Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

DSA
DYNAMIC • SPECTRUM • ALLIANCE

September 27, 2019

Before the
Australian Communications and Media Authority
ACMA
Australia

In the Matter of "Spectrum Sharing Overview and New Approaches" Invitation for Comment:

The Dynamic Spectrum Alliance (DSA) is a global, cross-industry, not for profit organization advocating for laws, regulations, and economic best practices that will lead to more efficient utilization of spectrum, fostering innovation and affordable connectivity for all. Our membership spans multinationals, small-and medium-sized enterprises, as well as academic, research and other organizations from around the world all working to create innovative solutions that will benefit consumers and businesses alike by making spectrum abundant through dynamic spectrum sharing.[1]

The Dynamic Spectrum Alliance's goals are to make spectrum abundant for broadband to connect the next four billion people, stimulate wireless innovation for next generation broadband, and accelerate an inclusive digital economy. We believe spectrum sharing plays a fundamental role in modern spectrum policy framework in achieving these goals and appreciate the opportunity to respond to the Australian Communications and Media Authority's (ACMA's) invitation for comments on its "*Spectrum sharing overview and new approaches"* information paper. We commend the ACMA for its leadership and urge the ACMA to enable even more spectrum sharing opportunities in anticipation of Australia's future digital and spectrum needs.

While Australia has made commendable progress with its National Broadband Network (NBN) rollouts, there nevertheless remain communities in rural and remote areas which are yet to be connected. Enabling more affordable access to spectrum resources to more players, such as local wireless Internet service providers (WISPs), is one key solution to connecting rural and remote areas. For example, allowing license-exempt and shared access to underutilized bands such as the UHF TV broadcast bands could offer opportunities for WISPs to provide low-cost services in rural and remote areas where fixed-line deployment may be uneconomic and unavailable. In urban settings, there has been an explosive growth of wireless data traffic and anticipated exponential rise in demand for more capacity and bandwidth which will put a strain on currently available spectrum resources. According to Cisco, Australia's mobile data traffic will grow 1.4 times faster than fixed IP traffic from 2017 to 2022,

[1] A full list of Dynamic Spectrum Alliance members is available on the Dynamic Spectrum Alliance's website at www.dynamicspectrumalliance.org/members.

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

at a CAGR of 37%.[2] Releasing more spectrum in the mid- and high-bands through spectrum sharing can help address this anticipated surge of demand on bandwidth.

As Australia continues to transition towards a digital economy and digital society, which will entail 5G deployments, new generation of Wi-Fi, smart city and IoT applications, it will require a significant expansion in the available license-exempt spectrum across low (sub 1 GHz), mid (1-7 GHz), and high (above 7 GHz) bands, in order to satisfy the projected increases in bandwidth consumption, especially at the network edges. In this regard, spectrum sharing will complement exclusive licensed spectrum access.

We applaud the ACMA for its recent efforts in expanding the classes of licensing arrangements to support 5G and other technological innovations,[3] and encourage the ACMA to continue this momentum towards updating spectrum management policies and practices, away from a predominantly exclusive licensing regime to a modernized policy framework that balances both licensed and license-exempt spectrum access and facilitates spectrum sharing.

We encourage the ACMA to consider increased adoption of Dynamic Spectrum Access (DSA) in Australia. Internationally, such frameworks have already been developed in major markets such as the US, UK, Canada, South Korea, and Singapore.

To conclude, we urge the ACMA to:

i) continue to examine opportunities to unlock new bands and access through spectrum sharing and DSA techniques;
ii) consider the costs and benefits of sharing a spectrum band versus exclusive licensing when examining new opportunities for access; and
iii) significantly improve the information exchange between government, industry, and public regarding spectrum use to enhance the efficient utilization of all spectral resources.

The Dynamic Spectrum Alliance submits the comments herein in response to the ACMA's issues for comment. Please do not hesitate to contact me for further discussions or clarifications on the subject matter.

Best regards,

Martha SUAREZ
President, Dynamic Spectrum Alliance

[2] Cisco Visual Networking Index, https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-highlights/pdf/Australia_2022_Forecast_Highlights.pdf
[3] ACMA, Class licensing updates: Supporting 5G and other technology innovations, https://www.acma.gov.au/theACMA/class-licensing-updates-supporting-5g-and-other-technology-innovations

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

DSA
DYNAMIC • SPECTRUM • ALLIANCE

Table of Contents

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

DSA
DYNAMIC • SPECTRUM • ALLIANCE

Question 1: Given current momentum in international markets and opportunities for other sharing models offered by 5G technologies, is it timely to develop a more detailed consideration of spectrum sharing opportunities in Australia?

The Dynamic Spectrum Alliance believes this is an opportune time for the Australian government and the ACMA to develop a more detailed consideration and adoption plan of spectrum sharing opportunities in Australia. The ultimate goal of such a plan would be to support national objectives, such as developing a digital economy and smart cities, leveraging and developing artificial intelligence applications, rolling out 5G deployment, and improving digital connectivity in regional Australia. Where radioelectric spectrum is naturally a shared resource, the ACMA should review how license-exempt, lightly-licensed spectrum, spectrum sharing, and similar approaches can be utilised to maximize access to the radio spectrum.

Licensed spectrum will undoubtedly continue to play a dominant and important role in the 5G wireless network buildout, under the existing carriers' business models, however, we also believe that 5G is primed to be more than just the next-generation cellular technology, or IMT-2020, but rather a combination of a diverse set of radio access technologies, operating on different frequency bands, under different authorization regimes, by existing operators and a greater number of new entrants, each serving a different set of customers and geographies with tailored applications and services, employing different business models. Not only will 5G be faster, provide higher capacity and lower latency, it will also be more efficient, innovative and ubiquitous.

To this extent a number of other economies are considering or enabling greater opportunistic spectrum sharing opportunities in the TVWS UHF and VHF bands, 3.5 GHz, 3.7-4.2 GHz, 5 GHz, 6 GHz, 37 GHz and 60/70 GHz band, amongst others to support user demand for more bandwidth for a range of operations including IoT applications and new generation of Wi-Fi. While the ACMA has recognized and described a number of notable global developments in its information paper, we would like to highlight a number of other global developments to showcase the growing momentum and some spectrum sharing use cases.

North America

Aside from enabling spectrum sharing arrangements in the TVWS bands and promulgating the Citizen Broadband Radio Service (CBRS), the Federal Communications Commission (FCC) is considering the authorization of an Automated Frequency Coordination (AFC) framework to facilitate shared access by unlicensed, licensed, and lightly-licensed entrants in underutilized bands, including:

- TV White Space (TVWS): In both the US and Canada, regulators have either concluded on a set of new and improved rules,[4] or launched additional regulatory consultation processes,[5] aiming to improve the existing technical rules governing the unlicensed, DSA to TVWS in the VHF and UHF bands, in order to allow more

[4] https://docs.fcc.gov/public/attachments/FCC-19-24A1.pdf
[5] https://www.rabc-cccr.ca/news/rss-222-2-and-dbs-01-2/

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

effective rural broadband coverage through shared access to TVWS spectrum. Additional proceedings have also been requested to further improve these rules to allow for additional and broader use cases such as narrow-band IoT.[6]

- 6 GHz: a proposal to expand the license-exempt 5 GHz band for Wi-Fi operations to include an additional 1200 MHz of spectrum in the 6 GHz band (5.95-7.125 GHz) band.[7] To manage interference with incumbent services in the 5.925-6.425 GHz and 6.525-6.875 GHz sub-bands, the FCC has proposed the use of an automated frequency control (AFC) system that would coordinate outdoor deployments to insure no interference with tens of thousands of point-to-point microwave links and other incumbents. In the 6.425-6.525 GHz and 6.875-7.125 GHz sub-bands, license-exempt devices would be restricted to indoor use operating at lower power, without an AFC system.

- 3.5GHz band (CBRS): On September 16, 2019, the FCC approved five private Spectrum Access System (SAS) administrators to commence initial commercial deployments (ICD) in the CBRS band.[8] The SAS is a dynamic DSA database that coordinates frequency use among the tiers of access and protects incumbents from harmful interference (discussed further below). ICD is the final step before full commercial operations in CBRS, and is a major milestone for dynamic spectrum sharing, DSA, and sensing technologies, as well as an achievement of governmental and private sector collaboration to serve the public interest.

- 3.7-4.2 GHz band: a proposal to authorize coordinated shared access by fixed wireless broadband operators (point-to-multipoint) in a substantial portion of the downlink C-band that will continue in use for Fixed Satellite Service (FSS) incumbents.

- 37-37.6 GHz band: a proposal to authorize coordinated shared use of the lower 37 GHz band by a variety of commercial and federal government users. The Shared Access Licenses and frequency coordination system are yet to be defined.

Latin America

In Colombia, the *Agencia Nacional del Espectro* (ANE), the Colombian spectrum regulatory agency published its final regulation for TVWS in 2017, becoming the first country in Latin America to finalise its TVWS regulations[9] and has recently updated the rules this year.

---

[6] https://ecfsapi.fcc.gov/file/1050380945109/White%20Spaces%20Petition%20for%20Rulemaking%20(May%203%202019).pdf

[7] FCC, FCC Proposes More Spectrum for Unlicensed Use https://docs.fcc.gov/public/attachments/DOC-354364A1.pdf

[8] Public Notice, Wireless Telecomms. Bureau and Office of Engineering and Tech. Approve Five Spectrum Access System Admrs to Begin Initial Commercial Deployments in the 3.5 GHz Band, GN Docket No. 15-319, DA 19-915, (rel. Sept. 16, 2019). https://docs.fcc.gov/public/attachments/DA-19-915A1.pdf

[9] DSA, http://dynamicspectrumalliance.org/wp-content/uploads/2017/08/DSA_Welcomes_ANE_TVWS_FINAL.pdf

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

In Argentina, a MoU has been signed between the Dynamic Spectrum Alliance and Argentinian Government Secretariat of Modernization to identify mutual areas of interest and promote the study of DSA, including the potential and possibility of developing a regulatory model to enable DSA use within Argentina.[10]

In Brazil, ANATEL the Telecommunications regulator has included TVWS as a technology under consideration for their regulatory agenda and plans to publish a public consultation about it before the end of the year. In Mexico, the *Instituto Federal de Telecomunicaciones* IFT has published a study about DSA and is considering dynamic spectrum sharing as an important tool for spectrum management.

Other countries such as Peru, Ecuador, El Salvador, and Chile have run some TVWS trials and are interested in exploring DSA as a tool to increase connectivity, especially in rural areas.

Africa

ICASA of South Africa led the African continent in embracing dynamic spectrum sharing in the TVWS by putting in place a regulatory framework in 2018.[11] Following South Africa's lead, NCA of Ghana[12] and INCM of Mozambique have each approved their respective TVWS regulation in 2019.

These regulatory approvals have stimulated and facilitated commercial exploitation of TVWS spectrum to bring affordable access to rural and remote areas, contributing to closing the digital divide in these countries. For example, Denmark-based Bluetown has announced a plan[13] that will provide broadband internet access to approximately 800,000 unserved people in the eastern part of Ghana. The project will use Wi-Fi and TVWS technologies to bring public Wi-Fi zones with affordable Internet access and free access to digital services (e-learning, e-health, news and more) as well as dedicated Internet access to local institutions and businesses. In South Africa, the Wireless Access Providers Association (WAPA) was awarded a grant from the U.S. Trade and Development Agency (USTDA) for a pilot project that will help improve internet access for rural and semi-rural areas in South Africa through the use of TVWS spectrum and associated radio technologies, as permitted by the regulatory framework put in place by ICASA.[14]

Such regulatory momentum continues to grow in Africa. Among other African countries, Uganda has already released its draft TVWS guidelines and is currently in the process of finalizing them following its public consultation in July 2018.[15] Other major African economies such as Nigeria and Kenya are also making progress in developing their own TVWS regulation, which can be expected in the near future.

[10] DSA, http://dynamicspectrumalliance.org/wp-content/uploads/2019/08/DSA_Argentina_Workshop_FINAL.pdf
[11] https://www.icasa.org.za/uploads/files/Regulations-on-the-use-of-Television-White-Spaces-2018.pdf
[12] https://www.nca.org.gh/assets/Uploads/Guidelines-for-TVWS-Data-Services.pdf
[13] https://www.businesswire.com/news/home/20190108006183/en/BLUETOWN-Announces-Partnership-Microsoft-Close-Digital-Divide
[14] USTDA, https://ustda.gov/news/press-releases/2019/ustda-expands-affordable-internet-access-south-africa-creates-new-us-export
[15] UCC, https://www.ucc.co.ug/wp-content/uploads/2017/09/TVWS-Guidelines-for-Consultation-9th-July-2018_v2.pdf

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

DSA
DYNAMIC • SPECTRUM • ALLIANCE

Europe

The European Union is considering unlicensed access in the 6 GHz band from 5925 to 6425 MHz. Similar to the FCC's pending rulemaking, the European Commission has tasked a working group to study the regulatory and technical feasibility of authorizing unlicensed RLANs to operate on a secondary basis in the 6 GHz band (5925-6425 MHz).[16] A final draft report, including an assessment of coexistence scenarios with band incumbents was published in May 2019, and it will be followed by a public consultation and a final report by March of 2020.

In the Netherlands, the Radiocommunications Agency Netherlands, has implemented the use of Licensed Shared Access of mid-band spectrum based on ETSI specifications in the 2.3-2.4 GHz frequency band.[17] Developed by the ETSI technical committee Reconfigurable Radio Systems (TC RRS), the specifications ETSI TS 103 235 and ETSI TS 103 379 offer a spectrum sharing solution among multiple distinct services including broadcast and entertainment Program Making and Special Events (PMSE) involving wireless cameras and portable video links.

In the UK, Ofcom has made available for spectrum sharing frequencies in the 3.8-4.2 GHz, 1800 MHz shared spectrum and 2300 MHz shared spectrum bands for new users while also considering including spectrum in the 26GHz band in the future.[18] Ofcom will manage and coordinate access to these bands on a per location, first come, first served basis where interested users can apply for two types of Shared Access license (distinguished by permitted power levels) to cater for different types of potential uses namely a per area license with a lower power limit and a base station license with a medium power limit.

France has published the results of their study about Spectrum Sharing and is planning to open a consultation about it.

Asia

A number of Asian countries have also been at the forefront of adopting dynamic spectrum sharing in the TV White Space bands. Countries that have approved shared access to TVWS include Singapore, South Korea, the Philippines. A greater number of Asian countries have conducted regulatory or commercial TVWS trials, including Japan, India, China, Indonesia, New Zealand, Bhutan, and Nepal.

As a broader policy directive, the State Radio Regulation of China published in 2018 an opinion piece on the need to take better advantage of DSA to more efficiently and effectively use spectrum resources amidst rising spectrum demands – an area the department will continue to research and pilot in China.[19]

---

[16] DG CNECT/B4. Mandate to CEPT to study feasibility and identify harmonised technical conditions for wireless access systems including radio local area networks in the 5925-6425 MHz band for the provision of wireless broadband services.
[17] ETSI, https://www.etsi.org/newsroom/news/1625-2019-07-etsi-specifications-on-licensed-shared-spectrum-successfully-implemented-in-the-netherlands-for-the-entertainment-industry
[18] Ofcom, https://www.ofcom.org.uk/__data/assets/pdf_file/0033/157884/enabling-wireless-innovation-through-local-licensing.pdf
[19] SRRC, http://www.srrc.org.cn/article20512.aspx

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

Similarly, Japan's Ministry of Internal Affairs and Communications (MIC) has released its Spectrum Reorganisation Action Plan (2019 Revision).[20] The MIC has set the 'Promotion of dynamic frequency sharing' as a key goal and aims to construct a dynamic frequency sharing system by 2020. In addition, in spectrum bands used by regional BWA and digital terrestrial television broadcasting, the verification for advanced frequency sharing between multiple wireless systems according to various needs will also be performed.

Given these examples of other global development and the current momentum towards greater shared spectrum and DSA use, we encourage the ACMA to take advantage of the experiences from other regulators and consider enabling and expanding the use of spectrum sharing and dynamic access in Australia.

Question 2: Are there recent developments in sharing techniques that industry and the ACMA should be aware of?

In the whitepaper entitled "*Automated Frequency Coordination - An established tool for modern spectrum management,*"[21] the Dynamic Spectrum Alliance makes the case that the use of databases to coordinate spectrum assignments has evolved but is *nothing new*. The basic steps are exactly the same as in a manual coordination process. What is new are: (1) surging consumer demand for wireless connectivity and hence the need to intensively share underutilized frequency bands; (2) significant improvements in the computation power to efficiently and rapidly run advanced propagation analysis and coordinate devices and users in near real-time; and (3) more agile wireless equipment that can interact directly with a dynamic frequency coordination database. There is no question that today we have the technical ability to automate frequency coordination and thereby lower transaction costs, use spectrum more efficiently, speed time to market, protect incumbents from interference with certainty, and generally expand the supply of wireless connectivity that is fast becoming, like electricity, a critical input for most other industries and economic activity.

Under a DSA approach, equipment communicates directly with a database to be granted access to spectrum at the location and time required on whichever frequencies are unused at the time by existing users. This is the approach which underpins TVWS devices and the CBRS regulatory regime in the US. Based on the type of device (fixed or personal/ portable) and its coordinates, information about the transmitter's location and operating parameters, and the technical rules the regulator puts in place to protect incumbents from harmful interference, a calculation engine determines the list of available channels at the secondary user's device location and its maximum permissible radiated power. This capability enables a regulatory framework for shared access without disruption to incumbent operations, giving regulators control and flexibility in improving spectrum utilization while simultaneously protecting against harmful interference. The FCC's and private industry's commencement of ICD in the CBRS band is the most recent example of the technical and commercial viability of DSA, even in the most challenging of spectral environments.

[20] Japan MIC, http://www.soumu.go.jp/main_content/000642376.pdf
[21] http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

Adopting dynamic database systems also has the added benefit of reducing the administrative burden on both industry players and the regulator by eliminating the need for each individual user to apply for permission to share spectrum and thus encouraging more users to leverage shared spectrum. To further enhance transparency and immutability, the use of blockchain is currently being investigated to manage spectrum databases.

Question 3: What are the (potentially new) use cases that might benefit from secondary or tertiary access to spectrum and who benefits?

There are a number of potential use cases that can benefit from secondary and tertiary access to spectrum for both coverage and capacity. Examples include non-critical IoT services, rural and remote connectivity, disaster-relief operations and new generation Wi-Fi.

Shared spectrum is expected to play a key role in connecting IoT for smart city applications, where according to Cisco, there are 259.9 million networked devices forecast in Australia by 2022, up from 143.2 million in 2017.[22] Given the large number of devices, it will not be feasible, nor will it be necessary to allocate spectrum for each device. Different use cases mean some IoT sensor networks will be less sensitive to throughput and latency but will have larger coverage requirements and lower power usage, while others will have high expectations on throughput and latency. These applications which may only require "bursts" of transmissions and are thus less time-sensitive would be key beneficiaries of secondary and opportunistic access to spectrum. Examples include sensors for traffic cameras, weather measurement devices, and warehouse logistics.

Research has shown frequencies in rural and remote areas are underutilized most of the time and enabling low-cost access to this spectrum could allow WISPs to offer more affordable broadband to communities where fixed-line access is unavailable. For example, dynamic sharing options in the TVWS bands can offer long-range, affordable connectivity especially for rural locations. Apart from mobile broadband, such use opens up additional opportunities for wider propagation of NBN satellite services in remote areas or particular service delivery scenarios such as health and education, or agricultural connectivity for farmers to use precision agriculture.

In times of disaster, real-time communications play a key role in saving lives pre- and post-disaster to warn citizens of impending disasters and facilitate evacuations before a disaster strikes and helping to coordinate disaster-relief efforts and support long term recovery after a disaster. In this regard, the use of TVWS radio technologies can be instrumental in providing on-the-ground communications for disaster relief respondents and disaster victims as TVWS communication networks can be setup swiftly to provide immediate on-the-ground communications network.

In the case of the new Wi-Fi generation, WLAN/RLAN will carry offload from cellular 5G technologies (total data offload to unlicensed going from 74% to 79% in 2022). This will lower the costs of network deployment for mobile

[22] Cisco Visual Networking Index, https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-highlights/pdf/Australia_2022_Forecast_Highlights.pdf

operators and for edge investment by neutral host and third-party providers (e.g., cable companies, enterprises that want to build private 5G networks to run factories). It will also lower costs for consumers. Additionally, this will allow gigabit class networks to be deployed in rural and suburban environments. Wi-Fi6 indoor use cases include residential Multi-AP / mesh networks, multiple dwelling unit (MDU), single-AP networks, high-density enterprise networks, indoor public venues and industrial IoT. Very low power portable Wi-Fi usages are for example mobile AR/VR, UHD video streaming, high speed tethering and in-vehicle entertainment.

Question 4: What are the potential challenges/impediments to the introduction of DSA in Australia—technical, industry capability, licensing and regulatory frameworks?

We believe that the technical and industry capability challenges to DSA today can be more than sufficiently addressed by a combination of technological innovation and policy/regulation. Today, the rapidly growing DSA industry includes global businesses, academia, radio manufacturers and regulators, which can share experiences and best practices on these areas.

In recent years, as demand for wireless connectivity has surged, the use of databases to coordinate more intensive and efficient spectrum sharing has emerged as a critical regulatory tool. Regulators in a number of countries have authorized automated and even dynamic frequency coordination databases to manage real-time assignments in shared bands and to protect incumbent operations (including military and public safety systems) from harmful interference. On the technological front, spectrum sensing cognitive radios have been developed, although these remain under experimentation and most regulators are more comfortable with the use of SAS or geo-location databases. Database technologies are widely available, sufficiently mature, scalable and secure.[23]

On the licensing and regulatory fronts, the ACMA will likely need to develop its own rules on spectrum sharing to ensure fair, safe, and responsible use while protecting incumbents from interference. In the case of TVWS, further regulations published by the US, UK, Canada, and Singapore, together with the Dynamic Spectrum Alliance's model rules[24] and regulations for TVWS, offer clear reference points for the ACMA. Importantly, there is also a need to change conservative mindsets in policymakers and industry that hold the conventional idea that spectrum cannot be shared. Where tiered access will enable spectrum to be shared by a hierarchy of users, the ACMA may need to conduct open discussions with primary users to alleviate worries and demonstrate how SASs or databases may be used to ensure primary users will maintain exclusive use where required. The Dynamic Spectrum Alliance is ready to support the ACMA in that process with demos or sharing more detailed information if required.

[23] http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf
[24] http://dynamicspectrumalliance.org/wp-content/uploads/2018/01/Model-Rules-and-Regulations-for-the-use-of-TVWS.pdf

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

Question 5: Facilitating spectrum access (e.g. monitoring, control, reporting, assignment) logically necessitates involvement from both government and industry. Are there any early thoughts on what an appropriate industry/government balance might look like? How might the ACMA facilitate shared spectrum access? How might the ACMA address this?

Due to the limited resource that is spectrum, there will always be arguments over how spectrum is allocated and shared among incumbents and secondary users. As acknowledged by the ACMA, non-interference is the key to enabling spectrum sharing in a fair manner.

In the case of TVWS, the Dynamic Spectrum Alliance has focused on developing a set of rules and guidelines for their use, and has published a set of Model Rules and Regulations for the use of TVWS.[25] These model rules can be adapted and provide guidance on geolocation and database access, how to administer a database, spectrum sensing in the TV broadcast bands, technical requirements for devices operating in the 8 MHz and 6 MHz band and others.

In the case of CBRS, adoption and implementation of the CBRS regulatory framework required an unprecedented amount of collaboration from private industry, the US Department of Defense, the FCC, and the National Telecommunications and Information Administration. In addition, a standards setting organization, the Wireless Innovation Forum, comprised of equipment manufacturers, tech companies, software providers, academic and governmental officials, created the technical standards for the band. Private industry is now deploying networks in CBRS and providing SAS services, as certified by the FCC, as part of ICD, which is being overseen by the FCC.

Question 6: What is the relevance of DSA examples such as the US Citizens Broadband Radio Service (CBRS) arrangements to the Australian spectrum environment? Are there other or lower cost alternatives to help inform access control and assignment systems of incumbent usage in a timely manner?

The CBRS system and recently-commenced ICD in the US demonstrate the viability of shared spectrum use among secondary and opportunistic users, while also ensuring protection of military and satellite incumbents from harmful interference. It should be kept in mind, however, that CBRS is a unique framework suited for a unique spectrum environment in the US requiring the accommodation and protection of unpredictable naval radar use. Spectrum sharing regimes need not be as complex in other countries or contexts. Indeed, DSA supports spectrum sharing regimes that are only as complex as required by the particular environment. Simpler is always better.

In that vein, a simpler version of dynamic spectrum sharing may be more relevant for Australia which has both noisy urban cities, as well as large land masses and remote and rural areas which will benefit from access to the underutilized spectrum for point-to-multipoint services. The same database approach could also be used to keep as many parameters as possible dynamic and configurable. For example, in defining geographical areas to be

[25] Dynamic Spectrum Alliance, http://dynamicspectrumalliance.org/wp-content/uploads/2018/01/Model-Rules-and-Regulations-for-the-use-of-TVWS.pdf

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

made available for mmWave band operations, the ACMA can utilize a geo-location database approach to keep the definition of geographical areas configurable in real-time. Authorizing multi-authorization arrangements and applying a dynamic database approach are two examples of such measures that would help to keep the regulatory framework for 5G and new broadband generation agile, flexible and future-proof.

Question 7: Under a multi-tier DSA approach:

Tier 1 (highest priority or incumbent) users would be expected to share spectrum with lower tier users when not being utilised. Are there any specific licensing and/or regulatory arrangements that might incentivise the tier 1 users to release unutilised spectrum for lower-tier access?

Research has shown that most allocated spectrum is actually unused most of the time, and for tier 1 incumbent users, there is a need to assure and possibly demonstrate that co-existence between lower-tier access users is possible, but also that tier 1 users will still retain exclusive use of the spectrum where required. When identifying spectrum sharing considerations, the ACMA will want to undertake in-depth studies to accurately identify how much and how often incumbents use the spectrum to assess how efficiently the spectrum is used.

The use of a geolocation database that can coordinate sharing among multiple users by monitoring use in real-time and reallocating lower-tier access users when required by incumbent users. This will enable different use cases for different frequency blocks and different channel bandwidths in different locations to make more efficient use of spectrum. And while there have been many pilots and deployments around the world which have demonstrated the viability and non-interference, experience has shown us that tier 1 users may need first-hand experience to convince them.

Under the CBRS regulatory framework, for example, the SAS coordinates CBRS frequency use and manages coexistence among the three tiers of access--incumbent (e.g., navy radar and satellite), priority access licensed (PAL), and general authorized access (GAA)--while the ESC network detects incumbent naval radar use of the band, thereby alerting the SAS to move commercial operations to non-interfering channels.[26] This framework ensures that incumbent and licensed operations can be protected and operate without harmful interference from other users of the band. Furthermore, the success of this framework, as most recently demonstrated in the commencement of ICD, creates conditions to make sharing acceptable for private and governmental stakeholders in other bands that are concerned foremost about the continuity and reliability of their operations.

The ACMA can also employ a “use-it-or-share-it” policy to prevent incumbent users from warehousing valuable spectrum resources if they are underutilized. Conceptually, use-it-or-share-it rules authorize opportunistic access to licensed spectrum that is locally unused or underutilized. Until the spectrum is actually put into service in a local area it should be available for non-interfering use by networks and devices. Licensees lose no rights whatsoever. Building on this precedent, in 2016 the FCC authorized opportunistic access by GAA users to unused

[26] See 47 C.F.R. § 96.

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

PAL spectrum.[27] Opportunistic use of unused PAL spectrum is controlled by the SAS, which requires that GAA users must periodically check with the database to renew permission to continue operating.

A general use-it-or-share-it authorization has a number of affirmative benefits. First, opportunistic access reduces spectrum warehousing in areas where the economics are least attractive for large ISPs, particularly in rural and other less densely populated areas. A use-it-or-share-it approach creates a general incentive for licensees to build out services more quickly, or to make greater efforts to partition or lease, since opportunistic use of the band will demonstrate that smaller ISPs and other users are finding value in the unused portions of their license area. This will discourage spectrum warehousing and increase access for operators that are ready to deploy, but who lack needed spectrum access in that local area.

Second, opportunistic access further encourages secondary market transactions by facilitating price discovery on both the supply and demand side. For licensees, it will both identify users interested in a potential lease or partition and provide information on the potential value (i.e., how much is my spectrum worth?). For users, opportunistic use is an opportunity to test the local market and to determine the value of a more secure, longer-term lease or partition agreement (i.e., how much am I willing to pay for spectrum?).

Third, opportunistic access will lower barriers to entry for innovative new use cases by parties that at least initially either cannot afford or do not believe they need to pay for exclusive use and interference protection. The option to deploy, at least initially, without committing to the cost of a long-term lease or license could be particularly useful for small rural ISPs. Although the duration of opportunistic access is uncertain, they can at a minimum use it to increase capacity

Tier 2 and 3 users need to vacate spectrum (regardless of their service type or communication urgency) for tier 1 users to operate seamlessly. Do we see potential services/service types in Australia who would fit the criteria of second or third tier users? What are the incentives to adopt a conditional (lower priority) spectrum than an unconditional (full access) spectrum?

As mentioned, a large number of networked devices are expected to come online in the near future, where not all of them will be allocated or require dedicated spectrum and bandwidth for operations, such as for narrowband IoT sensors which are used for non-critical, non-time sensitive applications.

Shared spectrum in different frequency bands can also be used to complement broadband connectivity and used by WISPs to provide rural connectivity under the Regional Connectivity Program using TVWS, WLAN/RLAN or LTE technologies. Broadband and digital technologies are recognized today not just as an enabling and powerful force for socioeconomic progress, but an increasingly *vital* part of 21st century infrastructure. And while urban communities enjoy the availability of gigabit connectivity, high-speed wireless broadband, and high-capacity networks, rural communities, globally, are lagging behind resulting in an ever-widening digital gap. While the Australian Government has performed a commendable job in promoting wider access through the NBN and

[27] Order on Reconsideration and Second Report and Order, GN Docket No. 12-354, at ¶ 177 (April 28, 2016).

Dynamic Spectrum Alliance Limited
3855 SW 153rd Drive
Beaverton, OR 97003
United States
http://www.dynamicspectrumalliance.org

Mobile Black Spot Program, the geography and low population density of rural Australia continues to make it challenging for the provision of affordable broadband in such areas.

Adopting a tiered system will enable more users to share scarce and valuable spectrum resources leading to lower-costs, lower barriers to entry, and most effective allocation of access for use by smaller businesses, farmers for agricultural connectivity, etc. This allows for and encourages competition and innovation by providers and new entrants to invest more significantly in network deployment instead of spectrum acquisition. As 5G standards and use cases continue to develop we strongly urge the ACMA to continue to consider more flexible, and multi-authorization licensing arrangements in different spectrum bands as it embraces Australia's future digital economy and society.