FirstNet/NTIA Notice of Inquiry on the Development of the Nationwide Interoperable Public Safety Broadband Network

Docket No. 120928505-2505-01

Comments of Rivada Networks, Inc.

November 9, 2012

Rivada Networks is pleased to have the opportunity to reply to this Notice of Inquiry. Public safety has an unprecedented opportunity for an historic improvement and modernization of its communication solutions through the FirstNet initiative. In order to benefit from this opportunity, the broadband communications solution must affordably meet the needs of our first responders. In an era where government budgets are contracting, it is critical that we aim to do more with less. It is also critical that public safety agencies at federal, state and local levels across the country become an integral partner in the planning and development of the nationwide network. Without this level of involvement public safety could ultimately opt-out in the most detrimental way - by not making use of the services at all.

Public safety has the opportunity to leverage a two trillion dollar per annum global wireless ecosystem. The convergence of commercial wireless technology, implemented with the unique requirements of public safety is an opportunity that must not be squandered. This unique opportunity will put the United States at the forefront of what we expect will be a global paradigm shift for public safety communications. Rivada Networks has an innovative approach to this opportunity, one that addresses all of the fundamental success criteria. We are pleased to have the opportunity to present a compelling and appropriate solution to FirstNet and the public safety community and we look forward to ongoing discussions regarding the Rivada approach.

The proposed approach outlined by FirstNet in its presentation on September 25, 2012 has many commendable attributes and the high level approach works on several levels. However, Rivada Networks believes there are considerations that need to be addressed in order to demonstrate a viable long-term solution. The events of the past week and the destruction caused by Hurricane Sandy serve to clearly illustrate that the commercial network is not a reliable communications option for public safety. It is our consensus that the initial FirstNet proposal is not yet an optimal public safety solution for the following reasons:

1. Reliance on existing commercial networks is unlikely to meet the requirements of the public safety community from both a network reliability and capacity availability perspective. As much as 25% of the entire commercial network was unavailable across the ten states affected by Hurricane Sandy – there was little or no commercial coverage available from any carrier in the areas worst affected.
2. Reliance on existing commercial solutions is unlikely to give public safety an acceptable level of local control of the network (Rivada 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 to FirstNet and the operational costs will likely exceed the ability of the public safety community to fund it.
4. The proposed 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. The proposed solution creates a government funded competitive advantage for the selected commercial operator(s), and may create the perception that the government is 'picking winners' – thereby restricting competition and driving up costs.

Rivada Networks proposes a solution that:

- meets public safety requirements, including on-demand 'ruthless' pre-emption
- gives public safety adequate control of the network
- does not require a single cent of taxpayers money
- competitively sell surplus capacity on the public safety network.

Rivada's approach is to privately fund the network build and operation, (built to both public safety and commercial requirements), and dynamically offer surplus capacity on the public safety network on a competitive basis to generate a recurring revenue stream that funds the build and operation of the public safety network.

Public Safety Requirements

The approach proposed by the FirstNet board is not an optimal solution for the public safety community, as it does not address their unique requirements in several key areas.

1. **Network Availability** - Commercial networks are not built to public safety standards and are regularly compromised during emergencies and major incidents.
2. **Coverage** - Commercial networks do not provide ubiquitous coverage, especially in rural areas where subscriber numbers are low and the business case may not be viable.
3. **Guaranteed Access** - Commercial networks, by their very nature, are responsible primarily to their shareholders and commercial customers, and may never offer genuine priority access as defined and understood by the public safety community.
4. **Local Control -** Commercial carriers are unlikely to provide public safety any significant level of local control in the planning and operations process. Due to its relative small size in the marketplace, public safety will always lose out to commercial interests whenever there is a conflict of interest.
5. **Adoption –** It is unclear what FirstNet and the carriers would charge for the service. Currently, service costs charged by the carriers are beyond the means of many public safety agencies. It is likely that this cost would increase if the carriers have to offer additional service such as priority service. Additionally, use of Federal funds to augment the carrier networks will leave little or no funding for other factors impacting adoption of the service.

Rivada Networks has been involved in public safety communications exclusively for almost a decade. In that time, we have responded and provided emergency communications to almost every major disaster in the United States, including Hurricane Katrina, Hurricane Gustav, Hurricane Ike, the Minnesota Bridge Collapse, and the California wild fires, among others.

In all of these incidents, and indeed many others (including 9/11), each and every one of the commercial cellular networks were simply not available. The lack of availability was as a result of one or more of the following causes:

- the network infrastructure suffered catastrophic physical damage and was rendered useless

- the incident occurred in an area with limited or no cellular coverage
- a huge surge in cellphone use during the incident meant public safety could not access the cellular networks.

All commercial carriers suffered loss of network availability during these incidents, since none were built to the necessary robustness standards. This partially debunks the idea that redundancy of MNOs will increase network reliability. If all of these backups are unavailable at the same time, there is no redundancy. While the use of satellite systems as final backup would provide redundancy in some areas, it is not clear if these systems can fully meet the public safety need for control, throughput, user devices, and cost.

Commercial cellular companies are simply not programmed to respond to major emergencies and as such cannot be relied on to restore the networks in the immediate aftermath of a major incident. Following Hurricane Gustav, for example, it took the cellular repair teams over a week to get resources on the ground to restore the networks. The network restoration effort for Hurricane Katrina took considerably longer. In the wake of Hurricane Katrina, the Federal Communications Commission tried to require commercial carriers to install backup batteries at all cellphone towers, but wireless carriers successfully sued to block the rule, arguing that they needed flexibility in how they provided backup power at their facilities and that installing batteries at every site would be prohibitively expensive. The minutes and hours immediately after the impact of a major emergency are the most crucial time for emergency workers and public safety users. Access to reliable communications is crucial in order to coordinate the response and minimize damage. Public safety needs to have access to sites that are hardened to survive these types of incidents, as well as a sufficient level of backup power in the event of electricity not being available. As such, reliance on commercial carriers for emergency use is not a valid option for public safety. It simply will not meet public safety's unique requirements.

Cost Considerations

FirstNet has very limited funds at its disposal. Its current allocation of $2bn is less than 1% of the cumulative US wireless network investments to date (Source: FirstNet presentation Sept 25 2012). If the plan is to use multiple networks to ensure reliability within the public safety spectrum, it means outfitting a large number of the existing MNO cell sites with Band 14 equipment. The $7bn FirstNet has been allocated is simply inadequate to upgrade all but a small fraction of these sites to LTE Band 14 capability. Alternatively, if a single MNO is upgraded with Band 14 equipment and commercial out-of-band networks used as backup, there are simply no commercial carrier incentives or mechanism to ensure public safety priority or access to backend systems from across all redundant networks.

While a carrier led deployment of Band Class 14 service has the potential to save money, it is certainly not guaranteed. For example, if the 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 antennas on the towers may not be feasible and add expense: installation, tower loading, backhaul provisioning, and additional lease costs are among the many additional costs. Ultimately, Rivada believes that these costs exceed the available FirstNet funding and that the cost to operate the incremental (BC 14) network will exceed public safety's ability to pay user fees. Therefore, in order for a carrier to justify the business case, it must leverage the spectrum for consumers.

This dynamic creates an incentive for the carrier to minimize the differences in how it operates the incremental 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. In the case that the infrastructure vendor cannot separate the performance information between the commercial and public safety base station, public safety may not receive useful information from a commercial carrier network.

The financial limitations placed on FirstNet require innovative business models in order to minimize the cost to public safety users and ensure that the network will be used by the intended audience. The network must not only provide advanced LTE broadband services - it must also ensure that first responders have genuine priority access on the network while at the same time providing a recurring revenue source that can be used to finance the continuing operation of the network. FirstNet must understand that in order to benefit from this opportunity, public safety must be able to afford the devices, service, and applications needed for their mission. The next generation devices may be more expensive than current commercial devices and that expense may impede adoption of the service. This in turn would require FirstNet to subsidize devices beyond the level carriers do today, and further challenge the MNO business model.

The need to have the public safety network stay within budget while delivering all of their unique performance requirements demands a radical shift in thinking. The new broadband network that public safety is about to deploy must be used to offer services to non public safety entities in order to be viable. Public safety, however, needs to have access to all available radio resources when required to ensure vital communication is achieved either for routine operations or critical incidents.

Concerns about the Commercial MNO

MNOs are deploying 4G LTE technologies on a limited basis with no specific plans to add base stations in rural areas where demand from subscribers for broadband technology is low. Therefore, the public safety network operated under existing MNOs will suffer from unserved areas. It is also widely understood that public safety needs broadband wireless service in rural areas and low traffic areas where incidents will arise. While the cost justification for a single operator may be difficult, there are many rural areas where a business case for several rural operators sharing the same RAN makes perfect sense.

It is especially unlikely that public safety will get true priority in a failover scenario, especially if public safety applications consume bandwidth at an unprecedented rate due to heavy use of streaming video, multi-cast communications, high density incident use, etc. Under these scenarios the MNOs fiduciary responsibility is to their shareholders and commercial customers - it seems clear that there is little incentive for MNOs to give genuine priority access or proper support resources to the public safety users.

<u>An Unfair Competitive Advantage</u>:

If the Federal funding is allocated to a single carrier in a region, that carrier will, for all intents and purposes, be a government subsidized competitor, with the net result that the government is essentially funding a private entity resulting in a distortion of the market. The carrier could leverage the funding for base stations, generators, redundant backhaul, and other systems that will make it inherently easier to compete with the other carriers in the region. In the urban, suburban, and many rural areas a business case exists to build capacity and coverage without any government or taxpayer funding. In this scenario, government funds would supplant investments that a private company should be making. Any investments in the infrastructure that enhance reliability, such as

generators and redundant backhaul will certainly enhance the marketability of the carrier's service even if there isn't justification for private investment. The single carrier would have access to free Band 14 spectrum. If the carrier also had access to the money to utilize that spectrum, there would be virtually no cost to the carrier for a substantial increase in capacity and enhanced robustness. Essentially, Federal funding for a single competitive carrier will create unfair competition in the marketplace. Taxpayer dollars should not go towards augmenting carrier networks where a private business case to do so exists and where those dollars affect the competitive landscape in that region. Instead, the spectrum and funding should benefit public safety, FirstNet and all the carriers.

Rivada Networks' Approach

Commercial wireless operators are currently in the process of deploying 4G LTE networks to meet increasing bandwidth requirements from their customers. However as the demand for bandwidth-intensive applications increases further pressure will be applied to the commercial wireless operators to provide the necessary radio capacity.

It is widely acknowledged that public safety agencies will need access to 20 MHz of spectrum to ensure they have sufficient bandwidth for the capabilities they need to respond to emergencies. Public safety agencies also need to have absolute control of the networks they use for critical communications. However, it is also widely accepted that the public safety community will not need the full 20 MHz of spectrum all of the time.

In addition to state of the art technology, and sufficient spectrum to use those networks, public safety agencies will need access to funding to build, operate and maintain the capabilities required. In order to reduce the overall cost of the project to the government, Rivada proposes an innovative approach whereby the cost of network development is privately financed and all costs, including build and ongoing operation, are subsidized by allowing fee-paying commercial users to access the public safety network. In this scenario, public safety will have absolute priority on the network, and will have permanent access to the entire 20 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 dynamically leasing capacity on a wholesale basis to all 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 annual operational costs associated with the network. Rivada will not be a competitor to the carriers, but will instead be a service provider for all carriers, as well as providing capacity for new entrants who can now compete as a result of the decreased barriers to entry.

The nationwide public safety network should re-use existing communications assets owned by public safety agencies wherever possible, including tower sites, backhaul capacity, network operations centers, and other relevant infrastructure. These public safety assets generally come with the additional benefit of hardened attributes such as the ability to support substantial generator power, high wind loads, and other important features. Where public safety assets are not available, the network will utilize commercial assets to speed deployment and minimize capital costs.

Benefits of This Approach

- It eliminates the funding required from the federal government for the initial build out and provides a recurring funding stream for the annual operation of public safety networks.
- It creates an opportunity for the federal government to do more outside of the initial network build with the available funding.

- It allocates resource control into the hands of those best positioned to use them – namely state and local public safety agencies – thereby reducing the risk of public safety not using the network.
- It creates the greatest likelihood of successful adoption due to the cost efficient availability of service for most public safety users and freeing up Federal funding for other critical elements of the solution such as devices, training, integration, and applications.
- It creates the environment for the private sector to develop new and innovative business models, thereby fostering the creation of an entirely new marketplace that will result in the creation of thousands of jobs and countless technological innovations, all of which result in increased revenue on the public safety network thereby improving the sustainability of the network for the public safety community.
- It eliminates the perception that the government is 'picking winners' by allowing new and existing operators to compete and allows supply and demand market dynamics to set pricing for sub-priority (below public safety), commercial users for surplus capacity on the network.

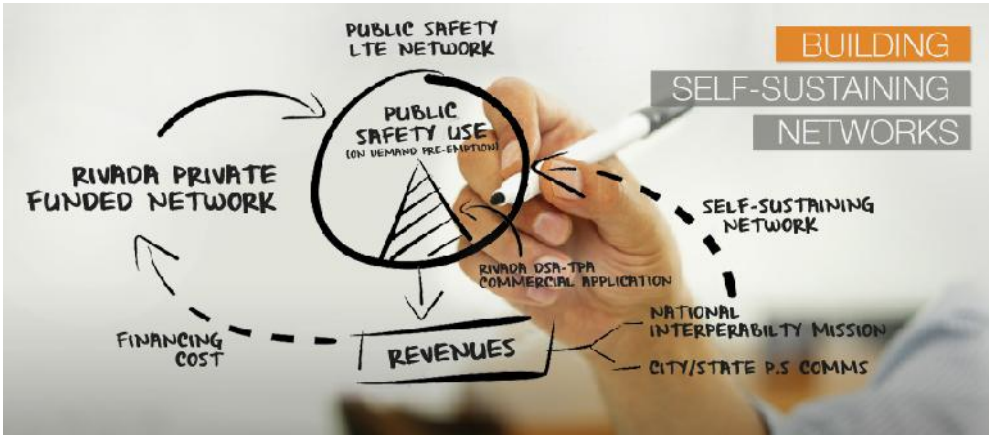
Rivada Networks has pioneered an approach to deliver and allocate public safety spectrum to users dynamically. Dynamic Spectrum Arbitrage-Tiered Priority Access (DSATPA), will enable dynamic arbitrage of network capacity to allow non-priority commercial access to the available spectrum, thus generating a potential source of revenue. The approach effectively manages a frequency band to ensure end users have access to the communications capabilities they require on an as-needed basis, and permits the spectrum controller to charge for use of surplus spectrum making the spectrum far more efficient by minimizing unused capacity.

Rivada's DSATPA approach is a spectrum resource optimization method that can be used by both public safety and commercial wireless operators. The approach enables spectrum 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's approach has the added benefit of complementing the FCC's mandated charter.

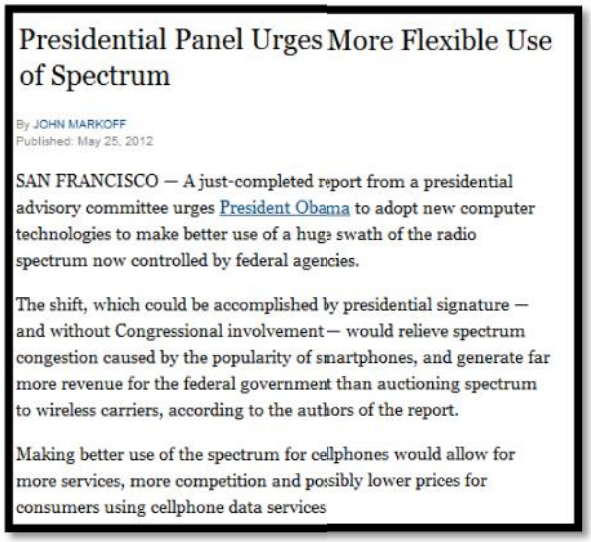
FCC Charter	**Existing Carrier Approach**	**Rivada Approach**
• Promoting competition, innovation, and investment in broadband services and facilities	✗	✓
• Supporting the nation's economy by ensuring an appropriate competitive framework for the unfolding of the communications revolution	✗	✓
• Encouraging the highest and best use of spectrum domestically and internationally	✗	✓
• Revising media regulations so that new technologies flourish alongside diversity and localism	✓	✓
• Providing leadership in strengthening the defense of the nation's communications infrastructure.	✓	✓

Rivada's Self-Sustaining Model



DSATPA is being pioneered by Rivada Networks to deliver and allocate public safety spectrum to users dynamically and effectively manage a frequency band to ensure end users have access to the communications capabilities they require on an as-needed basis. Rivada's approach has been mirrored by a recent Presidential Panel, which advocated the technology approach pioneered by Rivada.

"The report calls for a tiered system in which different users would have different priority, possibly based on whether they were a government user, a user who was prepared to pay more for a higher quality-of-service, or a casual user who might be assigned the lowest priority and pay the lowest rate".
New York Times, May 25, 2012



Presidential Panel Urges More Flexible Use of Spectrum

By JOHN MARKOFF
Published: May 25, 2012

SAN FRANCISCO — A just-completed report from a presidential advisory committee urges President Obama to adopt new computer technologies to make better use of a huge swath of the radio spectrum now controlled by federal agencies.

The shift, which could be accomplished by presidential signature — and without Congressional involvement — would relieve spectrum congestion caused by the popularity of smartphones, and generate far more revenue for the federal government than auctioning spectrum to wireless carriers, according to the authors of the report.

Making better use of the spectrum for cellphones would allow for more services, more competition and possibly lower prices for consumers using cellphone data services

Suggested Uses of Government Funding:

Rivada's unique approach provides tremendous flexibility for FirstNet to address the public safety need and not create an unwanted dynamic in the commercial marketplace. As such, Rivada has the following suggestions regarding government funding and the use of the spectrum:

- No tax dollars should be spent where a commercial business case clearly exists
- No tax dollars should be spent that creates an unfair advantage for certain operators
- The excess secondary capacity should be available to any commercial organization approved by public safety, FirstNet, the FCC and any other relevant authority.

Using private dollars 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 setup 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.

Rivada has fielded multiple deployable systems to various federal and state agencies throughout the country. Deployable systems should be used solely for emergency situations and are often the only source of communications during an incident. It is vital that FirstNet provide for a deployable capability and have this network strategically located and ready to respond to incidents throughout the United States at a moments notice. Deployable broadband systems should provide service to all emergency responders, including National Guard, Reserves, and any other relevant agency responding to an incident.

Conclusion:

The suggested Rivada Networks approach assumes an independent public safety controlled network that is privately financed (i.e. without the use of taxpayer dollars). This independent plan will not rely upon any single commercial wireless network operation 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 collective benefits sought by public safety, FirstNet, and Congress. It is also an approach that will be embraced by the business community since it stimulates the competitive environment by providing opportunities for new entrants and at the same time it avoids the perception that the government is distorting competition by selecting existing carriers.

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 public safety network. Dynamic Spectrum Arbitrage-Tiered Priority Access (DSATPA) 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:

- For Public Safety: It delivers a sustainable and affordable solution under the control of the public safety community and ensures a high adoption rate. It also provides the maximum benefit from this tremendous opportunity with the right network, devices, applications, and operations to ensure success.
- For FirstNet: It reduces the risk of low public safety adoption by involving public safety 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 FirstNet to focus on critical public safety capabilities such as the devices they require and the applications that will make them more effective.
- For The Taxpayer: It enables their chosen wireless carrier to provide access to more areas and provides greater availability for 911 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 provides taxpayer confidence that our government and government appointed officials are using their resources wisely without giving unfair competitive advantages to specific mobile network operators.

Rivada Networks appreciates the opportunity to present our comments and share our proposal. We look forward to working with FirstNet and the public safety community to define a future for public safety and place the United States on the forefront of the emerging global wireless standard for public safety communications. We are eager to work with FirstNet and the national public safety

community to demonstrate that our solution presents the right solution to capitalize on this historic opportunity. We are available to meet with FirstNet and public safety to discuss our suggested approach in more detail at your convenience.

Respectfully,

Declan Ganley
President and CEO