



Submission to

Australian Government
Productivity Commission

**Public Safety Mobile Broadband
Issues Paper**

May 29th, 2015



**Rivada Networks, US Office
1750 Tysons Boulevard,
McLean, VA 22102
USA**

**Rivada Networks, European Office
Moyne Park,
Tuam,
Galway,
Ireland**

29th May, 2015

**Public Safety Mobile Broadband
Productivity Commission,
Locked Bag 2, Collins Street,
Melbourne VIC 8003**

Dear Commissioner,

Rivada Networks is pleased to offer our response to the Productivity Commission's Public Safety Mobile Broadband (PSMB) Issues Paper. Rivada Networks welcomes the opportunity to present herein what we believe is an optimal solution to the PSMB requirements and challenges as posed by the Commission.

Rivada has provided communications solutions in support of the Public Safety response to almost every major disaster in the United States since Hurricane Katrina in 2005. Our board and management team have brought together their varied experiences to produce a focused approach to inventing and developing solutions uniquely tailored to the long term needs of Public Safety Agencies (PSAs).

The expertise gathered by Rivada has led to the development of the technology and offering presented in this submission, providing a compelling solution to Australia's requirement for an advanced Public Safety communications network. The Rivada team has extensive experience in designing, deploying and operating wireless broadband networks across the globe, combined with the expertise of having provided unique broadband wireless solutions to the Public Safety community both in the United States and internationally. Rivada is focused on providing PSAs and other first responders with the modern wireless network they deserve and need to do their jobs.

The approach we present provides PSAs with a state-of-the-art Long Term Evolution (LTE) broadband network that is completely interoperable with commercial wireless networks, and also provides a recurring revenue stream that subsidises the ongoing cost of maintaining the network. These goals — the most effective PSMB network, operating flexibility, the most efficient use of scarce radiocommunications spectrum, a positive revenue outcome, and the advantage of not “picking winners” — are unlikely to be achieved in any other way.

Rivada’s approach pays for the network’s build-out and operation. It provides an ongoing revenue stream to Australia’s PSAs that will grow with the expansion of market demand for wireless bandwidth. The potential upside for this growth is left where it belongs, on the Government, State and Territory balance sheets, for Public Safety’s benefit. There is no need for the Australian Government to surrender likely future increases in the value of one of its key assets—its spectrum—to raise money for a network build. When Public Safety needs it most, only a network that provides access to all 30MHz will do. Rivada’s approach ensures that the entire capacity of that network will always be available to PSAs within milliseconds.

Rivada Networks appreciates the opportunity to present our comments and share our thoughts. We look forward to working with the Productivity Commission and with Australia’s Public Safety community to place Australia at the forefront of the emerging global wireless standard for Public Safety communications. We are eager to demonstrate that our approach is the right solution to capitalise on this historic opportunity.

Yours sincerely,

Declan Ganley
Chairman and Chief Executive Officer
Rivada Networks

Contents

- 1.0 Overview 4
 - 1.1 Executive Summary 4
 - 1.2 How Rivada’s Approach Works 6
 - 1.3 US FirstNet and other International developments 7
 - 1.4 Dedicated Spectrum for Australia’s PSAs 8
 - 1.5 Rivada Networks Solution 10
 - 1.6 Benefits of the Rivada Networks Approach..... 11
 - 1.7 Hurdles/Obstacles 13
- 2.0 Vendor Background 16
 - 2.1 Rivada Networks Past Performance 17
- 3.0 Product Components 18
 - 3.1 Commercial Services - DSA-TPA 18
 - 3.1.1 Capacity leasing based on a Network Sharing Approach 19
 - 3.1.2 System Requirements 19
 - 3.1.3 Governance 20
 - 3.2 Portable Solutions and Coverage in Sensitive Environments 21
- 4.0 Cost 22
 - 4.1 Network Costing 22
 - 4.2 Maintenance & Support 22
 - 4.3 Subscriber Costs 23
 - 4.4 Financial Model 24
 - 4.5 Public Private Partnership Structure 26
- 5.0 Implementation and Maintenance 29
- 6.0 Conclusions 29

1.0 OVERVIEW

1.1 Executive Summary

Rivada Networks is a leading designer, integrator and operator of wireless, interoperable Public Safety communications networks. We provide advanced communications solutions to the Public Safety community, including Police, Fire, Emergency Medical Service, branches of the Military and other first responders. Rivada Networks delivers 4G voice, video and data through the latest in LTE infrastructure, offering state of the art capabilities to Public Safety, whilst serving to meet increasing public demand for wireless broadband capacity.

Rivada Networks is a market leader in the provision of interoperable communications networks in the United States, focused on advanced communications solutions to the Public Safety community, as well as communications solutions to first responders in the aftermath of natural and man-made disasters, and terrorist threats. Rivada Networks' customers include a diverse range of federal, state, and local agencies in the United States, including U.S. Northern Command (USNORTHCOM), the Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), and the National Guard Bureau (NGB). Rivada Networks has provided communications solutions in support of the response to almost every major disaster and civil emergency in the United States of America over the last decade. The expertise gathered during these experiences led to the development of the technology and solutions that are presented in our response to this Issues Paper.

The solutions and approach that we present provide Australia with a state of the art, fully interoperable Long Term Evolution (LTE) broadband network, and also provides a recurring revenue stream that subsidises the ongoing cost of maintaining the PSMB network.

The Issues Paper outlines a thorough and well thought through approach. It adequately considers the associated problems, objectives, constraints, options, costs, benefits, and risks. Rivada Networks welcomes the opportunity to present our comments and share our thoughts. We would appreciate the opportunity to coordinate with the Productivity Commission to define a future that places Australian Public Safety at the forefront of the emerging global wireless standard for LTE communications, while addressing overarching demand related issues in wireless broadband capacity in Australia.

Rivada Networks' response to the Productivity Commission's Issues Paper sets out an approach that allows Australia's PSAs to maximise the potential of a proposed allocation of a dedicated 30MHz of 700MHz spectrum - spectrum which went unsold in the 2013 frequency auction. This approach delivers state of the art broadband mobile communications capabilities that are able to rapidly provide for and fund services, leveraging 700MHz broadband spectrum.

By adopting Rivada Networks' model, the Australian Government will achieve:

1. The greatest possible nationwide control, coverage, load capacity and survivability for the PSMB network.
2. Complete Public Safety ownership and control over the bandwidth resource and infrastructure.
3. A standards-based, fully interoperable PSMB network.
4. Public Safety ultra-priority access (at the millisecond level) to all of the bandwidth across all of the 30MHz of spectrum. This unique 'ruthless pre-emption' technology ensures that the PSAs user experience across the entire network equates to clear lanes - as though there was no other traffic on any of the network.
5. Regular refresh and updates of equipment and handsets keeping pace with 4G LTE (and later 5G), innovation and allowing such capability to be migrated quickly into the front lines of Australia's PSAs.
6. A Public Private Partnership (PPP) financial model that fully privately funds the PSMB network deployment, operation and upgrades, with no cost to the taxpayer and without compromising ongoing operation of, and title to, key infrastructure or spectrum. The Rivada model minimises the upfront cost and risk to the Government of adopting this approach.
7. A significant source of revenue to fund Australia's Public Safety communications mission.
8. A 'carrier agnostic' nationwide mobile broadband LTE footprint, allowing for real-time competitive wholesale access which can reasonably be expected to benefit from the ever increasing 'scarcity' value of bandwidth without surrendering that upside potential to an individual entity, or group of commercial entities.
9. A solution that not only meets PSMB requirements, but also meets Australia's objectives of maximising the economic and social return from spectrum, while supporting its efficient allocation and use – as outlined in the Spectrum Review recently published by the Department of Communications.
10. A resource that will help further catalyse new business models, innovation and job creation across Australia.

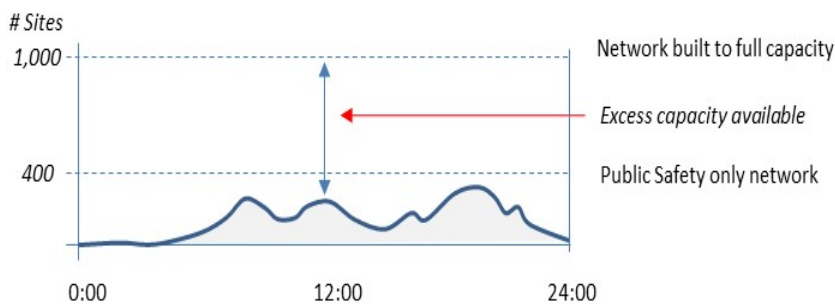
Rivada Networks' solution commoditises bandwidth. It does so at all levels, including at the most granular, a specific allocation of bandwidth, for a specific time segment, in a grid as small

as a subsector of an individual base station. Rivada’s patented spectrum-sharing technology, Dynamic Spectrum Arbitrage-Tiered Priority Access (DSA and DSA-TPA), does all of this dynamically and competitively. In short, this is an industry game changer that will be of immense benefit to Public Safety communications.

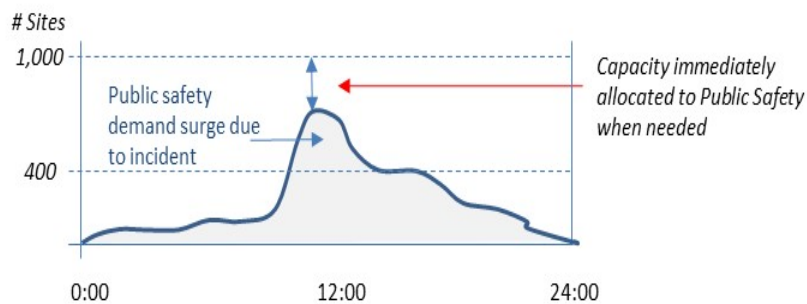
1.2 How Rivada’s Approach Works

Rivada Networks technology was originally developed in the US specifically to serve the needs of Public Safety. As a result, it was designed from the ground up to meet the highest standards of security and resilience. Rivada’s DSA model was developed to provide for the best possible Public Safety communications networks, solutions and coverage, while also providing for relief from, and in some cases the elimination of, any requirement to tap taxpayer resources to fund the building and operation of those networks.

Public Safety Network Traffic – Routine Operations



Public Safety Network Traffic – Emergency Situation



- Rather than building a network to support Public Safety only, Rivada proposes building out to the full capacity of the spectrum.

- The excess capacity available during normal operations can be re-sold on a wholesale basis.

- Network capacity is immediately made available to PSAs, if there is a surge in Public Safety use.

Rivada Networks recognises the absolute necessity for Public Safety to own and control its radio spectrum resources. We also understand that Public Safety can never compromise or lower their capabilities or standards to accommodate the needs of commercial/market requirements.

We believe that in adopting a DSA-TPA approach as outlined in this submission, Australia can achieve those goals and set a 'gold-standard' for next generation Public Safety broadband.

Rivada Networks is able to provide the Productivity Commission with a full operating demonstration of DSA-TPA enabled LTE on request.

1.3 US FirstNet and other International developments

In the United States, following the tragic events of September 11th 2001, the 9/11 commission report recommended that:

"Congress shall support pending legislation which provides for the expedited and increased assignment of radio spectrum for Public Safety purposes" (9/11 commission report, P396-397)

This objective was achieved with the February 2012 legislation establishing the First Responder Network Authority (FirstNet) and allocating the D-block of spectrum in the 700MHz band to Public Safety. Rivada is working to deploy its technology in the 20MHz of spectrum made available to Public Safety nationwide.

Authorised by Congress as part of the Middle Class Tax Relief and Job Creation Act of 2012, FirstNet has been tasked with establishing a nationwide, interoperable public-safety broadband network, and has been allocated \$7 billion USD to help finance the network rollout. This level of financial support is insufficient to roll out the required nationwide network, which will actually cost closer to \$50 billion USD. Therefore, a model that funds the proposed rollout may be deemed hugely attractive to FirstNet.

The organisation has stated that the value of secondary use of excess network capacity is perhaps the most important assumption in their models, and its draft RFP emphasises FirstNet's desire to maximise the value of its excess network capacity. Meanwhile, political support for Rivada's funding model is evidenced by the Federal legislation's calling for the creation of a dedicated nationwide broadband network for Public Safety with provisions for revenue generation through secondary market access on the network. Additionally, FirstNet's draft RFP highlights its objective of obtaining optimal value for excess network capacity.

Providing secure, cost-effective, reliable, and high quality access to communications bandwidth for PSAs and first responders is of paramount concern to the US Government. We live in an era in which natural disasters, terrorist incidents, or other unforeseen emergencies can take place in major population centres and compromise the ability of those engaged in life-saving work to communicate with each other.

In recent years, the US has made tremendous progress toward the goal of a nationwide Public Safety broadband wireless network. PSAs and practitioners have worked closely with Federal

agencies in a cooperative effort to develop a plan for the deployment of a nationwide interoperable Public Safety broadband wireless network. Wireless industry groups have formed task forces and committees to endorse existing wireless standards and develop additional Public Safety specific standards and operating procedures.

On April 21, 2015, the Government of Canada announced that 20 MHz of 700MHz spectrum will be designated for public safety broadband use. The Canadian Government wishes to largely replicate the FirstNet model. Rivada has met with all relevant Canadian Public Safety bodies and we have advised key representatives on Rivada's technology and approach.

The Government of Mexico has proposed visionary reforms for its wireless sector. Mexico is currently developing a radical Open Access Mobile Network project called "Red Compartida." The Ministry of Communications and Transportation's (SCT) and Mexico's Telecommunications and Broadcasting Law aims to create a new wholesale "carrier's carrier" network through a public-private partnership (PPP). It will use 90MHz of spectrum in the 700 MHz band, to be contributed free of charge by the government. Rivada's patented technology is ideally suited to make that spectrum available to Public Safety, subject to Government requirements, and to commercial bidders in a competitive, on-demand marketplace.

1.4 Dedicated Spectrum for Australia's PSAs

Leading Governments around the world, including the United States, Canada and a number of other G-20 countries, have either allocated or are currently working toward the allocation of harmonised, dedicated spectrum, consistently within the 700MHz band, for Public Safety. Public Safety agencies in these countries have lobbied and continue to lobby for the allocation of dedicated spectrum to provide them with the communications solutions they need to fulfil their mission, particularly in times of crisis.

There is consensus across the international Public Safety community that 4G LTE is the optimal communications platform, supporting data-rich, mission-critical applications. The solution that the Australian Government chooses must have the ability to seamlessly roam between the PSMB network and commercial 4G LTE networks. While doing so, the PSMB network must provide unprecedented coverage, capacity, and support for priority access and quality of service (QoS) to ensure the most critical PSA users receive the highest priority, and incorporate security mechanisms that work to ensure the Public Safety communications solution is secure, end-to-end, every time. This network must allow the Commonwealth, jurisdictions and PSAs to leverage existing investments in broadband infrastructure, while taking full advantage of the favourable propagation characteristics of the 700MHz band. Deployment of a 700MHz LTE network under broadly accepted industry standards will allow Australia's PSAs, State and Territory Emergency Services (SES) and other first responders to become nationally interoperable, within and across agencies and jurisdictions.

While an allocation to Public Safety of dedicated spectrum in the 800MHz band, as previously discussed at regulatory level in Australia, also merits serious consideration, harmonisation with the US FirstNet 700MHz band, coupled with the aforementioned developments in Canada and Mexico, will bring economic and other benefits. Governments across the world are supporting and recognising the benefits of allocated spectrum being harmonised within the 700MHz band. The distinctive physical properties of the 700MHz band are advantageous in terms of coverage and spectrum efficiency. A harmonised band enables commonality of equipment and chipsets worldwide, thus driving down the cost of handsets and equipment for Public Safety.

One of the main obstacles to achieving Australian Public Safety's desired future is the cost of building and operating a state of the art LTE network that meets the Productivity Commission's demanding Public Safety communications requirements. With this in mind, Rivada Networks proposes an approach that meets technical requirements, while putting in place an innovative financial solution that minimises the overall cost of the PSMB network to the Australian Government.

PSAs will need access to the proposed full 30 MHz of spectrum to ensure they have sufficient bandwidth to respond effectively to large-scale emergencies. Thankfully, emergencies on this scale do not happen every day, week, or month, and therefore not all of this 30MHz will be needed all of the time – the requirement is simply that bandwidth on this scale can be accessible immediately should the need arise.

Access to such highly prized spectrum is useless without the funding in place to build and operate the network. In order to minimise the cost to Government and provide on-going funding for the maintenance and expansion of a first-rate PSMB network, Rivada Networks proposes an innovative approach: Rivada privately funds the PSMB network, which allows for dynamic auctioning of excess bandwidth, when not being utilised by PSAs, to private commercial operators. This revenue stream provides on-going funding to PSAs for maintenance and expansion of the network, while leveraging their existing communications assets. Importantly, the PSAs retain ownership and control over the bandwidth resource and infrastructure.

Under such a proposal, the PSMB network operator would not act as a competitor to MNOs and other commercial carriers, but instead would operate as a spectrum-sharing service provider to all operators, providing excess Public Safety bandwidth to existing carriers and new entrants who will now be able to compete as a result of reduced barriers to entry provided by surplus Public Safety infrastructure capacity.

The benefits of this approach are significant. For starters, it can completely eliminate the requirement for Government funding of the initial build-out, and provides a recurring stream of funding for the annual operation and maintenance of the PSMB network. In turn, this allows the Government to allocate funding to do more outside of the initial network build. This

approach also allocates control of the network directly into the hands of PSAs, allowing them absolute priority access to their bandwidth, controlled by the agencies themselves.

MNOs are currently in the process of deploying 4G LTE networks to meet increasing capacity requirements for their customers. But consumer demand for wireless bandwidth is growing so quickly that even these network expansions are unlikely to prove sufficient. Rivada's wholesale market can help address this shortfall by making additional capacity available on a flexible, on-demand basis.

What's more, wholesaling excess capacity on the network will dramatically reduce the barriers to entry in the wireless space. New entrants can purchase bandwidth as needed, without the investment in a national mobile broadband network. Rivada's proposal also fosters the creation of an entirely new marketplace that will result in countless new innovations in mobile communications, and thousands of jobs in broadband wireless.

1.5 Rivada Networks Solution

Rivada Networks' DSA-TPA spectrum-sharing technology is a vehicle for substantially resolving the aforementioned challenges in an elegant way and provides a foundation for rapid evolution of the PSMB network.

- The Rivada model will fund the development of the national interoperable PSMB network and substantially subsidise operating costs.
- Rivada Networks effectively leverages leading edge technology to deliver the highest Return on Investment (ROI) for Public Safety communications by efficiently selling the unused network capacity and returning profits to Public Safety for funding ongoing operations of the PSMB network.
- Rivada Networks offers the only end-to-end Public Safety grade national interoperable broadband solution in the industry: leveraging existing Commonwealth, jurisdiction and PSA assets, developing to Public Safety standards, and utilising local Public Safety industry experts for network development and ongoing operations.
- By engaging with the MNOs and other commercial carriers as wholesale customers, Rivada Networks maintains significant influence over cross-network compatible devices for all network operators and their device manufacturers. The Rivada Networks approach can therefore guarantee that device costs are kept low and ensure that the Public Safety community has access to the same latest devices as the commercial world.

In assessing the optimal PSMB solution, the Productivity Commission must ensure that standards are followed that will allow for broad interoperability, cyber security, adequate

maintenance and high reliability. Implementations must be compatible with backend systems that will enable leveraging of shared systems, features and executive management functions. Most of these concerns are addressed directly by the LTE standards or can be adopted in a straightforward manner once the PSMB guidelines are established. By agreeing to adopt 3GPP-compliant LTE technology, a vast majority of the interoperability concerns can be put to rest. Leveraging LTE standards will also resolve the majority of integrity and security concerns.

The Rivada Networks solution fully supports the Productivity Commission's goals for interoperability and uniquely allows for implementation under Public Safety's current quality standards. Our networks will be built with fully 3GPP-compliant LTE infrastructure and are guaranteed to meet or exceed all national interoperability requirements.

1.6 Benefits of the Rivada Networks Approach

- It eliminates the funding required from the Australian and state and territory governments for the initial build out and provides a recurring funding stream for the annual operation of the PSMB network.
- It creates an opportunity for Government to do more outside of the initial network build with any proposed funding.
- It allocates resource control into the hands of those best positioned to use them – namely national, state and local PSAs – thereby reducing the risk that Public Safety Agencies will choose not to use the network.

Rivada Networks' DSA-TPA approach is a spectrum resource optimisation method that can be used by both Public Safety and commercial wireless operators. The approach enables bandwidth to be available in multiple domains dynamically, and allows Public Safety to benefit by delivering LTE capability to Public Safety users while at the same time reducing or eliminating the operational costs associated with the Public Safety element of an LTE network.

Rivada Networks approach has the added benefit of complementing some of the key recommendations outlined in the Department of Communications recently published spectrum review.

Dept. of Communications Spectrum Review	MNO Approach	Rivada Networks Approach
<ul style="list-style-type: none"> Replace the current legislative framework with outcomes focussed legislation that facilitates timely allocations, greater flexibility of use, including through sharing and trading of spectrum 	x	✓
<ul style="list-style-type: none"> Review spectrum pricing arrangements to make these consistent and transparent in order to support efficient use and to facilitate secondary markets 	x	✓
<ul style="list-style-type: none"> Provide for greater market-based activity, including by increasing the opportunity for spectrum holders to share and trade spectrum 	x	✓
<ul style="list-style-type: none"> Allow agencies to lease, sell or share their spectrum for their own benefit 	?	✓

DSA-TPA delivers and allocates Public Safety spectrum to users dynamically, and manages the frequency band to ensure end users have access to the communications capabilities they require on an as-needed basis.

The Rivada Networks approach assumes an independent Public Safety controlled network that is privately financed (i.e. without the use of taxpayer dollars). This independent network will not rely upon any single MNO in any region. The cost of financing along with the cost of continued operation, expansion and enhancement of the network can be sustained from revenues derived from the lease of excess Public Safety network capacity.

Rivada Networks believes that its approach delivers the benefits sought by the Productivity Commission and the PSAs. It is also an approach that will be embraced by Australia’s business community since it stimulates a competitive environment by providing opportunities for new entrants in the telecoms marketplace and at the same time it avoids the perception that government is distorting competition by selecting specific MNOs.

Shared use of spectrum via DSATPA enables multiple parties to benefit:

Government

- Fosters a more competitive landscape. Historically, spectrum was allocated to network operators for decades at a time through auctions or 'beauty contests'. DSATPA enables capacity increases without the risks associated with such 'winner-takes-all' awards of this scarce resource.

- Minimises government financial outlay. The whole roll-out of a designated Public Safety network can be privately financed using Rivada’s model.
- Additional revenue streams. DSATPA provides a new revenue stream to Public Safety and other agencies by enabling the buying and selling of available bandwidth in near-real-time.
- Neutrality in resource allocation. A DSATPA enabled marketplace fosters neutrality and competition, by providing an open marketplace for bandwidth trading.

Customers

- Faster throughput of data — essential for high-bandwidth services such as video.
- Lower prices. DSATPA and the commoditisation of bandwidth fosters more fluid and competitive pricing to the end user.
- Improved service experience. DSATPA greatly alleviates MNOs’ Quality of Service issues, particularly in dense urban centers during peak hours.

Operators

- Efficient allocation of CapEx and OpEx. MNOs can forgo significant potential CapEx investment by utilising DSATPA to meet growing subscriber demand.
- DSATPA offers a compelling solution to a number of obstacles faced by carriers, including site scarcity, build costs and complexity in urban areas, signal interference, zoning issues, ROI in rural locations, roaming interoperability issues.
- Allows operators to focus on sales, marketing and user experience.

Industry

- Spurs innovation among existing and new entrants to the marketplace.
- Enables more efficient use of the finite spectrum resource.
- Lowers the barriers to entry for new entrants.

1.7 Hurdles/Obstacles

Every jurisdiction possesses characteristics that will challenge the Public Safety communications solution. The differences in local concerns highlight the divergence between the way commercial systems perform today and the expectations of Public Safety communication users for the PSMB network.

Though the imaginable list of challenges is substantial, some of the more obvious concerns have been voiced consistently and are presented below:

1.7.1 Funding the Network

The build out and operation of a nationwide LTE network for Public Safety requires significant funding. The implementation of Radio Access Network (RAN) infrastructure for basic coverage alone represents a potentially huge outlay for the Australian Government. Innovative

approaches are required to get the cost of the network infrastructure down without sacrificing the expected network quality.

There would simply not be enough revenue generated by Public Safety users paying fees to support ongoing network operations. External, non-Public Safety customers will need to leverage the PSMB resources and pay ongoing fees in order to supplement the cost of network operations.

Introducing secondary usage to supplement operating costs creates challenges related to network priority for PSAs. These challenges can only be solved through innovative business models and enabling technologies that guarantee PSAs on-demand priority access to network resources. These technologies must also efficiently manage the access to the network for secondary users supporting PSAs, with a system that can deal with changing access priorities as new resources are required to assist in an emergency.

1.7.2 Meeting Public Safety Resiliency Requirements

Meeting Australia's need for coverage, capacity, reliability, priority and survivability makes implementing the PSMB network in Australia a challenge for any operator. None of the MNOs and other commercial wireless broadband service providers meet these requirements today.

Integrating existing hardened assets is a significant step toward meeting these expectations and should be formally included in the PSMB network requirements. Rivada Networks believes wholeheartedly in building and maintaining to Public Safety-grade quality standards, and proposes fully leveraging existing PSA communication infrastructure toward realising that objective.

1.7.3 Transition from Legacy Systems

Existing communication systems offer limited broadband capability and are based on many standards that are not conducive to interoperability. The United States, for example, is painfully familiar with the challenges of working in disparate technologies, where every agency, utility and partner has little to no access to common networks and interoperable devices. The PSMB network, as envisaged by Rivada, provides a single interoperable solution. But the path to a highly adopted and fully functional PSMB network will certainly face technology migration issues.

1.7.4 Device Costs

Public Safety cannot evolve efficiently if they are burdened with paying a premium for specialised devices that are not offered with the benefits of commercial economies of scale. Though LTE technology creates opportunities for Public Safety to leverage existing commercial device ecosystems, there are many exceptions to getting compatible products to market that need to be considered and actively managed.

Since only a limited number of frequency bands and radio access technologies can be supported in any single device, Public Safety must have enough influence to get manufacturers or partners to offer band-compatible device choices. Additionally, Radio Frequency (RF) modules that are routinely certified for use on commercial mobile networks need to be PSMB compatible. Even so, the PSMB network will inevitably feature devices intended exclusively for Public Safety use, where there are no commercial customers to offset the associated research and development cost. An example of such a device might be push-to-talk communicators, designed to be used in adverse conditions while wearing fire retardant gloves and full turnout gear. Even in these cases, however, the existence of a broad ecosystem of compatible devices will keep down the overall cost of even the most specialized gear.

For example, MNOs leasing PSMB network capacity are expected to sell devices that work on both commercial and Public Safety spectrum, providing for interoperability and dual use on Public Safety and commercial wireless networks. Handsets produced for the broad commercial market are thereby made available to all Public Safety users and secondary PSMB subscribers. The result is readily available commercial off the shelf (COTS) devices and RF modules at a lower associated cost.

1.7.5 Pace of Change

Communications technology is evolving quickly. Public Safety communications has traditionally been behind the curve in adoption since they have been forced to deal with inefficient spectrum, specialised infrastructure and costly devices. With proper spectrum allocation and the adoption of LTE technology as the wireless broadband communication standard, Public Safety can join the ranks of the MNOs and have access to scalable and affordable technology as it becomes available. This is not to say that Public Safety can afford to simply let the technology options evolve without their active participation. It does however supply a platform, ecosystem, standard and a global community of users that will share many common interests and concerns.

Public Safety partners must have a stake in the success of the adoption and be willing and able to innovate around open and shared platforms of the PSMB network.

1.7.6 Local Control

The operational requirements of a commercial wireless network are not the same as Public Safety's. The involvement of local Public Safety experts is essential to meet the needs of the agencies and other first responders. Any business model that integrates local control is challenging to implement and manage if the network is not a Public Safety driven implementation.

Enabling technology that allows for Tiered Priority Access and collaborative administrative control is needed for successful integration of local control by experienced Public Safety personnel into daily network operations.

2.0 VENDOR BACKGROUND

Rivada Networks' innovative integrated communications solutions offer a reliable, fully interoperable and cost-effective alternative to building expensive dedicated infrastructure to address the limitations of existing tactical networks through the use of wireless networks and COTS technology. In the US, Rivada Networks has significant experience in providing private networks for Homeland Security and other Public Safety agencies, and integrating these with commercial cellular networks. Rivada Networks has developed routing and roaming solutions that allow Public Safety users to roam between private networks to commercial networks. In addition, Rivada Networks has also developed an approach which allows Public Safety LTE network owners to lease network capacity to commercial users when the capacity is not required by Public Safety.

Rivada Networks has a wealth of experience in the field of deployable communications solutions for Public Safety. In the aftermath of Hurricane Katrina, the company deployed its first cellular systems, the Interoperable Communications Extension System (ICE-S) and the Joint Incident Site Command Center (JISCC) in support of USNORTHCOM. These systems were the first of their kind and greatly enhanced interoperability among the various agencies involved, including FEMA, US Army National Guard and Reserve Units, as well as state and local agencies. Based on this success, Rivada Networks was awarded several contracts to build, stage, and provide technical support, including onsite disaster support, for more than 100 systems fielded by USNORTHCOM, the Air Force Reserve Command, Army National Guard, and FEMA. In support of these systems, Rivada Networks responded to disasters such as hurricanes Gustav and Ike, as well as the Midwest floods. Rivada Networks has been instrumental in developing emergency response protocols for USNORTHCOM and helped to develop the three-tiered emergency response packages as detailed in USNORTHCOM publication 6-02.

Rivada Networks' solutions allow for maximum flexibility in deployments. These deployments can range from a simple relay to extend coverage, up to full communications support during disaster situations such as hurricanes and cyclones, forest and bushfires, earthquakes, floods, and terrorist events. Rivada Networks MDU platforms are designed to be operator friendly and allow for rapid setup and configuration. For example, the average setup time for a fully provisioned vehicle and associated equipment is less than 20 minutes.

2.1 Rivada Networks Past Performance

Rivada Networks is highly specialised in tactical communications solutions for Federal, Military, State, and local PSAs. The company is a multi-award-winning provider of deployable communications solutions; combining responsiveness, decision making, and flexibility - backed by exceptional resources in personnel, financial, automation, and technical support. Rivada Networks offers integration expertise, innovative solutions, strong past performance in certified communications solutions, and high quality, comprehensive service and support for Public Safety communications customers.

Examples of projects and past performance include:

- US Northern Command - Prime contractor providing engineering, integration, training, customer support and project management for its Command Control Systems Directorate, N-NC/J6. Managed Deployable Communications Networks in support of disasters such as Hurricane Katrina.
- Department of Homeland Security (DHS) and Federal Emergency Management Agency (FEMA) - Prime Contractor providing engineering, integration, logistics, training and O&M support for emergency alert system and deployable communications systems.
- Drug Enforcement Administration (DEA) - Prime contractor providing engineering and integration services to develop a concealable self-contained and self-sustainable automated sensor system to geo-locate and directionally find drug cartel members using various communications devices and report their location via a specially designed graphical user interface to Intelligence analysts. Also, prime contractor providing satellite phone and internet services in multiple locations within Afghanistan. Provided engineering, technical and program management services instrumental in the successful cut-over of a multi-site satellite communications network from existing State Department assets to those owned by the DEA.
- U.S. Coast Guard - Provided design, engineering and construction services for the Coast Guard's Valdez Command Center.
- US National Guard - Prime contractor providing engineering, integration, training, customer support, and project management for 19 Air National Guard Combat Communications Squadrons. Manage deployable communications networks in support of disasters such as Hurricanes Gustav and Ike.
- Air Force Reserve Command - Prime contractor providing multiple services for Air Force Reserve Combat Communications Squadrons. Engineered and integrated emergency communications packages and managed network operations centers and a satellite teleport facility.

The expertise gathered during emergency and disaster response led to the development of Rivada's technology and solutions. Rivada's board members, many of whom formerly held senior positions in the Public Safety, Defence and Telecommunications sectors, provide broad experience at all levels of government, including;

- General Richard B. Myers, USAF (ret), former Chairman of the US Joint Chiefs of Staff
- Field Marshal, the Lord Guthrie, Former Chief of the Defence Staff, United Kingdom
- Chief Christopher M. Moore, Former Chief of Police of the San Jose Police Department and founding *Chairman* of the *Public Safety Alliance* in the US
- Admiral James M. Loy, Former Deputy Secretary, US Department of Homeland Security
- Michael Jackson, Former Deputy Secretary, US Department of Homeland Security
- George Foresman, Former Under Secretary, US Department of Homeland Security

3.0 PRODUCT COMPONENTS

During Hurricane Katrina, Rivada Networks deployed emergency cellular base stations in the State of Louisiana with satellite backhaul. While able to provide emergency communications to first responders, we found that when demand was at a maximum, we were unable to provide prioritised access to key users who needed it most.

As a result of that experience, Rivada Networks spent a number of years developing Tiered Priority Access (TPA), allowing us to allocate access to bandwidth based on prioritisation of the user. Having developed TPA, we realised that if we could tier priority access at a local level, we could do it at any scale, allowing bandwidth to be commoditised and allocated to users based on real time valuation and dynamic allocation of that bandwidth.

TPA allows Public Safety control over its own permanent, dedicated network, granting full and absolute priority when needed through a throttling mechanism, while making the surplus bandwidth dynamically available to wholesale commercial users during the significant periods of fallow time when the Public Safety bandwidth is being lightly used by emergency responders.

3.1 Commercial Services - DSA-TPA

In order to reduce the overall cost of the project to the Australian, state and territory governments, Rivada Networks proposes an innovative approach whereby the cost of the network is subsidised by allowing commercial users to pay for access to the network when

Public Safety does not need the full capacity of the network in specific geographic segments. Under this approach, PSAs will have absolute priority on the network, and will have permanent access to the entire 30 MHz of spectrum and network capacity when needed. However, when the entire capacity of the network is not required by Public Safety, the network will allow commercial subscribers to use the network by leasing capacity on a wholesale basis to carriers and other broadband capacity purchasers. The revenue generated by the wholesaling of capacity to wholesale buyers will be used to pay for the build out and the operational costs associated with the network.

3.1.1 Capacity leasing based on a Network Sharing Approach

The proposed LTE solution enables Australia's proposed PSMB network to lease excess capacity with commercial operators based on RAN sharing under a multi operator network approach.

Any capacity leasing arrangements will be subject to terms and conditions laid down by Australia's PSAs and other key stakeholders. In this way, relevant stakeholders can decide upon the minimum level of capacity and radio spectrum resources they wish to have available for normal, day-to-day operations. In addition, there may be certain times of day, and days of the week, when the relevant jurisdiction wants additional radio spectrum resources available. As part of the capacity leasing arrangement, DSA enables Public Safety to not only manage and control user access to the LTE radio network, it also provides a robust and user-configurable method to restrict access and or shutdown access to specific users of the LTE network at set pre-arranged times or dynamically based on local congestion conditions, and enables PSAs to free up radio spectrum resources.

Under DSA, excess capacity leased on a temporary basis will revert back to PSAs near-instantaneously in the event of emergency. The DSA process for tiered shedding of non-Public Safety traffic enables Public Safety to always have full access to the radio resources of the PSMB network. The tiered shedding of non-Public Safety traffic in DSA is done via congestion triggers which are definable by Public Safety. Shutdown of the commercial access classes will be immediate and 'ruthless' on pre-agreed triggers, and those network operators leasing capacity understand that they are doing so on an interruptible tariff basis.

3.1.2 System Requirements

The PSMB network should employ the positive attributes of both network sharing and managed services with a tiered shedding or back-off process ensuring Public Safety users will have guaranteed access to the radio resources when they are needed. The network should enable spectrum and resources leases for various size areas including very small regions (e.g. per user, per sector, per base station, per cell cluster, per license county, per license area or any sub multiple or multiple of them). The resources should be made available on a time, usage, geodetic, or any combination of the three, for short durations as defined by the arbitrage process. All of these attributes should be policy based. This will improve spectrum efficiency and utilisation as it allows the use of spectrum by alternative users.

3.1.3 Governance

Currently, spectrum allocation and traffic usage schemes are handled in a mutually exclusive fashion. They are mutually exclusive since spectrum allocation is static and wireless traffic usage is dynamic. Wireless traffic usage is dynamic because it is both time and geographically dependent. Wireless traffic usage is time dependent since usage varies with increased usage in peak hours followed by lulls in usage in off-peak times. Wireless traffic is also geographically based since the location where subscribers use the network is also fluid and is correlated to the time. For instance, during the day a subscriber may use their mobile device while travelling to work, while at work, travelling back and off hour usage. The subscriber is not using the service 100% of the time and depending on what part of the day, the geographic location where service is being used is different.

In most commercial wireless networks, access for visiting subscribers is currently achieved through roaming agreements which enable a visiting subscriber to access the wireless network. The subscriber that accesses the wireless network has the same access privileges as the home network subscribers. The PSMB network should allow a commercial wireless subscriber to roam onto Public Safety's broadband network - but the roaming subscribers must be treated as secondary users, enabling differential service offerings.

This spectrum-sharing model should be based on current resource utilisation currently at the node or in a defined area. The model should use both stateless and stateful methods for dynamic RF resource allocations. The stateless method would involve coordinating resource usage between networks on a real time basis. The stateful process would be a store and forward approach following defined intervals. The Public Safety network should support both methods, allowing for more tailored resource allocation and utilisation.

The implementation of this model needs to be transparent to the MNOs and their subscribers. The Public Safety network achieves network resource allocation transparency through active real-time traffic monitoring and policy enforcement. Under Rivada's network architecture, the secondary user's access to the primary operator's RF resources is managed through a Dynamic Spectrum Controller (DSC) and Dynamic Spectrum Policy Controller (DPC), affording both stateless and stateful decisions.

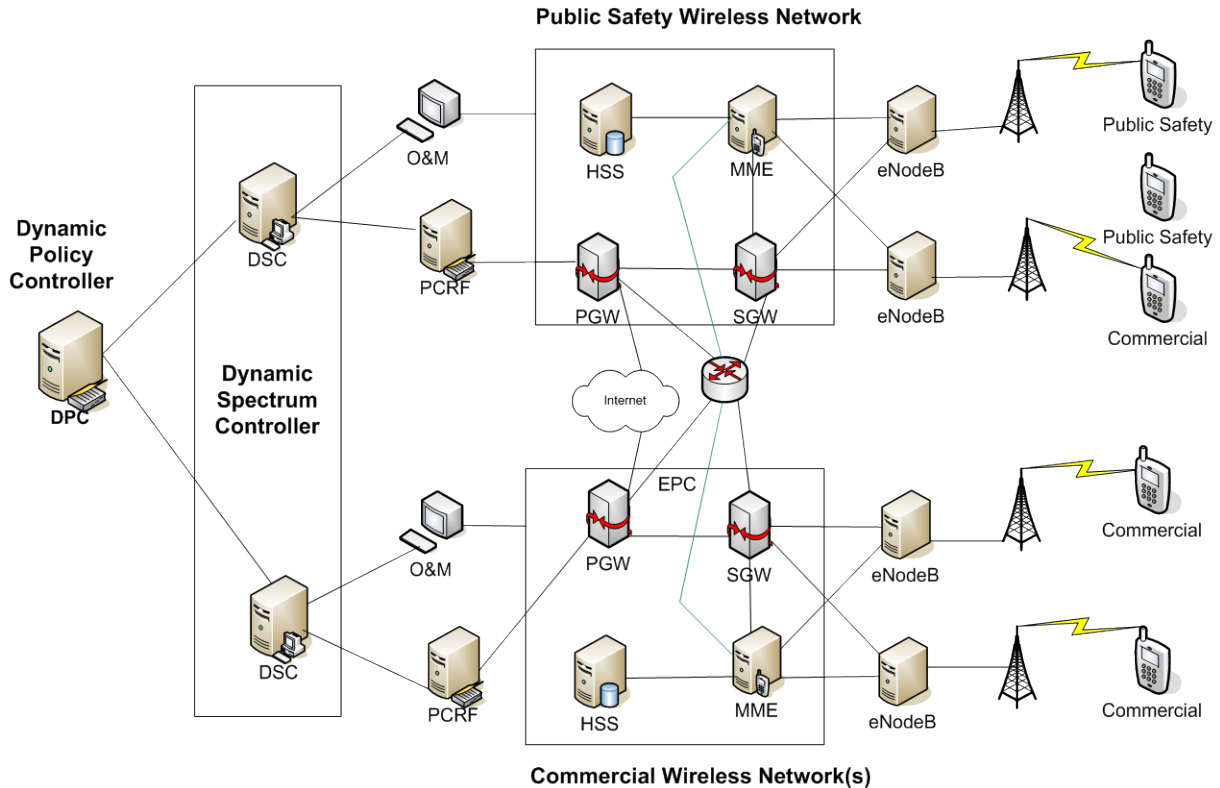


Figure 3.1.4-1: DSA architecture. *DSA enables dynamic leasing of spectrum.*

Available resources can be dynamically allocated and de-allocated. The resource information is controlled by the DSC and relayed to the DPC for central coordination. Based on rule sets in the process, the DSC will identify resources available for secondary use on a system level and cluster level. As traffic in the system increases and decreases, the resource pool for secondary usage will increase and decrease and will be reported to the DPC via the DSC.

3.2 Portable Solutions and Coverage in Sensitive Environments

In order to provide Public Safety-grade communications coverage in areas where broadband access and speed is limited and/or in remote locations and across Australia's diverse, ecologically sensitive environments, Rivada Networks proposes the utilisation of Mobile Deployable Units (MDUs). These are private, deployable, wireless systems with satellite backhaul. These systems can be meshed and integrated with the proposed PSMB and commercial networks.

Rivada Networks designed its MDUs based on COTS, LTE, cellular, wireless, satellite and other communications technologies. Rivada Networks utilises COTS components and can provide all engineering, systems integration, development, O&M and other services.

Rivada Networks is experienced in MDU implementations, having managed deployable communications networks in support of USNORTHCOM, DHS, FEMA, and the NGB.

4.0 COST

One of the main obstacles to achieving the objective of a nationwide LTE network for Public Safety is the enormous cost of building and operating a state of the art network that meets Australia's demanding Public Safety communications requirements. With this in mind, Rivada Networks proposes a solution that will meet all requirements, as outlined by the Productivity Commission, while minimising the overall cost of the network to the Australian, state and territory governments.

4.1 Network Costing

Rivada Networks proposes to conduct high level technical and RF modelling and will develop a high level network architecture based on generally accepted PSA requirements.

Rivada Networks will seek to re-use existing communications assets owned by the government wherever possible. This includes tower sites, backhaul capacity, network operations centres, and other relevant infrastructure. For the purposes of a costing exercise, we take a conservative approach to the re-use of existing infrastructure, assuming that very little of the existing infrastructure can be re-used. As such, it is possible that the overall cost of the project will be reduced once we determine exactly which existing resources and infrastructure can be leveraged.

4.2 Maintenance & Support

The exact cost of the network cannot be determined until detailed RF planning and engineering occur. This exercise cannot be undertaken until we have a detailed understanding of Australia's priorities in terms of network requirements and geographic coverage.

In addition to the build out costs of the network, there will be significant costs associated with the ongoing operation of this network. These consist primarily of costs associated with staffing the operation and maintenance of the network, backhaul capacity needed to run the network, power costs and other associated costs.

Taking an example of network, maintenance and support costings for a large, populous US State, key elements of the network planning, and hence the cost, include the following:

Users of the network will consist primarily of two groups:

- Public Safety users. In this scenario, we estimate up to 100,000 Public Safety users on the network from day one of operation, with that number doubling over the first five years of the project.
- Commercial users. We will provide wholesale capacity to commercial operators, with the network capable of supporting up to 5,000,000 commercial users across the sample State.
- The network is expected to take approximately 2 years from contract award to build.

Given some high level assumptions, we estimate that the capital expenditure (CAPEX) costs to build out the network will range from \$300m to \$500m. We further estimate that the network is likely to incur annual operational charges of approximately \$50m to \$75m, depending on configuration of the network. In totality, the cost of building and operating the sample network over a 10 year period is likely to be somewhere in the region of \$870m and \$1,360m.

4.3 Subscriber Costs

Under the Rivada Networks model, it is envisaged that the revenue generated through the commercial sales of excess capacity on the Public Safety network is sufficient to cover the annual cost of Public Safety's use of the network. This means that the cost to the Public Safety user is minimised. The exact level of contribution depends on the number of users that Australia intends to support on this network. The definition of a 'Public Safety User' tends to differ from country to country, and only after detailed consultation with the Australian Government, jurisdictions, PSAs and other key stakeholders will we be able to determine if the revenues generated will be sufficient to cover the entire cost of the Public Safety use of the network.

In terms of devices, it is likely that there will be a need for several different device types in order to meet the needs of the various PSAs that will use the network. This will be a decision made by each individual agency and as such the cost cannot be determined at this stage.

4.4 Financial Model



Figure 4.4-1: Self Sustaining Model: *Rivada Networks' approach for Australia's PSMB network provides a unique operating and funding model.*

Rivada Networks will provide government with the funds to build and operate the network, with no repayments being made until the network is complete and commercial services have begun to flow from the project. Revenues generated from Australia's Public Safety network will essentially pay for the network with the net effect that government does not commit any taxpayer dollars to the network.

Ultimately, it is our view that a carrier led model is not sustainable or cost efficient. Public Safety does not simply require a dedicated network – it will, in time, require new devices, services, and applications needed for its mission, and a network that drains costs rather than adds revenue is simply not desirable. Our model of a dedicated network that generates revenue, rather than an essentially hired out network that guarantees neither access nor control nor cost control, is much more advantageous and allows the allocation of revenues to the modernisation of other areas of Public Safety communications.

4.4.2 MNO-based solutions – key concerns

MNOs' civilian commercial communications networks are built for peacetime and periods of calm – they are designed to handle a steady volume of commercial civilian traffic, and rely heavily on the ready availability of electricity, a lack of network congestion, and conditions of general normality that frankly do not exist in those moments when PSAs are called into action en masse. Although there is an essential role to be played by civilian commercial carriers and

networks in interacting with the Public Safety network, it would be unwise to become overly reliant on them.

Rivada Networks has been involved in Public Safety communications on an exclusive basis for over a decade. In that time we have provided assistance during Hurricanes Katrina, Gustav, and Ike, as well as during disasters such as the California Wildfires and the collapse of the I-35 bridge in Minnesota. In all of these disasters we have seen the same pattern of events.

The network infrastructure suffered catastrophic physical damage, and combined with a natural surge in civilian cell phone use during the incident, as concerned people attempted to call their loved ones, Public Safety officials simply could not access the cellular networks, leading to sub-optimal performance and in some cases, confusion between agencies and responding units. In other cases, the disaster affected rural or remote areas with limited commercial network coverage to begin with.

In all of these cases, the limitations of relying on a commercially provided MNO network, designed for mass public use, became distressingly apparent.

MNOs are not programmed to respond to major emergencies and as such cannot be relied upon to immediately restore access to the networks in the immediate aftermath of a major incident:

- In Hurricane Gustav, it took the commercial networks more than a week to get repair teams on the ground before they could begin to restore the networks. In Katrina, it took considerably longer.
- During Superstorm Sandy, almost 25% of the entire commercial network was unavailable, and was not restored for several weeks in some places.

The first minutes and hours after a disastrous incident of this nature are absolutely critical to emergency response teams, and it is during this period that they most urgently require access to a telecommunications infrastructure built on sites that are hardened to survive this type of trauma, and supported by backup power in the event of electricity becoming unavailable. As such, reliance on commercial carriers for this kind of emergency situation is not a valid option for Public Safety, as it simply is not designed to provide, and is not capable of providing, for the unique requirements of modern Public Safety.

The destruction caused by Superstorm Sandy serves to clearly illustrate that the commercial network, in its current capacity, is not a reliable communications option for Public Safety. Relying on commercial networks is not an optimal Public Safety solution for the following reasons:

1. Reliance on MNOs and other existing commercial networks is unlikely to meet the requirements of the Public Safety community from both a network reliability and capacity availability perspective.
2. Reliance on existing commercial solutions is unlikely to give PSAs an acceptable level of local control of the network (Rivada Networks has hands-on experience with these challenges dating back to our Hurricane Katrina experience in 2005).
3. The cost of the proposed solution may far exceed the initial funding allocated, and the operational costs will likely exceed the ability of the Public Safety community to fund it.
4. A carrier-centric solution is unlikely to invoke high levels of Public Safety adoption due to the lack of Public Safety involvement in the planning and operations process.
5. A MNO-based solution creates a government funded competitive advantage for the selected MNO(s) and may create the perception that the government is 'picking winners' – thereby restricting competition and driving up costs. The biggest players are prevented from hoarding spectrum under a Rivada DSA enabled spectrum-sharing solution.

A much more desirable solution is the provision of a network dedicated to Public Safety, guaranteeing priority access to PSAs when it is most needed. The ability to fund the build out and operation of a cutting-edge PSMB network could become a major issue for budget-constrained jurisdictions. Allocating hundreds of millions, or more likely, billions of dollars to this effort is just not a realistic option. Furthermore, the nature of Public Safety is "bottom up" in its structure, right down to the most local level. The knowledge and appreciation of needs tends to reside at that level, and may be expected to flow up to the state, territory and Commonwealth level. It would seem logical that a successful PSMB model will cater to and provide for the flexibility that will be required in what are rarely uniform structures from one jurisdiction to another.

4.5 Public Private Partnership Structure

For a public-private partnership to function effectively the Commonwealth and jurisdictions must understand exactly what they can expect out of the partnership, how collaboration between government and the private partner will work and to what extent government will have influence or control over the local implementation and operation of the PSMB network. If the goals of the private partner differ substantially from the goals of the Australian Government, one can only expect friction throughout the ongoing relationship, as each party works toward differing objectives.

Rivada Networks will endeavour to overcome this potential obstacle by ensuring PSAs play a key part in the planning and operations of the network, working side by side with Rivada Networks staff. This approach is a key differentiator in what Rivada Networks is delivering and should serve to demonstrate Rivada Networks' level of commitment to a true partnership with Public Safety. In addition, Rivada Networks will implement a revenue sharing plan with Public Safety partners that will allow local entities to share substantially in the benefits of revenue generated from the wholesale of excess network capacity to third parties.

For Australia, the implementation of the PSMB network presents many challenges that go beyond the operating partnership. Rivada Networks believes that all challenges can be effectively overcome with thoughtful planning, the right partner/supplier agreements, and an operational model that is built to address the key concerns. While private funding of the network's construction and operation is certainly viable, the structure for implementing a privately funded approach must address Public Safety, legal and commercial (i.e., capital market) considerations to be successful. To succeed, any structure must be acceptable to government, the PSAs and those providing the funding for the network's construction and operation. Rivada Networks has developed a structure, described below, that addresses the interests and concerns of all three constituencies. Rivada Networks' approach makes use of the well-established public private partnership ("PPP") model that has been widely used in many infrastructure sectors.

One possible approach is to allow States, Territories and/or other jurisdictions to apply for authorisation from the Commonwealth to permit them to manage the spectrum in their respective jurisdictions. Spectrum can thus be made available through a government authorisation to the State of Victoria, for example, and a lease (the "Spectrum Lease") to a PPP that involves Victoria, debt providers, equity investors and Rivada Networks. The PPP would construct the network (using the debt and equity financing it obtains from lenders and investors), and collect access and usage payments from private and commercial end-users of the spectrum and the network to service (and repay) the debt financing obtained to build the network and support operating expenses (including any payments to Commonwealth and Victoria for the Spectrum Lease). Neither Public Safety users nor taxpayers would be charged. Rivada Networks, working in tandem with the State of Victoria, would manage the network operations. Rivada Networks' technology, as described above, makes this approach both operationally feasible and economically viable.

In terms of actual structure, commercial use of the spectrum could be organised as follows:

- The PPP would consist of two entities. One entity would act as the network Operating Company ("OpCo") and would hold all tangible and intangible assets of the Project (except for the Spectrum Lease). It would be the main borrower under the network debt financing facilities (the "Debt Financing Facilities"). There would also be a separate Special Purpose Vehicle ("SPV") that would have no assets other than the Spectrum Lease. The SPV would be a co-borrower under the Debt Financing Facilities.

- Spectrum Lease to be held in the SPV: Making the Spectrum Lease an asset of the SPV would isolate this critical asset from trade creditors and other potential claimants of OpCo, thereby giving the lenders under the Debt Financing Facilities the benefit of a lower likelihood of competing claims for the critical spectrum rights. The SPV would have no activities other than holding the Spectrum Lease and being a co-borrower under the Debt Financing Facilities.

We envisage a collateral package for the lenders that would include:

- all tangible and intangible assets of OpCo (including, critically, a cash management system into which the cash flows generated by payments from network end-users would be collected);
- all assets of the SPV (including the Spectrum Lease to the extent permitted by Government);
- the private (but not the State of Victoria's) ownership interests in each of OpCo and the SPV; and
- A consent agreement among OpCo, the SPV, the Debt Financing Facilities lenders, the State of Victoria and the Australian Government.

The consent agreement would ensure that the lenders' security interests would be recognised by all parties, that any transfers of ownership among the private owners of the PPP could be effected in an orderly fashion, and that the network would continue to be operated despite any transfers or in the event of a debt financing default or foreclosure.

It is critically important to stress that the proposed structure is carefully designed to ensure that neither the Australian, State, nor Territory governments would have any exposure to any liability or responsibility for any debt repayment if the revenues are insufficient to cover principal and interest payments under the Debt Financing Facilities. In the event of a default, the lenders would manage the process of transferring ownership of the privately owned portion of the PPP to new owners, and the consent agreement would ensure continued operation of the network during the transition process.

5.0 IMPLEMENTATION AND MAINTENANCE

Rivada Networks is proposing a Public Safety broadband network that is based on the broadband wireless solution derived from the 3GPP LTE standards, using a 700MHz Radio Access Network (RAN), an Evolved Packet Core (EPC), 700MHz-capable user devices, and the key interfaces exposed by these components. The proposed Public Safety LTE network will be nationwide and will be built to meet the coverage requirements of Australia's PSAs. The network will be capable of supporting not only PSA users but commercial users also.

The proposed Public Safety LTE network will comply with 3GPP standards and will also support a full spectrum of Public Safety multimedia applications. The proposed solution will be able to interoperate with commercial LTE networks. The solution may also interoperate with existing LMR networks via a powerful IP-based soft-switch capability enabling Public Safety users to easily migrate their existing LMR voice services onto their next generation LTE network, at their own pace.

This network will allow Australia to leverage its current broadband infrastructure, while taking full advantage of the favourable propagation characteristics of the 700MHz band. Successful deployment of this network will allow first responders to become fully interoperable with other local, state and territory, and national agencies on both a voice and data platform.

By choosing Rivada Networks' technology, Australia ensures that it has the most advanced, reliable LTE network on the market, one that reduces overall cost of ownership, sets the stage for future growth, and provides its PSAs with the ability to communicate quickly and seamlessly across multiple jurisdictions at all times, especially when the public needs them the most — during emergencies.

One of the key features of the LTE solution is that it can be launched quickly, with minimal risk. The network is agile, has an open LTE standards based ecosystem and comes with a comprehensive set of services that support the secure evolution to LTE. The proposed solution leverages a world-class professional services team known for its technical, engineering and installation expertise as well as its project management capabilities.

6.0 CONCLUSIONS

The Rivada Networks approach outlined in this document can be enabled through new dynamic spectrum allocation technologies compatible with the latest 3GPP LTE specifications and specifically designed for the benefit of an independent PSMB network. Dynamic Spectrum Arbitrage-Tiered Priority Access (DSA-TPA) technology will enable the network to allow non-

priority commercial access to network capacity on demand, thus generating a source of revenue. The approach delivers the following benefits:

- 1) Rivada Networks will fund the development of the national interoperable PSMB network and substantially subsidise operating costs.

In an era of limited government funding, the Rivada Networks approach supplements any proposed funding with substantial private investment that provides, on an ongoing basis, a revenue stream that allows Public Safety to strengthen and maintain a world-leading infrastructure while saving the Australian taxpayer potentially hundreds of millions, if not billions of dollars.

- 2) Rivada Networks effectively leverages leading-edge technology to deliver the highest ROI for Public Safety communications by efficiently selling the unused network capacity and returning profits to Public Safety.

Rivada Networks' investment in enabling technology allows us to deliver the most cost effective solution for Public Safety communications. Our DSA-TPA technology will give Public Safety the full benefit of a private network while monetising surplus network capacity at the highest competitive rates, thus maximising revenue to fund the ongoing operating costs of Public Safety communications.

For the Australian citizen, this extends high quality bandwidth across the country and provides greater access to emergency 000 and other critical calls. It provides increased commercial service, and competition in the wireless broadband market.

- 3) Rivada Networks is delivering the only end-to-end Public Safety grade national interoperable broadband solution in the industry: leveraging existing PSA assets, developing to Public Safety standards, and utilising local Public Safety industry experts for network development and ongoing operations.

For Australian Public Safety: The Rivada Networks approach delivers a sustainable and affordable solution and places the control of a dedicated disaster-resistant network into the hands of Public Safety officials who are guaranteed that it will be available to them when circumstances require. It also provides the maximum benefit from this tremendous opportunity with the right network, devices, applications, and operations to ensure success.

For the PSMB Network: It reduces the risk of low Public Safety adoption by involving PSAs to a greater extent in the delivery of the solution. It also enables greater investment in Public Safety differentiators at the lowest overall cost of adoption. It allows the PSMB operator to focus on critical Public Safety capabilities such as the devices, applications and emergency satellite communications backups.

For The Taxpayer: It enables their chosen wireless carrier to provide access to more areas and provides greater availability for 000 and other critical calls. It also provides for new services and job creation from innovative business models. It eliminates the risk that the taxpayer will need to fund network operations moving forward. And finally, allowing forward-looking business models such as ours offers taxpayers confidence that government is using its resources wisely without giving unfair competitive advantages to specific MNOs.

Administrative POC: Sean Ganley