

**Submission to the Parliamentary Joint
Committee on Law Enforcement
*Inquiry into Spectrum for Public Safety
Mobile Broadband (PSMB)***

Australian Communications and Media
Authority (ACMA) Submission

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Overview

The ACMA welcomes the opportunity to make this submission to the *Inquiry into spectrum for public safety mobile broadband*.

Spectrum management in Australia is carried out by the ACMA in accordance with the *Radiocommunications Act, 1992* ('the Act'). The object of the act specifies, among other things, that adequate spectrum is to be made available for defence, national security, law enforcement and emergency services. It also specifies that spectrum must be allocated in such a way that it is used efficiently, and that public benefit from its allocation be optimised.

This means that the ACMA should consider the needs of the community as a whole – balancing economic, commercial, consumer and public interests – when determining where and to whom spectrum is provided. Spectrum demand is driven by numerous factors, including international trends and markets (influenced by frequency harmonisation and equipment standardisation), operational and economic drivers.

Public safety communications are a key area of importance to the ACMA, and we remain committed to ensuring that Public Safety Agencies (PSAs) have sufficient access to the radiofrequency spectrum to enable them to undertake their role within the community.

PSAs have historically relied on narrowband (particularly voice) communications to support their operations. However, in recent years agencies have identified a need for data capabilities, particularly high speed mobile capabilities, with interoperability between different agencies and jurisdictions.

In May 2011, the Public Safety Mobile Broadband Steering Committee (PSMBSC) was established, with a membership drawn from Commonwealth agencies, including the ACMA, and numerous peak bodies representing PSAs. Part of the function of the PSMBSC was to identify, through consultation with PSAs, industry and the ACMA, the operational and technical requirements of a Public Safety Mobile Broadband (PSMB) capability. During this process it was envisioned that a dedicated PSMB network would provide coverage for PSAs in major population areas, on the States' and Territories' own advice that they could not afford to build infrastructure to provide coverage in most rural and remote areas. Outside these areas, coverage would be provided by commercial networks, through appropriate service-level agreements (SLAs).

Over the past decade the ACMA has been exploring how best to meet the spectrum needs of PSAs, for both narrowband and broadband capabilities, to address the increasing demand and importance spectrum has for PSA operations. It has become clear that there is no single-band solution to meet all mobile communication requirements of PSAs, given the highly dynamic and ever-changing nature of their operational requirements. Instead the ACMA has adopted a layered approach to providing spectrum for public safety communications, so as to support a flexible, 'system of systems' that can best support public safety needs. To realise this goal, the ACMA has facilitated several key spectrum initiatives:

- Implementing critical reforms in the 400 MHz band which is primarily a band for narrowband PSA communications;
- Making provision for 10 MHz of spectrum in the 800 MHz band for a dedicated wide-area PSMB capability (to be supported by SLAs with commercial operators); Providing access to 50 MHz of spectrum in the 4.9 GHz band which will enable extremely high capacity, short range data and video communications.

To achieve these initiatives, the ACMA has actively engaged both domestically (with PSAs and committees such as the PSMBSC), as well as internationally (in forums such as the International

Telecommunications Union (ITU) and the Asia-Pacific Telecommunity Wireless Group (AWG)). The latter involves detailed planning and negotiation with international government and industry bodies, which contributes to the harmonisation of spectrum, technology and applications to support public safety operations, both internationally and regionally (within the Asia-Pacific). Through this work, and ongoing alignment of Australian spectrum allocations with international regulations, Australian PSAs can benefit from improved economies of scale in equipment manufacture and enhanced interoperability with overseas counterparts.

Terms of reference

Pursuant to the committee's functions set out in subsection 7(1)(e) of the *Parliamentary Joint Committee on Law Enforcement Act 2010*, the committee will inquire into and report on:

- how much broadband spectrum law enforcement agencies need to be able to communicate safely and effectively during mission-critical events such as natural disasters and potential terrorist incidents;
- which of the 700 or 800 MHz bands is the most appropriate for law enforcement agencies given the current licensees occupying spectrum;
- how the necessary spectrum for public safety should be secured in a timely manner;
- what arrangements should be put in place to ensure that, in extreme circumstances, law enforcement agencies can effectively use spectrum of commercial carriers to protect public safety and maintain public order;
- what applications dependent on broadband spectrum will contribute significantly to saving lives and property;
- the impact on law enforcement agencies which utilise the available spectrum in relation to budgets, implementation strategies, current infrastructure and existing technology; and
- any other related matters.

These terms of reference are addressed individually in the following submission.

Question 1: How much broadband spectrum law enforcement agencies need to be able to communicate safely and effectively during mission-critical events such as natural disasters and potential terrorist incidents?

The PSMBSC studied several public safety operational scenarios to determine the necessary quantum of spectrum for a mobile broadband capability to the year 2020. In its consideration of the outcomes of the PSMBSC, and its own extensive analysis, the ACMA made the decision to set aside 10 MHz of spectrum in the 800 MHz band for a dedicated PSMB capability.¹ This quantum of spectrum was found suitable to provide a PSMB capability for the majority of scenarios studied by the PSMBSC, including regional natural disasters, with headroom to accommodate future needs.

The ACMA based its October 2012 spectrum announcement on the evidence previously provided by the PSMBSC. Relevant reports are the PSMB Spectrum Quantum Calculation Report² and the PSMB Demand Requirements³ which reported on requirements through to the year 2020. These reports are the work of the committee and its contractor, UXC Consulting, and were informed by input from PSAs on their operational requirements (including, among other things, applications to be supported, number of users on the ground and functional requirements).

Following the initial demand gathering work, the PSMBSC developed a number of operational demand scenarios, including day-to-day non-emergency use (business-as-usual), and various emergency scenarios, including natural disasters and a major inner-metro ('worst case') threat response. The ACMA played only an advisory role in this process, and did not influence how, or at what values, the various modelling parameters were set. These were set by the membership of the committee, including public safety representatives.

Through the contractor, a number of detailed reports were produced, which culminated in a range of spectrum bandwidth recommendations for the various operational scenarios considered. These reports were considered as evidence by the ACMA. The recommended spectrum needs for the various scenarios were considered individually.

Based on the recommendations in the PSMBSC's reports, the spectrum provided by the ACMA was considered sufficient for all of the scenarios modelled, except for the worst case scenario, which would not be able to be served solely by an 800 MHz PSMB network even if double the amount of spectrum was provided. For this specific scenario, a range of complementary provisions were identified, including additional use of commercial carrier networks, deployment of transportable base stations (cells-on-wheels, or "COWs) and deployment of WiFi hotspots using the 4.9 GHz band.

The ACMA undertook its own due diligence on the calculations and methodologies that led to the various spectrum recommendations in the steering committee's reports. It was found that the recommendations were conservative (in favour of the PSAs), and that the self-identified broadband needs of the public safety agencies could be met with less spectrum than identified by the PSMB. While these considerations were relevant, they did not determine the final decision. This due diligence simply provided a degree of confidence that there would be some headroom for future growth if required.

The large scale incidents modelled by the PSMBSC were based on two natural disasters, one based on actual events, and the other an extreme inner-urban threat response ('worst case' scenario), based on a hypothetical event. These scenarios were considered separately and were mutually

¹ For more information see: <http://www.acma.gov.au/theACMA/the-acma-to-deliver-a-multi-layered-spectrum-solution>

² *Public Safety Mobile Broadband Spectrum Quantum Calculation (Project 3)*, November 2011, rev 3.1

³ *Public Safety Mobile Broadband Demand Requirement (Project 1)*, November 2011, rev 2.2

exclusive. The ACMA's decision to provide 10 MHz of spectrum was considered adequate for the natural disaster responses, but not the latter event.

As stated earlier, the demand that would arise from the worst case scenario could not be adequately met by the provision of 2 x 10 MHz of spectrum in the 800 MHz band. The ACMA therefore identified other options to absorb the data demand that would arise from such a contingency, rather than provide a 'large quantity of spectrum that would be, for the most part, underutilised.

In the rare event of such a large scale incident occurring, the ACMA has identified other ways to increase any capacity shortfall, including the deployment of transportable base stations (an option also modelled by the PSMBSC), and an increased use of commercial networks, noting that the perceived vulnerability of commercial base stations to fail in extreme events is generally attributed to natural disasters rather than acts of terrorism or aggression.⁴

Furthermore, the ACMA has provided 50 MHz of spectrum in the 4.9 GHz band for deployment of extremely high capacity, short range data and video communications for PSAs (WiFi like services exclusively for PSAs). The 4.9 GHz band class licence has recently been completed and is now in force, providing PSAs access to this band.⁵ The band is internationally harmonised for this purpose and there is an existing market for public safety-grade equipment. Work on providing PSA access to this band was an ACMA initiative and has been ongoing for a number of years, pre-dating the more recent requirement for 800 MHz spectrum for PSMB.

Question 2: Which of the 700 or 800 MHz bands is the most appropriate for law enforcement agencies given the current licensees occupying spectrum?

With regards to any potential impact to existing users occupying spectrum, there is negligible difference between a PSMB spectrum allocation in either the 700 MHz and 800 MHz bands. Incumbent users in the 700 MHz band will be relocated to provide vacant spectrum for new services as part of the Digital Dividend project.⁶

Any potential relocation of existing users in the 800 MHz band is subject to the findings of the ongoing review of the band.⁷ Proposed band planning options, which discuss the potential relocation of incumbent licensees, are available in the ACMA discussion paper *'The 803-960 MHz band – exploring options for future change'*⁸ (the 800 MHz Review Discussion Paper). The purpose of this review, and any subsequent need to relocate existing services, is to create a new band structure which increases spectrum utilisation and efficiency. The consideration of a potential PSMB allocation in the 800 MHz band is only one aspect of the review. Subsequently, should no allocation be made

⁴ These initiatives are detailed in the ACMA paper *Spectrum for public safety radiocommunications – Current ACMA initiative and decisions*, available at:

<http://www.acma.gov.au/~media/Spectrum%20Outlook%20and%20Review/Information/pdf/Spectrum%20of%20public%20safety%20radiocommunications%20Current%20ACMA%20initiatives%20and%20decisions.pdf>

⁵ More information is available on the ACMA website:

<http://www.acma.gov.au/theACMA/Newsroom/Newsroom/Media-releases/new-spectrum-for-emergency-services>

⁶ More information on the Digital Dividend project is available on the ACMA website at:

<http://www.acma.gov.au/Industry/Spectrum/Digital-Dividend-700MHz-and-25Gz-Auction>

⁷ More information on the review of the 803-960 MHz band is available on the ACMA website:

<http://www.acma.gov.au/theACMA/Consultations/Consultations/Current/ifc-472012-the-803960-mhz-bandexploring-options-for-future-change>

⁸ This discussion paper is available on the ACMA website at:

http://www.acma.gov.au/webwrr/_assets/main/lib550052/ifc47_2012-803-960mhz_band.pdf

for PSMB in the 800 MHz band, is it unlikely that the proposed band structure options, and the need to relocate existing services, will vary from those presented in the 800 MHz Review Discussion Paper.

In terms of the physical differences between the two bands (including coverage, building penetration and antenna sizes), they too are negligible. Both bands have applicable equipment standards for 4th generation mobile technologies (developed through the international standards organisation the 3GPP, and known as Long Term Evolution or LTE); however the 800 MHz band is also harmonised in the Australia and Asia Pacific (AAP) region specifically for public safety communications,

The 700 MHz band is harmonised for public safety communications in the US and Canada, however spectrum arrangements (band plans) in those countries are vastly different to those of the AAP so equipment used in that region could not be used here.

Question 3: How the necessary spectrum for public safety should be secured in a timely manner?

As previously indicated, the ACMA has announced a provision of spectrum in the 800 MHz band for a dedicated PSMB network.⁹ Final arrangements for this PSMB allocation are still subject to the 800 MHz band review; however it is expected that first access to this spectrum will be available as early as 2015. Based on the timeframe estimates of the PSMBSC, it is anticipated that access will be available well within the timeframe of the earliest PSMB deployments (according to dates provided by jurisdictions).

Given that PSAs have indicated a phased roll-out of the dedicated PSMB network, and that coverage may not be extended to all populated areas, the ACMA has decided to enable access through area-wide apparatus licences. Licences will be issued only in areas where PSAs undertake to provide PSMB coverage. This will allow incumbent users (ie. users currently operating on frequencies earmarked for PSMB) to continue to operate in areas where there is not yet a dedicated PSMB network. Further details can be found in the 800 MHz Review Discussion Paper¹⁰.

The ACMA is an evidence-based regulator, and considering the currently available evidence (in particular that provided by the PSMBSC), remains of the view that the spectrum provisions announced in October 2012 will be sufficient to support a nationally-interoperable PSMB capability. However, it is acknowledged that this evidence is based on 'best-efforts' projections, as networks have yet to be deployed.

Given this, the ACMA will nonetheless revisit the sufficiency of the spectrum should circumstances justify this. Such circumstances would include a situation where, once a PSMB network capability is built out, PSAs face demand that exceeds (or realistically looks like exceeding, based on real world experiences and projections), the capabilities of the network. A decision to undertake such a review would also assess the extent to which agencies had explored and genuinely engaged any of the mitigation strategies described in the ACMA's *Spectrum for public safety radiocommunications* paper, included additional use of commercial networks, deployment of COWs and local data offload to the 4.9 GHz band.

⁹ For more information see: <http://www.acma.gov.au/theACMA/the-acma-to-deliver-a-multi-layered-spectrum-solution>

¹⁰ *The 803-960 MHz band – exploring options for future change*, available at: http://www.acma.gov.au/webwr/_assets/main/lib550052/ifc47_2012-803-960mhz_band.pdf

Additional spectrum that might be identified under these circumstances may or may not be from the 800 MHz band. Given the trend of LTE evolution towards “multi-carrier aggregation” (already provided for in the current 3GPP standard and evolving further in subsequent releases), it might not be necessary for any additional spectrum to be contiguous with the existing PSMB spectrum in the 800 MHz band.

For example, it might be appropriate to provide spectrum from a different, higher band to allow for multi-carrier aggregation in high demand areas, similar to the commercial operator model of using lower frequencies for coverage, overlaid with higher frequencies for capacity in high demand areas.

Furthermore, subject to the outcomes of the 803-960 MHz band review¹¹, there might be no impediment to PSAs acquiring additional spectrum in the 800 MHz at a later date. PSAs have the right to bid for access to additional spectrum and may elect to acquire additional spectrum via that means.

Question 4: What arrangements should be put in place to ensure that, in extreme circumstances, law enforcement agencies can effectively use spectrum of commercial carriers to protect public safety and maintain public order?

In its paper on spectrum for public safety communications¹², the ACMA listed certain provisions under the *Radiocommunications Act 1992*¹³ as a potential means to access additional spectrum to meet the demand that might arise from the ‘worst case’ extreme scenario modelled by the PSMBSC.

The invocation of these provisions is, to date, untested, largely because Australia has thankfully not yet experienced the kind of worst case event envisaged in the scenario planning. While the ACMA accepts that this concept needs further development, the ACMA continues to be of the view that these provisions are a viable option for access to additional radiofrequency spectrum during a major emergency, and should at least be explored further. The ACMA is available to assist PSAs in developing a concept of operations for this type of scenario. Similar provisions exist in the Act for (and are regularly used by) Defence.

Whilst the provisions in the Act may legally allow extraordinary access to additional spectrum, PSAs would also need to ensure that suitable equipment and infrastructure had been procured, in order to enable operation in the additional spectrum. This might include handsets with appropriate chipsets, and additional transmit and receive cards installed in base stations.

The ACMA also considers that a more suitable option could be for PSAs to gain access to commercial networks on a priority basis, when and where additional capacity is required – ie. rather than seeking to gain rapid access to commercial *spectrum*, they could instead gain access to additional *capacity*. This would negate the need to procure additional base station equipment and/or the need to invoke the abovementioned provisions of the Act.

Indeed, access to commercial networks is expected to be needed on a regular basis outside the coverage area of dedicated PSMB networks, so the necessary SLAs between PSAs and commercial operators should already be in place and could be extended to incorporate such an arrangement.

¹¹ *Review of the 803-960 MHz Band* at: http://www.acma.gov.au/WEB/STANDARD/pc=PC_312463

¹² *Spectrum for public safety radiocommunications – Current ACMA initiatives and decisions*, October 2012, p 14 available at: http://www.acma.gov.au/WEB/STANDARD/pc=PC_600085

¹³ Applicable provisions include Section 27, and Part 4.4 of the *Radiocommunications Act 1992*

This is merely offered as an observation, noting that contractual arrangements are a matter for those responsible for PSMB governance and procurement, and not the ACMA.

Question 5: *What applications dependent on broadband spectrum will contribute significantly to saving lives and property*

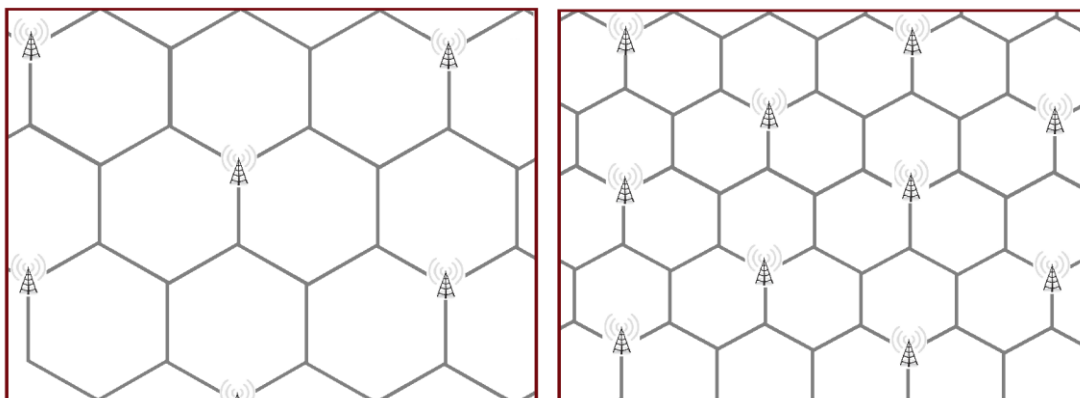
The ACMA cannot comment directly on what applications will ‘contribute significantly to saving lives and property’. However, the ACMA can provide some comment regarding ongoing international work to specify PSMB applications.

The ACMA, in consultation with PSAs representatives, is actively engaged in international forums to develop harmonised public safety mobile broadband applications. An example of this work is the development of the new AWG Report ‘PPDR applications using IMT technologies and networks’. This work is crucial to ensuring that internationally available public safety equipment can support the specific applications required by Australian PSAs, so they can benefit from equipment economies of scale and can interoperate with regional partners if/when needed.

Question 6: *What is the impact on law enforcement agencies which utilise the available spectrum in relation to budgets, implementation strategies, current infrastructure and existing technology*

The quantum of spectrum provided for PSMB can impact the deployment costs, but only to an extent. Providing the right amount of spectrum for any data network is based upon meeting the data throughput needs of users, when and where they need it, but usually on a prioritised basis. That is those with the most urgent need are provided with the data via a network prioritisation system. In a cellular network topology, meeting the minimum capacity requirement (bits/sec per number of users) means striking a balance between spectrum bandwidth and infrastructure (number of base stations).

For example, within the notional coverage area depicted below, the same capacity could be achieved in both the left (which uses a certain spectrum bandwidth) and right (half that bandwidth) scenarios. Note that as more spectrum is provided less base stations are needed (and therefore lower deployment costs).



This argument no longer holds once cell sizes increase towards their maximum limit (limited by radio propagation factors and maximum allowable power settings), where any increase in spectrum will directly add to the capacity, but the number of base stations cannot be decreased any further. In general terms, while additional spectrum for a ‘thin’ network can reduce capital expenditure, more

conventional, 'denser' networks are more scalable (ie. can tailor capacity to meet varying needs), more robust (network can better recover if a base station cease to operate) and more capable of handling spikes in data traffic (eg. due to an incident).

High value spectrum below 1 GHz is scarce, thus a trade off where spectrum is sacrificed to save on infrastructure should be avoided. From a whole-of-economy perspective, the conventional density approach both frees up the additional spectrum for other uses and maximises the efficiency in use of the spectrum provided to PSAs. The infrastructure density is scalable; however the bandwidth provided is not – once provided it cannot be used by other services.

From a technical planning perspective, 'thin' networks (more spectrum, less infrastructure) may also require non-standard equipment features (higher power mobile devices, higher base station antenna heights), which can necessitate reservation of additional spectrum blocks known as 'guard bands', as other services can no longer operate on directly adjacent frequencies. This means that even more spectrum (ie. over and above the additional spectrum needed for a thin network) may also be rendered unusable, which represents a further cost to the economy.

In determining the appropriate quantum of spectrum to be provided, the ACMA considered a wide range of inputs, including:

- Demand requirements as determined by the PSMBSC (through UXC consulting);
- Constraining and mitigating technical factors, including demand growth, headroom requirements and efficiency gains to be leveraged as part of the evolutionary growth of the technology (as per 3GPP standard);
- Other options to absorb demand spikes and coverage gaps/black spots inherent in non-homogeneous networks (eg. SLAs with commercial operators, local data offload onto 4.9 GHz spectrum);
- Jurisdiction-informed implementation plans including intended delivery models, coverage areas and deployment dates.

Spectrum is a finite and high-demand resource, and there is a likelihood that the 850 MHz expansion frequencies will be the last remaining spectrum to be provided for mobile broadband below 1 GHz for some years to come. Given the burgeoning demand for mobile broadband services, both in Australia and internationally, the ACMA cannot provide more spectrum than is considered necessary – particularly for the purpose of reducing build costs.

There is also a potential budgetary impact on existing users of the 800 MHz band that may be displaced as a result of the review of this band, including incumbent PSA users (currently using the band for non-PSMB purposes). Any potential requirement to migrate to a different frequency band will be subject to the final outcomes of the review, which is yet to be finalised. As indicated earlier, the purpose of this review, and any subsequent need to relocate existing services, is to create a new band structure which increases spectrum utility and efficiency. The consideration of a potential PSMB allocation in the 800 MHz band is only one aspect of the review. Subsequently, any requirement to relocate existing licensees is likely to be independent of whether or not spectrum is made available for PSMB in the band.¹⁴

Appropriate spectrum and equipment for public safety operations is also the subject of significant debate internationally. As such, organisations such as the ITU and the Asia-Pacific Telecommunity

¹⁴ More information on the review of the 803-960 MHz band is available on the ACMA website: <http://www.acma.gov.au/theACMA/Consultations/Consultations/Current/ifc-472012-the-803960-mhz-bandexploring-options-for-future-change>

(APT) are devoting resources to develop technical guidance for the development and deployment of public safety radiocommunications solutions. As part of this ongoing work the ITU has developed ITU-R Resolution 646, which identifies harmonised spectrum bands for Public Protection and Disaster Relief (PPDR) services. Of these bands, both the 800 MHz band and 4.9 GHz bands have been identified in the Asia-Pacific region for PPDR communications.

In contrast, the 700 MHz band is not regionally harmonised in the Asia-Pacific region for PPDR services. Whilst this band is used in the US for public safety services, the band configuration is significantly different to that used in the Asia-Pacific region (and adopted by Australia). As such, US equipment will not be compatible for use in Australia without modification.

To provide benefits to Australian PSAs, such as reducing costs (through equipment economies of scale) and improving interoperability with regional partner agencies, it is crucial that Australian spectrum arrangements are aligned with internationally harmonised bands for public safety mobile broadband applications. The 800 MHz band is therefore the most appropriate of the 'coverage' bands below 1 GHz for a cellular PSMB capability.