

Boeing Australia response to the ACMA Interim access to 5055-5065 MHz for Line of Sight Remotely Piloted Aircraft Systems Control and Non-Payload Communication links

Boeing Australia welcomes the ACMA initiative for interim access to part of the 5 030-5 091 MHz C-Band spectrum for remotely piloted aircraft systems (RPAS) in Australia.

The Australian and global unmanned aircraft systems (UAS) industry is undergoing exponential growth and consequently needs to be supported with forward thinking and timely spectrum regulation.

The Boeing Company, Boeing Australia and its subsidiaries are leaders in the field of unmanned technology innovation and integration, driving the safe design and integration of autonomous systems that include perception, machine learning, and advanced flight control systems.

Boeing's focus on UAS development includes mission-specific technologies for a wide range of tasks, including search and rescue, disaster response, asset and force protection, border security, wildlife monitoring, agricultural assessment, communications relay, anti-piracy, firefighting and supporting mining operations.

Boeing Australia has long sought reliable access to 5 030-5 091 MHz to support our products requiring protection in flight, which is not possible in the generally utilised class licence frequency bands.

With increasing numbers of UAS in the skies, larger aircraft using highly advanced technology, the access to secure spectrum to support UAS has never been greater.

The ACMA initiative is most welcome and Boeing Australia will seek to utilise this opportunity for our commercial and developmental projects.

Terminology

For the purpose of this paper:

- When referencing 'line of sight' (LoS) in the draft RALI it is understood technically this is 'radio line of sight' or 'RF LoS' as defined in ITU-R Report M.2171.¹
- Remotely piloted aircraft systems (RPAS), drones, unmanned aircraft (UA), unmanned aircraft systems (UAS), unmanned aerial vehicles (UAVs) are generically referred to as 'RPAS', unless referenced otherwise.

Boeing Australia appreciates the ACMA's positive actions to facilitate new RPAS spectrum in Australia and offers comments in this response to support and value add to the draft Radiocommunications Assignment and Licensing Instructions (RALI) in the interests of Australian RPAS industry, operators, aviation in general and public safety.

¹ *Radio line-of-sight (LoS)*: is defined as the direct radio line of sight radiocommunication between the unmanned aircraft (UA) and unmanned aircraft control station (UACS).

Boeing Australia is of the view that there are two overarching objectives that should influence ACMA's radiocommunication spectrum regulation for RPAS in this frequency band.

1. Industry to access the entire frequency band as soon as practicable for existing and emerging RPAS use cases, and
2. Ensuring the regulatory regime is appropriate for aviation safety-of-life spectrum.

Boeing Australia notes and agrees that these arrangements are interim and changes may be needed to the proposed RALI on the basis of international developments to radiocommunication operational standards for RPAS terrestrial LoS operations.

Boeing Australia views on aspects of the draft RALI

Spectrum Channelling arrangements

A total of 10 MHz is allocated at 5 055-5 065 MHz, roughly mid-way in the aeronautical mobile (route) service (AM(R)S) spectrum of 5 030-5 091 MHz. A maximum occupied bandwidth is 250 kHz for both ground and air radio stations. Thereby, a total of forty 250 kHz channels is available.

This siting of the interim frequency access midway in the frequency band may in part be based on an ICAO band plan to accommodate beyond LoS (BLoS) satellite operations in the top and bottom 20 MHz of the AM(R)S allocation of 5 030-5 091 MHz, with LoS frequency mid-band.² Recognising development of a BLoS satellite access is a far from being achieved, Boeing Australia supports use of the entire frequency range for terrestrial LoS communications until such time that BLoS RPAS operation is feasible.

Consequently, Boeing Australia, while welcoming interim access to the frequency band, is disappointed in the small 10 MHz allocation and is of the view that it will not be viable for use by larger and more sophisticated RPAS.

Conditional on industry uptake of the interim access spectrum, the 10 MHz allocation could quickly become occupied and unavailable in certain geographical locations.

With the entire AM(R)S C-band unencumbered it is not clear why ACMA has proposed the small allocation. There are minimal interference issues that would prevent the entire frequency band being available for LoS RPAS and adjacent frequency ranges are also lightly used. The notable requirement to protect RNSS system downlinks in the adjacent 5 010-5 030 MHz frequency band is covered under Radio Regulations footnote No. **5.443C**.³

The allotment of 250 kHz for air and ground stations is insufficient for more advanced medium/large RPAS.⁴ These type aircraft often require sophisticated CNPC Link Systems cumulatively needing more than 250 kHz including applications such as:

² Annex 10 - Annex 10 – Aeronautical Telecommunications - Volume VI - Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link

³ **5.443C** 'The use of the frequency band 5030-5091 MHz by the aeronautical mobile (R) service is limited to internationally standardized aeronautical systems. Unwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5010-5030 MHz band. Until such time that an appropriate value is established in a relevant ITU-R Recommendation, the e.i.r.p. density limit of -75 dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station'

⁴ Medium 25-100 kg, large >150 kg <https://www.casa.gov.au/drones/drone-rules/drone-safety-rules/types-drones>

- high bandwidth video for take-off and landing
- high-priority detect and avoid (DAA), sometimes visually (video)
- RPAS flight control and configuration messages
- air traffic control (ATC) communications, including distress calls and urgency messages
- flight safety telemetry messages, including low-priority DAA messages
- flight safety messages
- routine telemetry messages and air traffic services other than ATC communications
- in some instances, weather radar.

Boeing Australia and our subsidiaries are engaged in development and operation of UAVs that often require sufficient spectrum for large surveillance UAVs and potentially human passenger RPAS travelling over medium/long ranges. While the 250 kHz narrowband will easily accommodate the need of small UAVs for commercial requirements, which we support, ACMA needs to allocate more than 10 MHz to maximise the value of the interim access for medium to large UAVs, especially when sufficient spectrum is available and currently fallow.

Assignment procedure

The draft RALI has a 'notional' geographic service area for LoS operation of '200 km radius from the registered aeronautical station location.' For the purposes of the draft RALI Boeing Australia accepts this geographical services area.

However, as the service area is 'notional' it would be incumbent on ACMA to consider requests for a greater service area where operators have a business or experimental need.

Given the size of Australia and the value of RPAS operating in greater distances than 200 km extended service areas should be entertained. This may be achieved by the use of link ground stations to provide an increased operational range from the remote pilot control station. In such a configuration more CNPC links are needed and thereby putting additional pressure on the proposed 40 channel narrowband allocation.

Licence type

ACMA proposes issuing licences as 'aeronautical licences', usually for 12 months, and subject to established aviation operational and safety regulations. In accordance with the aeronautical licence provisions Airservices Australia will manage the aeronautical frequencies and this will now include the channels available in the AM(R)S C-band.

While fundamentally Boeing Australia has no issue with Airservices Australia's role, we are concerned that this will incur a level of administrative burden both on Airservices Australia and the operators. While Airservices rightly approves aeronautical services for licencing, in the case of allocating channels to RPAS in C-band it would be inefficient and time consuming to expect Airservices to do this administrative work.

In the June 2021 Boeing Australia response to the ACMA discussion paper on *Use of the 5 030-5 091 MHz band for remotely piloted aircraft system control and non-payload communications* we referenced a proposal made by the Aerospace Industries Association (AIA) in a petition to the FCC to *Adopt Service Rules for Unmanned Aircraft Systems ("UAS") Command and Control in the 5030-5091 MHz Band* for a dynamic frequency assignment process.

The AIA dynamic frequency assignment process proposes an authorised remote pilot in charge (PIC) can secure access to necessary frequency channels covering a specific geographic area, and then release those channels as soon as the UAS flight is completed.⁵

Central to the AIA proposal is an UAS or RPAS 'Frequency Assignment Manager.' The AIA proposal anticipates authorised PICs would initiate spectrum access requests, specifying the proposed take-off time and flight duration, as well as the geographic area and/or path of the flight. It is anticipated the automated database could either assign available frequency channels to the PIC, or should radio frequency channels at the specific geographic location or requested bandwidth be unavailable, immediately indicate the request is unsuccessful.

While the responsibility to establish and operate such a database would likely fall on Airservices Australia, the automation of the database would remove most of the onerous administration and introduce near real time availability for operators.

The AIA proposal is a creative means to dynamically assign and efficiently utilise the AM(R)S C-band spectrum. Boeing Australia encourages ACMA and Airservices Australia to explore this option or a similar cost-effective efficient channel assignment approach.

Finally, subject to the aeronautical licence conditions, operators must be accredited by the Civil Aviation Safety Authority to operate an aeronautical station. Boeing Australia fully supports this established licence condition.

Technical requirements

The specifications cited in the draft RALI are based on current ITU-R Reports and draft Recommendations. Boeing Australia is comfortable with this approach. As the ACMA indicates there may be changes to various standards in place, and being developed, for the CNPC RPAS use and any international developments may lead to variations in the current draft RALI.

In addition to the ITU-R publications used by the ACMA a key recognised standard for CPNC links is the United States' Radio Technical Commission for Aeronautics (RTCA) *Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial)*.⁶ Elements of these MOPS may well apply to the Australian situation bearing in mind they have been designed for application in the United States.

Boeing Australia endorses the ACMA open approach to potential variations to the draft RALI. This approach is essential in support for manufacturers and operators that ensures a global standard of services rules for the development and operation of RPAS as appropriate.

⁵ Full detail on this proposal is included in the AIA's [Petition to Adopt Service Rules for Unmanned Aircraft Systems \("UAS"\) Command and Control in the 5030-5091 MHz Band](#)

⁶ <https://www.rtca.org/sc-228/>

Applicable licensing conditions

The draft RALI proposes 'special condition 27' is 'to be applied to all licences authorising the operation of an AM(R)S RPA system in 5055–5065 MHz band.'

The condition states:

No interference shall be caused to any radiocommunication station or service and no protection from interference by such stations or services shall be afforded.

Boeing Australia is of the view this condition is not appropriate for this frequency band.

The 5 030-5 091 MHz frequency band is globally allocated as a primary aeronautical mobile radiocommunication (R) service.

The International Telecommunication Union's Radio Regulations - Article **1.33** defines AM(R)S as 'An aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes.'

There are some international and domestic caveats on AM(R)S C-band operations including:

- protection of radionavigation satellite services (RNSS) in the adjacent 5 010-5 030 MHz frequency band.
This is addressed with technical detail in RR Article **5** footnote No. **5.443C**.
- Protection of microwave landing systems under RR Article **5** footnote No. **5.444**.
This is no longer relevant as the technology is redundant, and in Australia no such systems are operational.
- Protection of a limited number of radio astronomy observatories in Australia. This is also afforded under various RR footnotes as well as footnotes to the *Australian Radio Frequency Spectrum Plan* Table of Frequency Allocations.
These protections are to specific geographical locations of Australian radio astronomy observatories have been in place for a long time and are well recognised.

The RPAS 5 030-5 091 MHz C-band allocation is, and must remain, aviation safety spectrum. The purpose of this allocation is to ensure the safety and regularity of flight for UAS operations, consistent with AM(R)S allocations for spectrum used by unmanned aircraft.

Currently the radiocommunication requirements of small UAVs or drones have been successfully met through the Low Interference Potential Devices (LIPD) and the Industrial Scientific and Medical class licence spectrum. Whereas, access to C-band ultimately will consist of more complex operations requiring access to protected spectrum not available in the class licenced frequency bands.

It is expected flights utilising the protected C-band will include missions and platforms larger than small or hobbyist aircraft, experimental and commercial carriage of human passengers, large payloads, and operations at a broad range of altitudes.

It is essential ACMA ensures that the use of the C-band RPAS spectrum is, and remains, an aviation safety-of-life allocation, and that licensee requirements are consistent with that condition.

Notional service area

The draft RALI includes a licence condition authorising the operation of an AM(R)S RPAS in the 5 055-5 065 MHz frequency band to a specific 200 km geographical service area:

The licensee should ensure that the notional geographic service area for LoS operation is confined to a 200 km radius from the registered aeronautical station location. i.e. 200 km radius from the registered aeronautical location.

Boeing Australia, in this early stage of regulation, does not have a concern with the geographical restriction except that ACMA should remain open to exemptions to this condition on a case by case basis.

Essentially there are many instances where RPAS can, and should, be utilised to operate much further than the 200 km radius from the aircraft station. This is foreseen in flight missions for military, mining, natural disaster monitoring and response and humanitarian and medical emergencies. This will require additional terrestrial infrastructure support mostly by link ground stations.

Standard duration of the licence

ACMA proposes RPAS operating in C-Band AM(R)S spectrum will be in accordance with the aeronautical licencing conditions which are typically 12 months.

Boeing Australia agrees this is an appropriate duration for the licences.

Operating parameters

The draft RALI includes an advisory note applied to all licences that the interim arrangements of the RALI may be amended subject to 'future planning and licencing considerations for the band.' The advisory note states:

This licence has been issued as part of an interim licensing arrangement to facilitate the use of 5055-5065 MHz for RPAS CNPC. Depending on the outcome of future planning and licensing considerations for the band, the ACMA may seek to amend the frequency or other operating parameters of the licence to align with longer-term planning arrangements.

Boeing Australia supports this advisory note and welcomes the flexibility of the regulator to remain open to the evolving standards across global standards development organisations that can afford operational and equipment manufacture harmonisation.

Conclusion

Boeing Australia welcomes and congratulates the ACMA on this initiative to make part of the AM(R)S C-Band radiofrequency spectrum available to the operation of RPAS in Australia subject to the conditions of the draft RALI *Interim access to 5055 – 5065 MHz for Line of Sight (LoS) Remotely Piloted Aircraft Systems (RPAS) Control and Non-Payload Communication (CNPC) links*.

In the interest of success of the interim access Boeing Australia proposes:

- Special condition 27 'no interference / no protection' is not appropriate for the frequency band 5 030-5 091 MHz allocated to the safety-of-life aeronautical mobile (R) service. This frequency band is allocated for safety-of-life operations globally through the International Telecommunication Union (ITU) Radio Regulations. Australia as a Member State of the ITU has an obligation to uphold the provisions of the Radio Regulations including this safety-of-life service allocation.
- The limited frequency access at 5 055-5 065 MHz with forty 250 kHz channels, while satisfactory for small RPAS operations, will not be sufficient for medium/large RPAS.
 - With the entire AM(R)S C-band unoccupied and no near-term possible use for BLoS satellite RPAS missions, the draft RALI should be reviewed to extend the amount of frequency variable and number and width of channels to accommodate operation of the larger UAV.
 - At a minimum ACMA should increase the 'interim' spectrum allocation to 20 MHz.
- ACMA should work with Airservices Australia to explore a means to establish a dynamic frequency assignment process to efficiently manage approved operator access to the frequency band on an automated basis.

In conclusion Boeing Australia commends the ACMA for taking this spectrum regulatory initiative and offers the above comments in good faith.

Boeing Australia is available to work with the ACMA to assist in ways we can to establish and expands RPAS C-band spectrum to the benefit of all.

Respectfully submitted,



Dr Brendan Nelson
President
Boeing Australia,
New Zealand and South Pacific



Neil Meaney
Regional Director Asia-Pacific
Global Spectrum Management
Boeing Australia Holdings

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