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 2022-2027

Boeing Australia Holdings appreciates the opportunity to respond to the ACMA's draft *Five Year Spectrum Outlook 2022-2027* 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 3,800 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
- Boeing Training & Professional Services Australia
- Insitu Pacific
- Jeppesen Australia

Our spectrum interests are many including, aeronautical, 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 at CMA stages of 'monitoring' and 'initial investigation'. Issues under 'preliminary planning' are subject to separate consultation and as such we provide no comments in this submission on those issues.

**1.5 GHZ (1 427-1 518 MHz) L-Band** Initial investigation

Current and future use

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

IMT identifications for the mobile service were introduced at WRC-15 across 1 427-1 529 MHz in Region 2 (RR footnote No. **5.341B**) and in the frequency bands 1 427-1 452 MHz and 1 492-1 518 MHz for Regions 1 and 3 (RR footnote Nos. **5.341A** and **5.341C** respectively).
The IMT/5G arrangements via the footnotes does 'not establish priority in the Radio Regulations' over other allocated services in the frequency bands.

ACMA is considering IMT/5G applications in this frequency range for Australia.
The introduction of IMT/5G applications in this part of L-Band has serious implications for the ongoing viability of the globally allocated primary mobile-satellite service (MSS) in the adjacent frequency band 1 518-1 559 MHz. An IMT/5G identification in the 1 427-1 518 MHz frequency band appears to be a means for ACMA to allocate additional 5G mid-band spectrum (1-6 GHz) in Australia.

Protection of the mobile-satellite service in the adjacent frequency band

The 1 518-1 559 MHz frequency range is heavily uitilsed 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 operators. 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.

Compatibility studies developed for WRC-19 show serious potential for harmful interference from IMT to MSS operations above 1 518 MHz. MSS aviation terminals specifically require protection of aeronautical earth stations operating in 1 518-1 559 MHz from high powered IMT/5G base stations near airports.

Evolving from the WRC-19 studies was a revision of Resolution **223 '***Additional frequency bands identified for International Mobile Telecommunications*' instructing the International Telecommunication Union (ITU) Radiocommunication Sector (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 address coexistence between MSS and IMT.[1] Several options are proposed in this new Recommendation to mitigate interference into MSS from new IMT/5G transmissions, most

[1] Document 5D/1078 Chapter 4 - Annex 4.4 – 'Working document towards a preliminary draft new Recommendation ITU-R M.[REC.MSS & IMT L-BAND COMPATIBILITY] - Adjacent band compatibility studies of IMT systems in the mobile service in the band 1 492-1 518 MHz with respect to systems in the mobile satellite service in the band 1 518-1 525 MHz'

commonly a guard band of up to 6 MHz.
The studies are the responsibility of ITU-R Working Party (WP) 5D (terrestrial mobile communications) in conjunction with Working Party 4C (spectrum utilisation MSS).
The progress of this complicated study is slow, with no work at the last two meetings of WP 5D.

As coexistence with MSS above 1 518 MHz is a major consideration, the simultaneous review of the Extended MSS L-band and the 1.5 GHz L-band, proposed by AMCA, is appropriate.
However, until ITU-R studies are settled, it would be of little to no value to progress consideration of an IMT/5G identification in Australia for L-Band and the planning status should be downgraded to 'monitoring' until there is useful clarity of mitigation options based on the outcome of ITU-R studies.

The APT Wireless Group (AWG) work plan on IMT/5G frequency arrangements for the 1.5 GHz, referenced in the draft FYSO have progressed to an APT Report.[2]
The Report simply provides a compilation of existing work on possible implementation of IMT in the frequency band 1 427–1 518 MHz. Notably the Report references the studies in ITU-R mentioned above.
The Report further noted ITU-R studies are ongoing and will need to be a consideration before administrations introduce IMT/5G in the upper part of the frequency band.

Aeronautical use of the frequency band

The 1 429-1 518 MHz frequency band is used nationally and in other countries for defence 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 heavily 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.

For L-Band 1 427-1 518 MHz planning Boeing Australia proposes:

- Supporting studies in ITU-R to develop an ITU-R Recommendation to address coexistence between MSS and IMT.
- Until such guidance from ITU-R studies is resolved revising planning status for 1.5 GHz to 'monitoring.'
- 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.

[2] APT/AWG/Rep-113 – 'APT Report on relevant information for considerations on the possible implementation of IMT in the frequency band 1 427-1 518 MHz'

**Extended L-band (1 518–1 525 MHz and 1 668–1 675 MHz) MSS** Initial investigation

The mobile-satellite service (MSS) 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.

As ACMA in the draft FYSO notes, MSS coexistence with potential 5G/WBB below 1 518 MHz is 'a substantial consideration' (see the 1.5 GHz section above).

The ACMA further states:

> We will undertake a simultaneous review of the extended MSS L-band and the 1.5 GHz band …. timing on a decision about progressing to the next planning stage and the related options paper is the same for the 1.5GHz band. ACMA is planning to review these bands 'to identify the spectrum use or uses that would maximise the overall public benefit and, if appropriate, vary spectrum management arrangements to support this use.

There is no guidance in the draft FYSO on a 'view' the ACMA might have on what (services/applications) 'would maximise the overall public benefit.' In the absence of such guidance it is assumed to be further wireless broadband (WBB) (5G/IMT) access.
If so, and also 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.

Nonetheless, any consideration of the introduction of WBB (5G/IMT) into L-band must be consistent with the outcomes of ITU-R technical studies to determine if coexistence with MSS is possible and if so, any necessary mitigation measures to protect existing and future MSS operations in extended L-Band. These ITU-R studies as described in the preceding 1.5 GHz comments are a long way from completion.

Given the current ACMA replanning of 3.4-4.0 GHz for WBB/5G and until the protracted ITU-R studies are settled, ACMA does not need to retain an 'initial investigation' status on this frequency range.

For extended L-Band planning Boeing Australia proposes:

- Downgrading the priority of this planning to 'monitoring'.
- Supporting studies in ITU-R to develop an ITU-R Recommendation to address coexistence between MSS and IMT.
- A planning review, should it be necessary in this 12-month FYSO cycle, to be undertaken in both L and extended L-Bands concurrently.

**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 for some countries via Radio Regulations footnotes, these applications specifically cannot claim protection from, or cause interference to, radiolocation services allocated in the frequency band, a condition of the footnote identification.

The frequency band is a part of the consideration of WRC-23 agenda item 1.2 for further identification of IMT and potential new mobile service allocations across a number of frequencies and various ITU Regions.[3]

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.'

The Department of Defence is concerned that expansion of IMT/5G into in this frequency range poses interference potential to Defence global radar operations.

Under the WRC-23 agenda item for this frequency range, ITU-R WP 5D is studying upgrading some countries in Region 2 to primary mobile service. The allocations are complicated and fundamentally authorised through Radio Regulations footnotes to the Table of Frequency Allocations. However, RLS must be protected and IMT cannot claim protection from interference. Defence is engaged in ITU-R studies to ensure the radar/RLS system parameters are taken into consideration for this purpose so as to protect their operation from interference.
Australia should work to ensure this provision remains and is enforceable.

Boeing Defence Australia is heavily 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 the study of WRC-23 agenda item 1.2 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 replanning in Australia for IMT/5G/WBB in 5G mid-band spectrum (1-6 GHz).

Boeing Australia proposes:

- Retain the current ACMA position to 'monitor' this frequency band conditional on,
- active participation in ITU-R studies on WRC-23 agenda item 1.2 to the extent that global defence radiolocation systems are properly accounted for in any possible outcomes that identify IMT applications in the frequency band.

[3] 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'

**4.5 GHz (4 400–4 500 MHz)** Monitoring

The frequency band is allocated globally on a co-primary basis to the fixed and mobile services. 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 frequency band in Region 2 and Australia for aeronautical mobile telemetry for flight testing by aircraft stations.

ACMA has noted in the draft FYSO some 'interest from domestic fixed and mobile wireless broadband users in pursuing this band for mobile broadband' (5G) in Australia.

Boeing Australia opposes a move to 5G in this frequency band given its close proximity to the aviation radio altimeter safety of life allocation at 4 200-4 400 MHz.

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.

A point of clarification in the draft FYSO, ACMA states 'Japan has made the 4500–4600 MHz band available for WBB.' It should also be noted that Japan's Ministry of Internal Affairs and Communications, has made the frequency range available for 5G with substantial mitigation provisions in place to protect aircraft radio altimeters operating in the frequency range 4 200-4 400 MHz.
The draft FYSO also states China is 'considering use of all or part of the 4400-5000 MHz band for WBB use.' In fact, 4 800-4 990 MHz was allocated for 5G in China in 2018.
We are aware China is not intending to put into use 4 400-4 500 MHz for IMT until such time that compatibility and coexistence with the aeronautical radionavigation service and radio altimeters operation in 4 20-4 400 MHz as provided for in China's Table of Radio Frequency Allocations footnote CHN 35.'[4]
We are not aware of any plans in China for the remaining section of the frequency band i.e. 4 500-4 800 MHz.

Radio Regulations footnote No. **5.440A** states that the frequency band 4 400-4 940 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations and includes Australia and some countries of Region 2. It is imperative that any future planning preserves the integrity and intent of the footnote. 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 should be retained.' This was also the same position for WRC-15.

In previous draft FYSO's the Department of Defence in relation to 4 400-4 500 MHz and 4 800-4 990 MHz stated 'both frequency bands are part of the harmonised Five Eyes and NATO spectrum used by aeronautical mobile services (AMS), fixed line-of-sight and non-

[4] China Table of Radio Frequency Allocations[4] footnote CHN 35 …' The IMT system shall not cause harmful interference to the aeronautical radio navigation service in the 4 200-4 400 MHz frequency band, and the IMT system cannot be put into use until the relevant compatible coexistence conditions are determined.' (translated)

line-of-sight for data, command, control and telemetry as well as for Navy fleet wide communications including mesh networks all of which are currently used by Defence in Australian territory today through either legacy systems or newly acquired systems across major Defence capability projects. AMS use also extends to command and control of weaponised systems. Due to the very complex spectrum environment including weaponised systems, either sharing or replacement of equipment will simply not be possible.
Boeing Australia and subsidiaries have defence contracts in place and are reliant on this frequency band remaining as 'principally for the purpose of Defence' for at least the next five years.

Boeing Australia opposes 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 and
- use of the frequency band principally for the purpose of defence and national security.

**4.8 GHz (4 800–4 990 MHz)** Monitoring

The frequency band is allocated on a primary basis to the fixed and mobile services in Australia, and principally for the purposes of defence and national security as provisioned in ARSP footnote AUS101.

ACMA draft FYSO notes:

> There is some interest domestically from mobile network operators as well as wireless internet service providers and other fixed wireless access (FWA) operators in pursuing this band for WBB in Australia. However, we are not aware of any significant interest in this band by regional bodies, such as the European Conference of Postal and Telecommunications Administrations (CEPT), the Inter-American Telecommunication Commission or the APT.

Boeing Australia agrees with the ACMA view that there is no interest to substantially refarm this frequency band for IMT/5G amongst regional intergovernmental groups such as the CEPT and the Inter-American Telecommunication Commission,' excepting the Russian Federation has an interest as included RR footnote No. **5.441B**.

Domestically there is no urgency or necessity to allocate 5G/IMT to this frequency range as the 3.4-4.0 GHz frequency band is under active replanning for these applications and will provide substantial access to the C-Band 5G mid-band spectrum for Australia's requirements.

Importantly, RR footnotes No. **5.440A** for the frequency band 4 400-4 940 MHz, and No. **5.442** for the frequency band 4 825-4 835 MHz identifies in Australia use of the frequency bands for aeronautical mobile telemetry for flight testing by aircraft stations in accordance with Resolution **416 (WRC-07)** while secondary to the fixed-satellite and fixed services.
During 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 footnotes **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 should be retained.' This was also the same position for WRC-15.

Boeing Australia uses this frequency band extensively for flight testing.

The 4.8 GHz frequency band has been identified for IMT by a number of countries at WRC-19, the closest to Australia being Vietnam, noting that such an identification does not establish priority over other allocated services (RR. footnote No. **5.441B**).

The frequency band is the subject of WRC-23 agenda item 1.1, which is studying protection (from 5G/IMT) of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories.[5]
This is fundamentally the outcome from WRC-19 addressing concerns about compatibility of IMT in the frequency band and is covered in the revised Resolution **223** *Additional frequency bands identified for International Mobile Telecommunications.* The Resolution calls for a review of the pfd protection limits for aeronautical and maritime mobile services.
Boeing Australia is of the view that a reduction of protection limits in this frequency band will adversely affect the existing services.
Consequently, defence platforms might be directly affected due to radiofrequency interference from IMT/5G in the frequency band. As such, it is critical to protect Defence systems operating in this band.
The frequency band is part of the harmonised Five Eyes and NATO spectrum used by Defence aeronautical mobile services (AMS), command, control and telemetry in Australian territory through either legacy systems or newly acquired systems across major Defence capability projects.
NATO is of the view that 'stations in the aeronautical and maritime mobile services operating in the band 4 800-4 990 MHz and located in international airspace or waters can only be fully protected on the basis of the pfd limit in RR **5.441B**.'
Boeing Australia and subsidiaries have defence contracts in place and are reliant on this frequency band remaining as 'principally for the purpose of Defence' for at least the next five years.

Boeing Australia proposes:

- retaining the 'monitoring' status on this frequency band
- ACMA monitor, and participate as necessary, in ITU-R studies in WRC-23 agenda item 1.1 to protect the services within Australia (and our Region as appropriate) from the introduction of IMT in countries identified in RR footnote **5.441B**, and ensuring the retention of RR footnotes No. **5.440A** and **5.552**
- the ACMA ensure the spectrum regulatory protection of the current arrangements in the frequency band in the interest of defence and national security use.

[5] 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)**

**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. ACMA notes there are 'arrangements in place to support fixed point-to-point services and television outside broadcast.'

The frequency band is the subject of WRC-23 agenda item 1.15 to harmonise earth stations in motion (ESIM) on aircraft and vessels with GSO FSS.[6] 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 Plan allotments and List assignments under the Appendix **30B**.

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 is also a development that can benefit industry and passengers flying domestically across the vast land mass of Australia.

Boeing Australia supports ACMA and Australia's participation in ITU-R WP 4A studies to facilitate the introduction of ESIM in the frequency range 12.75-13.25 GHz via WRC-23 agenda item 1.15.

**40 GHz (37–43.5 GHz)** Monitoring

The frequency band has 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, this frequency band is designated to be used principally for defence and national security, as provisioned in footnote AUS101A of the ARSP.[7]

At WRC-19 the 40 GHz band was identified globally for IMT/5G.
WRC-19 developed a new agenda item for the 2027 World Radiocommunication Conference 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).[8]

While 5G mmWave spectrum has been made available in Australia in the frequency ranges 25.1-27.5 GHz and 27-29.5 GHz, the ACMA has intimated both the 40 GHz and 47 GHz

[6] 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'
[7] ARSP footnote AUS101A – 'The Department of Defence is normally consulted in considering non-defence use of this service'
[8] 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'

frequency bands are favoured options for future identification for 5G mmWave spectrum. However, an obvious better option for both services would be a future IMT identification in 46 GHz (see below) thereby retaining the utility unencumbered in the 40 GHz frequency range for FSS and defence operations.

The ACMA notes that:

> the European Communications Commission (ECC) has commenced activities to develop an ECC decision on fixed/mobile WBB harmonisation in the 40.5–43.5 GHz band.

Additionally, it should be noted, the ECC is seeking a balanced outcome that satisfies both terrestrial and satellite interests via a band segmentation approach. While the ACMA is 'aware of interest from the satellite industry for access to this band' it could be more proactive in developing similar arrangements to the ECC to provide surety to both FSS operators and any potential mobile 5G mmWave identifications for the mobile industry on how they could coexist. Any work here will need to be in accord with ARSP footnote 101A i.e. in consultation with the Department of Defence.

Boeing was granted a license from the FCC on 2 November 2021 to launch and operate a non-geostationary satellite orbit fixed-satellite service system including operating in the 37.5-42.0 GHz (space-to-Earth) and the 47.2-50.2 and 50.4-51.4 GHz (Earth-to-space) bands (V-band). This system is at risk of being adversely affected by the introduction of 5G/IMT in the 40 GHz frequency range.

Should the ACMA decide to favour IMT/5G in this frequency range, rather than focus on 46 GHz or 47 GHz (discussed below), Boeing Australia proposes the ACMA:

- elevate this issue to 'initial investigation' status with a view to establish band segmentation of services so as to provide surety to both FSS and MS/5G interests,
- while working to include the interests of national security through consultation with the Department of Defence.

**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.

At WRC-19, more than 50 countries (mainly from Region 1) identified the 46 GHz band for IMT/5G (RR footnote No. **5.553A**).

Although Australia has an identification for IMT in the adjacent 47 GHz through RR footnote No. **5.553B** the 46 GHz frequency band could be a preferable option for 5G/IMT mmWave identification whereby the FSS and MS will be less encumbered for future developments than the 40 GHz option, subject to views from the Department of Defence in accord with ARSP footnote AUS62 regarding future defence use.

Boeing Australia proposes the ACMA:

- elevate the status of this frequency band to 'initial investigation' with a view to accommodate future 5G/IMT mmWave spectrum in Australia,
- subject to consultation and agreement with the Department of Defence.

**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.

At WRC-19, Region 2 and 68 other countries in Regions 1 and 3, including Australia, identified the 47 GHz band for IMT in RR footnote No. **5.553B**.

ACMA state they 'are also aware of interest from the satellite industry for access to this and the adjacent 48.2–50.2 GHz and 50.4–52.4 GHz bands. This may include uncoordinated class licence and coordinated earth station use.'
ACMA 'will consider including these bands in any future review of the 47 GHz band.'

Sections of the frequency band are the subject of WRC-27 agenda item to harmonise the band for earth stations in motion (ESIM) on aircraft and vessels (see 40 GHz above).[8]

ACMA make the following observation in the draft FYSO:

> We are also aware of interest from the satellite industry for access to this and the adjacent 48.2–50.2 GHz and 50.4–52.4 GHz bands. This may include uncoordinated class licence and coordinated earth station use. Consequently, we will consider including these bands in any future review of the 47 GHz band.

These higher frequency bands (Q/V band) represent greenfield opportunities for new satellite technologies including next generation high throughput satellites, 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.

Boeing was granted a license from the FCC on 2 November 2021 to launch and operate a non-geostationary satellite orbit fixed-satellite service system including operating in the 37.5-42.0 GHz (space-to-Earth) and the 47.2-50.2 and 50.4-51.4 GHz (Earth-to-space) bands 'V-band.'
Any future introduction of IMT should not diminish potential satellite operations in the frequency band. Consistent with RR footnote No. **5.553B** i.e. IMT does not have priority over other services in the frequency band.

Boeing Australia proposes ACMA:

- elevate the frequency band to 'initial investigation' and to find a balanced outcome that satisfies both terrestrial and satellite interests so providers can plan with a high degree of confidence that their spectrum requirements will be met while,
- retaining and protecting the utility of the existing FSS primary allocation in the frequency band.

- Support work toward a WRC-27 agenda item on ESIM in parts of the frequency band.

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

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

WRC-23 agenda item 1.2 considers identification for IMT/5G 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 IMT (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 poses interference potential for Defence global radar operations. As such Defence is interested in the global protection of defence systems in these two frequency bands (3.3-3.4 GHz and 10-10.5 GHz).
Defence is actively engaging in ITU-R Working Party 5D to ensure radar specifications are taken into consideration with IMT/5G compatibility studies.

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 replanning in Australia for IMT/5G/mobile broadband.

The protection of the existing primary fixed-satellite service allocation within the 7 025-7 075 MHz frequency range must be retained and protected from any new identifications for IMT/5G in 7 025-7 125 MHz.

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.

RPAS operating in non-controlled airspace currently use low interference potential device (LIPD) class licence for both CNPC and payload communications.
While this approach has proven useful for smaller RPAS and hobbyists' drones, the inherent low power constraints and frequency congestion of the LIPD are a disadvantage to medium to large RPAS running business and security operations at times in environments that require reliable safety-critical control links.

While the frequency band is available internationally it remains largely underutilised, primarily due to a lack of clear regulatory and licencing provisions from administrations and lack of visibility and understanding of the availability of the allocation for industry.
Furthermore, its utility for longer distance and international flights is restricted due to no satellites operational in the frequency range for BLoS communications.

The ACMA states:

> Acknowledging domestic and international momentum in this space, we released a discussion paper in Q1 2021 on international trends in the 5030–5091 MHz band. We recently published a summary of submissions to that consultation, along with arrangements to allow temporary access to part of the band (5055–5065 MHz) for LoS RPAS CNPC links. These interim arrangements will be in place while we await finalisation of relevant work within the ITU-R on band planning.

Boeing Australia welcomes 'temporary access' to part of the frequency band.
However, at the time if this submission this 'temporary access' does not appear to have come into effect. Also, it is curious to know why just 10 MHz is to be available for RPAS use in a frequency band which is unoccupied in Australia?

Boeing Australia in our submission to the 2021 ACMA discussion paper on 5 030-5 091 MHz argued strongly for spectrum regulatory access to the entire frequency range in Australia for terrestrial use. Without satellite coverage there is presently no BLoS use possible.

Boeing Australia acknowledges and agrees that ACMA is only responsible for the spectrum aspects of regulation 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.
The ITU-R is presently developing a preliminary draft new Recommendation on technical and operational characteristics used in analysing compatibility between UAS CNPC links operating in the AM(R)S and other services and possibly out-of-band emissions.[9]

ACMA states 'the timeframe for elevation of this frequency band to preliminary replanning status is dependent on the completion timeframe of relevant ITU-R studies.' Boeing Australia

[9] Working Document Towards a 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*

has previously argued ‘Spectrum regulators such as the ACMA have a part to play to ensure access to the allocated frequency band can be utilised at the earliest opportunity and especially on an interim and experimental basis where appropriate, subject to air safety regulatory requirements.’ Boeing Australia encourages a more proactive approach from the ACMA, especially in engaging in ITU-R studies on this frequency range.

Also, in Boeing Australia’s submission to the 2021-2026 FYSO we recommended ACMA ‘initiate and drive development of an Australian spectrum access strategy, or ‘device licencing regime’ for UAS/RPAS in the 5 030-5 091 MHz frequency band. This approach should address both LoS and BLoS spectrum needs for command and control communications.’ ACMA’s response in this year’s FYSO says it will ‘monitor the licensing requirements for drones alongside international developments in spectrum management.’ Boeing Australia strongly recommends ACMA take a lead in this process rather than continue to monitor. This is something the spectrum regulator can do now in anticipation of users being able to efficiently access this frequency band.

It is important to note the frequency band 5 030-5 091 MHz is only to access a small amount of internationally harmonised frequency 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.

As UAS communications are critical for safe management when operating in airspaces, ICAO standards and practises are obviously mandatory and are being developed.

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, assumedly because there is presently no operative satellite service available, appears counterproductive.

Boeing Australia commends the ACMA for working towards interim access to the frequency band for RPAS CNPC.

Boeing Australia proposes the ACMA:

- fast track complete access to 5 030-5 091 MHz for terrestrial RPAS/UAS CNPC use in Australia subject to aviation regulatory conditions not the remit of ACMA, and
- develop a viable licensing regime to facilitate the efficient management of this frequency range.

**Drone spectrum regulation**

Boeing Australia welcomes this year's slightly expanded discussion from previous FYSOs on 'drone spectrum regulation.'

Comments on this section are complementary and additional to those on 5 030-5 091 MHz issue above.

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

Boeing Australia welcomes the ACMA's engagement in various government initiatives relevant to the UAS industry in Australia. Boeing Australia has long called on the ACMA in FYSO and other public consultations to lead in the area of UAS spectrum requirements and we reiterate in this submission the need for the spectrum regulator to be proactive.

The UAS industry is expanding rapidly worldwide, with Australia at the forefront.
While aviation standards and technology development that accompany UAS operations are the responsibility of other regulators, intergovernmental agencies and industry bodies, access to spectrum access in Australia is the sole responsibility of the ACMA. Spectrum is coordinated in Australia by the ACMA and it should be focused on ensuring that UAS access is in place and facilitated in a timely manner.

As noted by the ACMA, UAS or 'drone spectrum' is well established for personal hobbyist use by individuals using unlicensed spectrum (LIPD class licence and ISM bands) to operate small aircraft over short distances. As is now realised there are increasingly other UAS applications requiring reliable communications including, search and rescue, newsgathering, surveillance, infrastructure inspection, package delivery and myriad of government and defence uses. One fundamental aspect to address this demand is access to radiofrequency spectrum with appropriate characteristics to meet the needs of users operating in a variety of scenarios and devices. For medium to larger commercial and government UAS reliable radiocommunication is required to control, track, and manage UAS operations safely.

The access to 5 030-5 091 MHz is specific to an international allocation for CNPC use only, using both terrestrial and potentially satellite communications. This matter is discussed in detail above. However, while there is some progress to access the 5 GHz spectrum in Australia, more spectrum needs to be made available for these larger UAS. The obvious aeronautical allocations in the Radio Regulations (notably 960-1 164 MHz) have long been a consideration, but have firmly been ruled out due to spectrum already being heavily encumbered for critical aeronautical navigation purposes.

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

A way forward

The ITU-R have been developing regulatory conditions for use of fixed-satellite service networks for control and non-payload and payload communications of UAS.
This is currently the subject of WRC-23 agenda item 1.8.[10]
Unfortunately, this work has been underway for the previous three World Radiocommunication Conferences and remains unlikely to progress at WRC-23.
Nonetheless, 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.

Boeing Australia encourages the ACMA to use the ITU-R 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 RPAS, the remit of other regulatory agencies, such as the Civil Aviation and Safety Authority and Airservices Australia.
The fundamental technical work has largely been settled. The ITU-R process has been stonewalled by non-technical vested interests. Nontheless 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.

Spectrum regulators such as the ACMA have a part to play to ensure access to the allocated frequency band can be utilised at the earliest opportunity. The ACMA through technical and regulatory spectrum determinations can support flexibility, capacity and reliability taking into account 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.
- Continue to support trial licences for AUS to enable access to the unencumbered 5 030-5 091 MHz frequency range.
- Open industry consultation on other possible frequency bands that may accommodate medium/large UAS communications and other options suited to explore alternative radio frequency access.

[10] 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,

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

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

29 April 2022

## List of abbreviations

| Abbreviation | Definition |
|---|---|
| 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) |
| 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 |
| 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 |
| MS | Mobile service |
| MSS | mobile-satellite service |
| NGSO | Non-geostationary satellite orbit |
| 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 |