Public Safety Mobile Broadband

Submission to the Productivity Commission

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Introduction

Vodafone Hutchison Australia welcomes opportunity to comment on the Productivity Commission's Issues Paper of Public Safety Mobile Broadband (**PSMB**). Decisions over the PSMB network will have significant implications for wireless telecommunications in Australia.

We strongly support the Productivity Commission's decision to undertake a first principles analysis of this issue. This is the best means of ensuring the proper identification of benefits and costs, as well as any unintended impacts each option may have for competition within the mobile services market.

The Productivity Commission should be cautious in its assessment of options that require PSAs to rely on a single MNO to deliver PSMB services. The presence of three MNOs is not sufficient to constitute a competitive market for the delivery of PSMB services. This is a simplistic assessment of the state of the market for PSMB services and fails to recognise the intractable market dominance that has emerged in this space. If the Productivity Commission wishes to assess the competitiveness of this market, it should assess the existing segment shares for the provision of enterprise and government telecommunications services and the geographic PSAs' coverage requirements against each MNOs' footprint. These facts will show the market for the delivery of PSMB services is not as competitive as the general consumer market for mobile services.

Furthermore, options that involve PSAs contracting with a single MNO to deliver PSMB services may distort competition in the mobile services market. The potential award of large government contracts, which could include capital payments for network coverage augmentation or upgrades to network resilience, to a single MNO is likely to have adverse effects on mobile competition. Such effects are fine if the market to deliver PSMB services is genuinely contestable as each MNO has the same opportunity to compete to win the contract. However, if it emerges that the market to deliver PSMB services is not contestable, then it would be prudent for the Productivity Commission to assess the potential consequences the award of large government contracts of this nature will have on competition in the broader mobile services market.

Vodafone believes that public safety agencies need to develop a more collaborative cross-industry approach and use their sizable expenditure to enhance the state of the market rather than distort it. This requires implementing a solution with multiple MNOs rather than pursuing a solution with a single MNO.

The Productivity Commission should consider a service provider model underpinned by agreements with multiple MNOs on a "pay-per-use" basis. A multiple MNO model will improve ex-post contract contestability as well as delivering additional benefits:

- better coverage redundancy;
- more capacity – all participating MNOs provide slices of capacity during critical incidents;
- commercially optimised for PSAs to get the best offer for 'business-as-usual' and planned events; and

- maximises the use of spectrum assets for the public benefit.

Vodafone considers there is significant merit for PSAs and for taxpayers under the multiple MNO model. We urge the Productivity Commission to consider this option further and are happy to provide additional materials as required.

Network technology

Historically, Public Safety Agencies (**PSA**) have relied on dedicated 'land mobile radio' (**LMR**) networks to provide basic (mainly voice) communications. PSA networks are now outdated and do not provide the broadband capability that is possible using modern telecommunications technology. The lack of genuine broadband capability inhibits PSAs from effectively and efficiently performing routine operations and responding to critical incidents. PSAs require a new communications network that is capable of delivering the full suite of telecommunications services.

We understand PSAs requirements are somewhat different to those of a typically commercial Mobile Network Operator (**MNO**). PSAs place much greater emphasis than MNOs on particular characteristics – very high security protocols, resilience, prioritisation and capacity during peak demand periods.

We believe an additional characteristic – longevity – should be critical to the assessment of PSAs' requirements. Network longevity is a function of technology lifecycles. These lifecycles can be prolonged through choosing standardised, widely adopted network technologies rather than proprietary technologies. In the mobile industry, this prolonged technology lifecycle is evident through the evolution from the first generation AMPS networks of the eighties to the second generation GSM networks of the nineties, then on to the third generation WCDMA networks at the turn of the century through to the fourth generation LTE networks of today.

Proprietary network technologies may meet PSAs short-term needs, but they will make it difficult for PSAs to integrate new radiocommunications innovations and may limit PSAs' scope to deploy their own network applications. The use of standardised technologies has propelled the mobile industry forward. By contrast, companies that have pursued proprietary technologies or less widely adopted standards (e.g. Wimax) have typically not survived in the wireless broadband industry.

Internationally, new network technology for PSAs is gravitating toward mobile (e.g., 3GPP) standards. This is a positive step and PSAs in Australia should follow this trend regardless of whether they build their own network or acquire services from MNOs. By leveraging the incentives the mobile industry has to continue to drive standards' development, the public safety mobile broadband network will insure itself against technological obsolescence and prolong the useful life of its network investments.

PSAs have expressed a desire for voice and data interoperability between different agencies within a State/Territory and with agencies in other State/Territory/national jurisdictions. The use of mobile technology standards supports interoperability as this is an essential feature in the mobile industry. In that

context, the use of standardised mobile technology has a second important dimension – the potential for interoperability between PSA and MNO networks. Both inter-jurisdictional and PSA/MNO interoperability dimensions are critical for maximising the utility of the PSAs' networks and ensuring that PSAs' requirements are met in a cost-effective manner.

The use of standardised mobile technologies is likely to low end-user device costs when compared to proprietary technologies. However, PSAs may have a range of purpose-specific device costs that may make devices more expensive than typically is the case for MNO devices.

Services

We understand the Productivity Commission has identified three broad categories of services required by PSMB networks:

- **voice services** including push-to-talk, dispatch and group communications;
- **download / upload of high resolution imagery** including satellite images, biometrics (e.g., fingerprints), images of persons of interest, building layout maps; and
- **video streaming and live video feed** including remote medical support, in-progress incidents or surveillance, wireless clip-on cameras, in-building fire rescue and airborne assessment of fire and flood scenes.

The desired service availability across these categories is very high, with 99.999% availability or better and failover and recovery mechanisms for mission-critical radio services.

The services identified belong in the network applications layer rather than the connectivity layer. For this reason they are related to, but somewhat independent of the connectivity layer decision. While the design of the network applications layer and the connectivity layer should be performed by a single entity, it is possible to use one supplier to build and operate the connectivity layer, while another supplier provides the services operating in the network applications layer. There is merit in considering the separation of these layers during the next phase of the Productivity Commission's Review.

The service categories noted above could be augmented by emerging machine-to-machine technology to deliver a more comprehensive telecommunications solution for PSAs. Examples of machine-to-machine services include:

- **remote sensing** including early detection of rural fire incidents and traffic incident monitoring;
- **vehicle and asset tracking** to facilitate logistics management and incident response;
- **monitoring and alarms** (e.g., remote health and medical services).

There are other well-established technologies that PSAs may find useful to augment their PSMB services. For instance, Vodafone has provided paging services to some PSAs for many years now. Paging has proven highly economical, reliable and efficient at alerting responders to critical incidents. It has also proven a resilient solution where cellular technology cannot be used or where cellular coverage is limited.

It is also important to consider the PSMB network requirements in the broader context of public safety communications requirements. For instance, communications with the public is often an important part of public safety responses during critical incidents. Today, the National Emergency Warning System (**NEWS**) is an example of how PSAs cooperate with MNOs to deliver public communications. Changes to the technology capability of PSAs could improve the efficiency, effectiveness and reach of public communications beyond traditional mobile channels to include channels like social media.

Prioritisation

The Productivity Commission suggests PSA demand for communications services can be split into three categories.[1] We recommend splitting PSAs telecommunications needs into four categories as the resource inputs required for critical incidents will vary depending on the nature of the incident:

- **business as usual** – such as responding to general incidents that involve a limited number of PSA officers. In modern contexts, it may also include the routine collation of sensor information. Demand for business as usual communications services is relatively stable and predictable.

- **planned events** such as major sporting events, music festivals or G20 meetings which require a larger than usual PSA presence. During these events, demand for communication services is expected to be relatively high in localised areas and it is predictable.

- **localised, large scale emergency incidents –** includes terrorist attacks, siege situations, fires in major buildings or other infrequent incidents which require large, cross-agency PSA responses. During these incidents demand for communications is expected to be very high in localised areas. There is uncertainty about timing and location of such events.

- **wide-area, large scale emergency incidents** – includes large bushfires, major floods, tropical cyclones and other that have significant impacts over a wide-area. Typically, these incidents occur in regional locations or on the outskirts of major incidents however they can occur in major cities (e.g., 2003 Canberra bushfires). During these incidents demand for communications is expected to be high over wide areas (and ongoing use of mobile networks by the community will typically be essential). There is uncertainty about the

[1] Productivity Commission (2015), *Public Safety Mobile Broadband*, Issues Paper, April, p6.

timing of such events but different geographic locations can be classified into broad risk categories, which facilitates forward-planning of network requirements.

The geographic aspects of PSAs needs are important to consider in assessing the requirements for a PSMB network. Demand for network **capacity** can be expected to reflect areas of population density and business activity, however demand for network **coverage** may exceed existing mobile network's coverage in some circumstances. In metropolitan areas, PSAs are likely to desire blanket coverage across greater city locations. In regional areas, coverage may be required at remote property locations, on infrequently used roads (including unsealed roads) and in remote bush lands.

Build or buy?

The fundamental choice facing governments, and the subject of the Productivity Commission review, is whether PSAs should **build** a dedicated PSMB network or **buy** services from a commercial MNO or pursue some hybrid of these two options.

Building a PSMB network

Networks are expensive to build and manage. Capital costs associated with site acquisition, building a tower, deploying network equipment and installing transmission infrastructure are very high. Additional capital costs will be incurred in building core networks and data centres, with these costs likely to be duplicated across each jurisdiction (and depending on agency arrangements they could be duplicated within a jurisdiction). Operating costs include electricity, maintenance, site lease costs and may include transmission lease costs and managed service fees.

Nevertheless, the build option (and various increments of the build option) should be fully explored by the Productivity Commission. The build option may provide a viable approach to meeting business-as-usual PSMB requirements. A PSMB network would not necessarily need to duplicate existing access network infrastructure. Indeed, there is significant scope to reduce the cost of building a PSMB network through a careful choice of spectrum bands and through leveraging existing telecommunications infrastructure.

Even if PSAs pursue a build option, developing relationships with multiple MNOs and with the NBN is likely to be of benefit. This will ensure cost-effective network deployment and to ensure appropriate access to available spectrum resources during critical incidents Co-location of sites with MNOs and the NBN, combined with location of sites on Crown Land, will reduce deployment costs. Rather than pursuing exclusive arrangements with a single MNO, PSAs should utilise the site portfolios of multiple MNOs to determine their optimal set of site locations. In addition, the ubiquitous access network being built by the NBN means the cost of backhaul for PSAs might be based on the incremental cost of the NBN connecting PSMB network locations. These factors make the cost of building a PSMB network much lower than is the case for a standalone, "greenfield" telecommunications network. PSAs could form co-location and roaming agreements with multiple MNOs to maximise contestability during the contract period.

A build option will provide PSAs with full control over purpose-specific aspects of the PSMB network. By contrast, while MNOs can theoretically provide a PSMB network with "mission critical" capability, this may require access to new spectrum, physical upgrades to existing network sites, core network upgrades and costs in designing and building purpose-specific network applications.

If PSAs identify requirements to build new sites beyond existing MNO and NBN wireless footprints, there may be opportunities for PSAs to defray their incremental capital and operating costs. PSAs could generate cost recovery revenue streams by encouraging MNOs to co-locate at the new sites and, if they choose to do so, by selling transmission capacity to these sites. Similarly, PSAs that are allocated dedicated spectrum could significantly reduce the opportunity cost of being allocated this spectrum if they sell excess capacity during non-critical incidents (while ensuring protocols are in place for priority access when a critical incident occurs). Both these issues have not been adequately leveraged by PSAs and this have been to their significant detriment.

If PSAs build and manage PSMB networks then it may be beneficial to appoint a PSA telco authority to coordinate State/Territory solutions, and to establish a national committee to take responsibility for ensuring interoperability and defining standards and protocols for inter-agency use of the PSMB network.

A multiple MNO service model

An alternative, less infrastructure dependent approach to delivering a PSMB services is for PSAs to pursue a service provider model underpinned by agreements with multiple MNOs on a "pay-per-use" basis. This solution could be implemented via agreements with two or three MNOs. In addition to significantly improving ex-post contract contestability, a multiple MNO solution would deliver several benefits:

- better coverage redundancy;
- more capacity – all participating MNOs provide slices of capacity during critical incidents;
- commercially optimised for PSAs to get the best offer for 'business-as-usual' and planned events; and
- it maximises the use of spectrum assets for the public benefit.

The proposed multiple MNO solution requires participating MNOs to implement Quality of Service prioritisation capability in their Core Network. It will also require arrangements to enable PSA services (USIMs) to roam on each participating MNO (and roaming agreements may be required between MNOs). PSAs will be able to steer their USIMs to the desired network as required and do so in a way that maximises contestability (e.g., a dynamic pricing approach might introduce contestability via an auction process). If the PSA identifies coverage gaps to the multiple MNO solution, incremental network build could be charged on a cost recovery basis taking into account any commercial value co-locating MNOs receive from the additional coverage.

The option of directly procuring some telecommunications services from MNOs is likely to be attractive in certain circumstances. For instance, the provision of wide-area machine-to-machine services is supplied in a more contestable market than general mobile services (as less spectrum capacity is required and there are lower deployment and backhaul costs). Moreover, machine-to-machine technology is developing rapidly and MNOs are more likely to stay at the cutting edge of those developments and have an incentive to offer innovations to PSAs given the contestability of the market.

Issues with the single provider model

The traditional tender process for PSA telecommunications services has not delivered value for money and resulted in distorting the adjacent mobiles market. MNOs who deliver to the specifications required by a PSMB network may require additional spectrum and may incur significant incremental costs, which they will recover via their contracts with PSAs. As such, any cost-benefit analysis must consider the unintended flow-on impacts, the award of such a contract (and possibly additional spectrum) to a single MNO will have on competition in the mobile services market. Moderate savings in the procurement of PSMB networks could be offset by the economic cost of a less competitive mobile services market that could ensue from the award of such contracts.

We do not consider charging a single MNO with the task of delivering a PSMB network will deliver the best outcome for PSAs for the following reasons:

- **Lack of genuine contestability** among MNOs to deliver a PSMB network – Telstra is widely recognised as delivering superior geographic coverage and enterprise solutions. It is unlikely that other MNOs can effectively compete with Telstra to deliver PSMB services if geographic coverage is a relevant consideration – Telstra hold over 60% of the spectrum commonly used to deliver mobile services in regional areas and has a lightly regulated monopoly over transmission services to many regional locations. These facts make it difficult for PSAs to establish a competitive procurement process for the delivery of PSMB services and makes it less likely that innovative PSMB solutions will emerge.

- **Avoidance of lock-in**. Once a network partner is selected it will be very difficult to change to an alternative provider and PSAs may be economically captured by their service provider. While there may be perceived short-term benefits from selecting a single MNO as a partner, the economic cost of such a decision may significantly increase through time particularly if PSAs cannot switch to alternative suppliers at a later date.

- **Need to maximise opportunities to leverage MNO assets in PSMB network**. Each MNO has spectrum, sites and transmission assets that could be utilised by a PSMB network. If PSAs select a single MNO as a partner it may unduly limit the utilisation of assets held by other MNOs (and is almost certain to distort the economic incentives for pursuing this option) leading to higher cost or constrained capacity choices during low probability, high impact emergency situations.

Spectrum requirements

Spectrum is an essential input into the provision of a PSMB network. Under the multiple MNO service provider model, PSAs may not need additional spectrum. However, under any of the models where PSAs have greater responsibility for infrastructure decisions, spectrum will be an essential requirement. Of course, allocating spectrum to PSMB networks may have significant opportunity costs, particularly if that spectrum deprives mobile networks of the capacity required to support consumers' forecast demand for mobile broadband services. Hence any decision over allocating spectrum to PSAs must be carefully considered.

PSAs' temporary demand for network capacity during critical incidents can be met without depriving the mobile industry of valuable spectrum resources. The temporal aspects of PSAs' demand for spectrum capacity during critical incidents enables innovative sharing solutions that minimise opportunity costs. For instance, MNOs could set up prioritisation protocols for PSAs to access existing spectrum when it is required during critical incidents. We encourage the Productivity Commission to explore this option during the next stage of the Review.

That said, dedicated spectrum may be deemed appropriate for PSAs to meet business-as-usual PSMB needs. It is therefore important that spectrum solutions are tailored to PSAs' specific requirements. We understand the most effective connectivity solution for PSAs will be one that:

- delivers widespread geographic coverage, with higher baseline capacity in metropolitan areas and high risk regional locations;
- enables capacity to scale for localised and wide-area emergency situations;
- enables deployment of ultra-high capacity solutions for localised, large-scale emergency situations as required; and
- delivers a cost-effective approach to remote sensing, vehicle/asset tracking and monitoring/alarms.

These requirements suggest a multi-band spectrum solution, as envisaged by the ACMA.[2] However, we believe some modifications to the ACMA proposal will enable more efficient delivery of PSMB solutions while minimising the under-utilisation of spectrum when it is not required for critical incidents. If spectrum is required by PSAs, we envisage a solution that comprises internationally harmonised LTE spectrum in the 400 and 800 MHz bands. This could potentially be augmented by drawing on MNOs spectrum in the

[2] ACMA (2012), 'The ACMA to deliver a multi-layered spectrum solution to support public safety mobile broadband capability', (http://www.acma.gov.au/theACMA/the-acma-to-deliver-a-multi-layered-spectrum-solution), Media release, 29 October.

900 MHz band and potentially in higher frequency bands. The reasons for our proposed choice set are outlined below.

400 MHz band – Unrivalled propagation characteristics deliver better economics for deployment than other band choices. The 400 MHz band provides a national spectrum solution, but it is particularly important given the coverage requirements of PSAs in regional areas. There is an opportunity to use standardised LTE technology (Band 31) using 2x5 MHz of spectrum in the band (452.5 – 457.5 uplink / 462.5-467.5 downlink). We understand there are existing users of this spectrum but the opportunity cost of reallocating the band to PSMB makes this a worthwhile option to pursue. The available spectrum could be expected to support voice services and image transfer. Support for video streaming may depend on site density.

800 MHz band (base coverage) – We support the ACMA's proposal to deliver 2x5 MHz of spectrum in the 800 MHz band (809-814 uplink / 854-859 downlink) to augment use of 400 MHz band in major cities and towns as well as other "high risk" areas. This band is standardised for LTE technology (Band 27) and carrier aggregation may be possible with the 400 MHz band holdings to deliver additional capacity (although the 400/800 MHz combination is unusual and may require a customised solution). There are existing services in this spectrum, including paging links operated by Vodafone. As with the 400 MHz band, appropriate planning and compensation to transition equipment to other bands will be required to reallocate this spectrum to PSAs for a PSMB network. The spectrum (and site density) of the 800 MHz band could be expected to support voice services, image transfer and video streaming. The spectrum could also support remote sensing, vehicle/asset tracking and monitoring/alarms.

800 MHz band (priority access) – Additional capacity may be required by PSMB networks during localised and wide-area emergency situations. The most cost-effective option is to utilise spectrum in a band already deployed by PSMB. It is not possible with the 400 MHz band to add more spectrum as part of LTE Band 31; it is possible in the 800 MHz band with up to 2x10 MHz of additional spectrum available (814-824 uplink / 859-869 downlink). However, the opportunity cost of setting aside this spectrum for PSMB is extremely high. This spectrum is attractive for mobile services and provides much needed low band spectrum capacity.

Given compatibility of technologies/site grids, there is scope for temporal spectrum sharing in this band where mobile services use the spectrum most of the time with PSAs being granted immediate, prioritised access to the spectrum during emergency situations. The spectrum could be sold to MNOs with a condition that PSAs have priority access based on a set of pre-defined protocols.

It is worth noting that PSA capacity requirements could be limited in geographic scope – for instance, if an incident occurred in the Brisbane CBD, PSAs would get immediate access to the spectrum in the Brisbane CBD (including a buffer area as required) while mobile services would continue to operate in the spectrum across the rest of Brisbane and in other parts of Australia. This spectrum (and site density) could be expected to support voice services, image transfer and video streaming during localised and wide area emergency situations.

400 or 900 MHz bands (PSMB machine-to-machine) – machine-to-machine technology provides PSAs with an opportunity to use telecommunications for remote sensing, vehicle and asset tracking and, monitoring and alarms. In contrast, to other PSA requirements, this telecommunications need could be supported using one-way network technology (i.e., information from the field is sent back to a central point for monitoring and analysis) or two-way technology. Low-Powered Wide Area (**LPWA**) or Cellular Internet of Things (**IoT**) networks provide a cost-effective solution for PSMB machine-to-machine needs. One-way LPWA solutions could utilise some of the spectrum in the 928-935 MHz range. Alternatively, two-way M2M LWPA solutions exist using spectrum in the 400 MHz band and LTE-M solutions may emerge in the 900 MHz band.

High band options (planned events and localised emergency situations) – there will be situations where PSAs require large amounts of spectrum to respond to localised emergency situations. It is unlikely to be economic to deploy blanket geographic coverage using high band spectrum nor is it likely to be economic to reserve large swathes of high quality spectrum for low probability, high impact emergency situations. This leaves policymakers with a choice of pursuing lesser quality spectrum to set aside for these infrequent situations; temporarily using spectrum held by others (including MNOs) during emergency situations or temporary deployment of infrastructure (e.g., cell on wheels). All options can and should be pursued by PSAs.

For localised emergencies, it may be preferable to use pre-defined agreements with MNOs that enable prioritised access to spectrum enabling rapid response during emergency situations than setting aside spectrum for this purpose. It would be beneficial for PSAs to enter agreement with all MNOs to access as much spectrum as it can as quickly as it can than simply entering an agreement with a single MNO.

Cells-on-Wheels (**COWs**) can be deployed in response to emergency situations. However, the logistics of deploying COWs during critical incidents may make this option inferior to the use of MNOs' high band spectrum.

By contrast, planned events typically impose significant loads on consumer mobile networks as well as increasing PSAs demand for network capacity (e.g., New Year's Eve in Sydney). Planned events should use a combination of dedicated high band spectrum (e.g., the 4.9 GHz band) and pre-event deployment of COWs to respond to anticipated demand.

We strongly oppose the use of unallocated 700 MHz spectrum for a PSMB network. This spectrum will be required by Australia's mobile networks in the future. It will be critical to meeting the future data demands of mobile consumers. Given the array of spectrum options available for a PSMB network and international standardisation of the 800 MHz band for Public Protection and Disaster Relief, we do not consider there is any merit in exploring the use of the 700 MHz band by PSAs.

It is likely that the Productivity Commission will need to rely on direct calculation approaches to measure the opportunity cost of allocating spectrum to PSMB purposes. Vodafone is willing to provide technical inputs to assist the Productivity Commission with this task if required.

Concluding remarks

A PSMB network will have a profound impact on the delivery of services for Australia's PSAs and deliver enormous benefits to first-responders in the police, fire, ambulance and emergency services. It is also important to realise that decisions over the PSMB network will impact adjacent markets, of which the mobile services market is probably the most relevant. In this context, the Productivity Commission's first principles approach to developing Cost-Benefit Analysis (**CBA**) is particularly important. It is imperative for the Productivity Commission to consider the direct impacts of the PSMB network on the delivery of Public Safety services and the indirect impacts that building and operating a PSMB will have on mobile services competition. We have identified options that will meet the requirements of PSAs, while minimising the opportunity cost from setting aside spectrum for low frequency, high impact incidents. We look forward to further exploration of these options during the next stage of the Productivity Commission's Review.