

Mr Chris Hose,
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Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

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Dear Chris,

Re: Spectrum sharing – Overview and new approaches – Information Paper.

Free TV members welcome the opportunity to provide comments on the Spectrum sharing – Overview and new approaches – Information Paper.

In summary, Free TV members can appreciate the importance of keeping abreast of new and innovative spectrum management practices which may have an application within an Australian regulatory environment.

Any assessment of the applicability of spectrum management trends in what are largely more populous spectrum markets should be evaluated on the basis of cost / benefit to the Australian market, regulatory environment, spectrum stakeholders and management of the Australian regulatory framework by the ACMA.

It would be a mistake to overlook and underestimate some of the already established and Dynamic Spectrum Access “like” frameworks which have already been innovatively established in partnership between the Australian regulatory authority and spectrum stakeholders. For example, that established many decades ago between PRIMARY broadcasting services and Secondary wireless audio transmitters aka wireless microphones in the VHF and UHF broadcasting service bands. Adequately described at - <https://www.acma.gov.au/theACMA/channel-finder>

Specific comments on the Information Paper follow where we believe we have addressed many of the issues for comment listed on page 4 of the Information Paper.

Executive Summary

“All access to spectrum is on a shared basis in some form”

Free TV response – this is not always the case. Some frequency bands and licensing schemes preclude spectrum sharing due to the characteristics of the technologies deployed and licencing in specific frequency bands.

“A key characteristic of most traditional approaches to spectrum sharing, at least coordinated access approaches, is that the arrangements are based on licensed use. This means that these sharing arrangements will sometimes not be well equipped to dynamically respond to an environment where actual spectrum use changes.”

Free TV response – on the other hand traditional and deterministically based sharing arrangements provide certainty for spectrum licensees.

“A key concept in many new and emerging sharing approaches is that they are informed by information on actual spectrum use, as opposed to authorisation/licensing descriptors that might appear, for example, in a database such as the Register of Radiocommunications Licences (RRL)¹.”

Free TV response - does the RRL indicate “actual spectrum use” or licensing details?

“Devices and/or systems that access spectrum under these sharing approaches usually need to be aware of the surrounding radiofrequency environment and be able to react to changes in the environment in a timely manner—certainly well outside traditional licensing/authorisation timeframes which can span multiple years in some cases.”

Free TV response - Is the data captured within the RRL always current and suitable for being applied to DSA? Would the cost of establishing a database on the scale of the RRL be a suitable model for management of DSA?

“Until recently, there have been very few implementations of non-traditional sharing arrangements of any significant scale. Specific measures such as dynamically occupying the so-called ‘white spaces’ in television broadcast areas have been mooted—even urged by some sectors of industry—but for a range of reasons implementation of these measures have failed to take flight either internationally or domestically.”

Free TV response – we would respectfully suggest that the so called “white spaces” are a myth. The reason the television broadcasting bands are segmented are for the purpose of reducing the impact of co channel interference between television services in adjacent planned geographic areas. However, the innovation of television broadcasters and many regulators globally to optimise spectrum use has been assign low power wireless microphones to these unassigned channels in a specific geographic area. The ACMA and the Australian television broadcasters promote the dynamic spectrum access for wireless microphones on their respective websites - <https://www.freetv.com.au/wp-content/uploads/2019/08/OP-27-Operation-of-Wireless-Microphones-in-Australia-Issue-4-December-2014.pdf>

“Most arrangements to date have only been either trials of DSA-type arrangements or simply variations on more traditional approaches to sharing (that is, more static than dynamic). The only truly broad-scale DSA undertaking that has been commercially implemented internationally has been the CBRS, with the formal launch scheduled for September 2019.”

Free TV response – we would welcome more information on the CBRS including what is the scale of the implementations to date, what is the interface between the national regulatory framework and the system manager, any identified cost / benefit analysis and performance benchmarks?

¹ See [ACMA website](#).

Introduction

This section of the Information Paper has been well researched, intuitively presented in easy to understand text and concisely constructed.

New approaches to sharing

“Dynamic spectrum access requires a set of rules and a decision-making process that can operate rapidly with little or no intervention by the regulator.”

Free TV response – If DSA is to be defined as “time based changes in spectrum occupancy by incumbent users” this statement would perhaps indicate an underlying objective is to “outsource” a component of regulatory / administrative burden from the regulator. What is not clear is how the “set or rules” and “mechanisms” would be licenced over time i.e. characteristics of the tiered systems within a specific DSA applied frequency range.

“A tiered access model sets out a hierarchical structure which defines users as being primary or secondary (or even tertiary). Access rules are implemented in a system which includes a database that contains technical and operational characteristics which determine the operational ‘footprint’ for each user. This spectrum footprint is derived from a range of metrics such as the amount of spectrum accessed, likely duration of operation, location and physical device characteristics (such as transmitter powers, antenna parameters). Users are assigned access to spectrum by the system in accordance with their assigned priority level.”

Free TV response – as suggested in Free TV’s introduction this has parallels of current sharing and licences sharing arrangements between PRIMARY, Secondary and Class licenced spectrum users in Australia. Two additional comments on a “tiered” approach are:

- a) How is this managed over time as technologies evolve and regulatory conditions change?
- b) In the model in Figure 2 how is the sharing managed on the perimeter of the Priority user’s boundary?

Spectrum sensing

“The core premise of a sensing model is that devices or supporting infrastructure can detect which communications channels are in use and which are available to be accessed in real time. Channel availability varies by location—a channel that may be in use in one location might be available at another location. Some models have a learning function which can determine which channels are more frequently available for a given location and sets weights its scanning algorithm accordingly.”

Free TV response – what determines the scanning algorithm – ITU Radio Regulations, ITU-R Recommendations or national technical and regulatory instruments? Who administers the development of the algorithm(s)? Who sets the standards for the design and manufacture of the sensors? Who maintains the sensors? Who assigns the frequency ranges and the characteristics of the systems which will operate in the frequency ranges?

Geolocation databases

“This is a well-established dynamic spectrum access model that involves the use of central databases that record individual device locations to manage access in a way that minimises interference to incumbent and (in some cases) other secondary access seeking users.”

“Under a typical implementation of this model, a database typically holds information pertaining to the location, operating parameters and protection requirements of incumbent services. This information is referred to by prospective access seekers in determining which spectrum spaces could be accessed while meeting incumbent protection requirements.”

“Devices can dynamically modify their operating parameters to protect incumbent services, including manipulation of transmitter powers, operating frequencies, antenna steering/positioning etc”

Free TV response – While spectrum access in the time domain may be dynamic, the characteristics for the sharing in the designated frequency range are “preset”. This raises a question about indicating in which “domain” each of the tiered users are operating and licenced – frequency, geographic, time and signal domains (refer page 6 of the Information Paper).

Decentralised access control

“The use of databases, sensing networks and pre-emption arrangements assume some sort of central access controller, which may be either an industry third-party provider or a government/regulatory function. This reflects the general trend of DSA considerations internationally, whereby governments prefer a ‘managed’ access regime over delegation of access decisions to the device level. Logically, this type of approach is most conducive to optimal interference management and spectrum efficiency.”

Nonetheless consideration has previously been given to uncoordinated device-centric DSA technologies—again, the abovementioned CRS concept in its purest form was initially an example of this approach. Such approaches might have merit in, say, LIPD frequency bands, where something like a ‘token passing’ access scheme between otherwise uncoordinated users (similar to a MANET and a blockchain in digital currency terms—see example in the box below) might be a useful way of optimising access in a decentralised framework.

Free TV response – How is the preferred approach to be determined?

Example of a decentralised DSA architecture: Application of blockchains

At a high level, blockchains are mechanisms of creating artificial scarcity. It is a kind of distributed database or ledger, and a way to keep track of information shared among multiple parties. There is no single party to control this secure and decentralized form of database. This makes it different to other dynamic spectrum access, such as TV white space which requires trusting third parties to administer their database. This highlights the unique feature of blockchain as a dynamic distributed spectrum management system requiring a dynamic distributed database.

There are two primary types of distributed ledger networks: Public and permissioned. In public (permission-less) blockchain systems such as Bitcoin, anyone can join the network.

Permissioned blockchains limit participation to identified users. While this restriction simplifies security and governance, it could make it easier for one or a small number of participants to exercise control.

The potential for blockchains to be applied to dynamic spectrum access has recently become a topic of interest. Four primary categories of shared access might be considered:

- unlicensed (primary non-cooperative)
- secondary markets (primary cooperative)
- opportunistic (secondary non-cooperative)
- cooperative sharing (secondary cooperative).

The term 'primary sharing' in this case means that all users have equivalent rights to access the spectrum, as is the case, for example, in unlicensed bands (or in Australia, bands listed in the LIPD class licence). In contrast, a secondary sharing regime implies a hierarchy of rights, where incumbents/primary users have superior rights to spectrum entrants/secondary users. TV white spaces, CBRS and LSA are all examples of this kind of rights-based relationship. Cooperative sharing means that ex ante agreements have been struck between the sharing parties regarding sharing. Secondary markets that involve voluntary exchange can be thought of as cooperative sharing. Finally, in non-cooperative sharing, users do not coordinate their use ex ante. Whether a public or permissioned distributed ledger is used might depend which of the above sharing scenarios are sought.

In France, the Agence National des Fréquences (ANFR) commenced a trial of blockchain for spectrum management in late-2018 with the aim of understanding the opportunities and risks of embedding this approach in new access technologies. The scope of this project was limited to frequency bands that can be used without authorisation, such as the 2.4 GHz and 5 GHz bands and bands between 470 MHz and 789 MHz that are used for short-range devices such as wireless microphones in Europe. They utilised a permissioned ledger rather the public version of blockchain.

Free TV response – As stated previously in this submission, the term “white spaces” refers to where television broadcasting bands are segmented for the purpose of reducing the impact of co channel interference between television services in adjacent planned geographic areas. They are licenced under the ACMA’s Radiocommunications (Low Interference Potential Devices) Class Licence 2015 to wireless microphones and standardised in AS4268 *Radio equipment and systems - Short range devices - Limits and methods of measurement*. Wireless microphone usage is ubiquitous and often congested in high media activity areas in capital cities.

Domestic considerations

“The common premise of most sharing models considered to date is that entities responsible for managing spectrum access by secondary access seekers have some degree of knowledge of usage patterns. The underlying idea is that an access-seeking user can ‘avoid’ or ‘work around’ incumbent users, through interference avoidance techniques based on spectral, geographic or time separation.”

Free TV response – if suitable sharing models already have been established within the Australian spectrum management framework why import an overseas model? Particularly when the required bandwidths, characteristics of the technologies, service density for the tiered access models required in Australia may differ from international models and may already be captured on the RLL. Albeit the RLL may need updating in its design to cater for any DSA “like” approach.

“These traditional sharing methods do not cater for scenarios where incumbent use cannot be predicted or measured, such as highly dynamic/itinerant services that are authorised by wide area licenses. In the case of the CBRS example, this is partially overcome through the deployment of sensor networks to provide real-time information on tier 1 use and inform the access controller accordingly. While this has been deemed an appropriate approach in the US environment, the infrastructure cost would unlikely be justifiable in a relatively small market such as Australia.”

Free TV response – This also raises a question re licensing of the sensing network, its performance and maintenance.

“A potential variation on CBRS might involve replacing sensing with pre-emption, for example, in which case incumbent users would be furnished with the regulatory tools to be able to pre-empt access to frequencies and/or areas at their discretion. This pre-emption would be the ‘exception’ case (although this is not to suggest it would be irregular); the ‘default’ would be that secondary access seekers would be able to deploy in the absence of any pre-emption notification.”

Free TV response – Does this “discretion” imply some regulatory qualifications which are normally required for licensing radiocommunications systems in Australia may be foregone for licensing a DSA technology?

“Such a model enables secondary access-seekers to deploy networks across the frequencies identified for shared access but allow incumbent users to pre-emptively clear that use within the areas/frequencies they require, when they are required. This aligns with the pre-emptive sharing model which relies on active communication (notification) between the incumbent and access-seeking services, rather than passive observance of protection requirements and knowledge of incumbent users’ operating characteristics.”

Free TV response – This seems to imply the “business case” for deployment of a DSA technology would possibly be based primarily on high density deployment to support the implied infrastructure.

“This model best lends itself to scenarios where the primary service is itinerant, sporadic and infrequent in nature, in terms of both geographic location and frequency. Such users might hold spectrum on a contingency basis for often nomadic platforms that might not necessarily be used everywhere or all the time. A sharing arrangement would not be intended to diminish this access, rather make better use of the unused spectrum/spaces.”

Free TV response – Is this likely to reflect low spectral efficiency?

Free TV, members look forward to participating in the further investigations the ACMA may undertake into the technical and regulatory aspects of new approaches to spectrum sharing.

Yours sincerely,



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