

Preamble.

This response has been prepared by the Australian Radio Communications Industry Association (ARCIA) Inc., a body representing the interests of the Land Mobile Radio (LMR) industry and with a mission to work to improve the effectiveness of the industry and to support management of the spectrum for the benefit of all. Within our role we see the need to provide advice and assist many of our clients with regard to technological changes and administrative issues regarding many spectrum areas.

Over recent years this Association has been accepted into working groups on many issues to provide a balanced and independent view on both the equipment details and configurations, as well as offering advice on how spectrum might be used to best advantage, including when new and pioneering concepts are involved. Through these various groups we have had a degree of involvement in discussions and workshops to date on the topic of Public Safety Mobile Broadband (PSMB) and every indication has been that we have been able to offer valuable input and advice.

In determining our input for this particular enquiry, we must first highlight that although our Association is comprised of membership from many different sectors and levels of involvement in wireless technologies, ARCIA as an industry association will have no direct benefit from any of the outcomes of the enquiry. Although some of our members might have individual benefits, these do not relate to ARCIA in any direct way. We know that some of our members will be presenting their own views, solutions and options to the enquiry and will outline their own positions.

ARCIA is offering this response on the basis that it does not represent in any way the individual positions of any of our members, nor has any particular member organisation had any significant input to the preparation of the response. In this regard the ARCIA response can be classified as being of an independent nature with information presented without bias or favour. We believe that our response reflects overall industry and technology positions that should be considered without any specific recommendations on which might be best or more suitable.

Although we do not profess to have a significant knowledge base or specialised skills regarding mobile broadband, since the time of our involvement in the PSMB Overflow Capability Working Group, we have made efforts to gain an understanding of some of the issues, options and suitability of various types of systems that could be of benefit. Many of our members, including the primary author of this document, have had direct experience with Public Safety Agencies in various forms over many years, some members as suppliers of equipment for LMR systems, others as actual volunteer members within the PSA system.

This background has enabled ARCIA representatives to have a degree of familiarisation with the potential needs of the PSA user community. It is our belief, proven under existing discussion formats, that we are able to often assist in outlining the needs and concerns of the PSA's when they have had limited knowledge of the technology. In many cases we have found that PSA's have had to rely heavily on the information from their existing or potential suppliers and if this information has been presented to be 'commercially advantageous' to the suppliers gain, then perhaps the PSA personnel have not had all options fully outlined.

As part of our responses to the following questions, we have attempted to open up areas of interest in many cases that will perhaps allow the Productivity Commission enquiry to evaluate all of the available options and then make a decision based on the broadest range of options possible. It is not our aim in the following response to make any recommendations or to draw any opinions as to a pre-determined outcome. There may well be some inference favouring one option over another; however, this will only have been done to balance up what might be seen as being the strongest system options being presented by other larger organisations.

Much of the information included will be anecdotal in nature, however, we are quite prepared to discuss any of the contents and outline what we believe to be the pertinent facts in any situation. Our singular aim in providing this response is that the community, PSA's and industry end up with the most appropriate and economically efficient Public Safety Mobile Broadband system that is available. Like the rest of Australia, our members will no doubt be indebted to the services offered by the PSA's in the future and we want to know they have the most appropriate facilities available. The result of this enquiry will heavily influence the strategic direction of mobile emergency communications in Australia for the next decade, perhaps longer, the outcome has to be derived from the most reliable levels of information available and with due consideration of all of the relevant facts and significant uncertainties that apply.

One further thing that is incumbent on the Commission as part of the enquiry process, there must be no blanket assumption that 'Mobile Broadband will be the singular answer to all of the PSA communication and interoperability problems'. It will be one part of the solution to some problems, however, it will not be the 'Silver bullet' that many expect, there will continue to be a need for the existing LMR narrow-band systems to operate for many years to come and these will provide the reliable underpinning of newer technologies whilst they are being proven to be as reliable. There will still be the issues regarding operational cooperation between jurisdictions and even between agencies that will need to be addressed and solved as part of the resultant outcomes.

Disclaimer – the information presented in this submission has been developed in accordance with the overall aims and position of the Australian Radio Communications Industry Association (ARCIA) Inc. and should not be taken as representing the position of any individual Association member. Any of our members who have specific views or opinions they wish to represent are able to make separate submissions and these should not be deemed to void the information presented by the Association in this document.

Response to the questions from the ‘Issues paper’

1. *What is the merit (or otherwise) of the proposed approach to undertaking first principles analysis in this study?*

ARCIA response - we agree with the methodology, however, it is vitally important that a measure of the ‘Social benefits’ offered by the Public Safety Agencies is also factored into the valuation outcome. The lack of immediate response to emergencies and natural disasters has a multiplying effect in the resultant impact on society, especially in terms of lives, injuries and property loss.

2. *What domestic or international developments, reports or experiences in PSMB (or related matters) are relevant to consider in this study?*

ARCIA response – we believe that the PSA’s are still not experienced enough with the potential usage of mobile data to be able to accurately forecast their ultimate demands. If the public carriers are surveyed on their initial estimates for mobile data they will acknowledge that the actual usage is far above any of their forecasts from early days. There is no reason to believe that the PSA’s are going to be any more accurate with their predictions of use, there will be new applications and product developments that will impact on future usage and this means that any present estimates must be evaluated with that possibility in mind. ARCIA would be very concerned if it turns out within a few years that the PSMB system does not meet the demands of PSA’s in emergency situations. As part of the supporting information ARCIA has previously provided links to some reference documents worthy of providing balance in the decision processes. The Commission should be looking towards gathering as much information from international sources as possible.

3. *What are the implications (if any) of the Australian Government’s review of the spectrum policy and management framework, and ACMA’s ongoing work on spectrum allocation matters, for the delivery of PSMB in Australia?*

ARCIA response – our Association has concerns that in developing spectrum management policy the ACMA have made assumptions with regard to the future PSMB system that may be coloured by competing demands for spectrum. The suggested spectrum needs taken into account with the review of the 800-900MHz band included assumptions that the PSA’s would not have large data needs, which we question in response 2 above. There was also the assumption that the various jurisdictions would not be able to fund the building of a private network and so little spectrum should be made available, leaving more spectrum set aside for the existing public carriers.

4. *Are there any other PSAs that should be considered within scope in this study? To what extent are communications between PSAs and the community relevant to this study?*

ARCIA response – In any emergency there will be other agencies involved beyond the main three (Police, Fire & Ambulance). With this in mind and to properly cater for the real needs of the future, services such as the various State Emergency Services (SES), Life Saving Australia, local Government and these other ‘second tier’ agencies should also have access. In times of major disasters there are going to need to be interoperable facilities for all agencies to be involved and have common information. The public networks not engineered to cope with such peaks in demand.

With regard to communications between the PSA’s and the community, this is becoming increasingly important in times of disaster, both for the PSA’s to advise community safety aspects, but even more importantly as part of the information gathering systems as in many cases it is data on ‘social media’ that provides an additional information to incident commanders on how to respond. This ability also means that for public carriers to prioritise data on their networks for PSA use could potentially limit the amount of information available from the general public due to system capacity limits being reached, a factor that must be considered when evaluating the benefits of public vs private networks for PSMB operation.

5. *How do the organisational and institutional arrangements for PSAs vary between the Australian jurisdictions? What implications (if any) does this have for the way in which PSAs procure, operate and use communications services?*

ARCIA response – we do not feel we can offer any information for this question, other than to highlight that many of the PSA’s have concerns with the sharing of information between agencies, let alone across jurisdictional borders. Some organisations will feel the need to retain their traditional status and control over communications especially when they are used to tailor made communication solutions for their operations. This will be an issue that will have to be addressed as part of the system security considerations.

6. *What is an appropriate definition of ‘mission critical’ communication systems and capability for the purposes of this study? What metrics should be used to assess whether capability is being delivered to adequate levels during mission critical circumstances? What evidence is there that existing capabilities are satisfactory or unsatisfactory?*

ARCIA response – again we do not feel we can offer much to the informed response to this question. There are definitions of ‘Mission critical’ developed as documents both by then TCCA and P-25TIG organisations. There will also be various definitions from within the PSA’s and early in the discussions there should be agreement on one single common definition to be applied to all PSMB considerations. We would suggest that as a minimum the definition should be along the lines of “Mission Critical Systems are durable, resilient and effective in all situations and conditions to enable front line responders to achieve timely and successful outcomes in all emergency situations”.

7. *What applications do PSAs currently use on their LMR networks that are provided for mission critical purposes? Does this differ by jurisdiction?*

ARCIA response – we believe that most of the existing services will have a degree of encryption on their LMR systems. It is highly likely that some or all of the radio communications may not be in encrypted mode, or at a low level of encryption for general operations. Location services are now commonly utilised on newer LMR systems, with a limited degree of ‘status messaging’ capability. There are also options available in many LMR systems for ‘Man down’ and ‘Duress’ calling systems, plus ‘Lone worker’ facilities, some agencies may be using some of these options. In addition mapping information will be required to interface with geographical information services (GIS) and similar spatial references.

8. *How often are PSA narrowband networks (such as LMR networks) renewed or upgraded, and to what extent are different jurisdictions at different points in this process? What are the costs involved in maintaining these networks?*

ARCIA response – this is a question for the PSA’s to respond to directly. From an industry perspective it appears to be an ongoing process of renewal over several years, with fixed infrastructure around every twelve to fifteen years and terminal devices anything from three to seven years.

9. *How do the different types of events that PSAs deal with affect their demand for communications capabilities? Can you provide examples or evidence to illustrate this?*

ARCIA response – again this is an area where the PSA’s will have to give their own indications. As an interested observer of the PSA environment for many years, we can advise that each agency will have totally different requirements, even for a single incident and these must all be factored into calculations. We would again reiterate our response to question 2 in that PSA’s have little ability to try and forecast future data usage when many applications and products are yet to be developed.

10. *How, and to what extent, are PSAs using mobile broadband capability provided over commercial networks, and related products and applications, to support their operational activities? Are there any lessons or insights from these experiences, including the benefits that are being realised?*

ARCIA response – we are not able to provide information on this question.

11. *How do other large organisations (such as government and corporate organisations with certain requirements which may be similar to those of PSAs) currently use mobile broadband services provided on commercial networks?*

ARCIA response – we are not able to provide information from organisations such as banks and financial institutions that utilise public broadband services. We can provide anecdotal evidence that the major resource companies are hesitant to use public networks for critical systems and that major mine sites in Western Australia have installed their own LTE systems to ensure that factors such as reliability, resilience and latency are under direct control for efficient operation of the facilities.

12. *What lessons or insights can be taken from the previous trials of Telstra's LANES model, including during the G20 summit in November 2014?*

ARCIA response – we are not privy to this information. We would point out that the LANES system is a proprietary protocol and this can have impacts in other areas such as provision of terminals for user agencies.

13. *Can commercial network solutions that involve dedicated spectrum for PSAs (and prioritised capacity in other spectrum bands during emergency incidents) allow for interoperability between networks operated by other mobile carriers and/or for end user to roam across multiple networks? Are there any technical, institutional or commercial barriers that would prevent this outcome?*

ARCIA response – from our knowledge of the commercial networks and the overall technology, there are NO technical barriers to prevent this functionality, it is based purely on commercial and competitive parameters.

14. *What applications could PSAs use if they had access to PSMB capability? How could this be expected to vary across PSAs?*

ARCIA response – as outlined in previous responses, any of the applications that will be of vital interest to the PSA's are yet to either be available in Australia, or to actually have been developed. PSA broadband is still a new technology and other than use for video and location services, little else has been explored at this stage. This means that many future applications that could be deemed as critical to an incident response could have data demands that would stress the public carrier services and cause significant problems as the requirements are still in 'smokeware'. As indicated in a previous response, there will be a definite need for spatial information facilities.

15. *To what extent could these applications replace or supplement the capability and systems currently used by PSAs on their narrowband networks?*

ARCIA response – we do not feel that we can provide valid information to this question.

16. *How important are communications between PSAs and the community during emergency incidents?*

ARCIA response – again, we are not qualified to provide information on this topic, other than to point out the increasing reliance on 'social media' information in incident response planning. There is ample evidence of the importance in the many reports from enquiries into major natural disasters such as Queensland flood enquiries and Victorian Bushfire enquiries to name a couple.

17. *What PSMB capability characteristics should be considered in this study?*

ARCIA response – although rarely mentioned in the discussions around PSMB to date, we believe that the National Broadband Network (NBN) has a role to play in the development of the PSMB capability. Much of the discussion has related to the devices and demand in the field at incidents, however, in order to have this information available there has to be a 'backhaul' path to the main data resources for incident monitoring and control. With the plans for the NBN to now be available

to localised ‘nodes’ around Australia, this will make available a backhaul facility with the pricing and facilities under control of the Government. It is also possible that with little configuration the NBN nodes could be configured to become ‘data hydrants’ to allow Cells-on-wheels (COWS) to be quickly connected to give extended or improved broadband capability at incidents. There are also developments in PTT-over-WLAN systems that could help to improve coverage by using ‘Hot spot’ technology.

One of the major issues for consideration by the Productivity Commission (PC) is the network configuration, with items like the ‘network cores’ needing to be included in the considerations. In basic terms there are two available options, centralised or de-centralised core systems. The public carriers use the centralised core format where they have a limited number of core switches at central locations and with every call there is administrative and operational traffic transported between the field base station and the central core, data traffic in both directions. This format means that the backhaul capability has to be quite high as there is significant demand for administrative traffic with every communication, plus loss of the ‘data pipe’ to the central core switch means the system is ‘dead’ beyond the signal break. We would suggest that for PSA’s this might not be the ideal situation as often a critical incident can also result in the loss of communication facilities. The alternative format is for de-centralised cores, where each broadband transmission site has its own inbuilt switch, with regular updates between each site and the primary control source to update administrative details. Under this format, the only traffic operating on the backhaul system is operational traffic and loss of the backhaul system would simply reduce the system to local operation, not a complete loss of facilities. With the decentralised core system the actual traffic on the backhaul network would probably fall well within the capabilities of the NBN and this would then offer a suitable format at potentially lower cost than the carrier-owned backhaul for centralised systems.

18. How should ‘national interoperability’ be interpreted in this study? Does it include interoperability between networks, devices and applications used by PSA in different jurisdictions? Does it extend to integrating communications services between different local PSAs (for example, police, fire, ambulance and other responders)?

ARCIA response – although not directly involved, it would be our opinion that ‘national interoperability’ should extend to all jurisdictions and all emergency services. The interoperability between PSA’s will increase with the passage of time and so there should be capacity to cover all requirements built-in to the system. This approach will create some concerns though, at present there is a ‘level of concern’ between the various agencies regarding the sharing of all levels of information, this has probably been the most significant deterrent towards interoperability to date. On a technical level the availability of gateway devices has meant that interoperability at an administrative level has been possible for several years.

19. Does delivering a PSMB capability raise any new opportunities for achieving national interoperability?

ARCIA response – we would suggest this opportunity offers the first real capability for true interoperability to date. The existing LMR networks have had a degree of interoperable features, however, the equipment choices and facilities selected by the various jurisdictions have limited the degree of success for interoperability. With the proposed PSMB network the network configuration is capable of re-configuration at any stage, this would mean that equipment from many agencies can be brought together and facilities equalised between terminals to provide true interoperability.

Of course, the inherent conservative attitudes within agencies regarding sharing of information will still exist but there will be fewer technical constraints involved in achieving that outcome.

20. Would the benefits, costs and risks of achieving national interoperability vary under different deployment options? If so, how?

ARCIA response – although we have no direct input to this question, philosophically we would suggest that the system(s) will need to be rolled out over a period of time, and may have different requirements for various locations. By utilising a combination system with some private network operations in major CBD areas to commence and public carriers for the other areas, the provision of facilities could be made available relatively quickly. After that, as demand or finances decreed, the private systems could be extended further out from the CBD areas.

One area that should be kept in mind as the systems are developed is the ability for the PSAs to operate Cells-on-wheels (COWS). With some services, these would not necessarily be trailer-mounted or towable devices, for instance, organisations like the Victorian CFA and South Australian CFS have ‘forward command vehicles’ located in many brigade premises around their respective states. It is entirely feasible that selected vehicles could be fitted with mini-COW facilities and as long as they could access the NBN they would become an extension of the PSMB network to provide coverage for significant incidents. With 4G technology these units would service ALL PSA terminals in the area. As mentioned previously, PTTOWLAN could also offer extra facilities here.

21. What progress has been made in putting in place arrangements to better coordinate emergency communications within and across PSAs and jurisdictions?

ARCIA response – this is an evolving situation and will continue to occupy the minds of communications planners for some time to come yet. For instance we believe that the Queensland Government are investigating as part of their Public Safety Communications (PSC) needs areas such as ‘Desired Future State’; ‘Barriers to change’ and developing a roadmap to integration and operability.

22. What level of network coverage do the existing networks used by PSAs (for narrowband voice and low-speed data capability) currently provide? How does this vary across jurisdictions?

ARCIA response – over recent years the development of ‘gateway devices’ which utilise IP-connected formats has meant that it is basically possible for equipment from various agencies to have the ability to communicate between each other in emergency incident situations. It would seem that in many cases the agencies involved have not had the impetus to sit together and establish the guidelines and formats for the devices to be installed and how the communications protocols would apply.

This raises the actual requirements for interoperability, in many minds of those outside of the PSA's the thought is that every person involved can communicate between each other, Police, Fire, Ambulance, etc. In the real world this is not the level that interoperability is really required. Each agency needs the ability to communicate with and control their own personnel and resources, with support from other agencies to realise their operational needs. With this in mind it becomes apparent that interoperability is really needed at an 'administrative' level rather than the actual 'first responder level'. Once this scenario is accepted the degree of interoperability is clarified and much easier to configure and maintain.

With regard to 'Network coverage' we would suggest that present LMR systems provide coverage well beyond the populated areas, for instance, within fifty kilometres of the Sydney CBD there are large areas of National Parks, these will have full LMR coverage for all ESO's, yet mobile phone coverage in those areas is limited. In remote areas there will also be LMR coverage well beyond the mobile phone coverage, and all of these areas are potential operational areas for ESO's.

23. What level of mobile broadband network coverage do PSAs require across metropolitan and regional Australia? Does this vary for different PSAs?

ARCIA response – as our members represent a diverse range of the general community spread around much of Australia, the final answer to this question is total coverage, our members would not be happy knowing they were not being protected by the best available facilities, so too the general public. This must also be based on actual geographic coverage and not 'population percentage' metrics. Bushfires, floods, major road accidents and similar emergencies are not restricted to areas of population density.

The obvious concern is that absolute coverage is not economically feasible, however, smart system design can account for much of the requirement. For instance, if a system with de-centralised switching is utilised, then the traffic from any particular 'Cell' back into the main database or control locations is kept to a minimum. Under this format the latency (amount of signal delay) is not as critical and so a satellite terminal could be used to give the backhaul with a COW to give the local incident area communications. There is also anecdotal evidence that LTE 'Backpack' units are available, as well as 'back-to-back' devices which can be used as system extenders.

24. What is the most appropriate measure of network coverage for use in this study?

ARCIA response – as indicated in the previous response, the coverage requirements must be based on geographic estimates and not 'population density' metrics.

25. What options are there for extending the mobile coverage of commercial networks?

ARCIA response – we understand that the commercial carriers already use COWs on their networks for special occasions, these include events like the Melbourne Cup Carnival and the Grand Prix, this is a known technology and can be used to increase the range or capacity of the networks. The question then arises whether the commercial networks could/would permit PSA COWs to be used for emergency coverage in certain conditions. One significant restricting factor would be the backhaul capacity as the commercial networks have their own backhaul and this may be tailored to suit the existing infrastructure and not be capable of readily accommodating extra temporary cells.

As outlined in the response to question 23, there are also other devices available; however, they may not be suited to the public carrier system formats.

26. *Would the benefits, costs and risks associated with achieving an acceptable level of network coverage for PSAs vary under different deployment options? If so, how? And with what operational consequences?*

ARCIA response – we are not able to respond meaningfully on this topic, other than to point out that all deployment situations and conditions should provide the same level of mission critical communications services to enable frontline responders to achieve timely and successful outcomes..

27. *How could voice services — traditionally carried on narrowband networks — be integrated into a mobile broadband network capability? What challenges and risks need to be accounted for? Are the challenges at the local level (due to legacy factors) greater than those at the national level?*

ARCIA response – the underlying answer to this question is yes, they can be assimilated onto a broadband network. The major area of concern is that the Press-to-talk (PTT) voice services should only be offered under equipment and conditions where there are advertised equipment standards (refer response to Q 29 below). One of the major risks is that if equipment that is not to an international standard is utilised, then the system and products may become proprietary and this then introduces the possibility of limited or restricted supply options in the future, see our comments regarding Telstra LANES in question 12 above.

This situation has already arisen with existing LMR services where the initial P-25 radio equipment supplied to many agencies differed from the true equipment standard in relation to the features and facilities of the supplied equipment. This did not appear to create a problem when the equipment was first supplied as there was very limited availability of equipment. However, as the supply market matured it has been found that many agencies have almost become ‘locked in’ to one supplier because of the lack of clarity regarding equipment standards. We would suggest that to work with any form of equipment that is not fully compliant with international standards, or has any degree of proprietary configuration may not be in the best interests of the PSA’s.

28. *What challenges or opportunities arise (from a technical, institutional and/or commercial perspective) from such integration, and would the benefits, costs and risks vary under different options for PSMB? If so, how?*

ARCIA response – we are not able to respond meaningfully on this topic.

29. *The Commission understands that there is currently work underway to develop voice applications for 4G/LTE networks for use in mission critical circumstances. When are these applications likely to become available?*

ARCIA response – The international standards for the equipment are developed by the 3GPP consortium, it is now known that the group have deemed that ‘voice facilities’ should be developed as part of Revision 13 of the project specifications. The agreement to develop the standard is the first step, beyond that it will require several suppliers to work along with the technical standards developers to ensure that the project can move ahead, and even more importantly, that once the

standard is adopted that they will manufacture terminals to suit the requirements. There is always the risk that to include the requirements there could be a resultant demand for memory in the ‘chip-sets’ that might mean that some other features may need to be deleted to accommodate a PSA template. If this were the case, the terminal manufacturers would then make a commercial decision about whether to support the PSMB needs or aim at a more lucrative commercial market. In the big picture, the needs of PSA’s in Australia will be minimal compared to commercial demand for terminals. Once the standard has been developed (estimated about two years delay), then the terminal design would follow and manufacturing behind that. General estimates are that it will still be several years before equipment configured to 3GPP voice specifications will be available.

30. What factors are important in ensuring the integrity and security of communications for PSAs? To what extent does this differ for different types of PSAs?

ARCIA response – we are not able to respond meaningfully on this topic. Our previous comment about the lack of open information sharing between agencies is relevant to this and the following questions. It is also important to ensure the integrity and security of communications helps to protect against criminal activity and possible cyber attack.

31. Would the costs and risks associated with ensuring the integrity and security of communications differ depending on how a PSMB capability is delivered? If so, how?

ARCIA response – although we cannot respond with any authority on this subject, it would seem to be logical that a private PSMB network would have a slightly higher degree of security than one shared with the general public?

32. What methods or metrics could be used to define and/or measure the level of security provided over a network that delivers mobile broadband capability?

ARCIA response – we are not able to respond meaningfully on this topic, however, we believe that organisations such as Price Waterhouse Coopers have identified that cyber attacks can be from multiple sources, including those inside an organisation, external hackers, opposing nations and criminal groups to name some. Security should be defined so that these types of threats are addressed, especially in a mobile terminal environment.

33. What additional security needs do PSAs have compared to other sectors with high security requirements for their communications?

ARCIA response – we are not able to respond meaningfully on this topic.

34. How should PSA demand for mobile broadband capability be estimated in this study, including their expected demand requirements into the future?

ARCIA response – as indicated previously, this will be a vexing question. In the early days of mobile broadband the public carriers all forecast their potential requirements looking ahead to the future; we would venture to say that all of these forecasts fell well short of the actual demand. The PSA’s run a very real risk of the same situation when forecasting now, we would believe that the original forecasts on which the initial PSMB discussions took place several years ago have now been dramatically modified. Although the PSMB market is nowhere near the size of the general telecommunications market, the similarities fall within the development of new ‘Applications’ (Apps)

and the increasing data demands of these Apps. The public safety market for mobile broadband is still a developing market world-wide and so not a lot of time or effort has been put into App development, to this end the PSA's don't know what is coming or what future requirements may be. Any forecast for demand should be treated as an indication only and factored by a significant amount for planning purposes. The bottom line for data demand is the amount of spectrum available, the public carriers confirm this with their constant and apparently insatiable demand for new spectrum, the PSA's must not be shackled with insufficient spectrum to gain future benefits.

We do note however that the public carriers have access to a range of frequency bands which allow them to boost throughput with microcells in denser population areas. Because the PSA's require a wider coverage area the data demand can only be catered for to the extent that sufficient spectrum is available to implement a tighter cell structure because of frequency reuse/clash considerations.

35. What methods or metrics could be used to define and/or measure the level of service capacity provided to PSAs?

ARCIA response – we are not able to offer any meaningful response to this question.

36. What level of capacity will PSAs need for a PSMB capability, and how will this differ between business as usual activities and large scale emergency incidents?

ARCIA response – obviously the demand for 'business as usual' requirements can be forecast with relative ease, although each of the agencies will have differing amounts as their normal operations are very different. The forecast of incident requirements should be re-classified into perhaps three levels to enable the agencies to build demand algorithms as they go, we would suggest that if examples were developed at low, medium and high level incident requirements it may be easier for agencies to develop better indications. This planning should also look at various types of incidents where the major agencies are involved in different formats, for instance bushfires and floods would have totally different needs from agencies. Similarly a serious transport accident in a rural area would be totally different to the same incident in a suburban area. This level of design will be critical to the success or failure of any PSMB system.

37. How might the demand for PSMB capability differ between types of PSAs? How could competing demands amongst PSAs be managed? Should particular uses be prioritised?

ARCIA response – although this falls outside of our area of expertise, we do understand that the three major agencies (Police, Fire & Ambulance) all have differing data needs and at different stages of any critical incident. In the event of an industrial explosion and fire fighting situation for example, the location of chemical hazards and the potential risk to responders would need to be known by all. In addition, the second tier responders will also have different needs which will probably be more administrative but still vitally important in the overall picture. With this in mind the relevant agencies will all need to plan out their potential data needs and input from all agencies must be considered.

38. *How would the benefits, costs and risks of ensuring sufficient capacity vary under different deployment options?*

ARCIA response – again, the demands will vary between agencies and different incident types, this will also affect the demand and priority of broadband traffic. With major incidents there will be the competing demand of PSA's requiring significant amounts of data capacity with little latency, yet incident controllers will also be looking to ensure that information that can be gleaned from social media might be helpful in developing an overall view of an emerging situation. This will mean that in a PSMB operating on a public network, either permanently or in an overflow capacity will have to be sure that it doesn't swamp the network capacity, particularly with no control over the public demand in situations affecting the broader community such as fire or flood.

39. *What level of resilience do PSA narrowband networks usually provide and how does this differ from commercial mobile broadband networks?*

ARCIA response – this will differ between agencies, however, our members report that for LMR narrow-band voice systems it is usual practice to have at least three days of power back-up for 'high density' population areas, and between seven and ten days as a minimum in remote or high-risk areas. It is also usual to have some form of back-up to communications back-haul links to ensure that remote transmission sites have a degree of protection from loss or failure of equipment. In the opinion of our ARCIA members, system resilience is one of the major factors that must be considered in PSMB system needs. Anecdotal evidence from major incidents, both within Australia and internationally, is that often the narrow-band systems continue to operate long after other communications systems fail, and in many cases the public carrier networks cease to operate from either loss of power or the backhaul link systems are out of commission in a shorter timeframe.

40. *What methods or metrics could be used to define and/or measure the level of resilience provided by the networks used to deliver PSMB?*

ARCIA response – this should be a reasonably simple calculation for any PSMB network. In narrow-band radio there are various calculations to take into account regarding transmission cycling times and the requirements for back-haul, etc. With LTE systems the power requirement of the equipment is constant and so there are simple calculations to configure standard power requirements and the amount of back-up power required. If a site is to operate of alternative energy sources such as wind or solar, the equipment suppliers have algorithms available for all areas to provide the calculations.

41. *What priority should be given to the capacity to stand up a replacement service within a specified timeframe in the event of a physical or network based disruption?*

ARCIA response – all of the PSA's will have similar arrangements already in place for their narrow-band radio systems and the same plans should be in place for the PSMB network. An incident controller will already have an indication of his system reliability and has every right to believe that his mobile data will perform to similar levels. Should the ultimate decision be made to operate on a public network, then it may be necessary to ensure that local access arrangements are in place to cover any eventualities where the network might be down but the physical support team are located in a centre quite some distance away, it is highly likely that the technical support team may only be domiciled in capital cities and this will make service restoration a much longer and perhaps unacceptable period of time.

42. *Are there any barriers (for example, institutional, informational and/or technological) to, or challenges associated with, delivering a resilient PSMB capability? How might this differ between different deployment options?*

ARCIA response – although resilience planning is a very practical arrangement, there are other areas that have to come into the equation as well. For instance, there has to be a similar level of consideration given to the resilience of the backhaul network. With all of the options being considered there is a high likelihood that the backhaul will operate on commercial networks, either in part or fully. This means that the backhaul network has to be ‘hardened’ to the same level as each cell site. If the system is designed to operate with centralised switching this becomes even more critical, as a backhaul failure will potentially disable every terminal beyond the point of failure, so they may still be capable of operation on a local site but without system administrative contact they cannot function, this is why backhaul resilience is more critical in some design formats than others. There will also be the spectrum costs including direct cost, availability and the cost of competing demands for the spectrum to be considered.

43. *How could future developments in technology, or growth in demand for mobile broadband services and capacity, affect the sustainability of PSMB capability under different deployment options?*

ARCIA response – this is an important issue, as we have outlined previously the PSA’s still will not have a full understanding of the possible future applications that could form part of their operational needs. Given that PSA equipment renewal programs tend to be based on several years of service and not at the whim of product developers aiming at a mass consumer market, there is a very real risk of equipment or applications becoming inoperable if the network configuration changes. From a network perspective it would probably be more conservative but perhaps safer if the PSMB was a private network where any system revisions or changes were under the control of the relevant jurisdictions. Operation on a commercial network could see the network parameters modified to suit the ‘latest whizz-bang features’ and this could lead to a situation where the network requirements of the PSMB are compromised to meet the commercial demands of the network operator. Even with strict Key Performance Indicators (KPI’s) it would be difficult to ensure that this situation would not arise. As a shareholder in one of the major network suppliers, the author of this document might have concerns if the long-term profitability of the commercial system was to be compromised by external forces and a competitive edge lost?

44. *How will the convergence of voice and data services affect the sustainability of PSMB capability under different deployment options?*

ARCIA response – this is a critical area and given the resilience and reliability designed into existing voice systems, the users have every right to demand that the move of voice services onto data platforms is equal to or better than reliability of present systems. This has to be a ‘non-negotiable’ criterion. One of the side issues involved with this transfer is the fact that many operators will wish to use their device for multiple functions, a reasonable expectation but one fraught with danger. If we consider that an operator in the field wishes to simply have data access, telephone option and also PTT voice capability as part of his team as functions on his device, if he is active on a telephone call then he will not be capable of being included on any ‘group voice call’ as the device will give priority to the telephone call, hence a team leader or critical team member will not be part of a

critical communications, and will not have any way of knowing this situation has happened. Anecdotal information from America was that the agencies who took up Nextel services as a combined mobile phone and narrow-band radio ended up in many cases re-issuing radio equipment to ensure that team members were always in communication.

Another factor that must be considered is the viability of multi-purpose devices under operational conditions, for example the access protocols for duress or similar functions, plus the limitations provided by the user's personal safety equipment, such as gloves worn by fire-fighters. These will all need consideration as part of the overall suitability of singular device operations.

45. What challenges are involved with delivering a mobile broadband capability to PSAs by 2020? Do these differ under alternative deployment options?

ARCIA response – we are not in a position to provide a complete set of criteria for this question, however, we would suggest the following should be some of the areas of interest –

- a) For a private network –
 - How will the coverage footprint be designed
 - Who will have the capability to convert the agency wishes into real coverage terms
 - How will the backhaul capacity be handled and what data capacity will be needed
 - Will the system be centralised or decentralised core network switching
 - To what extent will or can existing agency infrastructure be utilised
 - Who will have the overall responsibility for system performance
- b) For public network operation –
 - Who will determine the contractual KPI levels given the multitude of agencies involved and the varying levels of performance during different types of incidents
 - Who will set the parameters for 'hardening' of the carriers networks to meet PSA standards
 - How will the carriers backhaul capabilities be linked into the contractual conditions to ensure they meet the same criteria as the actual transmission networks
 - What will the response times be for urgent repairs under incident conditions
 - Who will be the coordinating agency for monitoring and controlling the relationship between the carrier(s) and the network users?
- c) For a combined network with part private and part public infrastructure –
 - All of the above, plus
 - How will the carriers set the operational frameworks to ensure that when PSA operations move onto the public networks, either in overflow mode or because traffic requirements from an incident lead to 'load-shedding', to ensure that demands from both public use and PSMB use are maintained?
 - How to provide coverage for areas that are presently not included in the coverage footprint of the public carriers yet will have significant demand from PSA's, for example the National Park area to the South of Sydney.

46. *What potential obstacles exist to a mobile broadband network being fully compatible with a range of end-user devices? Does this depend on the network deployment option?*

ARCIA response – we touched on one of the potential problems in our response to question 43 above. Mobile Broadband is a highly consumer driven technology and the network and terminal manufacturers respond to consumer demand and technology advances. This leaves the possibility that future developments of PSMB type network applications might not be capable of being accommodated within the established terminals memory restrictions. Similarly, spectrum considerations need to be kept in mind, as the product development goes ahead and new spectrum areas are developed, the ‘device chip-sets’ will have to reflect the spectrum plans of the public carriers. In some way this could mean that the Australian PSMB allocation might be better served to be in the unallocated 700 MHz spectrum where it will remain adjacent to the major carriers and chip-sets are more likely to be maintained, operation in the 800MHz segments might see a situation where there is a restricted availability of devices due to the spectrum not being a widely used segment for mobile broadband in other areas of the world.

47. *How does the method of ensuring interoperability impact on the cost of the system to PSA's?*

ARCIA response – it is our understanding that with LTE technology the interoperability or otherwise of terminal devices will primarily be a function of the core network configuration, actual terminals will be the same. It may be that the ‘Chinese walls’ will become a function of the agency internal networks and they may have more challenges than at a terminal level.

48. *What detailed options should be evaluated in this study? What underlying assumptions and key parameters would be associated with each option?*

ARCIA response – we have outlined above that one of the major consideration should be whether the system preference if for centralised or decentralised core switching and this will be determined to some extent by the public versus private network decision. Again a second factor will be the backhaul capability and methodology which is a critical component of any mobile data network.

49. *What (if any) assumptions or parameters should be ‘common’ across all options?*

ARCIA response – we are not in a position to respond to this question in detail, however, we would suggest that mobile broadband should provide the same level of service regardless of the methodology of the system provision, plus the integrity and security of communications should be considered to be of the highest priority across all options.

50. *What are the sources of costs relevant to this study?*

ARCIA response – there are multiple reports and resources available for this purpose and other than the report prepared for ARCIA by Windsor Place Consulting we see no benefit in us listing these resources.

51. *In what ways could delivering a PSMB capability affect non PSA users? How would these effects differ across deployment options? What methods could be used to estimate these effects?*

ARCIA response – we are not in a position to provide detail in this regard, however, as outlined previously the needs of the general public and social media tools are an important aspect for consideration by incident planners. Given that the network demand during ‘business as usual’ operations on a private network would be relatively low, perhaps there is potential for some low-level data requirements from Utility companies could be accommodated to generate income and offset the operating costs of the network. This could include metering data from utilities such as water and gas where they are simply collecting data on a regular basis and could be handled in ‘quiet times’ on the PSMB network? There could also be some other possibilities fro within the transport industries, either from Public Transport support systems or even the developing Intelligent Transport Systems.

52. *Is it appropriate to consider option values as part of the cost benefit analysis in this study? If so, how? What information or data is relevant?*

ARCIA response – whilst we cannot contribute greatly to this question, we would trust that options such as build, own, operate and managed service would be part of the consideration, or even some form of a mix of both public and private.

53. *Are the network cost elements identified in box 4 relevant for this study? What specific cost items would fall within these categories? What other network costs should be considered? What is the nature and materiality of these (and other relevant) costs under alternative PSMB options?*

ARCIA response – we are not in a position to respond to this question.

54. *What method(s) should be used to estimate the network costs of different deployment options for delivering PSMB? What studies should inform the Commission’s thinking in this area?*

ARCIA response – we are not in a position to respond to this question.

55. *What network cost components are interdependent with other costs, or other parameters (such as assumptions about the amount of spectrum allocated)? What is the nature of these interdependencies?*

ARCIA response – we are not in a position to respond to this question.

56. *What data sources could be used to estimate expected PSMB traffic requirements, and the network infrastructure elements required to deliver PSMB capability under different deployment options?*

ARCIA response – we are not in a position to respond to this question.

57. What data sources could be used to estimate the cost of the infrastructure, equipment and operation in delivering PSMB capability under different deployment options?

ARCIA response – one of the primary factors to be considered in the network costs is that the actual LTE base station equipment will probably be the lowest cost part of the fixed cell costings. The costs associated with fixed infrastructure such as equipment masting, power sources, site access and other items will be much higher than actual equipment costs, and will have an ongoing expense associated as well. If the system is to be a private network, then consideration must be given to utilising as much existing infrastructure that the agencies either own or have good access conditions already in place, in some cases it may be worth added equipment cost to remain on low-cost sites, given the ongoing cost considerations. As also indicated previously, if the proposed system were to be operating with de-centralised network switching, there is the potential for the NBN to become part of the back-haul capability, plus there are many other back-haul options such as ‘State-owned’ railway systems and utility companies who may have Fibre Optic capacity available.

58. What is the appropriate approach (or approaches) to model the opportunity costs of spectrum under different deployment options? What issues does ‘spectrum sharing’ raise for estimating these opportunity costs, and how might they be addressed?

ARCIA response – as mentioned in the reference documents to the Issues Paper, our Association commissioned Windsor Place Consulting to value the spectrum utilised for LMR equipment in Australia. As part of this project they were unable to find many resources to identify spectrum value internationally, however, the report should give reasonable pointers to the spectrum valuation. The most significant part of the exercise is to avoid using purely economic benefit as the means of valuation, there must be an element of ‘Social benefit’ applied as well. Although not clarified in the Windsor Place report, the general consensus was that the social benefit was in the order of ten times the economic benefit derived from spectrum use. The results of the Windsor Place research valued the 400 MHz LMR spectrum used in Australia within a range of \$1.99billion and \$3.72billion.

One significant issue that must be kept in mind in the evaluation is that not all data is equal, and that there is a direct relationship between data and spectrum. Transfer of data is directly related to the amount of spectrum available, this is why the public carriers are seeking as much spectrum as possible to be able to offer increasing ‘benefits’ to their customers and so increase the competitive edge of their network. In considering the ‘opportunity cost’ of the spectrum, there must be a relationship determined between the value of ‘social media’ data traffic on the public carrier networks and the value of operational data traffic on any PSMB network, whether via private or public transmission systems. ACMA have for many years supported the carriers submissions of each and every byte of data on their networks being combined as part of the overall benefit of their systems and as such a contribution to the overall Australian GDP. With this in mind, there need to be a valuation of the benefit of such social media such as a tweet about a new pair of shoes against the PSA traffic. If this social media traffic is deemed to be one percent or even ten percent of the importance of PSA traffic, then the ‘Opportunity Cost’ of spectrum should be evaluated by the same factor. In essence, once data is put onto a network, it all has even value, so the value must be applied to the spectrum it uses. The marketing agencies of the public carriers set their pricing and data access rates to suit a ‘competitive market’ where all providers operate under similar conditions and mind-sets, there is little or no consideration given to the underlying spectrum requirements needed to provide the additional ‘free data’ marketing positions.

59. *What data sources could be used to estimate the opportunity costs of spectrum under different deployment options for PSMB?*

ARCIA response – our Association has serious concerns with the estimates used by the ACMA economists. For instance, in the recent review of Opportunity Cost Pricing (OCP) for the 400 MHz band, the ACMA utilised figures on usage and licencing from their own records and noted that in South-East Queensland that there was still a shortage of spectrum in the 450-470 MHz segment, yet elsewhere in their documents they also noted that due to the pending development of the Government Wireless Network (GWN) in that area many agencies had not undertaken equipment refresh or spectrum changes as required. This skewed the results, yet the ACMA continued along the line of scarce spectrum means that OCP increases are justified. In evaluating the OCP situation, all factors must be recognised and the values apportioned accurately, not to suit an argument for a pre-determined outcome.

60. *What is the appropriate discount rate, or range of discount rates, to use in this study?*

ARCIA response – we are not in a position to respond to this question.

61. *How far into the future should costs and benefits be measured?*

ARCIA response – this is a difficult question, historically the equipment refresh and update for PSA's has been measured in terms of ten years or more, and in many cases this should still be the case. The problem is that with mobile broadband the technology refresh and update is probably more likely to be two to three years maximum. Perhaps from a fixed infrastructure perspective the existing refresh rate would be in the vicinity of fifteen years and should be evaluated on a ten year cycle, however, terminal devices should be considered in a much quicker timeframe. This will be an unexpected expense item for PSA's as equipment refresh is going to be much higher and maintenance on terminal devices will potentially be much lower with a move towards disposable terminals.

62. *What are the sources of benefits relevant to this study?*

ARCIA response – we are not in a position to respond to this question.

63. *How can the potential benefits of PSMB capability (in terms of PSA outcomes) be estimated? Is scenario analysis useful? How should scenarios be constructed to reflect an appropriate range of situations faced by PSAs?*

ARCIA response – we are not in a position to respond to this question.

64. *Can you identify any trials or pilot programs of PSMB capability? Are there any insights to draw from these experiences about potential benefits (or costs)?*

ARCIA response – we are not in a position to respond to this question.

65. *Can you identify evidence or examples that illustrate the effects of PSMB capability on PSA outcomes?*

ARCIA response – we are not in a position to respond to this question.

66. What method(s) should be used to value the effects of PSMB capability on PSA outcomes?

ARCIA response – we are not in a position to respond to this question.

67. Is there research that considers how the costs of responding to natural disasters, crime or other events could be affected if PSAs had access to mobile broadband?

ARCIA response – we are not in a position to respond to this question.