-R Recommendation SA.363-5: Space operation systems frequencies, bandwidths and protection criteria [15];*
- *ITU-R 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 [16].*

The coordination process is to determine whether a proposed PTS system is outside the specified minimum required separation distance. If this criterion is met then coordination is deemed to be successful.

Specific Step Clarification

Step 1: Any proposed PTS base station transmitter that is within 20 km of a deep space Earth station receiver will be deemed to cause unacceptable interference. Therefore, the proposed service will not be registered.

Any proposed PTS base station transmitter that is equal to or greater than 20 km from a deep space Earth station receiver will be deemed to not cause unacceptable interference.

4.12. Assessing Interference: PTS into CSIRO Alice Springs Earth Station

Interference to the Earth station receiver operating at 2106.40625 MHz from a potential PTS base station transmitter operating in the 2110-2170 MHz band is assessed using the methodology described in this section.

The coordination process is to determine if the proposed PTS base transmitter is located within a minimum separation distance of the victim Earth station receiver.

Specific Step Clarification

Step 1: Minimum separation distance for respective PTS frequencies around the site of the earth station receiver¹⁷ is provided below:

Operating Frequency (for PTS services)	Minimum Separation Distance
2110-2125 MHz	50 km
2125-2140 MHz	25 km
2140-2170 MHz	N/A

Any PTS system located within the minimum separation distance for a specific operating frequency will be deemed to be causing unacceptable interference. Therefore, the proposed service will not be registered.

Any PTS system in the frequency range 2140-2170 MHz does not require any coordination with the earth station receiver.

¹⁷ The earth station is located at 23°45'41" S, 133°52'52"E, GDA 94.

4.13. Assessing Interference: PTS into TOB

Protection of fixed TOB receivers from adjacent band 2 GHz 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 band fixed stations existing in the RRL at the time of licensing of the fixed TOB receiver. TOB receivers in the band 1980-2010 MHz adjacent to the PTS base station receive band cannot claim protection from mobile PTS transmitters.

To assess whether a fixed TOB receiver station will potentially be exposed to unacceptable interference from existing adjacent band 2 GHz 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:

$$P_{rx} < -147.3 \quad (4.13-1)$$

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:

$$P_{rx} = P_{ob} - L_p + G_{rx} \quad (4.13-2)$$

Where:

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

P_{ob}: Out of band e.i.r.p from a PTS service dependant on frequency offsets from band edge (see Table 4.13.1)

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

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

Out of band Power at Frequency Offset from band edge (dBm/MHz)				
Offset	0.0 - 0.75 MHz	0.75 - 1 MHz	1.0 - 5.0 MHz	5.0 - 20.0 MHz ¹⁸
	27.22	17.22	6.22	-0.78

Table 4.13.1: EIRP emission limits for 2 GHz PTS apparatus licence services

For more detailed parameters of TOB systems refer to [RALI FX21](#).

¹⁸ The ACMA recommends that a minimum of 5 MHz offset is used.

4.14. Site Engineering Aspects

At shared sites, or sites in close proximity, a number of potential interference mechanisms other than co-channel or adjacent channel interference may occur. These include: intermodulation; transient and spurious emissions; receiver desensitisation; and, physical blocking. These mechanisms are caused by non-linear and often complex processes that are, usually, not readily predicted using information contained in the ACMA's RRL. Nevertheless, a number of "site engineering" methods can be applied to address these potential interference scenarios. These include, but are not limited to, RF filtering, site shielding, frequency separation, site locations and power reduction.

Most of the above mentioned methods require co-operation and co-ordination between licensees. This is most easily achieved where the two systems are owned by the same licensee. In reality however, neighbouring systems are seldom owned by the same licensee, and therefore formal discussions may be required.

In the case of co-siting with spectrum licensed devices, if the interference from the spectrum licensed device is not the result of operation of the radiocommunications device in a manner that does not comply with the respective conditions of the licence, then licensees must take reasonable steps to negotiate arrangements likely to reduce the interference to acceptable levels. To assist in such situations, operators are also referred to the document *2GHz Spectrum Licence Technical Framework - Guidelines [7]* which specifies a minimum spectrum licence notional receiver performance.

The ACMA expects that licensees (or their site managers) will work cooperatively and apply good site engineering practice to resolve problems¹⁹.

4.15. Assignment Priority Order

Site Sense

PTS systems are required to observe site sense rules in the 2 GHz band by deploying base station transmitters in the 2110-2170 MHz portion of the band and base station receivers in the 1920-1980 MHz portion of the band.

¹⁹ Refer to RALI FX-3 section 3.3 for further discussion.

Assignment Rules

1. Preferred assignment allocations

In order to facilitate efficient use of the spectrum and an orderly assignment process, spectrum should preferentially be assigned to the following prospective applicants in the following segments of the 2 GHz band:

- VHA: 1920 – 1930 / 2110-2120 MHz
- Telstra: 1930 – 1940 / 2120-2130 MHz
- Applicants without a 2 GHz band spectrum licences should be preferentially assigned in the 1940 – 1950 / 2130-2140 MHz band in regional Australia.
- Optus: 1950 – 1960 / 2140-2150 MHz

In remote Australia existing spectrum licensees may also opt for the following assignment allocations:

- Optus: 1960 – 1965 / 2150-2155 MHz
- Telstra: 1965 – 1975 / 2155-2165 MHz
- VHA: 1975 – 1980 / 2165-2170 MHz

In the event the preferred assignment allocations are not available to the respective applicant, alternative spectrum can be sought. In this case assignments should be made from the highest frequency down taking into account *Rule 2* below.

2. Rules relating to applications for two paired 5 MHz channels²⁰ or one paired 10 MHz channel

As described in Part 5 of this RALI, in any given area²¹ applicants may not be assigned more than 20 MHz of spectrum. Wherever possible, applicants should be assigned contiguous spectrum lots. In the event the preferred assignment allocations are not available, applicants seeking two paired channels in the same area should preferentially be assigned two paired 5 MHz channels within the following frequency ranges:

- 1920 – 1930 / 2110-2120 MHz
- 1930 – 1940 / 2120-2130 MHz
- 1940 – 1950 / 2130-2140 MHz
- 1950 – 1960 / 2140-2150 MHz
- 1960 – 1970 / 2150-2160 MHz
- 1970 – 1980 / 2160-2170 MHz

²⁰ In the event that an applicant with an initial 5 MHz assignment applies for a second 5 MHz assignment in the same area, the rules relating to applications for two 5 MHz channels shall apply to the second application.

²¹ For the purpose of applying this rule a given area is the frequency reuse area of 45 km.

The same rule applies to licensees seeking access to one paired 10 MHz channel in the same area

In addition to these rules, assignments in the 2 GHz band should be made using channel sizes appropriate for the emission designator of the service deployed. That is UTRA (UMTS/WCDMA) assignments should be made in 5 MHz channels. However, E-UTRA (LTE) assignments can be made in 5 MHz or 10 MHz channels depending on the bandwidth of the emission designator. This requirement ensures RRL information accurately reflects what is deployed. This assists in coordination with other services such as BWA and point-to-point links is based as closely as possible on actual system characteristics. This will best ensure spectrum availability to all services operating in and around 2 GHz band.

Part 5 Licensing

5.1. Overview of Licensing

A Public Mobile Telecommunications Service Class B (PMTS B) apparatus licence for a PTS system may be issued to authorise the operation of a service that consists of 2 or more land stations. Devices used by consumers to communicate with the land stations would be authorised by the *Radiocommunications (Cellular Mobile Telecommunications Devices) Class Licence [2]*.

A PTS licence is defined in the *Radiocommunications (Interpretation) Determination [17]* as:

PTS licence means an apparatus licence issued for a service that consists of 1 or more stations that are operated for the provision of a public mobile telecommunications service.

Under the PTS licence type, the PMTS B licensing option is available for service in the 1920-1980 MHz and 2110-2170 MHz.

PMTS B apparatus licences authorising operation in the 1920-1980 MHz and 2110-2170 MHz bands will only be issued in geographic areas that are located outside the embargo areas defined in *RALI MS03: Spectrum Embargoes [3]* for the 1920-1980 MHz and 2110-2170 MHz bands.

In the 1920-1980 MHz and 2110-2170 MHz bands, 5 MHz and 10 MHz wide channelling will apply. No licensee may be assigned more than 20 MHz of spectrum (two paired 5 MHz channels or on paired 10 MHz channel) in the same area.

5.2. Licence Conditions

The operation of radiocommunications equipment authorised by a PTS licence is subject to:

- conditions specified in the *Radiocommunications Act 1992 [18]* (the Act), including an obligation to comply with the Act;
- conditions specified in the *Radiocommunications Licence Conditions (Apparatus Licence) Determination [19]*, the *Radiocommunications Licence Conditions (PTS Licence) Determination [20]*, *Radiocommunications (Cellular Mobile Telecommunications Devices) Class Licence [2]* and any other determinations made by the ACMA under section 110A(2) of the Act;
- the *Radiocommunications Licence Conditions (PTS Licence) Determination*, this includes conditions that allow the use of low-powered indoor devices (such as femtocells) under the following conditions:
 - *has an indoor fixed antenna and a radiated true mean power less than or equal to 24 dBm EIRP/occupied bandwidth;*
 - *is operated on a frequency specified in the licence for the operation of a radiocommunications transmitter that is, or is part of, another base station*

under the licence (the other base station); and

- *if the licence specifies an emission designator for emissions made by a radiocommunications transmitter that is, or is part of, the other base station – is operated in accordance with that emission designator; and*
- *is not used to extend the coverage area within which radiocommunications made by the other base station may be received.*
- conditions specified in the licence; and
- any further conditions imposed by the ACMA under section 111 of the Act.

5.3. Advisory Notes

The following user selectable **Advisory Note FS** must be attached to all licences authorising PTS systems in the 1920 - 1980 MHz band:

The shared spectrum arrangements and uncoordinated nature of mobile-satellite service transmitters operated under class licences in the 1980-2010 MHz band:

- a. may result in interference from nearby class licensed radiocommunications devices and may reduce system performance; and*
- b. protection from such interference cannot be afforded.*

The following user selectable **Advisory Note FA** must be attached to all licences for PTS sites located within 100 km of a spectrum licence boundary:

If interference to a station operated under this licence is caused by a radiocommunications device that is authorised to operate under a spectrum licence, the ACMA will consider any dispute from the starting point that the spectrum licence has priority over this licence, irrespective of the date that the spectrum licensed device was first operated.

The following user selectable **Advisory Note BL** must be attached to all licences for PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz that will be used to deploy devices underground:

This frequency band is currently under review to accommodate changes in technology. This review may lead to a requirement to change frequency or to cease transmission.

5.4. Special Conditions

Conditions of operation, which apply to an individual licence, will be printed on the licence under the heading 'Special Conditions'.

Special Condition FZ will be applied to all PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz. The intention is to encourage licensees to

cooperate and, where necessary, equally compromise to resolve adjacent channel interference.

The licensee must cooperate to the extent necessary to prevent its radiocommunications services from inhibiting the use of radiofrequency spectrum by other licensees operating under a public telecommunication service licence in the area surrounding the station location specified on this licence.

Special Condition FA1 will be applied to all PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz. The intention is to ensure that transmitters operating under a PTS licence do not cause harmful interference Earth station receivers operating in the 2200-2300 MHz band.

The operation of radiocommunications transmitters under this licence must not cause harmful interference to earth receive apparatus licences issued before the date of approval of this licence.

Special Condition C21 can be applied to spectrum accesses associated with PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz that will deploy low powered ubiquitous transmitters and meet the coordination criteria specified in this RALI. This allows transmitters that meet the criteria specified to be deployed without the need to record site specific information.

Special Condition C21

A person must not operate a:

- a) radiocommunications transmitter that is, or is part of, a station other than a registration exempt station otherwise than in accordance with section 8 of the Radiocommunications Licence Conditions (PTS Licence) Determination 2024 (PTS LCD); or*
- b) registration exempt station otherwise than in accordance with sections 9, 12 and 13 of the PTS LCD.*

*In this condition, **registration exempt station** has the same meaning as in the PTS LCD and also means a station:*

- a) that is, or incorporates, one or more radiocommunications transmitters (a **relevant transmitter**); and*
- b) for which each relevant transmitter:*
 - (i) has a fixed indoor antenna; and*
 - (ii) is operated with a radiated true mean power not greater than 24 dBm EIRP per occupied bandwidth; and*
 - (iii) is operated on a frequency specified in this licence for the operation of a radiocommunications transmitter; and*
 - (iv) if this licence specifies an emission designator for emissions made by a radiocommunications transmitter – is operated in accordance with that emission designator; and*

- (v) *is located within 15 kilometres of another base station (other than a low power base station) operated under this licence; and*
- c) *if a radiocommunications receiver is part of the station – the receiver is operated on a frequency specified in this licence.*

Special Condition C2 must be applied to all spectrum accesses associated with PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz that will deploy low powered ubiquitous transmitters within 15km of a spectrum licence geographical boundary. This prevents low powered ubiquitous terminals from being deployed within a spectrum licence space.

Special Condition C2

The licensee is not authorised to operate a station: (a) in the geographic areas; and (b) on the frequencies, where a spectrum licence is in force.

Special Condition C23 must be applied to all spectrum accesses associated with PTS licences in the frequency range 1920 to 1980 MHz and 2110 to 2170 MHz that will deploy devices underground.

Special Condition C23

A person must not operate a:

- a) *radiocommunications transmitter that is, or is part of, a station other than a registration exempt station otherwise than in accordance with section 8 of the Radiocommunications Licence Conditions (PTS Licence) Determination 2024 (PTS LCD); or*
- b) *registration exempt station otherwise than in accordance with sections 9, 12 and 13 of the PTS LCD.*

*In this condition, **registration exempt station** has the same meaning as in the PTS LCD and also means a base station:*

- a) *that is, or incorporates, one or more radiocommunications transmitters (a **relevant transmitter**); and*
- b) *that is located in an underground space; and*
- c) *for which each relevant transmitter:*
 - (i) *is operated with a radiated true mean power not greater than 10 micro watts per occupied bandwidth, when measured at an opening above ground that connects to the underground space; and*
 - (ii) *is operated on a frequency specified in this licence for the operation of a radiocommunications transmitter; and*
 - (iii) *if this licence specifies an emission designator for emissions made by a radiocommunications transmitter – is operated in accordance with that emission designator; and*
- d) *if a radiocommunications receiver is part of the station – the receiver is operated on a frequency specified in this licence.*

5.5. Spectrum Access Records

Technical details relating to the PTS system's base station, including, but not limited to, the actual operating EIRP, location, antenna height, type and orientation and transmit/receive frequency band, should be recorded.

Notes:

- Where sectorised antennas are used, details of the antenna model, down-tilt, polarisation and azimuth²² should be recorded for each sector.
- Where steerable beam antennas are used, details of the highest gain achievable through antenna phasing should be recorded.
- The coordination process described in Part 4 requires that protection to and from PTS mobile stations be calculated on the basis of assumed notional “worst-case” parameters for the PTS mobile station located within the 15 km coverage area from the PTS base station location. However, it is not required that data for the assumed PTS mobile station location should be recorded in the RRL.

RALI Authorisation

21/03/2024

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Spectrum Infrastructure Branch

Australian Communications and Media Authority

²² Where the sectorised antennas are combined to achieve an effectively omni-directional coverage (on a single channel) it is not necessary to specify the azimuth of each sector antenna.

Glossary

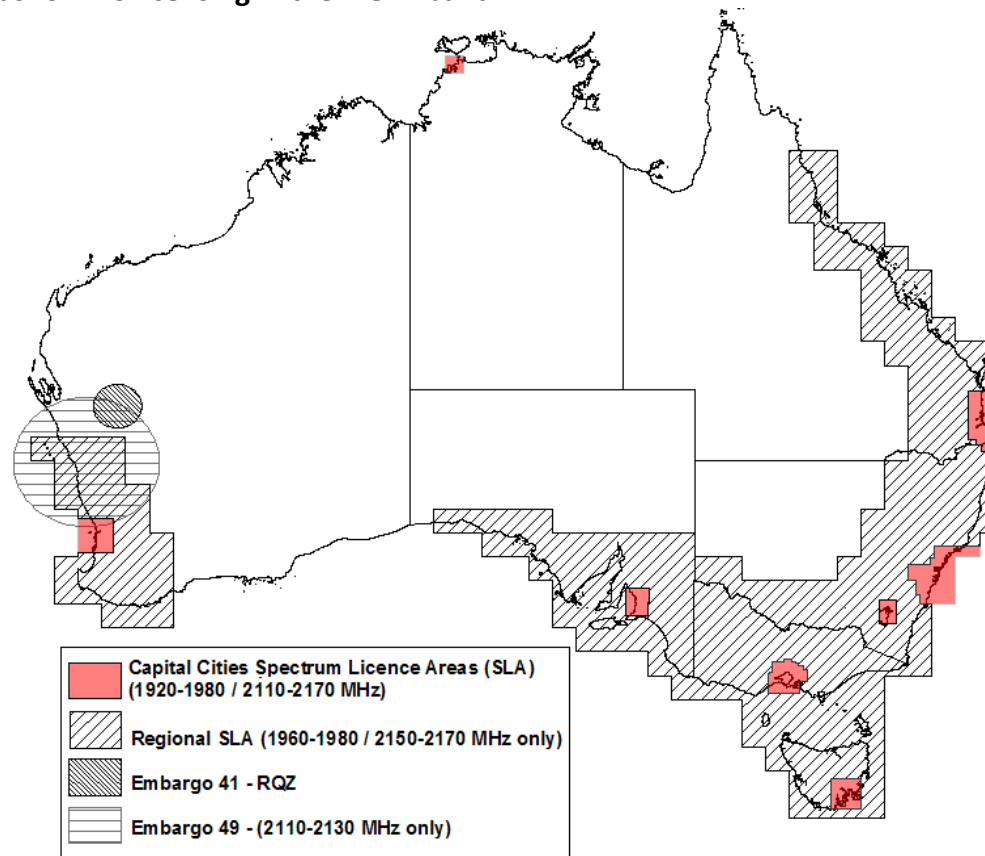
ACMA	Australian Communications and Media Authority
AL	Apparatus Licensed
ARQZWA	Australian Radio Quiet Zone Western Australia
BWA	Broadband Wireless Access
DECT	Digital Enhanced Cordless Telecommunications (previously known as Digital European Cordless Telecommunications)
EIRP	Equivalent Isotropically Radiated Power
FDD	Frequency Division Duplex
FWA	Fixed Wireless Access
ITU	International Telecommunication Union
LCD	Licence Conditions Determination
MSS	Mobile Satellite Service
PR	Protection Ratio
PTS	Public Telecommunications System
RALI	Radiocommunications Assignment and Licensing Instructions
RPE	Radiation Pattern Envelope
RRL	Register of Radiocommunications Licences
Rx	Receiver
SL	Spectrum Licensed
TDD	Time Division Duplex
TVOB	Television Outside Broadcasting
Tx	Transmitter

REFERENCES

1. *Australian Radiofrequency Spectrum Plan 2021*, Australian Communications and Media Authority, 2021, <https://www.legislation.gov.au/F2021L00617/asmade/text>
2. *Radiocommunications (Cellular Mobile Telecommunications Devices) Class Licence 2024*, Australian Communications and Media Authority, 2024, <https://www.legislation.gov.au/F2024L00315/latest/text>
3. RALI MS03 - Spectrum Embargoes, Australian Communications and Media Authority, 2023 <https://www.acma.gov.au/publications/2019-10/rules/rali-ms03>
4. *Radiocommunications (Spectrum Re-allocation Declaration) No. 2 of 2000*, Australian Communications Authority, 2000, <https://www.legislation.gov.au/F2004B00496/asmade/text>
5. RALI FX-3 - Microwave Fixed Services Frequency Co-ordination, Australian Communications Authority, [RALI FX3: microwave fixed services | ACMA](#)
6. 2 GHz Spectrum Licence Technical Framework – Section 145 Determination, means the *Radiocommunications (Unacceptable Levels of Interference - 2 GHz Band) Determination 2023*, Australian Communications and Media Authority, 2023, <https://www.legislation.gov.au/F2023L00159/asmade/text>
7. 2 GHz Spectrum Licence Technical Framework -Radiocommunications Advisory Guidelines, mean either the *Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters - 2 GHz Band) 2023* or *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 2 GHz Band) 2023* Australian Communications and Media Authority, 2023, [2 GHz technical framework | ACMA](#)
8. *Radiocommunications (Mobile-Satellite Service) (1980-2010 MHz and 2170-2200 MHz) Frequency Band Plan 2022*, Australian Communications Authority, 2022, <https://www.legislation.gov.au/F2022L00843/latest/text>
9. RALI MS32 - Coordination of Apparatus Licences within the Australian Radio Quiet Zone Western Australia, Australian Communications and Media Authority, [RALI MS32: Australian Radio Quiet Zone Western Australia | ACMA](#)
10. *Television Outside Broadcast (1980-2110 MHz and 2170-2300 MHz Frequency Band Plan 2022*, Australian Communications and Media Authority, 2022, <https://www.legislation.gov.au/Series/F2022L00843>
11. RALI FX21 - Television Outside Broadcasting Services 1980-2110 MHz and 2170-2300 MHz, Australian Communications and Media Authority, [RALI FX21: Television outside broadcasting services | ACMA](#)
12. ITU-R Recommendation P.526, version 4 onwards, “*Propagation by Diffraction*”, International Telecommunications Union, <http://www.itu.int/pub/R-REC>
13. ITU-R Recommendation P.452, “*Prediction procedure for the evaluation of*

microwave interference between stations on the surface of the Earth at frequencies above about 0.7 GHz", International Telecommunications Union, 2005, <http://www.itu.int/pub/R-REC>

14. ITU-R Recommendation SA.1157, "*Protection criteria for deep-space research*", International Telecommunications Union, 1995, <http://www.itu.int/pub/R-REC>
15. ITU-R Recommendation SA.363-5, "*Space operation systems frequencies, bandwidths and protection criteria*", International Telecommunications Union, 1994, <http://www.itu.int/pub/R-REC>
16. ITU, "*Radio Regulations*", 2008 onwards, <http://www.itu.int/pub/R-REG>
17. *Radiocommunications (Interpretation) Determination 2015*, Australian Communications Authority, 2015, <https://www.legislation.gov.au/F2015L00178/latest>
18. *Radiocommunications ACT 1992*, Commonwealth of Australia, <https://www.legislation.gov.au/C2004A04465/latest>
19. *Radiocommunications Licence Conditions (Apparatus Licence) Determination 2015*, Australian Communications Authority, 2015, <https://www.legislation.gov.au/F2015L00210/latest>
20. *Radiocommunications Licence Conditions (PTS Licence) Determination 2024*, Australian Communications Authority, 2024, <https://www.legislation.gov.au/F2024L00316/latest/text>

Attachment 1: Designated areas for PTS licensing in the 2 GHz band.

Apparatus licences for PTS systems may only be issued in the areas outside the shaded areas on a site coordinated basis. For precise definition of area boundaries refer to *Radiocommunications (Spectrum Re-allocation) Declaration No. 2* [4] and *RALI MS03-Spectrum Embargoes* [3]. Note that the areas defined by the Regional SLA and Embargo 49 do not extend across the entire 2 GHz band. Also note that the SLA for Canberra only occupies the bands 1935-1980 / 2125-2170 MHz, however criteria developed in this RALI does not allow apparatus licensing in this area.

Attachment 2a: Protection Criteria: PTS receivers**PROTECTION CRITERIA**

For the purposes of this attachment adjacent channels are defined with respect to the victim receiver's channel size. For example, in the case of an interference assessment for a point-to-point transmitter operating in a 14 MHz channel into a PTS receiver operating in a 5 MHz channel, the first adjacent channels refers to the 5 MHz channel either side of the victim receiver's occupied channel. The same logic is used to determine 2nd, 3rd and 4th adjacent channels.

1. Victim PTS base station receiver and interfering 1.8 GHz, 2.1 GHz or 2.2 GHz fixed link transmitter

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx
Co-channel	-102 (dBm per 5 MHz channel) -99 (dBm per 10 MHz channel)
1 st Adjacent Channel	- 57 (dBm per 5 MHz channel) - 54 (dBm per 10 MHz channel)
2 nd Adjacent Channel	

2. Victim PTS mobile receiver and interfering 2.1 GHz or 2.2 GHz fixed link transmitter

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx
Co-channel	-92 (dBm per 5 MHz channel) -89 (dBm per 10 MHz channel)
1 st Adjacent Channel	-59 (dBm per 5 MHz channel) -56 (dBm per 10 MHz channel)
2 nd Adjacent Channel	

3. Victim PTS base station receiver and interfering BWA base station transmitter

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 5 MHz → 5 MHz
Co-channel	-102 (dBm per 5 MHz channel)
1 st Adjacent Channel	- 57 (dBm per 5 MHz channel)
2 nd Adjacent Channel	- 52 (dBm per 5 MHz channel)
3 rd Adjacent Channel	

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 10 MHz → 5 MHz
Co-channel	-102 (dBm per 5 MHz channel)
1 st Adjacent Channel	- 57 (dBm per 5 MHz channel)
2 nd Adjacent Channel	- 52 (dBm per 5 MHz channel)
3 rd Adjacent Channel	- 52 (dBm per 5 MHz channel)
4 th Adjacent Channel	

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 20 MHz → 5 MHz
Co-channel	-102 (dBm per 5 MHz channel)
1 st Adjacent Channel	- 57 (dBm per 5 MHz channel)
2 nd Adjacent Channel	- 57 (dBm per 5 MHz channel)
3 rd Adjacent Channel	- 52 (dBm per 5 MHz channel)
4 th Adjacent Channel	- 52 (dBm per 5 MHz channel)
5 th Adjacent Channel	

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 5 MHz → 10 MHz
Co-channel	-99 (dBm per 10 MHz channel)
1 st Adjacent Channel	- 54 (dBm per 10 MHz channel)
2 nd Adjacent Channel	

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 10 MHz → 10 MHz
Co-channel	-99 (dBm per 10 MHz channel)
1 st Adjacent Channel	- 54 (dBm per 10 MHz channel)
2 nd Adjacent Channel	- 49 (dBm per 10 MHz channel)
3 rd Adjacent Channel	

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx 20 MHz → 10 MHz
Co-channel	-99 (dBm per 10 MHz channel)
1 st Adjacent Channel	- 54 (dBm per 10 MHz channel)
2 nd Adjacent Channel	- 49 (dBm per 10 MHz channel)
3 rd Adjacent Channel	

Note:

In the case of BWA interfering into PTS base station receivers, in some instances protection is afforded as far as the third adjacent channel due to the increased interference potential from BWA remote station transmitters.

4. Victim PTS mobile receiver and Interfering PTS base station transmitter (Note a)

Frequency Offset (MHz)	PROTECTION CRITERIA Digital Interferer Tx → Digital Victim Rx
Co-channel	-92 (dBm per 5 MHz channel) -89 (dBm per 10 MHz channel)
1 st Adjacent Channel	

- a. This only applies for protection between stations of different licensees, where a minimum separation distance of 45 km between PTS base stations of different licensees is applicable. No minimum separation distance applies to different stations operated by the same licensee. In such cases, it is expected that the licensee would manage interference between such stations.

General Notes:

1. Separate protection criteria for analog system interferers have not been defined. Digital criteria shall be applied in such cases.
2. When PTS channels sizes are greater than 5 MHz protection criteria should be scaled accordingly.

Attachment 2b: Protection Criteria: 1.8 GHz, 2.1 GHz and 2.2 GHz fixed link receivers**PROTECTION RATIOS**

For the purposes of this attachment adjacent channels are defined with respect to the victim receiver's channel size. For example, in the case of an interference assessment for a PTS transmitter operating in a 5 MHz channel interfering into a point-to-point receiver operating in a 14 MHz channel, the first adjacent channel refers to the 14 MHz channels either side of the victim receiver's occupied channel. The same logic is used to determine 2nd and 3rd adjacent channels.

1. Victim 1.8 GHz, 2.1 GHz or 2.2 GHz fixed link receiver and Interfering PTS transmitter

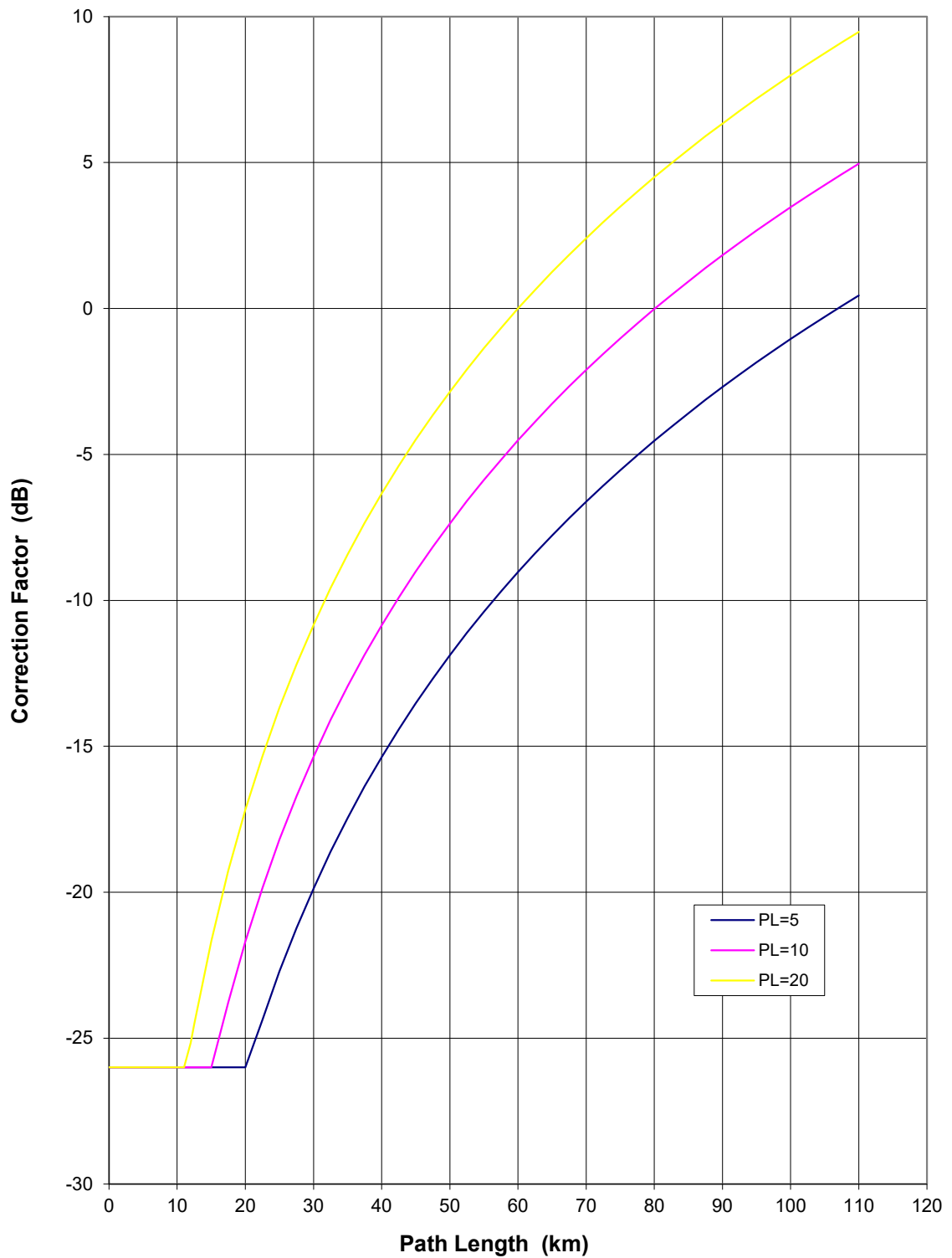
Frequency Offset (MHz)	REQUIRED PROTECTION RATIO (dB) Digital Interferer Tx → Digital Victim Rx
Co-channel	60
1 st Adjacent Channel	30
2 nd Adjacent Channel	0
3 rd Adjacent Channel	

General Notes:

1. Protection ratios are based on a 60 km path length and 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) of 20. For other path lengths and P_L values refer to the correction factor graph at Attachment 2c.
2. Separate protection ratios for analog victims have not been defined. The above-mentioned protection ratios for digital systems shall be applied in such cases.
3. Provisionally, protection ratio values quoted here are identical to those included in RALI FX-3 for comparable cases. However, designers should be advised that in future these values (and the comparable values in RALI FX-3) may be revised downward to increase the density of spectrum usage in these bands.

Attachment 2c: Protection Ratio correction factors

MULTI PATH



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.

Attachment 3: PTS system deployment model**Equipment types**

The equipment types and technologies considered in developing this RALI were:

- UMTS UTRA FDD (or WCDMA). A FDD CDMA system supported in the 2 GHz spectrum auctions for IMT2000/3G. Relevant standards are ETSI TS 125 104 (base station) and ETSI TS 125 101 (user equipment).
- E-UTRA FDD (or LTE). Relevant standards are 3GPP TS 36.104 (base station) and 3GPP TS 36.101 (user equipment).

Deployment model and general equipment characteristics

Deployment model values were chosen after considering typical PTS parameter values. The cell radius value (within which mobile stations will be protected under the constraints of the deployment model) was chosen to provide a reasonable protected deployment area but at the same time to promote opportunities for frequency re-use in other areas (by not protecting weak edge-of-coverage signals).

Base station Parameters	Deployment model Value	Range	Unit
Transmit Power	50	25 - 120	W
Feeder Loss	2	2	dB
Antenna Gain	19	11 - 19	dBi
F/B	28	0 - 30	dB
EIRP	67	56 – 71	dBm
Spurious EIRP > 30 MHz offset	-14	-14	dBm
Reference Bandwidth	5	5-20	MHz
Rx Noise Floor	-102	-100 → -102	dBm/5MHz
Antenna Height	30	variable	m
Maximum Cell Radius ²³	15	from 11 - 15	km
Adaptive Transmit Power Control	enabled	not specified	

Mobile station parameters	Deployment model Value	Range	Unit
EIRP	32	25 - 40	dBm
Rx Bandwidth	5	5-20	MHz
Rx Noise Floor	-98	-96 → -98	dBm/5MHz
Body Loss	8	8	dB
Antenna Height	1.5	1.5	m

²³ Cell radius for cases where the base station communicates with mobile stations with external antennas. While practical systems may in some cases achieve greater ranges, such operation is regarded as fortuitous and have not been catered for when developing planning models and protection criteria.

Notional Mobile Station

Maximum transmit power =	1 W (30 dBm/5 MHz)
Maximum antenna gain =	2.1dBi (omni directional)
Height =	1.5 m
Maximum cell radius =	15 km

Deployment scenarios

It is expected that, in most cases, base stations will be deployed in a manner that provides 360° coverage around the base station site. This could be achieved using an omni-directional antenna or a combination of sectored antennas. In the 2110-2170 MHz band, the base station transmitter is the interfering element to other services and the mobile receiver is the element being interfered from other services. In the 1920-1980 MHz band, the mobile station transmitter is the interfering element to other services and the base station receiver is the element being interfered from other services. All elements must be considered in the interference analysis.

Emission Masks

Emission characteristics should conform to the relevant standard paying particular attention to co-existence requirements.

In addition to this, PTS base station transmitters are required to comply with the emission limits set out in Attachment 4 of this RALI

Protection Criteria

Unlike fixed link protection ratios, which until now have been conservatively based and in many cases provide considerable excess fade margin, the PTS protection criteria in this RALI are deliberately biased towards permitting a high level of spectrum re-use while affording reasonable – though not excessive – levels of protection to the notional PTS service areas.

The maximum unwanted signal level for PTS receivers has been based on a level equivalent to the noise floor of the receiver (with an assumed receiver system noise figure of 5dB for the base station and 9 dB for the mobile). For a base station, within a nominal 5 MHz channel the level of -102 dBm has been specified. For a mobile station, within a nominal 5 MHz channel the level of -90 dBm has been specified, which takes into account an estimated body loss of 8 dB. Both of these protection criteria provide an interference-to-noise ratio of 0 dB (i.e. I/N = 0 dB).

Attachment 4: Emission Limits for PTS Operating in the 2 GHz Band

The equivalent isotropically radiated power (EIRP) of each PTS base station shall not to exceed the following levels:

- (a) +55 dBm horizontally radiated power measured in any 30 kHz bandwidth within the licensed bandwidth in the Upper Band, 2110 to 2170 MHz;
- (b) +12 dBm measured in any 30 kHz bandwidth between 0 kHz and 750 kHz above the upper and below lower edge of the licensed bandwidth;
- (c) +2 dBm measured in any 30 kHz bandwidth between 0.75 MHz and 1 MHz above the upper and below lower edge of the licensed bandwidth;
- (d) -9 dBm measured in any 30 kHz bandwidth between 1 MHz and 5 MHz above the upper and below lower edge of the licensed bandwidth; and
- (e) -16 dBm measured in any 30 kHz bandwidth at any point more than 5 MHz above the upper and below lower edge of the licensed bandwidth.

This emission requirement is shown graphically in the following diagram:

