



Boeing Australia Holdings

Submission to the
Australian Communications and Media
Authority consultation

EXPIRING SPECTRUM LICENCES (STAGE 2)



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Submission to the ACMA consultation

Expiring spectrum licences (stage 2)

Boeing Australia Holdings welcomes the opportunity to respond to the ACMA consultation on expiring spectrum licences (ESLs): stage 2 'Information gathering, and views on uses of frequency bands and alternative licence conditions.'

About Boeing Australia Holdings

Boeing Australia Holdings (Boeing Australia) employs more than 5,000 people 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 uncrewed and autonomous systems.

Boeing Australia subsidiaries:

- Boeing Aerostructures is Australia's only manufacturer of high-end aero-structure components, providing customers with a complete solution to aircraft component manufacture – from developing the most aerodynamic and efficient design, to rigorous testing processes.
- Boeing Defence Australia is Australia's leading defence aerospace enterprise, supporting some of the largest and most complex programs for the Commonwealth of Australia, the Australian Defence Force – including the Royal Australian Air Force, Australian Army and Royal Australian Navy – and commercial customers.
- Boeing Distribution Australia is a leading solutions provider of aftermarket supply-chain management services for the aerospace, defence and marine industries, serving more than 500 customers in Australia.
- Insitu Pacific specialises in the design, development, and manufacture of high-performance and low-cost uncrewed aircraft systems for commercial and military applications.
- Wisk Aero, a leading advanced air mobility company and developer of the first all-electric self-flying air taxi bringing the future of flight to Australia.
- OzRunways, a market leading Electronic Flight Bag (EFB) developer and service provider in Australia and New Zealand and a trusted EFB provider in regions such as South Africa, Latin America and Asia Pacific.
- Jeppesen Australia, providing industry leading innovative electronic informational products, services, and software, supporting business, commercial, government and military, flight planning, crew training, navigation mapping, scheduling and more.

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

Boeing Australia offers the following comments addressing the request of the Minister for Communications that as part of the ESL process, ACMA ‘form considered views on the effectiveness of alternative licence conditions in achieving certain objectives.’

Focus of our submission

The Australian and global uncrewed aircraft systems (UAS) industry is undergoing exponential growth and in-part requires forward thinking and timely spectrum regulation to underpin and support this growth.

We acknowledge the recent Ministerial Policy Statement (MPS) —Expiring Spectrum Licences.

It is encouraging that across both the MPS and ACMA’s ESL consultation paper there is a clear objective supporting the ACCC position to explore future arrangements that reduce the barriers to entry for new users of spectrum for either new use cases or existing uses, as a dynamic and competitive telecommunications market is most likely to promote the public interest.¹ It is further recognised the current allocated spectrum licences under consideration for expiry are predominantly used for public mobile phone services referred to more broadly by ACMA as wireless broadband (WBB).

In this submission Boeing Australia is directly opening discussion on potential allocations of spectrum to support the rapidly evolving UAS industry in Australia, subject to outcomes of the ESL process.

In making this submission we further acknowledge the scarcity of spectrum in general, especially given the considerable number of licences across the ESL frequency ranges. Boeing Australia recognises the valuable radiocommunication services currently operating in the ESL frequency bands. It is not our intention to comment or speculate on the incumbent services, all of which are expected to argue to retain their allocations, except to say there can be scope for rationalisation and sharing of some parts of relevant ESL frequency bands consistent with the MPS and ACCC position.

Boeing and UAS

The Boeing Company, Boeing Australia and its subsidiaries are leaders in the field of uncrewed technology innovation and integration, driving the safe design and operation of autonomous systems using advanced flight control reliant on access to radiofrequency spectrum.

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

Boeing Australia has long sought reliable access to additional spectrum to support our existing and evolving products challenged by saturation and sharing of currently allocated spectrum for drones or uncrewed aircraft vehicles (UAVs).

¹ Source - the ACCC response to the initial (stage 1) ACMA 2023 consultation on expiring spectrum licences.

Need for UAS spectrum

The UAS industry is rapidly and exponentially expanding across many countries including Australia.

Much UAS growth will come from larger scale commercial and industrial aircraft while there is also a trend for UAVs to become smaller, lighter, more efficient, and cheaper. This type of commercial UAV will be readily available to the public at large and used for an increasing range of purposes. UAVs are also utilising autonomy and are expected to operate in swarms for certain operations.

With the increasing number of UAVs in the skies, and larger aircraft using highly advanced technology, secure spectrum availability and certainty to support UAS has never been greater.

In Australia there is no exclusively allocated spectrum for UAS apart from limited interim access to C Band.² Consequently, UAVs rely largely on access to congested unlicensed spectrum (in Australia LIPD and ISM) for the necessary control links between the ground station and aircraft commonly flying at low altitude.³ UAS operations are highly localised within line of sight of the aircraft operator. UAV operations in these frequency bands is also limited to low RF power levels further restricting range of operations. It is imperative that UAS as an expanding and important aviation industry has access to dedicated spectrum needed to safely support technologically advanced UAS communications platforms that enable more complex flights including beyond-visual-line-of-sight (BVLoS).

Various aeronautical radiofrequency allocations exist in the ITU Radio Regulations, however these allocations were made long before the advent of autonomous aircraft and are considered heavily encumbered by traditional air traffic and insufficient to accommodate new UAS operations

Consistent with consideration of alternative use cases of the subject expiring spectrum licences, the Boeing Australia submission encourages new regulatory thinking for parts of the subject radiofrequency bands to support future operations of uncrewed aircraft services (UAS) in particular the medium to larger and commercial uncrewed aircraft vehicles (often referred to as drones).

This submission proposes options for consideration of new allocations to UAS and/or potential assimilation with existing services.

Types of payloads

Commercial UAS typically use two types of radiocommunications, the safety-critical functions often referred to as 'C2' (command and control) or 'control and non-payload communications' (CNPC) links transmitting time critical control and safety commands for flight operations, and 'payload' not needed for piloting. Enough spectrum must be allocated to meet the individual and aggregate bandwidth requirements of the C2 links.

Identifying and allocation of new spectrum for UAS is a major challenge, as competing radiocommunication services occupy a substantial quantity of priority radiofrequency bands, evidenced in the ESL process. For UAV C2, communications are more challenging and often require clear channel operation to avoid interference from other radio services. However, evolving technologies are expected to provide greater robustness and resilience to harmful interference from other radio communication devices.

² RALI MS48 [Interim access to 5055 – 5065 MHz for Line of Sight \(LoS\) Remotely Piloted Aircraft Systems \(RPAS\) Control and Non-Payload Communication \(CNPC\) links](#)

³ LIPD - [low interference potential devices](#); ISM – Industrial, Scientific and Medical

Whereas the payload communications are tolerant to degrees of permissible interference and capable of using a variety of radiofrequency bands and systems.

Examples of UAV payload operations are many and include those referenced above in 'Boeing and UAS.'

In response to specific questions asked of the consultation Boeing Australia offers the following response to issues of direct relevance to UAS spectrum as an alternative and/or additional option to be considered under the ESL process.

We welcome stakeholder views on our initial views on the uses of frequency bands subject to this ESL process.

We welcome engagement from rail safety licensees about suitable timeframes for potential transitions to the 1900 MHz band.

We also welcome any additional evidence or analysis on and related to these initial views on uses of the frequency bands subject to this ESL process.

All ESL frequency bands are potentially suitable for UAS applications most likely on an apparatus licence basis.

The ability to utilise radiofrequency that propagates over larger distances has clear advantages for UAS missions. Boeing is exploring use of robust Position, Navigation and Timings (PNT) solutions as traditional GNSS becomes more susceptible to interference. Radiofrequencies that propagate further than currently available would be a significant opportunity enabling operating distance potentially out to at least 40-50 km from a transmitter.

Boeing Australia offers the following general comments regarding suitability of UAS integration into the specific radiofrequencies subject of the ESLs.

2.3 GHz

In some countries parts of this frequency band is used for aeronautical flight testing for both crewed and uncrewed aircraft. In the UK and US the frequency range for aeronautical telemetry is across parts of 2 302-2 360 MHz.

With potential integration of UAS in this frequency band sharing arrangements with incumbent WBB will need to be established to ensure both services can coexist and under what technical and regulatory conditions. Whether this is a C2 allocation or general payload allocation is yet to be determined.

UAS currently has equipment that can operate in this frequency band.

1 800 MHz

Boeing Australia notes the request from ACMA for advice of the intentions of rail safety authorities on a possible transition of their services to the 1 900 MHz frequency band. Given the 1 800 MHz frequency band is currently allocated for rail and public travel safety there is a reasonable corollary to consider the frequency band for UAS. It is understood the rail system uses a mix of fixed and WBB (3G and 4G) applications. The future service moving to 1 900 MHz is expected to be a 5G vertical operation.

Should rail remain in the 1 800 MHz frequency band UAS may well coexist as the two services are complementary and without significant interference potential. In the event of rail transitioning out of the frequency band there would be enough spectrum (up to 30 MHz) to consider elements of C2 UAS aviation allocations country wide. When referencing C2 applications the most bandwidth and frequency intensive is currently video, but other applications such as sense and avoid capabilities use far less spectrum and be separated from more spectrum intensive applications.

There are many other potential applications that would be to the benefit of UAS through a mix of payload communications that can operate as a secondary allocation.

In the event of WBB retained in the frequency band Boeing Australia requests consideration of the proposal aligned to the railway allocations or a reduction of the amount of spectrum for WBB given that MNOs have 3G and 4G services in the frequency range of which 3G will sunset and be redundant at the time of the ESL in 1 800 MHz.

In the case of C2 spectrum, ideally around 30 MHz would be required to support line-of-sight (LoS) operations for safety of life purposes, whereas payload has no defined spectrum requirement.

UAS currently has equipment that can operate in this frequency band.

2.5 GHz mid-band gap

It is noted the 50 MHz spectrum licence to television outside broadcasting (TOB) is a consideration of the current ESL process. Boeing Australia has no view on the TOB licence but does flag an interest in the band should the ESL process decide on alternatives in the frequency band of which UAS would be a consideration subject to similar conditions being met as described above in 1 800 MHz.

3.4 GHz

As this frequency band is presently being refarmed for long-term 5G services this is not an option for UAS radiofrequency access.

We welcome stakeholder views on whether UIOLI or UIOSI conditions would be effective in achieving more efficient use of the spectrum.

In particular, we are interested in views as to whether existing use of the spectrum under ESLs is inefficient and whether UIOLI or UIOSI regimes would be effective in facilitating access to spectrum for secondary users and licensees that would result in more efficient use of the spectrum.

We welcome any evidence or analysis that could support these views.

Boeing Australia has no strong views on the concept of UIOLI or UIOSI as a spectrum efficiency tool. Our proposal in this submission is not for spectrum licence, but most likely apparatus licensed assignments. Allocation of radiofrequency spectrum is a due consideration for the spectrum regulator and the application of UIOLI is supported, including a possible 'keep what you serve' process as used in other jurisdictions. Our understanding is UIOSI is commonly part of ACMA regulatory kit which we support.

We welcome stakeholder views on the issues that we would need to take into account in designing and applying alternative licence conditions to spectrum licences to ensure they are fit-for-purpose and achieved desired outcomes.

We welcome any evidence or analysis that could support these views.

Boeing Australia has provided some initial detail on how licensing for UAS applications in potential radiofrequency spectrum released in the ESL process may be achieved in our comments on 1 800 MHz and other frequency bands.

Should there be an expression of interest to consider UAS integration Boeing Australia welcomes the opportunity to provide more detail on alternative licence conditions as part of the next stages of the ESL process.

We welcome stakeholder views on the matters that we would need to consider if rollout obligations or a UIOLI regime were implemented via conditions in spectrum licences, including views on when compliance should be assessed.

We also welcome stakeholder views on operational and resourcing matters that we would need to consider if rollout obligations or UIOLI were implemented.

No comment

Comments on public interest criteria

Boeing Australia in general agrees with the ACMA view 'that the use of the relevant spectrum for WBB is likely conducive to the long-term public interest' but has issue with the suggested 'range of potential use cases ... that could be facilitated through various potential licensing options.' This is addressed by our submission to the ESL stage 2 process to include consideration of UAS use case.

The following responds to the potential future use of the spectrum for UAS, and how it promotes the long-term public interest.

Criterion 1: facilitates efficiency

Currently UAS has access to unlicensed radiofrequency bands that are heavily utilised, thereby prone to interference from other operators and restricted to very low RF power levels. Access to spectrum such as that of the ESLs addresses these severe operational inefficiencies. Dedicated spectrum provides business surety, operational improvements to interference protection, greater flight distance and safer aviation.

AURA Network Systems in their April 2023 submission to the US National Telecommunications and Information Administrations request for comment on Developing a National Spectrum Strategy, stated policies should be developed 'to ensure that spectrum availability is an enabler of the industry's growth. This includes both making new spectrum bands available as necessary and creating streamlined processes to repurpose existing spectrum bands to higher and better use cases, including new aeronautical or UAS uses.'⁴

⁴ National Telecommunications and Information Administration - [Development of a National Spectrum Strategy](#) Comments of Aura Network Systems, Inc April 2023

Spectrum is a component of the Advanced Air Mobility (AAM) Regulatory Framework and described as ‘a cohesive and comprehensive outcome-based legislative and regulatory framework that is effective, flexible, efficient and encourages safe and sustainable growth and innovation.’⁹

The Emerging Aviation Technologies National Aviation Policy Issues Paper notes ‘spectrum management in general, and targeted spectrum reforms for drones in particular, will play a key role in enabling the social and economic benefits that drones are expected to facilitate.’⁵

Criterion 2: promotes investment and innovation

UAS are becoming a commonplace operational necessity. Global defence operations are increasing their UAV fleets due to far cheaper cost structures and the ability to fly aircraft into dangerous territory without risk to a flight crew. For defence operations UAVs are widely considered the future of air warfare, and the scope of missions they can be tasked is expanding in part because of low cost, flexibility, endurance and autonomy.

Boeing Australia, supported by the Royal Australian Air Force and local manufacturers, produced the first military aircraft to be designed, built and flown in Australia in over 50 years the [MQ-28](#) (Ghost Bat). The MQ-28 is a UAV built through advanced robotics, composite materials and digital engineering pioneering locally developed key manufacturing innovations in the areas of robotic drill and fill, shimless assembly and full-size determinant assembly. These innovations significantly reduce assembly costs, compared with traditional methods.

Boeing Australia subsidiary Insitu Pacific has been an industry leader in UAS services to Australia and the Asia-Pacific region since 2009. Insitu Pacific specialises in delivering superior information and persistent night and day intelligence, surveillance and reconnaissance mission experience in some of the most extreme environments in the world, using payloads that deliver high quality critical information in multi-domain missions. Key defence platforms include industry-leading ScanEagle and Integrator UAS.

On the commercial front Boeing Australia subsidiary Wisk has developed the world’s first all-electric, self-flying air taxi. Wisk UAVs facilitate safe, everyday flight that can reduce urban congestion - and provide future green tourism and transport alternatives. With assistance from Austrade, Wisk is developing options in South East Queensland including electric air taxis to the 2032 Olympic and Paralympic Games in Brisbane.⁶ Wisk has a presence in New Zealand and underwent successful test flights this year.

The above are only three of many examples of Boeing’s global development of UAS connected to Australia.

A recent report commissioned by Airservices Australia on the projections of the growth of commercial drones in Australian skies over the next two decades notes ‘the commercial drone industry in Australia is at an inflection point. Over the next twenty years drone flights are projected to grow on average by 20% per annum, culminating in around 60 million flights each year by 2043. This growth presents a once-in-a generation opportunity to unlock a new, enduring and world-leading aviation market in Australia.’⁷

⁵ [Emerging Aviation Technologies - National Aviation Policy Issues Paper](#) Department of Infrastructure, Transport, Regional Development and Communications September 2020

⁶ [Wisk’s self-flying, electric cars to land in Australia](#) – Austrade 9 February 2023

⁷ [‘Sizing the future drone and advanced air mobility market in Australia’](#) Scyne advisory - commissioned by Airservices Australia February 2024

Criterion 3: enhances competition

The nature of UAV communications is such that transmissions are only during flight. Geographically where many UAVs operate there will be competition for spectrum slots. Subject to sufficient spectrum availability competition between users is not anticipated on an ongoing basis, only at times of demand and at a given geographic location.

C2 communications will require dedicated clear spectrum whereas payload communications may have considerable ability to share with other services dependent on the application. Transmission of video payload communications can occupy substantial spectrum.

Consistent with the *Intergenerational Report 2023* quoted in the ACMA ESL consultation paper, UAS radiofrequency access is a substantive new technology requiring creative use of spectrum and competition between manufacturers to accommodate users of equipment with devices capable of utilising a variety of interchangeable radiofrequencies with minimal or no interference. Where some radiofrequency interference occurs between services, competitive research creates means to minimise quality of service disruptions. This is illustrative of UAS industry spectrum access fostering innovation, adoption and ongoing improvement in line with the sentiments of the *Intergenerational Report 2023*.

Criterion 4: balances public benefits and impacts

UAS is increasingly common for commercial, defence, and government use. The net public benefit across the three domains is not easily quantifiable but nonetheless considerable. However, one measure of the economic benefits of the UAV industry in Australia places it at \$15 billion by 2040.⁸

UAVs can be the backbone to defence where crewed aircraft are too expensive or missions are required in high risk environments. Commercial applications are boundless including many of the attributes listed above under payload uses. Government services across federal, state and local agencies increasingly use UAVs for surveillance, new transport opportunities, disaster management and law enforcement.

The UAS industry is creating change and adding value to a variety of services for the public and government.

Criterion 5: supports relevant policy objectives and priorities

UAS has significant benefit for regional and remote communities in social, commercial and industrial applications. Remote areas are an environment where UAV activity excels with access to mostly unencumbered spectrum and the ability to cover large areas quickly and efficiently. The benefits to remote communities are realised in terms of immediacy and cost. The Australian Association for Uncrewed Systems (AAUS) has noted 'regional and remote communities are disadvantaged by increased living costs and reduced access to essential services like healthcare and education ... Addressing the tyranny of distance is about ensuring Australians have the same opportunities and access to services regardless of where they live in the country' and UAS can address these issues.⁹

⁸ [Economic Benefit Analysis of Drones in Australia](#) – Final Report Department of Infrastructure, Transport, Regional Development and Communications 23 October 2020

⁹ [Advanced Air Mobility \(AAM\) Industry Vision and Roadmap](#) – Australian Association of Uncrewed Systems 2024

The Emerging Aviation Technologies National Aviation Policy Issues Paper notes ⁵

These applications [drones] and their users will require greater assurances in the quality and reliability of spectrum access arrangements than is currently provided, necessitating a mix of new and existing approaches to radiocommunications licensing and spectrum management.

UAVs can help overcome traffic congestion in major cities through parcel delivery and future people carriage while having the ability to cost effectively travel long distances in regional and remote areas, to deliver parcels, food and medical supplies.

The benefits UAS to Australia's regional and far remote communities is now being realised with delivery of critical medications to remote communities, agricultural surveillance and management, mining observations and support.

The North Australia Centre for Autonomous Systems notes¹⁰

The use of Remotely Piloted Aircraft (RPA) to transport goods and people over broad distances is rapidly becoming a reality. This disruptive technology has the potential to solve many of the infrastructure challenges of living and working in remote northern Australia.

Summary

- Boeing Australia supports and welcomes a broad consultative approach to consider 'new entrants and use cases' to maximise spectrum use of expiring spectrum licences.
- Noting the *Radiocommunications (Ministerial Policy Statement – Expiring Spectrum Licences) Instrument 2024* section 7 'Facilitating opportunities for new entrants and use cases, including for low earth orbit satellites' states

the ACMA should consider where there may be scope to strengthen service offerings by enabling access for new entrants, smaller providers or innovative applications.

Boeing Australia is of the view that in this context UAS is relevant to ACMA deliberations.

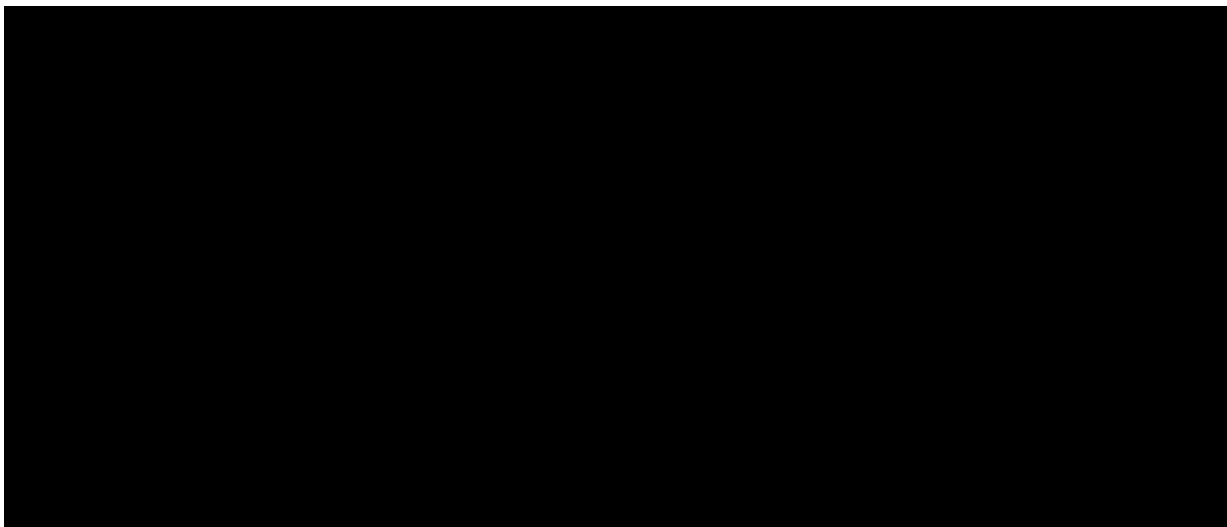
- Boeing Australia acknowledges spectrum regulation is only one aspect of safe air travel management and other agencies also have essential roles and regulatory input e.g. CASA and ICAO.
- Typically aviation spectrum regulation is globally harmonised, however in view of Australia's unique geographical isolation, vast remote areas and densely populated urban centres, Boeing Australia proposes UAS innovation as discussed in this submission is viable in an Australian context and of considerable benefit to the community.
- Supplementary to the above point, Boeing Australia is of the view global harmonisation to achieve equipment economies of scale is not relevant in this instance as existing equipment is available that can communicate with UAVs in the radiofrequency bands the subject of most of the expiring spectrum licences.
- As this submission is responding to Stage 2 'information gathering' of a four part process, the options proposed by Boeing Australia are at a high level and require further detail, notably on

¹⁰ [Drone transport](#) – North Australia Centre for Autonomous Systems 2023

coexistence parameters between services and applications to ensure safe operation of safety of life C2 communications where they may be utilised.

- In the event WBB spectrum allocations are retained in the present or similar allocations, Boeing Australia is of the view that any further allocations to IMT/WBB in Australia that may impinge on current allocations of other services including aviation and fixed satellite services, should not occur until the efficient refarming of existing IMT/WBB spectrum has been undertaken, especially as 3G services are sunseting before the current WBB licences expire.

Respectfully submitted,



5 June 2024

List of abbreviations/glossary

Abbreviation	Definition
3G	Third generation mobile phone service – being closed down this year
4G	Fourth generation mobile phone service -
5G	Fifth generation mobile phone service
AAM	Advanced Air Mobility
AAUS	Australian Association for Uncrewed Systems
ACCC	Australian Competition and Consumer Commission
ACMA	Australian Communications and Media Authority (spectrum regulator)
BVLoS	beyond-visual-line-of-sight
EFB	Electronic Flight Bag
ESL	Expiring spectrum licence
FSS	fixed-satellite service
GHz	Gigahertz
GNSS	Global navigation satellite service
ICAO	International Civil Aviation Organization
IMT	International mobile telecommunications
IoT	Internet of Things
ISM	Industrial scientific and medical
ITU	International Telecommunication Union
LIPD	Low interference potential devices
LoS	line-of-sight
M2M	machine to machine
MHz	Megahertz
MNO	Mobile network operator (e.g. Telstra/Vodafone/Optus etc)
MPS	Ministerial Policy Statement (on expiring spectrum licences)
MS	mobile service
QoS	Quality of service
RF	radiofrequency
RPAS	remotely piloted aircraft systems
RR	Radio Regulations
UAS	uncrewed aircraft systems
UAV	Uncrewed aircraft vehicle
UIOLI	use-it-or-lose-it
UIOSI	use-it-or-sell-it
WBB	wireless broadband

