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The Boeing Company submission to the New Zealand Radio Spectrum Management Draft Five Year Spectrum Outlook 2022-2026

The Boeing Company (Boeing) appreciates the opportunity to respond to the Radio Spectrum Management (RSM) 'Draft Five Year Spectrum Outlook 2022-2026.'

We commend RSM for the comprehensive and insightful paper identifying future spectrum management options to benefit New Zealand and the region.

Boeing in New Zealand

Boeing has a long presence in New Zealand and we are looking to expand our operations.

Air New Zealand was a global launch customer for the 787-9 and operates 14 of the Dreamliner variant on long haul routes. With 787-10 airplanes on order for 2024 delivery, the airline's Dreamliner fleet is on track to grow to 22. The new Dreamliner aircraft will replace Air New Zealand's fleet of eight 777-200ERs. Air New Zealand's widebody fleet also includes seven 777-300ERs.

The Royal New Zealand Air Force (RNZAF) became Boeing's fifth export customer for the P-8 Poseidon (after Australia, India, Norway and the U.K.) acquiring four of the surveillance aircraft. The aircraft will deliver support to New Zealand's peace and security operations, maritime surveillance, resource protection, humanitarian and disaster responses in New Zealand, the Pacific, and further abroad. The aircraft are expected to enter into service from 2023.

The RNZAF operate two Boeing 757-2K2 aircraft. The aircraft provide strategic airlift to carry personnel and equipment in support of operations and deployments and are also used for VIPs as well as ministerial and trade missions around the world.

Boeing has been contracted to restore the RNZAF's airborne anti-submarine warfare capability, including developing an airborne underwater intelligence solution for the P-3K2 fleet. The project includes upgrading and modification of aircraft components, as well as provision of inflight and ground-based simulation for training.

Boeing distribution, the world's largest diversified aircraft parts distributor (formerly Aviall), based in Auckland have a long history of providing essential parts to the New Zealand airline and defence industries.

Boeing's global and regional spectrum interests are many including, aeronautical, space, fixed and mobile satellite services, radiolocation, maritime, 5G, IoT and M2M applications.

We appreciate the opportunity to respond to RSM's 'Draft Five Year Spectrum Outlook2022-2026.' We offer the following comments of direct interest to Boeing based on RSM's 'Work Plan Priorities' in the consultation paper.

Review and re-plan the 24-30 GHz band including technical consultation

Boeing understands RSM is still in the process of replanning the frequency band following last year's public consultation. RSM is proposing to introduce to this frequency band mmWave 5G and associated applications such as wireless broadband (WBB).

The existing 24-30 GHz frequency range globally accommodates important Ka Band satellite services primarily for aeronautical and maritime use above 27.5 GHz.

The satellite Ka Band (with uplinks largely around 27.5-30 GHz) has characteristics that are aligned to the spectrum efficiency goals of RSM. These include:

- Antennae beams being much more focused, supporting high throughput using the same amount of bandwidth, driving down the cost of the spectrum and per MB price.
- Ka-band spot beams have a higher effective isotropic radiated power (e.i.r.p.) at beam centre in comparison to Ku-band spot beams.
- Focused spot beams allow frequency reuse whereby several beams can reuse the same frequency band, boosting the capacity of the satellite system and spectrum efficiency.

There is increasing utility of this frequency range for a proliferation of new versatile earth station in motion (ESIM) satellite communications with GEO satellites that were globally assigned in a WRC-19 outcome in the frequency ranges to 17.7-19.7 GHz and 27.5-29.5 GHz. Furthermore, a new agenda item for WRC-23 is currently in study for ESIM communications with non-GSO systems covering the frequency ranges 27.5-29.1 GHz and 29.5-30.0 GHz.

It is noted New Zealand is fortunate to have spectrum reserves in the frequency range 24-30 GHz to accommodate both the high throughput 5G applications (mmWave < 27.5 GHz) while maintaining satellite primary access to the 27.5-30 GHz spectrum.

Boeing is of the view that frequency above 27.5 GHz in New Zealand should be preserved largely for the existing and future fixed satellite service (FSS) allocations.

Boeing supports an identification in 26 GHz for 5G/IMT and MBB applications given there are no other services planned to occupy the spectrum and it leaves ample frequency for New Zealand mobile network operators with more than adequate mmWave spectrum.[1] Thereby retaining FSS and rapidly growing ESIM applications operating in the existing Ka band allocations without any necessity to introduce inherently problematical sharing arrangements with 5G/IMT.

Review and re-plan 3.3-3.4 GHz

Noting consultation has been concluded on the 3.3-3.4 GHz frequency range and a final determination to our knowledge has not been made, Boeing wishes to draw RSM's attention to the global use of 3.3-3.4 GHz for radiolocation and specifically defence radar.

It appears RSM is to adopt a relatively low-key planning approach to 3.3-3.4 GHz for the introduction of low power or industry vertical network 5G applications which may be for indoor, local or regional use. While noting RSM's comment 'it is unlikely that equipment for Radiolocation will be available in the 3.3 GHz band it is also unlikely that new uses of 3.3 – 3.4 GHz will have an impact on Radiolocation.' This does not take into consideration itinerant or future use of radiolocation for defence purposes.

[1] Noting the upper level of 26 GHz is generally 27.5 GHz and not the New Zealand frequency limit of 28.35 GHz.

The new 5G applications proposed by RSM could be managed to coexist with radar that when operational would only transmit at less than 10% of the time. In the case of significant interference into either system, radar or 5G, dynamic spectrum access may be employed to address potential interference.

Boeing does not have a view on the options proposed for the frequency band but simply note there may have been limited consideration to regional and global defence radar usage and we would appreciate RSM taking this into consideration as part of the planning.

Review and re-plan 3.4-3.8 GHz and potentially 3.8-4.2 GHz bands, including technical consultation

The frequency range 3.4-3.8 GHz is considered an optimum frequency range for new 5G and MBB applications due to its ability to provide good data rates combined with favourable propagation characteristics.

The frequency range has long been allocated globally on a primary basis to (FSS) downlink (space to Earth). Although for New Zealand the allocation for FSS primary effectively starts at 3 600 MHz with a small 10 MHz range just below 3 600 MHz.

Across a number of administrations this long standing FSS allocation has been under threat from the introduction of new 5G applications. As a result FSS in some jurisdictions (including Australia) has been restricted, or reallocated, to the upper part of the standard C-Band around 3.8-4.2 GHz.

While the C-Band frequency range is unquestionably favourable for 5G/IMT it also provides satellite operators and users with a reliable, uninterrupted communications capability particularly prevalent throughout the Pacific. The characteristics of these lower radio frequencies for satellite downlink communications (coupled with uplink in 5 925-6 425 MHz), are exceptional for multi-continent coverage and resilient to rain fade. Satellite C-Band is now widely used for affordable broadband connectivity in the Pacific with services reaching rural and remote areas otherwise not accessible.

RSM's is proposing to accommodate new private 5G/IMT networks or 'industry verticals' in the frequency ranges 3.3-3.4 GHz and 3.8-4.2 GHz. RSM notes with multiple users across these frequency ranges interference management might be more difficult. Nonetheless, it could work as viable option to administratively allocate licences (using geographical and technical conditions) to address the problem of interference.

The frequency range 3.8-4.2 GHz requires more detailed consideration. As noted previously the frequency range has been allocated to FSS for many years and given prolific innovative satellite developments, such as ESIM, RSM should consider preservation of C-Band FSS across 3.8-4.2 GHz. Boeing, the satellite industry and aviation in general remain concerned about potential interference to the FSS from new 5G applications noting that the International Telecommunication Union (ITU) has demonstrated that co-frequency sharing between FSS and IMT services is neither feasible nor practical in C-Band.

Taking the above into consideration it is also expected the recent allocations in the frequency band (3 590-3 750 MHz) to the three New Zealand mobile network operators would be sufficient for the foreseeable future.[2]

[2] https://telecom5g frequencies new zealands.com/504285/new-zealand-sensibly-abandons-latest-5g-auction-and-just-hands-the-spectrum-over/

Therefore, further expansion of 5G/IMT to 3.8-4.2 GHz, in Boeing's view, should not be a priority for RSM at this stage.

Aircraft radio altimeter potential interference issues in C-Band mobile service allocations

Importantly, with the entire 3.4-4.2 GHz frequency range, Boeing seeks RSM's engagement to carefully consider the protection from interference to aircraft radio altimeters allocated globally in 4.2-4.4 GHz from new high power 5G MBB applications to be introduced in parts of the 3.4-4.2 GHz frequency range.

As is widely known, the aviation industry has expressed serious concern about the introduction of new 5G/IMT applications near the frequency range allocated to radio altimeters. Examples of mitigation measures to protect radio altimeters from 5G MBB interference in other countries include:

- In the United States the Radio Technical Commission for Aeronautics (RCTA) *Assessment of C-Band Mobile Telecommunications Interference Impact on Low Range Radar Altimeter Operations* released in October 2020 clearly demonstrates that 5G base stations present a major risk of harmful interference to radar altimeters across all aircraft types, with far-reaching consequences and impacts to aviation operations.[3] Noting that this study focuses on the recent US allocation to 5G in the frequency range 3.7-3.98 GHz.
  The US 5G network became operational in January this year and mitigation measures have been introduced and are frequently revised, examples include: -
  - FAA has introduced a series of Notice to Air Missions (NOTAMS) and providing information on restrictions or procedures that pilots and others need to follow and regularly updated Alternative Method of Compliance (AMOC) alternative ways to mitigate an unsafe situation.
  - Telecommunication companies operating 5G in this frequency range have limited power output on some transmitters and not switched-on others located close to airport runways.
- In Canada the spectrum regulator ISED, established interim technical rules in the newly allocated 5G frequency range 3 450-3 650 MHz to mitigate potential interference to radio altimeters (November 2021).
  The main interim protection measures introduced in Canada include:
  - Exclusion and protection zones to mitigate interference to aircraft around certain airport runways where CAT I/II/III automated landing is authorised.
  - A national antenna down-tilt requirement to protect aircraft used in low altitude military operations, search and rescue operations and medical evacuations all over the country.

  ISED in conjunction with the Canadian Transport Agency and telecommunications companies is currently undertaking flight tests to further define the extent of the problem.

[3] RCTA Paper No.274-20/PMC-2073

- Similar mitigations to that of Canada (above) apply in France across the frequency range 3 490-3 800 MHz.[4]

In addition, studies are being carried out in Europe, to assess more precisely the risks of interference and possible interim and longer-term remedies.

Many aviation regulators have issued safety information and awareness bulletins in addition to the measures implemented above, including New Zealand's Civil Aviation Authority that published a safety message that require to 'Do not use 5G devices inflight if you have a radar altimeter' November 2020. The most recent airworthiness bulletin from the Australian airline regulator, CASA, is AWB_34_020 Issue 7.

Boeing is engaging globally in response to this issue. We remain highly concerned of the major risk that 5G telecommunications systems in C-Band mobile service allocations can cause harmful interference to radar altimeters on all types of aircraft—including commercial transport airplanes, business, regional, and general aviation airplanes, helicopters. Without considered mitigation, this risk has the potential for broad impacts to global aviation where the 5G network is operational near the aeronautical radionavigation service 4.2-4.4 GHz frequency band.

This problem cannot be resolved solely by aviation in the near term, it requires an interim solution with cooperation of aviation and spectrum regulators working with the mobile industry.

Boeing seeks RSM's regulatory engagement and consideration of this concern in the replanning of 3.4-4.2 GHz for 5G/MBB applications in New Zealand and we stand by to actively assist and participate in an open public consultation on the replanning.

Investigate use of 6 GHz for Wi-Fi 6E

Noting that consultation has closed in June last year on 'Planning for WLAN use in the 6 GHz band,' Boeing wishes to take the opportunity to provide some comments on Wi-Fi development in New Zealand.

Boeing expresses its support for the RSM's proposed identification of additional spectrum in the 5 925-6 425 MHz frequency band for wireless local area networks (WLAN) or Wi-Fi applications under a General User Radio Licence (GURL). As noted by RSM in the 'Planning for WLAN use in the 6 GHz band' consultation paper there is substantial need for additional spectrum available for unlicensed use and to the direct benefit of users and New Zealand industry.

Boeing employs a wide range of WLAN systems to support our leadership in the design and manufacture of aircraft, defense, and aerospace systems. Unlicensed wireless systems contribute to research and development, automated manufacturing, and are incorporated within many of the aircraft, defense systems, and aerospace vehicles manufactured by Boeing.

RSM has proposed not to allocate the upper 6 GHz range (i.e. 6 425-7 125 MHz), as was also decided in Australia. While Boeing sees scope to use this frequency range in New Zealand we also understand and respect RSM's view that in New Zealand's case the additional 500 MHz should be ample.

In future provisioning of 5 925-6 425 MHz for WLAN/Wi-Fi use Boeing seeks RSM's consideration to maintain the power levels proposed:

[4] https://www.anfr.fr/en/frequency-site-management/bande-3490-3800-mhz/

- 24 dBm (11 dBm/MHz) for indoor use only
- 14 dBm (1 dBm/MHz) for all locations (includes user devices, outdoor access point)

For the indoor power use it is especially important for aviation that the inside of aircraft is treated or defined, as the case may be, as 'indoor' spaces for purposes of any proposed GURL. Furthermore, the use of 6 GHz unlicensed spectrum for transmissions involving aircraft parked at airport facilities should also be defined as 'indoor' use.

We raise this concern because some countries in provisioning new Wi-Fi 6 have sought to redefine aircraft use as 'outdoors.' To do so would severely curb the utility of aircraft WLAN applications, aspects of aircraft safety and customer service expectations.

In regard to potential aggregate interference from WLAN/Wi-Fi devices to FSS space station receivers Boeing agrees with RSM's view that the aggregate level of any increased WLAN/Wi-Fi transmissions would not pose an interference issue with a small increase to the RF noise floor, as would be expected in New Zealand.

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Respectfully submitted

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