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Australian Communications and Media Authority

Registration and technical requirements for Radionavigation-Satellite Service (RNSS) Repeater Devices (RRDs)

RALI: MS 49

DATE OF EFFECT: AUGUST 2025

Amendment history

Date	Comments
August 2025	Initial release

Suggestions for improvements to Radiocommunications Assignment and Licensing Instruction MS 49 may be addressed to:

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

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

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

Contents

1 Introduction

1.1 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide licensing procedures for Radionavigation-Satellite Service (RNSS) Repeater Devices (RRDs). For the purposes of this RALI, RRDs:

- are in the radiodetermination service;
- are terrestrial devices that are designed to receive RNSS signals transmitted from satellites and retransmit the signals locally to a specific type of enclosed service area described in this RALI;
- are devices that are not subject to a permanent ban under the *Radiocommunications (Jamming Equipment) Permanent Ban 2023*;
- are capable of retransmitting signals from a range of RNSS constellations within their frequencies of operation (listed below), including (but not limited to) Global Positioning System (GPS), Global Navigation Satellite System (GLONASS[1]), Galileo and BeiDou; and
- are devices that comply with ETSI Harmonised Standard EN 302 645.

The information in this document reflects the Australian Communications and Media Authority's statement of current policy in relation to licensing and frequency coordination for RRDs. In making decisions, ACMA officers and accredited persons should take all relevant matters into account and decide each case on its merits. Issues relating to this document that appear to fall outside the enunciated policy should be referred to:

The Manager, Spectrum Planning Section
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or by email to: fregplan@acma.gov.au.

1.2 Scope

This RALI differs from many other RALIs as it does not prescribe a process for coordination between services. Rather it provides information for licensees on the general conditions under which RRDs may be licensed and the procedure for doing so (Chapter 4 – Technical requirements for RNSS Repeater Devices). Subject to the conditions described in this RALI being met, an RRD will generally be licensed and registered on the Register of Radiocommunications Licences (RRL). No coordination against other devices or services is required.

The additional guidance provided in this RALI (Chapter 5 – Additional guidance) is provided to assist in meeting the conditions. It is not binding nor does following that guidance guarantee the conditions will be met and a licence will be issued.

[1] Also an expansion of its Russian name: Global'naya Navigatsionnaya Sputnikovaya Sistem

This RALI only pertains to the licensing of RRDs. RNSS receiver devices, including those that might be served by an RRD, are authorised under the Radiocommunications (Radionavigation-Satellite Service) Class Licence 2025 (or any instrument which replaces that instrument). It also does not include any information related to the licensing of pseudolites.

The scope of this RALI is limited to radiocommunications licensing, which is not the sole permission necessary to deploy and/or operate an RRD. One of the conditions of licensing a device pursuant to this RALI is that the entirety of the RRD's intended service area must be confined within an area in which operation of the device is permitted by the owner/administrator(s) of that area.

Lastly, within the intended service area, there is an expectation that RRDs will be deployed in a way that augments RNSS reception without distorting or providing misleading positioning and timing information. This means that careful RRD network design and layout will be necessary in order to maintain positioning integrity within the service area. A radiodetermination licence does not absolve an operator from any legal recourse that may result from poor network design or layout or faulty equipment.

2 Service description

An RRD is characterised as a device designed to receive RNSS signals at surface locations on the earth, originally transmitted from satellites, and to retransmit them to service areas where RNSS signal reception would otherwise be poorly received or not received at all, such as in indoor, undercover or underground environments.

The definitions for RNSS receiver, RNSS repeater station and RNSS repeater system are included in the Radiocommunications (Interpretation) Determination 2025 (ID 2025).

3 Licence structure

RRDs will be authorised under the radiodetermination licence type.

Under the ID 2025, a radiodetermination device's purpose is primarily one of:

(a) determination, on the basis of propagation properties of radio waves, of:

(i) the position of an object; or

(ii) the velocity of an object; or

(iii) other characteristics of an object; and

(b) the obtaining of information about characteristics mentioned in paragraph (a).

The operation of a radiocommunications device authorised by a radiodetermination licence is subject to:

- conditions specified in the *Radiocommunications Act 1992* (the Radcomm Act), including an obligation to comply with the Radcomm Act;
- in particular, as stated in paragraph 107(1)(d) of the Radcomm Act, a condition that any radiocommunications device operated under the licence must comply with all standards applicable to it under the equipment rules;
- conditions specified in any determinations made by the ACMA under section 110A of the Radcomm Act;
- conditions specified in the licence under paragraph 107(1)(g) of the Radcomm Act; and
- any further conditions imposed by the ACMA under section 111 of the Radcomm Act.

4 Technical requirements for RNSS Repeater Devices

4.1 Deployment Conditions

RRDs will be restricted to deployments in fixed locations and in undercover, underground and/or indoor locations only. This means that the radiating antenna or element will be located undercover, underground and/or indoors.

4.2 Intended Service Area

An RRD intended service area is to satisfy all of the following criteria:

- An area confined entirely within an enclosed structure or underground environment, such as a building, aircraft hangar, tunnel or mine;
- An area in which an RNSS receiver would not otherwise be able to adequately receive satellite transmitted RNSS signals for the purposes of timing and positioning; and
- An area in which RRD coverage (in its entirety) has been expressly permitted by the site/facility/area owner or occupant.

4.3 Frequencies of Operation

Subject to this RALI, RRDs will transmit in all or part of the frequency bands:

- 1164 – 1300 MHz
- 1559 – 1610 MHz.

4.4 Relevant Standards

The licensing regime for RRDs will require that devices are compliant with ETSI Harmonised Standard EN 302 645. RRD installations also should take into account the recommendations given in ECC Recommendation (10)02.

4.5 Installation Requirements

EN 302 645 is to be complied with to its entirety. Some of the key installation requirements in EN 302 645 are presented below:

4.5.1 System limits

A maximum retransmitted RNSS signal Effective Isotropic Radiated Power (e.i.r.p.) is not prescribed, however the total RNSS repeater system gain, including summed receive/transmit antenna gains and all radiofrequency (RF) amplifiers, is not to exceed 45 dB. That is:

$$G_{total} = [\text{antenna gain(s)} + \text{amplifier gain(s)} - \text{cable losses}] \leq 45 \text{ dB}$$

A total cable loss of up to 3 dB can be taken into account, thus the total sum of antenna and amplifier gains must not exceed 48 dB for cabling losses ≥ 3 dB.

Chaining two or more RRDs to increase overall system gain above +45 dB would generally not be permitted as this increases the risk of harmful inference to unacceptable levels.

The maximum output power of the RNSS repeater system, when subject to signals that are not defined as RNSS type signals, should be restricted to a limit of -20 dBm.

This limit applies to the out-of-band emissions of non-RNSS type signals that have been received and amplified within the RNSS repeater bands. This limit also applies to any emissions of non-RNSS type signals, that have been partly amplified, and that are adjacent to, but outside of the RNSS repeater bands. The limiting output power is not to exceed –27 dBm for a synthesised (sinusoidal) input signal below 1151 MHz.

Spurious emission limits are listed in Tables 2 and 3 of EN 302 645. Table 2 of EN 302 645, reproduced below in Table 1, prescribes general out-of-band spurious transmission limits.

Table 1 RRD transmitter spurious emissions outside permitted frequency ranges (ETSI Harmonised Standard EN 302 645)

Frequency range	Maximum e.r.p. (≤ 1 GHz), e.i.r.p. (> 1 GHz) (dBm)	Measurement bandwidth (kHz)
30 – 47 MHz	-36	100
47 – 74 MHz	-54	100
74 – 87.5 MHz	-36	100
87.5 – 118 MHz	-54	100
118 – 174 MHz	-36	100
174 – 230 MHz	-54	100
230 – 470 MHz	-36	100
470 – 862 MHz	-54	100
862 MHz – 1 GHz	-36	100
1 – 1.164 GHz	-30	1000
1.3 – 1.559 GHz	-30	1000
1.61 – 12.75 GHz	-30	1000

Table 3 of EN 302 645 contains more stringent limits in specific frequency bands where certain technologies are operating within the service area. That table is reproduced in table 2 below with the exception of frequency bands that are not relevant to Australian spectrum allocations. Please note that some frequency bands in table 2 are overlapping with frequency bands in table 1. In all cases, table 2 will have precedence over table 1.

Table 2 Specific spurious emissions limits for protecting systems operating in certain frequency bands (based on ETSI Harmonised Standard EN 302 645 excluding bands that do not reflect the Australian use of the spectrum)

Band for co-existence requirement	Maximum e.r.p. (≤ 1 GHz), e.i.r.p. (> 1 GHz) (dBm)	Measurement bandwidth (kHz)
960 – 1.151 GHz	-52	1000
1.805 – 1.88 GHz	-47	100
1.71 – 1.785 GHz	-61	100
1.9 – 1.92 GHz	-52	1000

All of these limits stated in this sub-chapter must be complied with. A special condition is stated in Chapter 4.7.1.3 and will generally be included on licences.

4.6 Boundary Conditions

Operators of RRDs are to ensure that device positioning and EIRP levels are such that the calculated emissions on any permitted frequency will not exceed a level of -140 dBm/24 MHz, as received by an isotropic antenna at a distance of 30 metres from any edge of the service area. In this context, “edge” includes any openings from the indoor/undercover space such as tunnel entry/exit points or hangar doors. Calculations are to be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation, clutter loss etc). This boundary condition is adopted from the National Telecommunications and Information Administration (NTIA) Manual of Regulations and Procedures for Federal Radio Frequency Management section 8.3.28.

4.7 Registration[2]

Details of the RRD, including its location and relevant operating characteristics, are to be registered (through the process of apparatus licensing) in the RRL prior to operation. In addition, the licensee is to provide a point of contact (see Chapter 4.7.2 – Advisory notes) and ensure that the point of contact can be contacted directly for immediate correction in case of equipment malfunction or misalignment resulting in interference to RNSS reception outside the intended service area.

[2] This registration is completed as a part of the apparatus licensing process.

4.7.1 Applicable licensing conditions

The licensee must comply with the conditions set out in the *Radiocommunications Licence Conditions (Transmitter Licence) Determination 2025* (or any instrument which replaces that instrument) and in individual licence(s).

Conditions of operation which apply to an individual licence are to be printed on the licence instrument. The application of special conditions by the ACMA will be considered on a case-by-case basis as required. However, the ACMA generally intends to impose the following conditions.

4.7.1.1 No interference to other stations

For all licences authorising the operation of RRDs:

> *No interference shall be caused to stations of other services operating in accordance with the Australian Radiofrequency Spectrum Plan.*

4.7.1.2 Boundary condition

For all licences authorising the operation of RRDs:

> *Radionavigation Satellite Service (RNSS) Repeater Devices (RRDs) are limited to a maximum Effective Radiated Power (ERP) value that will result in power levels not exceeding a power spectral density of -140 dBm/24 MHz, as received by an isotropic antenna at a distance of 30 metres from the boundary of [name of the enclosed operational area to be added here].*
>
> *Compliance with the above requirement can be verified via calculation that is based on free space propagation with no allowance for additional attenuation (e.g., building attenuation, clutter loss etc).*
>
> *On request from an officer of the ACMA, the licensee must provide the ACMA copies of these calculations within 20 working days.*

4.7.1.3 System, unwanted emission and spurious emission limits

For all licences authorising the operation of RRDs:

> *Radionavigation-Satellite Service (RNSS) Repeater Devices (RRDs) must comply with the following technical limits:*
>
> 1. *The total RNSS repeater system gain must not exceed 48 dB for cabling losses ≥ 3 dB.*
> 2. *The maximum output power of the RNSS repeater system, when subject to non-RNSS type signals, must be restricted to a limit of -20 dBm.*
> 3. *Spurious emission from the RNSS repeater system must be limited as per Tables 1 and 2 of RALI MS49.*

4.7.1.4 Notification to the affected users

For all licences authorising the operation of RRDs:

> *The licensee must take all practical measures to notify Airservices Australia and other major users of RNSS devices for positioning and timing*

information, using the contact details provided in RALI MS49, before devices authorised by this licence are first operated.

Contact details applicable to the above special condition are listed on the ACMA website: RALI MS49. Notification is to include the relevant licence number, contact point for the licensee and the date when operation will commence.

4.7.2 Advisory notes

The following advisory notes are to be added to all licences authorising the operation of RRDs:

4.7.2.1 Point of contact

The designated point-of-contact for the resolution of harmful interference caused by a radiocommunications transmitter authorised by this licence is XXXX (name) at XXXX (phone no).

4.7.2.2 System definition

This licence authorises XX numbers of RRDs to be operated at XX (location).

4.7.2.3 Non-compliance of the boundary condition

Any malfunction, misalignment, or tampering of the equipment or misalignment of its location which results in an increased power spectral density (as stated in the boundary condition) outside the intended service area could cause harmful radio frequency interference to RNSS receivers, including those in aircraft and/or ground based facilities.

5 Additional guidance

It is critical that the installation of RRDs does not cause any degradation of service for any period of time to RNSS receivers operating outside the service area. It is also critical that RRD placement and installation will minimise the geographic extent of the 'handover' area at the service area edge and that positioning integrity will be maintained within the service area. The conditions (including the incorporated standard) set out in Chapter 4 of this RALI are designed to achieve this goal; however, installation factors will influence the extent to which these conditions are met. The following is intended to be read as guidance to help meet these conditions and is neither mandatory nor can following it be considered as a replacement for meeting the conditions in Chapter 4, when included on a licence.

The 'handover' area refers to the interface between the service area and the outside area served by RNSS satellites (i.e. 'normal' RNSS operation). By definition, RRDs transmit on the same frequencies as RNSS, so there is a geographic point at which the signal levels from the RRD and RNSS satellites will be roughly equal and RNSS reception is likely to be adversely affected. Adherence to the boundary conditions set out in Chapter 4.7.1.2 should ensure that the handover area is confined to within the service area. For example, in a tunnel, this would be somewhere close to (but inside) either end of the tunnel opening. Implementation should also be conducive to the minimisation of this handover area, which will be a function of the positioning and number of RRDs within the service area.

Adherence to boundary conditions will also minimise the risk of interference to RNSS receivers outside the service area occurring. To lower the risk of interference, RRD operators should consider:

- An RRD network design that places RRD transmit antennas as close as possible to the areas that are intended to be served, so as to enable minimal RRD transmission power. This may necessitate that multiple lower power RRDs are used instead of a smaller number of higher powered RRDs.
- Through-building attenuation varies by building materials and other construction factors. Depending on RRD positioning, this might not be sufficient to meet the prescribed boundary conditions in all cases, especially considering that doors and windows, for example, usually provide considerably less through-building attenuation than solid walls.
- Use of antenna (inwards) directivity, RRD placement as far away as possible from boundaries and/or the application of additional boundary RF attenuation or shielding might help further ensure adherence to the boundary conditions.
- Cabling loss of up to 3 dB is factored into the total RRD system gain. Any loss greater than 3 dB will limit the effective area of each RRD. Spacing between the RRD receive and transmit antennas should be sufficient to ensure the device operates correctly (noting the need to have good visibility of the sky for the receive antenna), but close enough to minimise cabling loss. Similarly, cabling loss can be minimised through the use of high quality, low loss cables.

6 RALI Authorisation

[~~Not~~ Approved] 25/06/2025

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