

Boeing Australia Holdings (Boeing Australia) welcomes the invitation to comment on the ACMA's 'Replanning of the 3 700-4 200 MHz band Options paper.'<sup>1</sup>

The 3 700-4 200 MHz frequency band spectrum is critically important to many established Australian C-Band satellite services and is immediately adjacent to frequencies allocated for aeronautical safety of life services.

Boeing Australia recognises the importance of services currently allocated and the introduction of wireless broadband (WBB) a variant of International Mobile Telecommunications (IMT) to the frequency range 3 700-4 200 MHz. Noting identified declining use of point to point (P2P) applications that may be accommodated in other frequency bands also allocated to P2P.

As the planning process is now maturing and three Options are presented each option is considered and addressed in this response.

The options presented in the ACMA replanning paper include variations that could easily be construed as additional options to the three proposed. Especially the vagaries of 3 900-4 000 MHz being left open to include potential new application creep beyond 3 900 MHz. Apart from this issue, and due to time constraints, only the three base options presented in the paper are considered and not the variations alluded to elsewhere.

Under any option the frequency range 4 000-4 200 MHz should be unchanged, to prevent the introduction of new terrestrial applications that have the potential to cause interference to safety of life aeronautical radio altimeter operations in the adjacent 4 200-4 400 MHz frequency band. This effectively establishes a guard band of 200 MHz that has been accepted by ACMA. In support of the guard band the ACMA has published, in association with this replanning paper, a 'Wireless broadband and radio altimeter compatibility study - Spectrum planning paper.' This preliminary compatibility study is addressed in this submission.

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<sup>1</sup> Boeing Australia Holding's portfolio includes advanced manufacturing of commercial aircraft composite components, defence systems design and development, modeling and simulation, research and development, support and training, and unmanned systems.



## **Response to the Options**

### **Option 1**

This option sees incumbent fixed satellite services (FSS) cleared of the frequency range 3 700-3 900 MHz. Many stakeholders and ACMA appreciate that this is an unacceptable burden on FSS and consequently the option is not supported.

Australian FSS operations are often across multiple countries in the region and reallocating FSS from 3 700-3 900 MHz will have significant follow on implications and may not be possible where services are locked to these frequencies.

### **Option 2**

In the frequency range 3 700-3 900 MHz shared arrangements for WBB terrestrial applications would apply to FSS on a 'first-in-time shared, coordinated basis.' This arrangement is expected to be Australia wide with exception for satellite earth station protection zones (ESPZs).

Meanwhile from 3 900-4 200 MHz existing allocations continue, especially for FSS.

Recognising that only 100-200 MHz of spectrum is being sought by mobile operators and there is little evidence of WBB being taken up below 3 700 MHz, this option should satisfy necessary WBB requirements.

Should Option 2 be adopted Boeing Australia suggests ACMA negotiate directly with Australian licenced FSS operators about the ability they have to accommodate changes to their existing and future services under this option.

### **Option 3**

This option sees in the frequency range 3 700-3 800 MHz wide area (WA) WBB deployments in metropolitan and regional areas while removing FSS. FSS in remote areas will be retained on a shared and coordinated basis with local area (LA) WBB.

For the 3 800-3 900 MHz frequency range new arrangements are proposed for FSS sharing and coordinating with LA WBB applications on a first in time basis.

This sees greater burden on FSS operators than Option 2 and provides generous scope for mobile network operators to introduce WBB applications.

Similar to Option 2 above, should Option 3 be adopted Boeing Australia suggests ACMA negotiate directly with Australian licenced FSS operators about the ability they have to accommodate changes to their existing and future services under this option.



### **The frequency range 3 900-4 000 MHz**

This frequency range is consistently referred in the paper as what appears to be an optional extension of the options proposed below 3 900 MHz. However, based on past consultation it is difficult to see that this spectrum is indeed being called upon with any necessity for WBB applications. Accordingly any suggestion of extending proposed arrangements above 3 900 MHz to 4 000 MHz should be abandoned until such time as there is a quantifiable industry need to consider the extra spectrum 'real estate.'

### **International developments**

The ACMA has provided some examples of the reallocation of FSS from the frequency range 3 700-4 000 MHz in other administrations.

It is apparent much of that activity is focused on the lower portion of the frequency band and inordinate suppression of primary FSS is not being realised globally except in circumstances where the use of FSS is substantively different (US and UK notably) to the important role it plays in Australia.

Additionally, there is considerable effort across European administrations to afford access to IMT/5G applications in the frequency range 3 600-3 800 MHz with differing approaches on either protection of existing FSS operations or relocation of those services to a geographical protected area or different frequency range (see [ECC Report 254](#)). Here again we see the focus for new applications is in the lower portion of the band.

It is incumbent on the ACMA to facilitate the best means of support and protection of existing and future FSS access in Australia while creating opportunity to expand 5G/IMT/WBB applications.

The ACMA have quoted two 2023 ITU World Radiocommunication Conference (WRC-23) agenda items focusing on IMT that are, with one exception, not relevant to Australia or the Asia-Pacific region. The exception being consideration of an IMT identification in the frequency range 7 025-7 125 MHz (not the subject of this replanning), whereas the frequency range 3 600-3 800 MHz being studied is only for Region 2 (the Americas) not Australia or the region.



### **Protection of radio altimeters operating in 4 200-4 400 MHz**

The replanning paper references the necessity to protect the operation of aircraft radio altimeters in the adjacent frequency range 4 200-4 400 MHz from possible interference from the introduction of WBB terrestrial communications below 4 200 MHz. The ACMA states that it 'considers that a guard band of no more than 200 MHz would be sufficient in this case.'

Furthermore, the ACMA speculates that 'smaller guard bands (potentially with coordination arrangements) could be considered when more detailed parameters for radio altimeters performance are obtained.' This is covered in more detail in the accompanying ACMA 'Wireless broadband and radio altimeter compatibility study – Spectrum planning paper.'

Boeing Australia welcomes the ACMA's interest in such a study and the acknowledgement of the necessity to provide a guard band of 200 MHz to ensure interference from the proposed new applications is not caused to the safety of life operation of radio altimeters.

The study however does not clearly determine an outcome nor does it necessarily identify a purpose beyond either supporting the maximum 200 MHz guard band or conversely implying a reduced guard band might be possible due to undetermined improvements in radio altimeter technology and subsequent robustness to reject spurious terrestrial transmissions causing interference. The need for a reduced guard band from the regulator's point of view is understandable. However, given the safety of life aspect of protection of radio altimeters any reduction would need to be supported by unequivocal studies that show radio altimeters can tolerate a reduced guard band. Unfortunately the possibility of a reduced guard band is currently not possible unless other mitigation measures likely to be unacceptable to mobile interests are imposed.

Even by its own admission the ACMA study does have notable deficiencies. These include the limitations of the visualize program and the comment in the executive summary that 'for real world applications, it is not yet clear how the potential interference identified in these studies translates into an actual risk to these systems.'

In response to the study Boeing Australia has consulted widely including, Alrservices Australia, Department of Defence, the broader Boeing Global Spectrum Management team, Boeing Australia subsidiaries and other aviation industry subject matter experts in radio altimeters. While the window for the consultation paper does not provide enough time to examine the compatibility study in detail we do provide the following high-level responses.

- As noted in Recommendation ITU-R M.2059 'radio altimeter systems are designed to operate for the entire life of the aircraft in which they are installed. The installed life can exceed 30 years, resulting in a wide range of equipment age, performance and



tolerance.' While newer equipment will have better tolerances consideration of the array of different and older systems must be taken into account.

- The ACMA singular 'worse case' scenario of an aircraft approach to a runway over a 5G WBB base station does not afford the many different and sensitive uses of radio altimeters across various scenarios and against a broader spread of introduced terrestrial RF.
- There needs to be an awareness of the use of larger UAS and emergent electric vertical takeoff aircraft likely to operate with radio altimeters amongst an array of RF-based obstacle sensors. These aircraft will operate at low altitude over and in areas where we would expect significant concentrations of 5G BS. Many of these aircraft will operate without a pilot on-board and therefore the potential impact of interference on the safety of flight could be substantial.

Specifically on the study Airbus has commented:

- The ACMA study relies on a formula to estimate the return signal level to the altimeter (footnote 10). This formula is not adapted to RA installed on air transport commercial aircraft. RTCA DO-155 (Annex) loop loss formula and graphs are more appropriate as it takes into account appropriate Waveform, RA beamwidth (60°), roll, pitch, worst case reflectivity.
- The AAS antenna uses 2° downtilt without beamforming. The beamforming can exceed this limit when it points toward the sky. Notice also that, at the opposite, when the AAS antenna is pointing down to the ground the scenario is worse than when it points toward the horizon: indeed secondary lobes appear especially when the number of elements is high (16x16 for instance) and the element spacing is larger than 0,5λ. Those secondary lobes cause high power interference at high elevation angle.

On the basis of current information Boeing Australia maintains that 200 MHz is a necessary guard band to protect radio altimeters in 4 200-4 400 MHz frequency band. While ACMA is seeking technical evidence to have such a guard band reduced, the reality is aviation interests are concerned that the guard band may be insufficient in the future with the effective noise floor increase of 5G applications across 3 700-4 000 MHz. This concern has been expressed to the ECC by ICAO to the 53<sup>rd</sup> ECC plenary meeting (Document [ECC\(20\)INFO 06](#)).

The ACMA is encouraged to continue to engage with industry and airline regulatory authorities Airservices Australia, CASA, and international interests especially the International Telecommunication Union and Radiocommunication Sector Study Group 5 responsible for ITU Reports and Recommendations on radio altimeters, notably Recommendation [ITU-R M.2059](#) and Report [ITU-R M.1186](#).



## Conclusions

Based on the options presented in the replanning paper Boeing Australia supports Option 2 with a secondary preference for Option 3. Reasons are described above.

Each option incurs an operational and financial cost to FSS operators. Should either option be adopted the ACMA will need to work closely with licensed Australian satellite operators to define transitional arrangements including yet to be determined end dates for reallocation or restacking and where applicable sharing arrangements with WBB that does not diminish the primary status of FSS in the frequency band.

The replanning paper makes regular references to a frequency range of up to 3 900 or 4 000 MHz as optional when considering variations to existing services and introduction of WBB applications. In both options mentioned above Boeing Australia does not see that the extended variable to 4 000 MHz for new WBB applications is supportable on available evidence. In all instances the 3 900 MHz should be the upper limit and not 4 000 MHz.

The ACMA has committed to, and Boeing Australia supports, a guard band of 200 MHz in the upper frequency range to protect the operation of radio altimeters in the adjacent 4 200-4 400 MHz frequency range.

Respectfully submitted,

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