Testimony of Mr. Declan Ganley, Chairman and CEO, Rivada Networks International LLC, to the House Committee on Energy and Commerce Subcommittee on Communications and Technology hearing entitled "Oversight of FirstNet and Emergency Communications."

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Executive Summary

During Hurricane Katrina, Rivada Networks deployed emergency cellular base stations in Louisiana with Satellite backup. While able to provide emergency communications to first responders, we found that when usage capacity was at maximum, we were unable to provide prioritised access to key users who needed it.

As a result of that experience, Rivada 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, dynamic allocation of, and access to, 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 bandwidth is not being used by emergency responders.

This dynamic spectrum arbitrage revenue generating ability can allow private capital sufficient security to construct these networks for cities and states, and, in a great many of these cities and states, will provide surplus funding which could help fund the nationwide FirstNet mission. In our view, FirstNet has the best opportunity to achieve a nationwide public safety network that is fully interoperable. While a state "opting out" of the FirstNet model is permitted by the legislation, it is in our opinion neither optimal nor necessary. The best path to success for states and cities is under the FirstNet umbrella.

The ability to provide a dedicated Network that guarantees absolute prioritisation for public safety, while eliminating the burden to the taxpayer and generating surplus revenue to fund the maintenance, expansion, and improvement of the network is obviously compelling. Partnering with private capital, public safety gains a state of the art network, built to public safety standards, and a new stream of revenue that eases, and in cases may eliminate, this burden on the American taxpayer.

These core goals – the highest quality public safety network, flexibility, and a positive revenue outcome, are unlikely to be achieved in a more efficient way.

Introduction

From the days of her birth as a nation, through her journey to world superpower, America's strength has been built on her unique capacity to address the great challenges of the day by harnessing the ingenuity and inventiveness of her people and her Government. For 237 years, the United States has been the mother of invention, providing the world with electricity, telephones, air travel, new medicines, and the internet itself.

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 legislation establishing FirstNet and allocating the D-block to public safety.

The challenge of providing this secure, cost-effective, reliable, and high quality access to communications bandwidth for public safety agencies and America's first responders is of paramount concern in an era where natural disasters, terrorist incidents, or other unforeseen emergencies can take place in major population centres, placing immense strain on existing communications infrastructure and often compromising the ability of those engaged in life-saving work to communicate with each other.

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 public safety agencies 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 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 cellphone 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 cellular communications network, designed for mass public use, became distressingly apparent.

Commercial cellular companies simply 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 over a week to get repair teams on the ground to restore the networks. In Katrina, it took considerably longer.

- During Hurricane Sandy, almost 25% of the entire commercial network was unavailable, and was not restored for several weeks in some places.

To tackle this problem, the FCC tried, in the aftermath of Hurricane Katrina, to require commercial carriers to upgrade their cellphone towers to something approaching a public safety standard, including the installation of backup batteries at cellphone towers so that they might operate in an environment deprived of electricity. The companies successfully sued to block the rule, arguing that the cost of such statutory improvements would be prohibitively expensive, and that they required flexibility in the provision of backup power at their facilities.

The first minutes and hours after a disastrous incident of this nature are absolutely critical to emergency response teams, and 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.

A much more desirable solution is the provision of a network dedicated to public safety, guaranteeing priority access to public safety when it is most needed.

Up to now, however, the ability to fund the build out, and operation of a cutting edge public safety broadband network has been a major issue for most cash-strapped jurisdictions. Allocating billions of dollars to this effort is just not a realistic option for the majority of states. Furthermore, the nature of public safety in America 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 flow up to the state and federal level. It would seem logical that a successful FirstNet model will cater to and provide for the flexibility that will be required in what are rarely uniform structures from one state to another. No two state structures are identical.

At present, any state that builds its own network can, in collaboration with FirstNet, allow commercial services on the network (although only through a public private partnership). Legislation requires revenues generated by the state to be used only for the construction, maintenance, operation, or improvement of the public safety broadband network. Given the spectrum crunch that commercial carriers are currently facing, these state public safety networks have the potential to generate significant revenues for the state, and the nationwide FirstNet mission by the wholesale of any excess capacity on the network.

Rivada has therefore developed the world's first technology that seamlessly allocates excess spectrum to where it is most needed. It combines prioritization of users on the network with a real-time auctioning process, and is capable of allocating previously unused bandwidth to other networks and users, thereby minimizing unused resources on the network and providing a source of funds for the build out and operation of the public safety network.

Rivada's proposal

Commercial wireless operators are currently in the process of deploying 4G LTE networks to meet increasing bandwidth requirements for their customers. However, as demand for bandwidth continues to exponentially increase, further pressure will be applied to operators to provide the necessary radio capacity.

It is widely acknowledged that public safety agencies will need access to their full 20 MHz of spectrum to ensure they have the necessary and sufficient bandwidth for the capabilities they need for comprehensive emergency response situations. However, thankfully, emergencies on this scale do not happen every day, week, or month, and therefore not all of this 20MHz will be needed all of the time – the requirement is simply that bandwidth on this scale can be accessed immediately should the need arise. Much like an F-15, it is not needed every day – but when it is needed, it is really needed, and thus must always be available.

In addition to bandwidth, public safety agencies will also require access to funding to build, operate, and maintain the facilities required. In order to eliminate the cost to Government, and provide on-going funding for the maintenance and expansion of a first-rate public safety communications network, Rivada proposes an innovative approach as follows:

- The development of a purpose built, top of the range broadband LTE network dedicated to, and controlled by, the public safety agencies, funded by private investment, utilising and re-using existing communications assets owned by public safety agencies (tower sites, backhaul capacity, network operations centers, etc).
- The on-going real-time auctioning of excess bandwidth not being used by public safety agencies to private commercial operators on a dynamic basis, providing on-going funding to the agencies for maintenance and expansion of the network.
- Under such a proposal, the operator would not operate as a competitor to commercial carriers, but instead would act as a service provider to all carriers, providing access to 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 the public safety infrastructure.

The benefits of this approach are legion. For starters, it can completely eliminate the requirement for Federal Government funding for the initial build-out, and provides a recurring stream of funding for the annual

operation and maintenance of public safety/FirstNet networks. 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 the public safety agencies, allowing them absolute priority access to their bandwidth controlled by the agencies themselves.

By reducing the barriers to entry to the commercial market for new entrants, allowing them to purchase bandwidth dynamically without the investment in a national cellular network, this proposal also fosters the creation of an entirely new marketplace that will result in countless new innovations in cellular communications, and thousands of jobs in broadband cellular communications, as well as increasing the revenue available to fund public safety communications and improving the sustainability of the FirstNet network.

Dynamic Spectrum Arbitrage Tiered-Priority-Access (DSATPA)

Rivada Networks has pioneered an approach to deliver and allocate public safety spectrum to commercial users on a dynamic basis. Dynamic Spectrum Arbitrage Tiered-Priority-Access (DSATPA) enables dynamic arbitrage of public safety network capacity to allow non-priority commercial access to the available spectrum, thus generating revenue for the public safety network. This approach manages a frequency band to ensure end-users have access to the capabilities they require on an as-needed basis, and allows the spectrum controller to charge for use of surplus spectrum. This makes the spectrum much more efficient, by maximising its revenue value and minimising/eliminating unused spectrum.

DSATPA is a spectrum resource optimisation method that can be used by both private commercial, and public safety wireless providers. It allows spectrum to be available in multiple domains dynamically, and allows public safety to benefit by delivering LTE capability to public safety users while reducing or eliminating its operational costs.

A technical explanation of DSATPA is included on pages 9 and 10 of this document.

Dynamic Spectrum Arbitrage

Dynamic Spectrum Arbitrage (DSA) has been developed by Rivada Networks to deliver and allocate public safety radio assests as a short term lease to secondary users dynamically.

DSA enables Public Safety to charge secondary users for the use of underutilized radio resources on a dyanamic basis. The dynamic reallocation of underutilized radio resources makes the spectrum and radio resource use far more efficient. DSA also provides the method to pay for the buildout and operation of the LTE public safety network without taxpayer funding.

DSA is a policy driven resource allocation scheme and is unque in that it can enable:

- Dynamic bidding process for radio resources
- Provides a centralized arbitrage process
- Provides local control of resources
- Uses existing specifications
- Incorporates a Backoff Process

For public safety the DSA backoff process is essential and ensures that public safety always have immediate access to the leased radio resources when needed.

DSA involves the use of the Dynamic Policy Controller (DPC) and the Dyanmic Spectrum Contoller (DSC).

Figure 1 is a high level diagram of a public safety and commercial wireless network that utilize DSA.

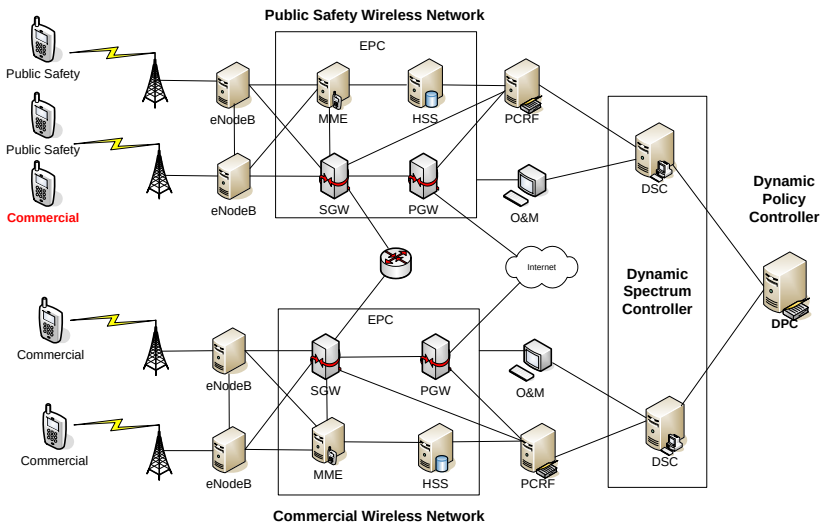

Figure 1: High Level DSA Architecture

The DPC in figure 1 is used to coordinate DSA policies and share relative information between wireless carriers which is agreed upon. The DPC facilitates the charging policy and resource requests which are then put forth to the DSC.

The DSC faciliates the traffic and capacity management policy implementation and is add on to the OMC/NMS of a wireless carrier. The DSC also oversees the backoff processes ensuring primary users have priority access following policy decisions.

The cost considerations

Firstnet has limited funds at its disposal. Its resources constitute less than 1% of the cumulative US wireless network investments to date. If the alternative to the Rivada proposal is to use multiple commercial networks to ensure reliability within the public safety spectrum, this will mean outfitting a huge number of existing MNO cell sites with Band 14 equipment. The $7bn FirstNet has been allocated is simply inadequate to upgrade all but a fraction of these sites to LTE Band 14 capability. Alternatively, if a single MNO is upgraded to this capability, there are simply no incentives for commercial carriers, or indeed effective mechanisms, to ensure priority access for public safety.

While a carrier led deployment of Band Class 14 service has the potential to save money, it is certainly not guaranteed. For example, if vendor implementations prevent adding Band Class 14 to existing base stations due to lack of scalability or security concerns, new eNodeBs may be required. Furthermore, additional large antennas on towers may not be feasible and add expense. Add to this installation, tower loading, backhaul provisioning, and additional lease costs and the potential to add great expense accumulates quickly.

Ultimately, we believe that these costs exceed available FirstNet funding and that the cost to operate the incremental network will exceed Public Safety's capacity to pay user fees to the commercial carriers, who, in order to then justify the business case, will have to leverage the spectrum to consumers, compromising priority access.

These issues create an incentive for the commercial carrier to minimize the difference in how it operates the public safety network and ultimately dilutes the public safety offering. For example, the carrier is unlikely to provide detailed system performance information to public safety, nor will it allow public safety to control the system configurations to its benefit.

Ultimately, it is our view that this 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 FirstNet revenues to the modernisation of other areas of public safety communications.

Opportunities arising from savings under Rivada approach:

Rivada's approach provides tremendous flexibility for FirstNet to use its funding to address other pressing areas of public safety need, rather than expending valuable resources on a commercially provided public safety network. Using private dollars in this manner wherever possible is far more efficient and enables FirstNet to use its limited funding for investments in the following areas:

- Construction of towers and shared RAN in challenged areas

While Rivada does not support investments in infrastructure where it already exists, FirstNet investments could be made in areas where commercial service does not exist today (or is inadequate) but where private investments do not have a viable business case. FirstNet could put out for bid projects that involved the construction of towers, shared backhaul, and shared eNodeBs such that all carriers could benefit from the investment. This would then benefit both public safety and the public and enhance our general broadband goals

- Public safety specific devices

FirstNet could invest in the development or subsidization in devices to support the specific needs of the public safety community. Because there will be a large ecosystem for Band Class 14 devices with the Rivada approach, commercial class devices will be affordable. In order to compete with the other carriers, however, FirstNet would need to subsidize even these less expensive devices. FirstNet could leverage its funds to stimulate the development of new specialized devices that otherwise would generate little commercial interest.

- Hosted public safety applications

Many agencies are not able to fully benefit from public safety applications due to their cost. FirstNet hosted applications could further improve the usability of the network for all public safety user groups and enhance adoption by providing basic functionality to public safety and services for 3rd party integration of advanced features.

- Applications and Application Platforms

FirstNet should fund an effort to develop applications that support public safety operations, with application platforms that enable public safety specific standards, and include freely available published programing interfaces. The creation of standards for public safety application development will encourage developers to create additional commercial products that are configurable and fully interoperable. These platforms will be the genesis of a sustainable product ecosystem that will reduce costs and create important choices for public safety professionals. Funding that would otherwise be allocated to network build and operations should be used to ensure applications are affordable, reliable, and adequately meet public safety's comprehensive requirements.

- Emergency Deployable Systems

Public safety needs emergency systems under its control that can seamlessly be integrated with the public safety network. These systems should be capable of being set up to facilitate communications when normal service is compromised or unavailable. Even hardened sites can become compromised during major incidents. A critical element of these systems is satellite backhaul. Public safety requires guaranteed access to a nationwide dedicated satellite bandwidth facility to ensure these systems can interoperate with the nationwide network during emergencies. Rivada's significant experience in this area indicates that all too often local responders are forced to scramble to procure satellite access during emergencies – when it is in most demand and least likely to be available. In the past few days, Craig Farrill of the FirstNet board has authored an authoritative piece on this issue, which may be found here.

Conclusions

FirstNet has limited funding, and the Rivada approach supplements that 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 American taxpayer hundreds of millions of dollars, our approach also 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.

For the American citizen, this extends high quality bandwidth across the country and and provides greater access to 911 and other critical calls. It provides increased commercial service, and competition in the cellular market.

For Firstnet, it involves public safety itself at the heart of delivering the solution, and allows FirstNet to focus its resources on other critical public safety capabilities like investment in new devices and emergency satellite communications backups.

It has been my honor and pleasure to speak with you and the members of this honorable committee today, Mr. Chairman. On behalf of Rivada Networks, it would be our privilege to be of service to FirstNet and the public safety community as they strive to improve capabilities and place the United States on the forefront of the emerging global wireless standard for public safety communications. I would like to thank you for this opportunity to talk to you about a solution which presents a historic opportunity for public safety to secure its communications future, secure a new funding platform, and deliver the service the American people deserve. Thank you again, and I will be happy now to take your questions.