Boeing Australia Holdings
Pty Ltd
A.B.N. 42 101 168 932
Level 10, 10 Bridge Street
Sydney NSW 2000
Australia

Boeing Australia Holdings
Response to the Australian Communications and Media Authority
Draft Five-Year Spectrum Outlook 2023-2028

Boeing Australia Holdings appreciates the opportunity to respond to the ACMA's draft *Five Year Spectrum Outlook 2023-2028* consultation paper (draft FYSO).

Our response focuses on key radiofrequency bands of interest to our domestic, Asia-Pacific and global operations active in Australia.

About Boeing Australia Holdings

Boeing Australia Holdings (Boeing Australia) employs more than 4,000 people in 38 locations across Australia through a network of subsidiary companies.

Boeing Australia has an extensive supply chain supporting our advanced manufacturing of commercial aircraft composite components, defence systems design and development, modeling and simulation, research and development, support and training, and unmanned systems.

Boeing Australia subsidiaries:

- Boeing Australia Holdings Limited
- Boeing Defence Australia
- Boeing Aerostructures Australia
- Boeing Distribution
- Insitu Pacific
- Jeppesen Australia

Our spectrum interests are many including, aeronautical, unmanned systems, defence, space, fixed and mobile satellite services, radiolocation, maritime, 5G, IoT and M2M applications.

We offer the following comments of direct interest to Boeing Australia based on radiofrequency bands discussed in the draft FYSO.

1.5 GHz (1 427-1 518 MHz) - Preliminary replanning

Current and future use

This high demand frequency band is presently allocated globally on a primary basis to fixed and mobile services with parts of the band allocated to space operations (Earth-to-space), broadcasting and broadcasting-satellite services.

IMT/5G identifications for the mobile service have been introduced across the frequency ranges 1 427-1 452 MHz and 1 492-1 518 MHz in Regions 1 (RR footnote **5.341A** and **5.341C** respectively) and in the entire frequency range of 1 427-1 518 MHz in Region 2 (RR footnote No. **5.341B**). The IMT/5G arrangements via the footnotes does 'not establish priority in the Radio Regulations' over other allocated services in the frequency bands.

For Regions 1 and 3 regulatory provisions and coordination triggers on BSS (sound) to protect IMT were introduced via a revision of Resolution **761 (Rev.WRC-19)**.[1]

Meanwhile work continues in the International Telecommunication Union Radiocommunication Sector (ITU-R) with a 2019 update to Recommendation ITU-R M.1036 to include frequency arrangements for implementation of the terrestrial component of IMT in the 1.5 GHz band.[2] The Recommendation also notes studies are still being conducted in accordance with Resolution **223 (Rev.WRC-15)** to provide possible technical measures to facilitate adjacent band compatibility.[3]

The ACMA notes 'there is support domestically from WBB representatives for progressing the re-farming of this band,' when in fact there is no WBB to be 'reframed' it is assumed the intention is to 'reallocate' services and applications in the frequency band for WBB.

Protection of the mobile-satellite service (MSS) in the adjacent frequency band

The adjacent 1 518-1 559 MHz frequency range is heavily utilised by a wide variety of satellite services worldwide (with the accompanying 1 626.5-1 660.5 MHz Earth to space link).

L-band is one of the lowest radio frequencies available for satellite services. The frequency range is highly suited for satellite communications in part due to a longer wavelength, thereby less affected by atmospheric attenuation in comparison to higher frequencies. L-band supports exceptionally high link availability, stable operations in the harshest of weather conditions, and facilitates increasingly higher speed broadband communications to users anywhere around the world.

The ITU-R compatibility studies have shown serious potential for harmful interference to MSS operations above 1 518 MHz from IMT in the adjacent lower frequency band.

MSS aviation terminals specifically require protection of aeronautical earth stations operating in 1 518-1 559 MHz from high powered IMT/5G base stations located near airports.

An outcome of WRC-19 saw a revision of Resolution **223** '*Additional frequency bands identified for International Mobile Telecommunications*' instructing the ITU-R to conduct compatibility studies to develop technical measures to ensure coexistence between MSS in the frequency band 1 518-1 525 MHz and IMT in the frequency band 1 492–1 518 MHz. These studies are still ongoing and focus on developing an ITU-R Recommendation to

[1] Resolution **761 (Rev.WRC-19)** - Coexistence of International Mobile Telecommunications and the broadcasting-satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3
[2] Recommendation 1036-6 - Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations
[3] Resolution **223 (Rev.WRC-19)** - Additional frequency bands identified for International Mobile Telecommunications

address coexistence between MSS and IMT.[4] Several options are proposed in this new Recommendation to mitigate interference into MSS from introduced IMT/5G transmissions, most commonly a guard band of up to 6 MHz.
The progress of this complicated study is slow, with limited work undertaken at the last meeting of ITU-R Working Party 5D (February 2023), the document remains at a low or initial status of a 'working document.'

Until the ITU-R adjacent band compatibility studies are settled, it would be of little to no value to progress consideration of an IMT/5G identification in Australia for extended L-band until there is useful clarity from the studies on technical measures to facilitate adjacent band compatibility between IMT operating potentially across the entire 1 427-1 518 MHz frequency range with existing MSS in 1 518-1 525 MHz.

The APT Wireless Group (AWG) have produced a Report 'on relevant information for considerations on the possible implementation of IMT in the frequency band 1 427-1 518 MHz' that simply provides a compilation of existing work, mostly ITU-R, on possible implementation of IMT in the frequency band 1 427–1 518 MHz.
Notably the Report references ITU-R studies are ongoing to develop technical measures to facilitate adjacent band compatibility between IMT in the frequency band 1 492–1 518 MHz and the MSS in the frequency band 1 518–1 525 MHz. The Report concludes 'APT Members are also encouraged to consider the results of these studies when implementing frequency arrangements for IMT in their countries.'

Aeronautical use of the frequency band

The 1 429-1 518 MHz frequency band is used nationally and in other countries for flight testing and aircraft control and non-payload communications (CNPC). The Australian Radiofrequency Spectrum Plan 2021 (ARSP) footnote AUS3 identifies use of the frequency band 'by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.'

Boeing Australia is committed to development of aircraft communications in the frequency band. Any future determinations in this frequency band should, as a priority, retain and protect the identification for flight testing as indicated in the ARSP footnote AUS3.

The Department of Defence noted in their submission to the 2022 FYSO;

> 'the need for spectrum for unmanned vehicles. This could potentially be supported through national arrangements across frequency bands including 1.5 GHz…. Defence finds that professional unmanned vehicles (in particular small to medium size) will likely need further spectrum options outside of class licensing regime e.g. popular WiFi bands.

Boeing Australia fully supports this view.

In May 2022 ACMA released the 'Review of the 1.5 GHz band' discussion paper which posed options for future use of the frequency band and coexistence issues with services in, and adjacent to, the frequency band.
ACMA has yet to respond to the May 2022 discussion paper.

[4] Document 5D/1668 Chapter 4 - Annex 4.5 – 'Working document towards a preliminary draft new Recommendation ITU-R M.[REC.MSS & IMT L-BAND COMPATIBILITY] - Technical and regulatory measures to provide compatibility between IMT and MSS, with respect to MSS operations in the frequency band 1 518-1 525 MHz for administrations wishing to implement IMT in the frequency band 1 492-1 518 MHz'

For 1.5 GHz (1 427-1 518 MHz) preliminary replanning Boeing Australia proposes:

- Supporting ITU-R studies to develop technical measures to facilitate adjacent band compatibility between IMT in the frequency band 1 492–1 518 MHz and the MSS in the frequency band 1 518–1 525 MHz.
- Until such guidance from ITU-R studies is resolved and options for extended L-band (see next section) are progressed the planning status for 1.5 GHz should be downgraded to 'initial planning'. Noting ACMA does not expect to release an 'options paper' on this frequency band until well into 2024.
- Under any future planning decisions, the need to retain the priority status of aeronautical mobile service for telemetry over other uses by the mobile service in accordance with ARSP footnote AUS3.
- Explore the options to accommodate UAS CNPC and payload communications in the frequency band.

Extended L-band (1 518–1 525 MHz and 1 668–1 675 MHz) MSS – Preliminary replanning

As noted above for 1.5 GHz the mobile-satellite service has a primary global allocation across 1 518-1 559 MHz (space to Earth) and the complementary 1 626.5-1 660.5 MHz (Earth to space) link, referred to as 'extended L-band.'

In the Radio Regulations both frequency ranges also have mobile and fixed allocations (mostly co-primary), while the upper frequency band has some primary meteorological services, radio astronomy and space research services allocations in parts of the frequency range.

ACMA had in previous FYSOs treated 1.5 GHz and 'extended L-band' as a composite consideration. In the current draft FYSO extended L-band has taken a precedence over 1.5 GHz for consideration of new IMT/WBB and 5G applications being introduced in Australia. The ACMA has decided 'it was appropriate to progress consideration of the extended L-band before the 1.5 GHz band,' although there is no detail on the reason for this decision.

In the absence of any further guidance it is assumed the priority is to replan the frequency band for expanded wireless broadband (WBB) 5G/IMT access.
If so, and not stated in the draft FYSO, WBB/5G/IMT would not be possible in the 1 668-1 675 MHz frequencies as 5G/IMT is incompatible with the sensitive and passive array of allocated services.

Given the current ACMA implementation of 3.4-4.0 GHz for WBB/5G including a spectrum auction of parts of the frequency band in the 2nd half of 2023 and until protracted ITU-R studies are settled, ACMA does not need to progress additional WBB/5G/IMT access to this important satellite radiofrequency band.

For extended L-band planning Boeing Australia proposes:

- Better guidance from the regulator on what it is planning for extended L-band i.e. is this to facilitate further WBB/5G/IMT applications, and if so,
- how ACMA proposes to protect existing primary mobile-satellite services, meteorological services, radio astronomy and space research services allocations in Australia from interference from new and incompatible WBB/5G/IMT applications?

3.3 GHz (3 300-3 400 MHz) - Monitoring

The 3.3 GHz frequency band is globally allocated to radiolocation services (RLS) on a primary basis. While there are IMT identifications afforded to some countries via footnotes to the Radio Regulations Table of Frequency Allocations, these applications specifically cannot claim protection from, or cause interference to, RLS allocated in the frequency band, a condition of the footnote identification.

The frequency band is a consideration of this year's ITU World Radiocommunication Conference for further identification of IMT and potential new mobile service allocations across a number of frequencies and various ITU Regions.[5]

In Australia ARSP footnote AUS100A applies and stipulates the frequency band is 'designated to be used principally for the purposes of defence and national security and the Department of Defence is normally consulted in considering non-defence use of this service,' as noted by ACMA in the FYSO.

The Department of Defence is concerned that expansion of IMT/5G into in this frequency band poses interference potential to Defence global radar operations. In the Department's submission to the 2022 FYSO it noted any potential future 'reallocation will impact a growing number of Defence radar capabilities including non-itinerant systems.'
Defence also noted the results of Study F of ITU-R Report M.2481[6] that clearly indicated that 'possible implementation of mitigation measures, applicable to Australian scenarios, could only make IMT deployment overly restrictive and further denying spectrum to key Defence radar capabilities that will be in service for several decades.'

Boeing Defence Australia is committed to providing equipment and services for the Department of Defence for radiolocation operations in this frequency band. It will be particularly important to monitor, and if necessary engage in progress of WRC-23 agenda item 1.2 at the conference to ensure developments in Regions 1 and 2 do not adversely affect the Department of Defence's radiolocation use, that at times are required beyond Region 3.

For Australia there is no solid case to seek IMT identification in this frequency range for the foreseeable future. Especially while 3.4-4.0 GHz is currently under implementation in Australia for IMT/5G/WBB in 5G mid-band spectrum (1-6 GHz) including a 5G spectrum licence auction in the 2nd half of 2023.

Boeing Australia proposes:

- Retain the current ACMA position 'monitor' for this frequency band.
- As this is a priority Defence frequency band ensure DoD is consulted on all future considerations.

[5] WRC-23 agenda item 1.2 'to consider identification of the frequency bands 3 300-3 400 MHz, 3 600 3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis'
[6] Report ITU-R M.2481 – 'In-band and adjacent band coexistence and compatibility studies between IMT systems in 3 300-3 400 MHz and radiolocation systems in 3 100-3 400 MHz'

3400–3575 MHz and 3700–4200 MHz bands – Implementation

While these frequency bands are undergoing reallocation for the introduction or extension of WBB/5G services Boeing Australia reiterates our serious concern about inadequate temporary mitigation measures to protect the safe operation of aircraft radio altimeters in the nearby frequency range of 4 200-4 400 MHz.

Radio altimeters are essential components of an aircraft for safe operation. The radio altimeter is the only sensor onboard an aircraft providing a direct measurement of aircraft clearance over the terrain and other obstacles. A radio altimeter is used during all phases of flight, but significantly during precision approaches to landing, determining aircraft proximity to the ground, and collision avoidance systems. A failure in this sensor can lead to catastrophic results.

Studies conducted internationally have analysed the impact of 5G systems in the frequency range 3 400-4 200 MHz. The studies have led to the USA, France, Canada, India and Japan introducing various mitigation measures to protect radio altimeters from interference from 5G transmissions. Each country has different 5G technical rollouts and consequently different mitigation measures to protect radio altimeters, i.e. one size does not fit all. For Australia the frequency ranges and power levels are susceptible to cause interference to the operation of group 2 and 3 radio altimeters (predominately used on civil aviation aircraft in Australia).

Our concerns have been previously documented in various submissions to the ACMA through the replanning process of these frequency bands and most recently to our 'Response to the ACMA's Proposed spectrum re-allocation declaration for the 3.4 GHz and 3.7 GHz bands - consultation paper.'[7]

The ACMA has proposed in the consultation paper temporary mitigation measures for WBB private networks operating at 3 800-3 950 MHz yet zero mitigation measures for the widespread operation and expansion of 5G commercial networks across Australia operating in 3 400-3 800 MHz.
While Boeing Australia welcomes the interim mitigation measures proposed for WBB private networks allocated in the frequency range 3 800-3 950 MHz, we express our profound concern that similar mitigation measures are not proposed for spectrum licensed 5G operations across Australia in the frequency range 3 400-3 800 MHz.
Boeing Australia does not accept that the ACMA has properly or correctly determined that mitigation measures are appropriate above 3 800 MHz but not necessary immediately below 3 800 MHz. This remains an ongoing concern to Boeing Australia and other Australian aviation industry interests.

Meanwhile, the aviation industry is actively addressing the problem by developing new technical standards for radio altimeter equipment designed to reject spurious and unwanted emissions from 5G transmissions. This is a process that will take time as technical standards are still under development and equipment is to be manufactured and eventually installed in aircraft.

The risk of harmful interference from new 5G/WBB to radio altimeters in the near term cannot be mitigated only by the aviation industry. In order to avoid unacceptable outcome from an incident where radio altimeters are negatively affected by 5G transmissions, the mobile service industry and spectrum regulators need to cooperate with the aviation industry to support appropriate interim mitigation measures to prevent interference to aircraft radio altimeters in the frequency band 4 200-4 400 MHz.

[7] ACMA consultation Draft allocation and technical instruments for the 3.4/3.7 GHz bands auction

Boeing Australia proposes:

- ACMA should expand the current mitigation measures proposed for 3 800-3 950 MHz to 5G commercial services in the frequency range 3 400-3 800 MHz consistent with what has happened in other jurisdictions.
- The regulator and telecommunication companies should work cooperatively on this mutual problem to establish and monitor agreeable and appropriate temporary mitigation measures to protect safe air travel in Australia from potential interference to critical aircraft radio altimeter operations from new and expanding 5G services.

4.0 GHz (4 400–4 990 MHz) - Monitoring

The frequency band is allocated globally on a co-primary basis to the fixed and mobile services also with a primary allocation to fixed-satellite services in 4 500-4 800 MHz.

For the frequency range 4 400-4 800 MHz in Australia, ARSP footnote AUS101 states the frequency band is 'principally for the purposes of defence and national security.' Also, RR footnote No. **5.440A** identifies the entire frequency band in Region 2 and Australia for aeronautical mobile telemetry for flight testing by aircraft stations and No. **5.442** identifies in Australia, the frequency band 4 825–4 835 MHz is also allocated to the aeronautical mobile service, limited to aeronautical mobile telemetry for flight testing by aircraft stations.

It is essential to commercial and defence aviation that any future planning preserves the integrity and intent of the footnotes.
Furthermore, in the domestic preparations for WRC-19, in reviewing existing Radio Regulations Table of Frequency Allocations footnotes that include Australia's name, it was noted for footnote Nos. **5.440A** and **5.442**, that the frequency bands are 'used by fixed and mobile stations operated by the Department of Defence, including for aeronautical mobile telemetry for flight testing by aircraft stations. Hence, this footnote(s) should be retained.' This was also the same position for WRC-15.

ACMA has noted in the draft FYSO 'there is some interest domestically from mobile network operators as well as from wireless internet service providers and other fixed wireless access operators in pursuing this band for WBB in Australia.' Further, Boeing Australia agrees with the ACMA observation that there is no widespread support for use of the frequency band for 5G/WBB applications from regional communication bodies such as CEPT, CITEL and APT.

Boeing Australia opposes a move to accommodate 5G in this frequency band given its proximity to the aviation radio altimeter safety of life allocation at 4 200-4 400 MHz. This mirrors the same predicament described above for the 3 400-3 575 MHz and 3 700-4 200 MHz frequency bands.

Radio altimeters are an essential component of a commercial and military aircraft enabling precision approach, landing, ground proximity and collision avoidance functions to work properly. Recently industry studies have identified potentially serious inference into radio altimeter systems from the operation of 5G macro base stations near the frequency band. Until this matter is resolved, it is in the critical interest of public safety this frequency band not be considered for identification of IMT/5G.

In previous draft FYSO's the Department of Defence noted in relation to frequency bands 4 400-4 500 MHz and 4 800-4 990 MHz Defence platforms could be directly affected due to possible radio frequency interference by the IMT in these frequency bands. The frequency ranges are part of the harmonised Five Eyes and NATO spectrum used extensively by defence. Such use is not compatible with 5G/IMT applications in the same frequency range.

The ITU World Radiocommunication Conference this year (WRC-23) will consider ongoing protection of aeronautical and maritime mobile services from IMT operations in international

airspace and waters. Currently services are protected by a pfd limit applied through RR footnote No. **5.441B**. The NATO position seeks to retain the pfd limit noting that this is 'consistent with the decisions of WRC-15 and WRC-19, the protection of aeronautical and maritime mobile stations operated in the band 4 800-4 990 MHz located in international airspace or waters needs to be maintained. This protection is on the basis of the pfd limit provided in RR **5.441B**, and cannot be fulfilled only through application of RR **9.21**.'[8] This position is consistent with the current Australian Preliminary Position for the WRC-23 agenda item.

Boeing Australia and subsidiaries have defence contracts in place and are reliant on this frequency band remaining as 'principally for the purpose of Defence.'

Boeing Australia is opposed to the introduction of 5G/IMT in this frequency range in Australia through the course of this five-year outlook and proposes:

- Retention of the planning status of 'monitoring' for this frequency band recognising the importance of protection of safety of life aeronautical radio altimeters in the adjacent 4 200-4 400 MHz frequency band.
- ACMA ensure the spectrum regulatory protection of the current arrangements in the frequency band in the interest of defence and national security use including continued support for the current Australian Preliminary Position on WRC-23 agenda item 1.1.
- Ensuring the retention of RR footnotes No. **5.440A** and **5.442**, and
- the need to retain access to part of the frequency range allocated via footnotes to the RR Table of Frequency Allocations to aeronautical mobile telemetry for flight testing by aircraft stations.

13 GHz (12.75–13.25 GHz) - Monitoring

The frequency band is allocated on primary basis to the fixed service, fixed-satellite service (Earth-to-space) and mobile service, and on a secondary basis to the space research (deep space) (space-to-Earth) service in all three ITU Regions.

The frequency band is being considered at this year's ITU World Radiocommunication Conference (WRC-23) for the purpose of harmonising earth stations in motion (ESIM) on aircraft and vessels with the GSO FSS.[9] The WRC-23 agenda item aims to facilitate in-flight broadband connectivity. The growing demand for Internet-based applications on aircraft calls for increased capacity for these services. This follows similar ESIM harmonisation in other frequency bands at previous WRCs.

The Radio Regulations Appendix **30B** planned satellite allotments includes this frequency range and the introduction of ESIM should not result in any changes or restrictions to the existing protected Plan allotments and List assignments.

As these applications are intended to operate globally, including across Australia, harmonised spectrum for ESIM would facilitate ESIM on aircraft registered outside of Australia entering our air space. ESIM Internet high-speed broadband connectivity to aircraft

[8] WRC-23 agenda item 1.1 'to consider, based on the results of the ITU R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the pfd criteria in No. **5.441B** in accordance with Resolution **223 (Rev.WRC-19)**'

[9] WRC-23 agenda item 1.15 'to harmonize the use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally'

directly benefits aviation industry operations and passengers flying domestically across the vast land mass of Australia.

Boeing Australia supports:

- Australia's Preliminary Position on WRC-23 agenda item 1.15 to establish a regulatory framework to facilitate aeronautical and maritime ESIM in the frequency range 12.75-13.25 GHz, and
- upgrading the planning status of this frequency band to 'initial investigation.'

40 GHz (37–43.5 GHz) - Monitoring

There are primary allocations in the Radio Regulations for a range of services in different sections of the frequency band including space research, fixed, mobile, mobile satellite and fixed-satellite services.

In Australia, the 37-37.5 GHz part of the frequency band is designated to be used principally for defence and national security, as provisioned in footnote AUS101A of the ARSP.[10]

At WRC-19 the 40 GHz band was identified globally for IMT/5G.
WRC-19 developed a provisional agenda item for the 2027 World Radiocommunication Conference (WRC-27) for sections of the frequency band to be harmonised for earth stations in motion (ESIM) on aircraft and vessels (similar to 13 GHz above for WRC-23).[11]

With 5G mmWave spectrum recently made available in Australia in the frequency ranges 25.1-27.5 GHz and 27-29.5 GHz, there is no pressing need to consider 40 GHz for more 5G mmWave spectrum. It remains questionable about how useful mmWave 5G spectrum is considering the Republic of Korea Ministry of Science and IT revoked mmWave licences in their country as operators did not utilise their access the frequency bands.[12]

The Australian Mobile Telecommunications Association in their 2022 FYSO submission said 'the 40 GHz band, is not a short-term priority for industry.'

Boeing Australia proposes the ACMA:

- Retain the planning status of this frequency band as 'monitoring'
- Support a WRC-27 agenda item for the harmonisation of the frequency band to accommodate ESIM on aircraft and vessels with the GSO and NGSO FSS, and
- support and retain access for the presently allocated services.

[10] ARSP footnote AUS101A – 'The Department of Defence is normally consulted in considering non-defence use of this service'
[11] WRC-27 agenda item 2.2 'to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed satellite service'
[12] Korean govt falls for 5G fallacy over 28GHz | Light Reading

46 GHz (45.5–47 GHz) - Monitoring

The 46 GHz band has primary allocations in the Radio Regulations for mobile, mobile-satellite, radionavigation and radionavigation-satellite services in Australia. However, as the ACMA notes, apart from some radio astronomy observations 'in Australia, there are currently no formal arrangements for any services in the band.'

ARSP footnote AUS62, indicates that parts of the band might be used in the future for defence.

With 5G mmWave spectrum recently made available in Australia in the frequency ranges 25.1-27.5 GHz and 27-29.5 GHz, there is no pressing need to consider 40 GHz for more 5G mmWave spectrum. The Australian Mobile Telecommunications Association in their 2022 FYSO submission said 'the ~40 GHz band, is not a short-term priority for industry.'

Boeing Australia proposes the ACMA:

- Retain the planning status of this frequency band as 'monitoring,' and
- support access to the frequency band for presently allocated services.

47 GHz (47.2–48.2 GHz) - Monitoring

The frequency band has primary allocations for fixed, mobile and fixed-satellite services in Australia, although according to the ACMA there are currently no formal arrangements for any services in the frequency band in Australia.

These higher frequency bands (Q/V band) represent greenfield opportunities for new satellite technologies including next generation high and very high throughput satellites, and ubiquitous broadband. Most major satellite operators have systems under development and some operational satellites have a Q/V band capability built in.

The frequency band has been identified for IMT/5G in Region 2 and many other countries (not Australia). With 5G mmWave spectrum recently made available in Australia in the frequency ranges 25.1-27.5 GHz and 27-29.5 GHz, there is no pressing need to consider 47 GHz for more 5G mmWave spectrum. It remains questionable about how useful mmWave 5G spectrum is considering the Republic of Korea Ministry of Science and IT revoked mmWave licences in their country as operators did not utilise their access to the frequency bands.[12]

The Australian Mobile Telecommunications Association in their 2022 FYSO submission said 'the ~40 GHz band, is not a short-term priority for industry.'

Sections of the frequency band are the subject of a provisional WRC-27 agenda item to harmonise the band for earth stations in motion (ESIM) on aircraft and vessels with the GSO FSS (see 40 GHz above).[11]

Boeing Australia proposes the ACMA:

- Retain the planning status of this frequency band as 'monitoring'
- Support the WRC-27 agenda item to harmonise the band for ESIM on aircraft and vessels with the GSO FSS, and
- support the presently allocated services specifically retaining and protecting the utility of the existing FSS primary allocation in the frequency band.

Bands being studied under WRC-23 agenda items 1.2 and 1.4

Boeing Australia's interest is only in the agenda item 1.2 issue.

WRC-23 agenda item 1.2 considers identification for IMT/5G in the frequency bands 3 300-3 400 MHz, 3 600–3 800 MHz, 6 425–7 025 MHz, 7 025–7 125 MHz and 10.0-10.5 GHz (only 7 025-7 125 MHz is directly relevant to Region 3 which includes Australia).

The agenda item also considers a potential primary allocation to the mobile service in some countries where it currently doesn't exist.

The frequency bands 3 300-3 400 MHz and 10.0-10.5 GHz are a primary RLS allocation and important to defence operations (see 3.3 GHz above).

In Australia ARSP footnote AUS100A applies and stipulates the frequency band 3 300-3 400 MHz is 'designated to be used principally for the purposes of defence and national security and the Department of Defence is normally consulted in considering non-defence use of this service.' The Department of Defence is concerned that expansion of IMT/5G into in this frequency range in Regions 1 and 2 poses interference potential for Defence global radar operations. As such Defence is interested in the global protection of defence systems in the two frequency bands (3 300-3 400 MHz and 10-10.5 GHz).

The current Australian Preliminary Positions for WRC-23 agenda item 1.2 supports an IMT identification in the 7 025–7 125 MHz frequency band subject to 'ITU-R studies showing that coexistence is technically feasible and subject to appropriate regulatory and technical conditions being in place to protect existing primary services in this band (and in adjacent bands, as appropriate) now and into the future.'

For Australia, in the foreseeable future, there is no solid case for IMT/5G deployment in these frequency ranges. Especially, with 3.4-4.0 GHz currently under implementation for IMT/5G/mobile broadband and a spectrum licence auction for parts of that frequency range in the 2nd half of this year.

The existing primary fixed-satellite service allocation in the 7 025-7 075 MHz must be retained and protected from any new identifications for IMT/5G in 7 025-7 125 MHz. Studies have shown IMT and FSS are not compatible and FSS has conceded significant amount of spectrum to IMT through the past 15 years.

As mentioned there is no substantive case for further expansion of IMT spectrum in Australia especially noting the comments above and the fact that Australian MNOs are in the process of closing down 3G services which will then free up considerable allocations to be refarmed for IMT/5G.

Boeing Australia proposes:

- The ACMA and Australia support the Department of Defence in their protection from interference from IMT of the global primary radiolocation service in 3 300-3 400 MHz and 10.0-10.5 GHz, and
- retention of the utility of the primary FSS allocation at 7 025-7 125 MHz.

5 030–5 091 MHz RPAS - Initial investigation

At WRC-12, the 5 030–5 091 MHz frequency band was identified in the Radio Regulations for use by line-of-sight (LoS) and beyond line-of-sight (BLoS) remotely piloted aircraft systems (RPAS) control and non-payload communication (CNPC) links. It is only recently that spectrum regulators, notably ACMA have moved to free up access to this frequency band to accommodate RPAS communications.

RPAS operating in non-controlled airspace predominately use low interference potential device (LIPD) class licence for both CNPC and payload communications.
While LIPD access is useful for smaller RPAS and hobbyists' drones, the inherent low power constraints and congestion of the LIPD radio frequencies are a disadvantage to medium to large RPAS running business and security operations at times in environments that require reliable safety-critical control links. These constraints have been acknowledged by ACMA in a positive response that has recently seen arrangements put in place to facilitate temporary access to part of the frequency band (i.e. 5 055–5 065 MHz) for LoS RPAS CNPC links. ACMA states these interim arrangements will be in place until the finalisation of work within the ITU-R on a draft new ITU-R Recommendation that specifies terrestrial air-ground links characteristics operating in the aeronautical mobile radiocommunication service in the band.[13]

While satellite access for BLoS use is not presently available, the internationally harmonised frequency band is important to support economies of scale and global interoperability of radiocommunication equipment for RPAS and Boeing Australia welcomes the 'temporary access' to part of this frequency band.

The frequency band needs to be protected for future requirements for UAS and in the event that demand exceeds the current 10 MHz access ACMA should move expeditiously to free up more of the frequency band.

Boeing Australia acknowledges and agrees that ACMA is only responsible for the spectrum aspects of RPAS regulation in Australia whereas further air safety regulatory provisions are the mandate of the Civil Aviation and Safety Authority and Airservices Australia, and any arrangements in the frequency band are to be developed in consultation with those agencies and ICAO standards and practices.

It is important to note the frequency band 5 030-5 091 MHz only provides a small amount of internationally harmonised spectrum for RPAS CNPC. There is a pressing need for much more spectrum to be available, for both CNPC and payload applications for medium to large RPAS, this is discussed under 'Drone spectrum regulation' below.

The ACMA in establishing Australian technical characteristics UAS CNPC links, should be addressing both line-of-sight and beyond line-of-sight systems spectrum regulation. To not consider BLoS communications and regulation appears counterproductive.

While it is recognised no current satellite access is available for payload operations in 5 030-5 091 MHz to support the aeronautical mobile-satellite (R) service, given the rapid developments across the satellite industry especially non-GSO constellations it is possible a viable service could become available. For Australia's vast airspace this is perhaps the best option for countrywide and intercontinental UAS operations. Rather than seeing regulation follow technological advancements Boeing Australia encourages ACMA to take a lead in

[13] Preliminary draft new Recommendation ITU-R M.[CNPC_CHAR_5GHz] - Characteristics and protection criteria of terrestrial and satellite unmanned aircraft system control and non-payload communications links operating in the aeronautical mobile (route) service and aeronautical mobile satellite (R) service in the band 5 030-5 091 MHz

developing regulations that can be applied for future BLoS radiocommunications for UAS especially in this globally allocated frequency band.

Boeing Australia commends the ACMA for introducing arrangements for interim access to the frequency band for RPAS CNPC.

Boeing Australia proposes the ACMA:

- Support ITU-R efforts to develop international radiocommunication regulations for both terrestrial and satellite RPAS communications in this and other frequency ranges at ITU-R Study Group and World Radiocommunication Conference fora, and
- consider and facilitate access to the entire 5 030-5 091 MHz frequency range dependent on developing user demand.

Drone spectrum regulation

For consistency in this section we reference generically 'UAS' (unmanned aircraft systems) of medium to larger size aircraft for commercial, government and defence use.

The UAS industry is expanding rapidly worldwide, with Australia often at the forefront. While aviation standards and technology developments that accompany UAS operations are the responsibility of other regulators, intergovernmental agencies and industry bodies, access to, and regulation of, spectrum in Australia is the sole responsibility of the ACMA.

As noted by the ACMA, UAS or 'drone spectrum' is well established for personal hobbyist use by individuals using unlicensed spectrum (LIPD class licence in Australia and ISM bands) to operate small aircraft over short distances.

Boeing Australia welcomes creative and world leading initiatives by the ACMA in spectrum access for the medium/large commercial and defence UAS industries. Notably last year's arrangement for temporary access to a portion of the 5 030-5 091 MHz frequency band is a significant step forward. Nonetheless, aviation requires more formally identified spectrum for medium to large UAS operations than available across LIPD class license and the small amount of spectrum provided in the 5 030-5 091 MHz AM(R)S allocation.

As noted in the draft FYSO, 5G is expected to be a feasible option for UAS communications. However, there are obvious constraints for the more demanding medium/larger UAS for flight coverage that may travel beyond 5G network range and issues of high reliability QoS for CNPC requirements.

The existing aeronautical allocations in the Radio Regulations (notably 960-1 164 MHz) have been ruled out as the frequency bands are already heavily encumbered for critical aeronautical navigation purposes. The quantum of spectrum required for future UAS operations is currently undefined and industry and government are encouraged to continue to work together in determine near and long-term requirements.

Boeing Australia supports ACMA collaboration with CASA, the Department of Infrastructure, Transport Regional Development, Communications and the Arts, and the Emerging Aviation Technologies sector to further refine future Australian UAS spectrum requirements, avenues for government support and necessary regulations.

Going forward

The ITU-R have been developing regulatory conditions for use of fixed-satellite service networks for CNPC and payload communications of UAS.
Global CNPC use in FSS allocations is currently a consideration of the ITU's World

Radiocommunication Conference later this year.[14]
Unfortunately, this work has been underway for the previous three World Radiocommunication Conferences and is again struggling to progress at WRC-23.
Should this not progress at the conference Boeing Australia is of the view that formally mandated ITU-R regulatory conditions are not essential in this instance for the use of FSS allocations for RPAS communications in Australia and between likeminded countries supported by ICAO standards and practices.

The fundamental ITU-R technical work has largely been settled but the process has been stonewalled by non-technical vested interests.
Nonetheless, the mature technically relevant aspects of the studies can be the basis to expand spectrum access for UAS in non-segregated airspace. In Australia (under Region 3 identification) this includes 12.2-12.5 GHz, 12.5-12.75 GHz, 14-14.7 GHz and 29.5-30 GHz frequency bands.

Boeing Australia encourages the ACMA to use the ITU-R technical work as a basis for developing appropriate regulatory conditions to facilitate FSS spectrum for this use. This is conditional on no constraints to the FSS and procedures in place for safe operation of UAS, the remit of other regulatory agencies, such as the Civil Aviation and Safety Authority and Airservices Australia and ICAO standards and practices.

The ACMA through technical and regulatory spectrum determinations can support flexibility, capacity and reliability considering the wide range of opportunities and uses that are emerging in this dynamic market. Continued and deeper engagement on these issues is particularly important and encouraged.

Boeing Australia proposes the ACMA:

- Explore with a view to support and instigate the use of FSS allocations (based on work in ITU-R) for CNPC and payload access to spectrum for medium to large RPAS in cohort with ICAO standards and practices.
- Continue to support trial licences to enable UAS access to viable frequencies outside of the LIPD/ISM bands.
- Continue to support government and industry consultation and cooperation on frequency bands that may accommodate medium/large UAS communications and other options suited to explore alternative radio frequency access.

[14] WRC-23 agenda item 1.8 ‘to consider, on the basis of ITU R studies in accordance with Resolution **171 (WRC-19)**, appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution **155 (Rev.WRC-19)** and No. **5.484B** to accommodate the use of fixed-satellite service (FSS) networks by control and non-payload communications of unmanned aircraft systems’

Boeing Australia appreciates the opportunity to respond to the ACMA's forward spectrum planning in this submission.

Respectfully submitted

[redacted]

[redacted]

Maria Fernandez
President
Boeing Australia,
New Zealand and South Pacific

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

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List of abbreviations/glossary

Abbreviation	Definition
5G	Fifth generation mobile phone service
ACMA	Australian Communications and Media Authority (spectrum regulator)
AM(R)S	aeronautical mobile radiocommunication (R) service (used for safety of life communuications)
APT	Asia-Pacific Telecommunity
ARSP	Australian Radiofrequency Spectrum Plan
AWG	Asia-Pacific Telecommunity Wireless Group
BLoS	beyond line-of-sight
CEPT	Conference of Postal and Telecommunications Administrations (Europe)
CITEL	Inter-American Telecommunication Commission
CNPC	control and non-payload communication
ESIM	earth stations in motion
FCC	Federal Communications Commission (USA)
FSS	fixed-satellite service
FWA	fixed wireless access
GHz	Gigahertz
GSO	geosynchronous orbit (of a satellite postioned above Earth)
ICAO	International Civil Aviation Organization
IMT	International mobile telecommunications
IoT	Internet of Things
ISM	Industrail scientific and medical
ITU	International Telecommunication Union
ITU-R	International Telecommunicatiuon Union - Radiocommunication Sector
LIPD	Low interfernce potential devices
LoS	line-of-sight
M2M	machine to machine
MHz	Megahertz
mmWave	Millimetre wave (spectrum roughly from 30-300 GHz)
MNO	Mobile network operator (e.g. Tesltra/Vodafone/Optus)
MS	Mobile service
MSS	mobile-satellite service
NATO	North Atlantic Treaty Organization
NGSO	Non-geostationary satellite orbit (does not maintain a stationary position)
PFD	Power flux density
QoS	Quality of service
RLAN	Radio Local Area Network
RLS	Radiolocation service
RPAS	remotely piloted aircaft systems
RR	Radio Regulations
UAS	unmanned aircraft systems
WBB	wireless broadband
WP	Working Party (of the ITU-R)
WRC	World Radiocommunication Conference