

Motorola Solutions' response to the ACMA's discussion paper:

Spectrum sharing

Overview and new approaches

AUGUST 2019

Context

Within Australia and internationally Motorola Solutions (Motorola) is a major supplier of radiocommunications equipment and services to governments, emergency services organisations, the mining industry, the energy industry, manufacturing sectors, transportation, tourism, telecommunications carriers and telecommunications service providers.

Motorola has been a leader in the field of radiocommunications for 85 years, excelling in the research and development, production, marketing and efficient operation of radiocommunications equipment and systems all over the world. Motorola's brand is indeed synonymous with high quality radiocommunication products and services. As a world-wide operation with close operator links Motorola believes that its accumulated experience qualifies it well to comment on this discussion paper.

Motorola is a strong supporter of standards based technology and spectrum harmonisation with Australia's major markets in Asia, Europe and the Americas. This support helps to ensure that up-to-date radiocommunications equipment is readily available. Use of standards based technology and spectrum harmonisation with other major markets reduces costs for manufacturers and service providers, maximises competition, and results in lower costs for consumers.

The primary commercial interest of Motorola is in the provision of solutions encompassing the design, manufacture and supply of communications equipment, systems and services for the Public safety agencies, land mobile radio and broadband data users. Motorola knows that issues relating to the allocation of radio frequency spectrum impact directly on the demand for its communications products and the issues discussed here are particularly relevant.

Radiocommunications are essential for agencies involved in the defence or national security of Australia, law enforcement or the provision of emergency services. Two-way radio provides the communication infrastructure for a wide range of industries ranging from agriculture, mining & construction through to transportation & hospitality. Private broadband data radio systems provide a wide range of industry and enterprise users custom capabilities that are not otherwise available.

Motorola thanks the ACMA for the opportunity to comment on its discussion paper on the Spectrum sharing -Overview and new approaches. Motorola submits that one area of spectrum management that would enable greater spectrum sharing is missing from the sharing consultation. This has previously been mooted both in the US and in Australia as 'noise floor management'. In effect though it is simply an implementation of the ITU Radio Regulations Article 3, paraphrased 'learn to live in an interference environment'.

Many technologies still come to the ITU-R seeking greater protection than the previous generation. We wonder whether this is sustainable in the long term? However, the simple addition of a theoretical noise floor as a design requirement could potentially open up bands where access is currently restricted. Early examples of this exist in the ACMA's RALI MS-8 amongst others.

The actual margin would of course depend on the bands and the technology types, 6dB is used only as an example in order to raise the noise floor so that receivers take into account noise from other systems.

Other than this element Motorola congratulates the ACMA for its forward thinking demonstrated in the 'Sharing paper' and looks forward to engaging with the ACMA in the future.

Motorola encourages ACMA to offer parts of 3400-4200 MHz for localized broadband systems using highly innovative sharing techniques such as CBRS. Similar approaches have recently been followed in Germany and UK. We

believe that these approaches will greatly improve enterprise, industrial, and productivity levels. Indeed, many 5G (as well as 4G) services can be offered in these bands on shared basis with Fixed and Fixed satellite services. One only has to look at the success of the WiFi shared bands and ecosystem worldwide to see the promise of shared bands and localized uses of spectrum. Similar successes can be had in locally licensed and shared use of these bands.

Shared spectrum can offer localized broadband systems unique capabilities through highly customized levels of coverage, capacity and security that nationwide or public cellular systems cannot readily offer. By offering a part of 3400-4200 MHz (in particular 3700-3800 MHz) for industrial and enterprise use, ACMA will be wisely increasing nationwide spectrum utilization while improving productivity and connectivity for thousands of entities and users.

Motorola notes the changes in use globally, with the most common being a re-farming of the band for mobile and associated services such as Fixed Wireless Access (FWA). A revaluation of this segment of the band is timely and an opportunity to evaluate the value of new services and measures to either grandfather or phase out legacy FSS is also needed.

Motorola notes that there is currently no spectrum available for private networks using CBRS technology. This band would appear to present a good option for these technologies to provide services and systems in areas where there are no alternatives. Industries which would benefit from this approach would be mine-sites, large integrated agricultural enterprises and any other application operating over a moderately large area.

CBRS offers many advantages for Australia's industrial and economic development:

1. **INCREASED ACCESSIBILITY:** CBRS and its increased accessibility is a game-changer for business enterprises. Currently, there is no publicly available broadband spectrum for use by private businesses. As a result, some organizations looking for private broadband coverage are required to

lease through carriers – often requiring a multi-million dollar system. Other businesses turn to public LTE or WiFi to address their business data needs. While this has enabled workers to accomplish tasks on their mobile devices that previously required a computer or their physical presence on the job, network congestion, weak signals in certain locations and security remain critical issues.

2. CBRS introduces publicly available broadband spectrum for the first time – significantly lowering the barrier to entry for business enterprises. And unlike previous systems, it does not require an organization to purchase spectrum making it a much more cost-competitive option for broadband coverage. Organizations are able to design their own coverage, customizing the network to meet their unique needs. The system can easily be expanded or downsized to evolve with their business.
3. **MORE EFFICIENCY:** The economics of CBRS technology are more efficient than those of distributed antenna systems – networks of antenna nodes that provide wireless service within a geographic area or structure. In addition, the speed and consistency of service are considered potentially “more reliable than Wi-Fi”. While WiFi has revolutionized wireless networking, it does have its drawbacks. WiFi coverage and capacity can be limited, access points can be finicky and sign-on processes can be tedious. Ultimately, WiFi wasn’t designed for complex commercial operations. CBRS overcomes these limitations and provides a more efficient option for large commercial enterprises like airports and factories – providing comprehensive on-site coverage that can blanket every corner of your operation.
4. **GROUND-BREAKING ADVANCEMENT:** But perhaps the most ground-breaking advancement of this newly introduced access to private broadband spectrum is the ability to employ highly-reliable LTE networks that support the growing number of IoT devices. These devices, including smart meters, real-time surveillance systems and worker safety monitoring sensors, are increasingly becoming critical parts of business



operations and they require constant, reliable broadband access. CBRS provides this, enabling organizations to embrace the potential of IoT.

Ultimately, CBRS makes it possible to create an affordable, private data network at a lower cost and without the reliance on a wireless carrier. Looking forward, CBRS and the infinite capabilities it will unlock will help to drive automation, workforce productivity, efficiency and safety – all critical concerns for today's forward-looking organizations.

Motorola therefore supports the 'alternative' arrangements whereby an 'area licence' could be issued to support a private LTE network over such areas. This could be in incumbent spectrum where Dynamic Spectrum Access is possible or as a primary service in unencumbered geographical areas.

Our detailed responses are enclosed

A handwritten signature in blue ink, appearing to read 'Bhatia', with a horizontal line underneath it.

Bharat Bhatia

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Responses to ACMA's questions.

1. Given the 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?

This is a good time to consider sharing to allow more entrants and thus more competition in the telecommunications market. MSI generally supports developing and deploying spectrum sharing technologies for both 4G and 5G networks in Australia. There is a wide range of spectrum sharing techniques that can be effectively employed in Australia to improve spectrum access and utilisation.

While Spectrum Licensing opened up a number of bands in the past which enabled growth in the mobile communications market, one basis for this form of licensing has failed. Initially it was envisaged that a market would develop whereby spectrum was traded or shared. This has not eventuated with the large carriers tightly holding their spectrum for either services or to deny spectrum to others for competition reasons.

Spectrum is now becoming congested. The IMT community seeks more and more spectrum, perhaps to deliver services or perhaps to devalue spectrum lots. Regardless of the reasons there would appear to be more than sufficient 5G spectrum available for the major carriers in Australia and indeed globally. There is insufficient spectrum available for small carriers and for niche services such as for large mine-sites or large agricultural businesses. The best way to deal with this demand and congested spectrum is through various sharing methodologies some of which are outlined in the paper.

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

Yes, there have been significant developments in the UK and Germany, as well as ongoing developments in the US in spectrum sharing deployments. In particular, the UK regulator Ofcom is opening up some very large spectrum sharing bands (e.g., 3.8-4.2 GHz), where relocating incumbents would be difficult and time-consuming. Ofcom is also readily making localised spectrum available in unused areas in popular cellular bands. Both of these items will greatly improve overall spectrum utilization, which is an overarching goal of regulators worldwide. The German regulator Bundesnetzagentur is making available the 3.7-3.8 GHz band for industrial private broadband systems, which will significantly improve productivity for industry. In the US, the CBRS band is finally rolling out and enjoys widespread industry support (with the CBRS Alliance industry body currently having over 120 members). All of these countries realise the value of spectrum sharing technologies.

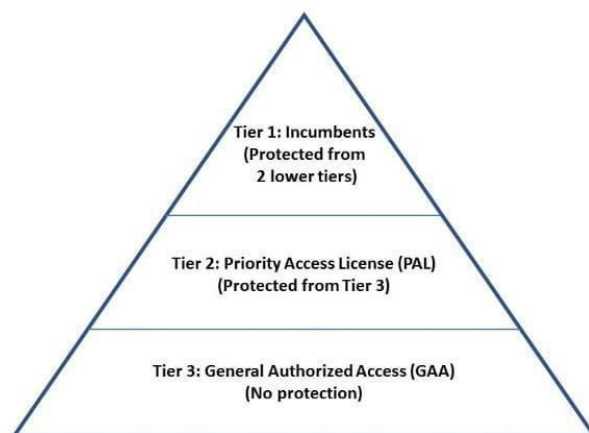
Some of these countries (e.g., UK and Germany) are promoting more traditional sharing of localized broadband spectrum resources (that are managed and licensed more statically through the regulator), while other countries (e.g., the US) are managing spectrum more dynamically. MSI supports the former approach in cases where spectrum use is more static (e.g., with relatively fixed base stations and incumbents), while also supporting the latter case where spectrum use is more dynamic (e.g., by the military in the US). In both cases, the key is that valuable spectrum resources are being effectively utilized by other users to improve access or performance.

CBRS, or the Citizens Broadband Radio Service, is a system that in the US has been allocated 150 MHz of spectrum in the 3.5 GHz band. CBRS is designed with a three-tiered spectrum sharing framework enabling it to share with various incumbent services (in the US that is military radar and FSS Rx links). At

the top is the Incumbent Access tier. This is specifically allocated to existing users of the band, who will receive permanent access and site-specific protection or be given a grandfather period.

The second tier is the Priority Access tier. Users in this tier must protect incumbents but are granted protection from the lowest tier users. In the US a 'priority' fee is payable to gain this level of protection. These licenses can be purchased at auction with limited renewal rights.

The final tier is General Authorized Access (GAA), which covers the remainder of the spectrum and is available for general use. This three-tiered framework is managed through a Spectrum Access System (SAS) that works to protect higher-tier users from interference from lower-tier users, while optimizing the efficient use of available spectrum for all users.



US CBRS Tiers

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

Private networks, in mine sites or on large agricultural enterprises are examples of where a private network utilising spectrum sharing in the 3 GHz band would provide great benefit.

Several parties benefit from improved access from spectrum sharing, since increased spectrum access allows increased innovation, improved broadband access, and increased industrial and enterprise productivity levels. So called private broadband networks can positively impact all of these areas. These networks can support improved capacity, tailored coverage and other capabilities (e.g., improved security and privacy) that are better suited for specific classes of users (e.g., enterprises, that only need improved access over a campus area). Improved spectrum access brings these capabilities to a much wider class of users.

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

A number of systems are evolving, many of which, such as EESS, are demanding more and more protection. This is incompatible with spectrum sharing and will lead to congestion and unnecessary denial of service. It is incumbent on regulators to challenge any system that is claiming extra protection or protection levels in excess of that normally applicable to that service. Obviously some services, such as PPDR and sensitive RAS facilities (such as the SKA) do require extra protection. However care must be taken to not waste spectrum protecting ‘paper’ systems.

Existing systems also pose a challenge. With the exception of sensitive systems such as certain RAS facilities and PPDR the ACMA should look at lowering the levels of protection provided so as to allow ‘secondary’ systems such as CBRS access to spectrum.

Some years ago both the FCC and ACMA investigated a concept then known as 'noise floor management'. In the case of the fixed services (FS or FWA) this would simply include a requirement to allow for extra noise in the link budget. A small additional margin of (say) 12 dB would enable many other users into a band. Obviously the best area to introduce such a concept would be in the 3400 – 4200 MHz so as to allow shared access to the band. The concept could then be introduced as licences are reissued in other bands.

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? MSI supports significant industry involvement in developing regulations. One example of spectrum sharing industry development is the Wireless Innovation Forum's Spectrum Sharing Committee, which is the FCC recognized multi-stakeholder industry group used for developing spectrum sharing standards for the CBRS band in the US. Either ACMA or the industry can perform the day to day management of shared spectrum.

There needs to be a balance between regulatory intervention and flexibility. Initially in the first band a system of 'as required' reporting would seem to be necessary as apart from legacy systems the ability to monitor and record interference levels would (should) be inherent in the new systems.

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 US CBRS system is designed to operate with mobile incumbents (e.g., naval radar systems) in a dynamic manner. It is unlikely that ACMA will need such a dynamic approach to accommodate additional users of spectrum. As such, more regulator driven spectrum access approaches (such as the localised broadband licensing methods used in the UK) may be appropriate, especially initially. As spectrum sharing becomes more popular, it may be desirable to automate such licensing processes (e.g., in a geo-location database approach).

As opposed to requiring costly or extensive sensing networks, an informing incumbent approach is recommended, since it lowers deployment costs and will speed spectrum sharing deployment. In this case, an incumbent may directly inform a spectrum management database that it intends to (actually) utilize particular frequencies in a particular geographic region (with agreed upon operating parameters that are utilized to compute interference protections for the incumbent).

Many systems would be able to access a band depending on the regulatory measures used. However CBRS is currently the only system that has been demonstrated to be able to use dynamic spectrum access to use otherwise underutilized spectrum resources.

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?

Sharing should be based on actual spectrum usage, and spectrum hoarding should not be tolerated in most cases. If the spectrum is not utilized for a valid purpose in a particular area, it should be made available for additional uses (with the proper interference protections to incumbent system usage). In some cases, it might be appropriate to pay an incumbent spectrum holder reasonable fees for spectrum access to incentivise them to make spectrum available. In other cases, a use-it or lose-it approach may be more appropriate (such as the UK approach to unused cellular spectrum).

- > 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?

Many business and use cases require at least some assurance to spectrum access most or all of the time. This can be achieved through providing access to multiple channels or bands of shared spectrum (e.g., 3GPP B42 and B43), where at least some spectrum can reasonably be expected to be available in a particular area at any given time. Both unlicensed use (e.g., Tier 3 GAA in CBRS) and licensed (e.g., Tier 2 PAL in CBRS) usage models can be important, if there is enough spectrum available to accommodate them. Licensed uses generally provide more assurance that spectrum is available based on geographic or frequency coordination (assuming that incumbents are relatively fixed). Unlicensed approaches can also help to support a rapid rollout of technology (e.g., WiFi-like approaches) if enough spectrum is made available. So, both types of uses may be important.