

Before the  
**DEPARTMENT OF COMMERCE**  
**National Telecommunications and Information Administration**  
Washington, DC 20230

In the Matter of	)	
	)	
Public Wireless Supply Chain Innovation Fund	)	Docket No. 221202-0260
Implementation	)	RIN 0693-XC05
	)	

**COMMENTS OF DeepSig Inc.**

DeepSig Inc. appreciates the opportunity to respond to NTIA’s request for comment (“RFC”) on the implementation of the Public Wireless Supply Chain Innovation Fund (WIF).

DeepSig Inc. is a venture-backed, product-centric company developing revolutionary wireless processing software solutions using cutting-edge machine learning techniques to transform 5G, sensing, and critical wireless applications. By weaving AI machine learning into radio signal processing functions, DeepSig makes the future of wireless more intelligent, efficient, autonomous, and affordable for 5G and beyond. Open RAN allows for this transformation to occur by disaggregating and virtualizing the majority of 5G base station functionality on commercial servers or in the cloud. DeepSig is delivering a family of AI software products that improve the user experience through enhanced connectivity while reducing power consumption and providing spectrum awareness to detect security threats and interference.

Founded and headquartered in Virginia, DeepSig’s mission is to enhance the user experience while reducing power consumption and costs that can best be achieved and deployed in Open RAN systems.

Modern wireless systems, especially 5G Massive MIMO systems, are increasingly complex and costly to develop, optimize and operate. Machine learning is rapidly transforming how wireless communications systems are designed and optimized, as in other fields such as computer vision, natural language processing voice processing, etc. By designing communications systems and components natively with an AI centric and data-driven methodology (known commonly as AI-Native), wireless systems can deliver unprecedented levels of performance and automation.

DeepSig's OmniPHY<sup>®</sup> solutions leverage AI-Native design of fundamental communications system components to drastically improve performance in today's wireless systems through transparent replacement of signal processing software. The software’s first deployment is a straightforward patch to Intel<sup>®</sup> FlexRAN<sup>™</sup> 5G Open RAN software and can easily be retargeted to other 5G systems. OmniPHY<sup>®</sup> rethinks how communications systems may be learned end-to-end for beyond 5G and non-standards communications systems to significantly improve performance by allowing for complete adaptation in the physical layer.

## I. INTRODUCTION

The Wireless Innovation Fund provides a path for the US to regain the advantage in wireless technology innovation and to rebuild the Nation's ability to design and manufacture leading-edge, cost competitive, wireless infrastructure. Crucial to this is moving away from the vertically integrated, single vendor, wireless solution to disaggregated open Radio Access Networks ("RAN"), emphasizing virtualization that enables multiple agile hardware and software vendors to compete for RAN components. As an innovative venture-back software vendor seeking to enhance software performance and offerings within Open RAN we are emphatic about this opportunity, and truly believe Open RAN can be a key enabler to bringing new innovative ideas to market more quickly, as documented in this 2021 Light Reading article "Startups Cheer Open RAN for Opening the Door" ([Light Reading](#)). Wireless systems are traditionally hard to integrate and optimize and are becoming even more challenging to optimize as new widely varying frequency bands, band-sharing, band-aggregation, and variety of services are added to the available spectrum. AI is demonstrating that it can replace numerous classical algorithms and system functions with neural networks (i.e. data-driven deep learning) to dynamically learn optimum ways to improve the user experience while reducing power consumption and significantly impacting the performance of many RAN components. Furthermore, AI can multiply the effectiveness of network planners and network operations, allowing them to evaluate and optimize site deployments to reduce deployment time, cost, and integration risk and to automate optimizing and mitigating faults and security threats or failures within the network.

## II. ACTIONS TO ENCOURAGE INNOVATION

A priority of the WIF should be to provide resources to small innovative US companies that are increasing the performance and competitiveness of Open RAN. Specifically this should be focused on those that have operational software and hardware demonstrating key wireless improvements such as reduction in power, improvement in utilization and sharing of spectrum, and enhancements to the user experience as well as those that have existing private investment and momentum into offering real solutions into the Open RAN marketplace. The rapid advancement of AI technologies should be targeted as a means to process wireless signals more efficiently while employing learning to adapt to changes in the environment. This is not only a means to accelerate and improve Open RAN performance but a means to accelerate technologies that will be foundational within 5G-Advanced and 6G. Innovative small companies focused in this area should receive funding to enable and accelerate staff participation, leadership, and contributions in wireless standards groups such as 3GPP, ORAN, and TIP. Often incumbent technology companies suppress new ideas to enhance their IP value and market dominance while restricting new entrants, or restate and adapt new innovative ideas repeatedly in their filings and contributions to claim credit from small company innovations without due credit. Support of US innovation, IPR development, and standards contributions from innovative small US companies is critical.

Finally, Open RAN does not mean open source; it means open interfaces and interoperable components as defined at the network element level. While Open RAN may leverage some open-source software and components when it makes sense (e.g. for interface testing or test cases), attempts to force Open RAN efforts to open source or to royalty-free models by USG could in fact, be limiting for startups' abilities to establish effective and sustainable business models and IPR

leadership models which best serve the long-term sustainability and market impact of many underlying component technologies.

### **III. FUNDING OF PILOTS AND PRODUCTIZATION TO REDUCE MARKET RISK**

The US needs to accelerate the velocity of innovation through rapid testing, validation, productization, and adoption with unbiased feedback. These steps to operationalize next-generation R&D are extremely costly and become major barriers to delivering the long-term benefits of advanced technologies. The Wireless Innovation Fund should fund companies to demonstrate new technologies to improve wireless performance in any aspect (especially those that impact operator Open RAN adoption and value) through an orderly gated process that first demonstrates a concept in the lab, and if successful, followed by small and then large-scale multi-cell trials.

The testbeds should have regular coordinated sprint schedules so that successful ideas can rapidly advance from prototype to deployment and unsuccessful ones rapidly rejected so that their authors can address shortcomings and retest. Academic research is often useful in considering future directions in basic research; however, if it does not have a rapid and economical path to productization, it is doubtful to have a significant impact on the acceleration and competitiveness of Open RAN.

While testbeds should initially focus on the performance evaluation of 5G (and 4G), they should also consider the evolving needs of Open RAN by developing technology to evaluate 5G Advanced and 6G. For example, while the virtualization emphasis of Open RAN enables new technologies to be evaluated through software upgrades, UE simulators (smart phones, hotspots, etc.) with similar capabilities are needed. To the greatest extent possible, funding should accelerate immediate Open RAN performance and deployment by funding technologies with applicability to near-term enhancements that also provide a path to beyond 5G performance thereby establishing IPR and technology leadership.

### **IV. PHYSICAL LAYER SECURITY THROUGH ENVIRONMENTAL SENSING**

Wireless security and fault monitoring today are often pursued by monitoring wired network interfaces, Key Performance Indicators (KPIs) and software configurations. However, as wireless gains an ever-increasing portion of the communications and control infrastructure, it is vitally important to protect against deliberate attacks and unintentional interference that can impair communications capacity and even take control of or disrupt networks. The Fund should support spectrum awareness within Open RAN, a key software technology that leverages existing and future high-volume industry radio unit (RU) receivers to sample the wireless environment and provide near real time air-interface monitoring functions, potentially via RAN Intelligent Controller (RIC) xApps.

The spectrum monitoring functions should use industry proven AI sensing products to detect, learn, and locate new signals and to sense anomalies to minimize the time to respond to threats.

By doing so, the WIF can help provide improved performance within Open RAN for shared-spectrum bands, unlicensed spectrum bands, security and operation enhancements. Furthermore, spectrum monitoring is a key enabler for NextG spectrum utilization techniques, which leverage real-time feedback in spectrum to ensure optimal utilization between multiple users while recognizing and mitigating disruptions autonomously.

These efforts should produce outputs such as data streams that can be ingested by industry Graphical Information Systems (GIS) displays or SIEM platforms (e.g. Kibana, Splunk, etc) to show anomalous activity, location of anomalous emitters, general metrics of spectrum usage and triggers in mitigation and response and/or industry standard reporting formats to enable traditional cyber security tools to focus efforts on the location and manner of potential intrusions.

## V. FUND STEPS TO 5G ADVANCED AND 6G

Open RAN grew after much of 5G was designed, and traditional vertically integrated vendors had already established IP and capability strongholds. The Open RAN ecosystem has had to play catch-up with the traditional equipment providers. The strength of disaggregation is that technology companies can focus on advancing specific components of a 5G system and accelerating the full RAN system dramatically faster through collaboration and interoperability and with a lower effort than is required by highly vertically integrated systems, which must accelerate every layer of the stack within one company. AI is demonstrating the potential to improve many facets of Open RAN ranging from RU AI-enhanced signal condition, DU AI-Native air interfaces, CU scheduling optimizations, and RIC on-line machine learning, system optimization, and automated provisioning. The WIF should resource rapid introduction of AI within commercial Open RAN offerings while also funding recipients to champion the technology at standards bodies to move 5G Advanced and 6G towards more intelligence, user experience, energy efficiency, cost-effectiveness, and US leadership. DeepSig is the industry leader, leveraging private investment to “achieve the industry’s first AI-Native call on Open RAN” while proving technologies to accelerate 5G Open RAN and 6G ([Business Wire](#)).

## Conclusion

In conclusion, we greatly appreciate the opportunity to submit these comments for your review. DeepSig firmly believes the WIF funding has tremendous potential to lift the Open RAN ecosystem to become ubiquitous, allowing for a continuous cycle of growth and innovation for many generations.

In doing so, NTIA should focus on areas that can immediately be adapted into the ecosystem allowing for improvements in cellular communications. In recap, this can be best achieved by:

- Innovative small companies should receive funding to enable and accelerate staff participation, leadership, and contributions in wireless standards groups such as 3GPP, ORAN, and TIP.

- The Fund should support new technologies to improve wireless performance in any aspect (especially those that impact operator Open RAN adoption and value) through an orderly gated process that first demonstrates a concept in the lab, and if successful, followed by small and then large-scale multi-cell trials.
- To the greatest extent possible, funding should accelerate immediate Open RAN performance and deployment by funding technologies with applicability to near-term enhancements that also provide a path to beyond 5G performance thereby establishing IPR and technology leadership.
- The Fund should support spectrum awareness within Open RAN, a key software technology that leverages existing and future high-volume industry radio unit (RU) receivers to sample the wireless environment and provide near real-time air-interface monitoring functions, potentially via RAN Intelligent Controller (RIC) xApps. By leveraging AI awareness in spectrum systems, it will significantly improve functionality, including mitigating interference and decreasing the drop call rate.
- Finally, the WIF should resource rapid introduction of AI into Open RAN within commercial Open RAN offerings while also funding recipients to champion the technology at standards bodies to move 5G Advanced and 6G towards more intelligence, user experience, energy efficiency, cost-effectiveness, and US leadership.

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