Before the

National Telecommunications and

Information Administration

Washington, D.C. 20230

In the Matter of	)	
National Strategy to Secure 5G Implementation	)	Docket No. 200521-0144
Plan	)	RIN 0660-XC047
	)	

Comments of Blue Danube Systems, Inc.

Blue Danube Systems, Inc. (Blue Danube) files comments in response to the National Telecommunications and Information Administration (NTIA) Notice on the Secure 5G and Beyond Act of 2020 (Act),[1] signed into law on March 23, 2020, seeking comment on behalf of the Executive Branch, to develop an Implementation Plan. The Act "requires the development of a strategy to ensure the security of next-generation wireless communications systems and infrastructure" within 180 days of enactment.[2]

In this proceeding, Blue Danube addresses the questions raised by the NTIA in the Notice to develop an Implementation Plan to facilitate and accelerate the rollout of 5G in the United States (U.S.). NTIA seeks answers to questions organized under four lines, Facilitate Domestic 5G Rollout, Assess Risks to and Identify Core Security Principles for 5G Infrastructure, Address Risks to U.S. Economic and National Security during Development and Deployment of 5G

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1 Pub. L. 116-129, 134 Stat. 223-227 (2020), Secure 5G and Beyond Act of 2020 (Act)

2 The National Strategy to Secure 5G Implementation Plan Comments, 85 Fed. Reg. 32016-17 (2020).

Infrastructure Worldwide, and Promote Responsible Global Development and Deployment of 5G. Blue Danube, in its comments, addresses NTIA's specific questions related to its 3D beamforming MaMIMO technology and why startups and small companies are essential to the 5G ecosystem ensuring innovation in next-generation networks.

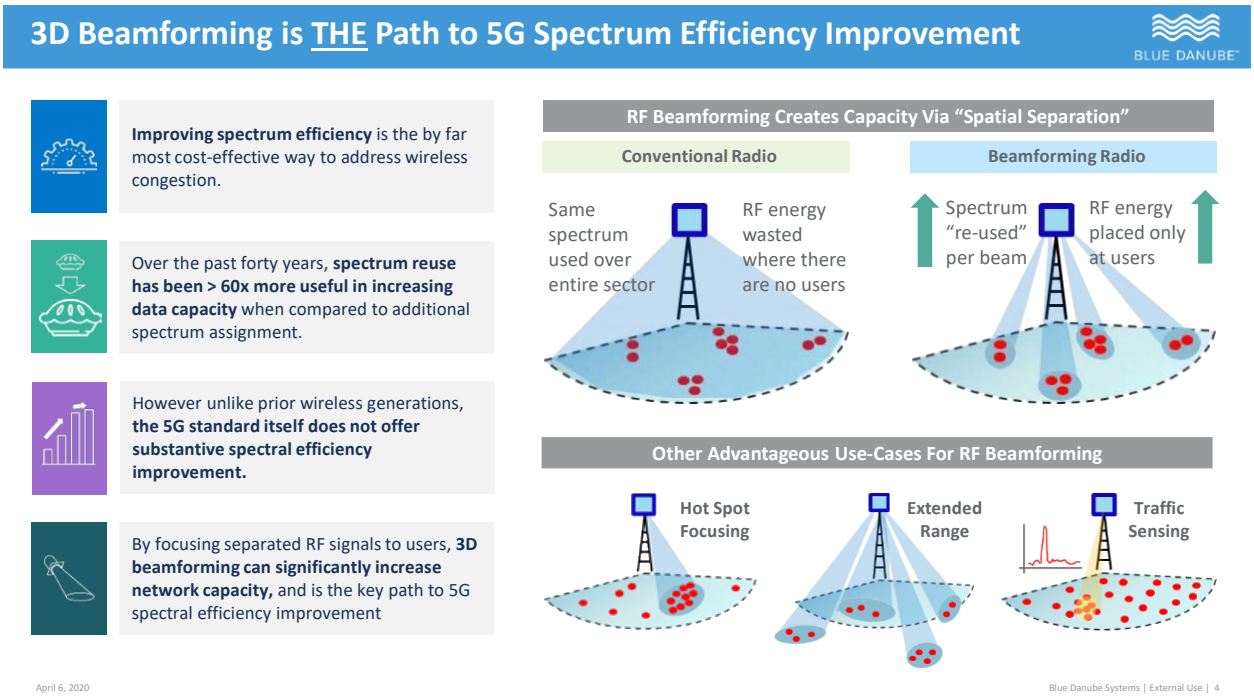
I. Background

Blue Danube is the only United States (U.S.) vendor providing advanced Phased Array Radio Antenna Systems (Massive-MIMO) solutions for LTE and 5G Networks. The company is a U.S.-headquartered small business, and a supplier of advance Phased Array Radio Antenna Systems for use with both LTE (4G) and 5G. Blue Danube is U.S.-owned, and all development and manufacturing occurs in the U.S. Principal owners include Sequoia Capital, Northgate Capital, Silver Lake Capital, AT&T, Stanford University, and Blue Danube own employees.

Blue Danube has developed and is manufacturing 3D beamforming MaMIMO radios based on a breakthrough in phased arrays, similar to systems used by military and intelligence agencies, but at a much lower cost. Blue Danube builds next-generation commercial wireless solutions for mobile networks and other applications using this 3D beamforming MaMIMO solution.

Blue Danube's Coherent MaMIMO solution brings 5G beamforming to today's commercial and government networks, dramatically increasing network capacity and end-user experience. With a cloud-based software suite that uses Artificial Intelligence (A.I.) and Machine Learning (M.L.) techniques, Blue Danube's technology enables an up to a 10X capacity increase with today's smartphones.

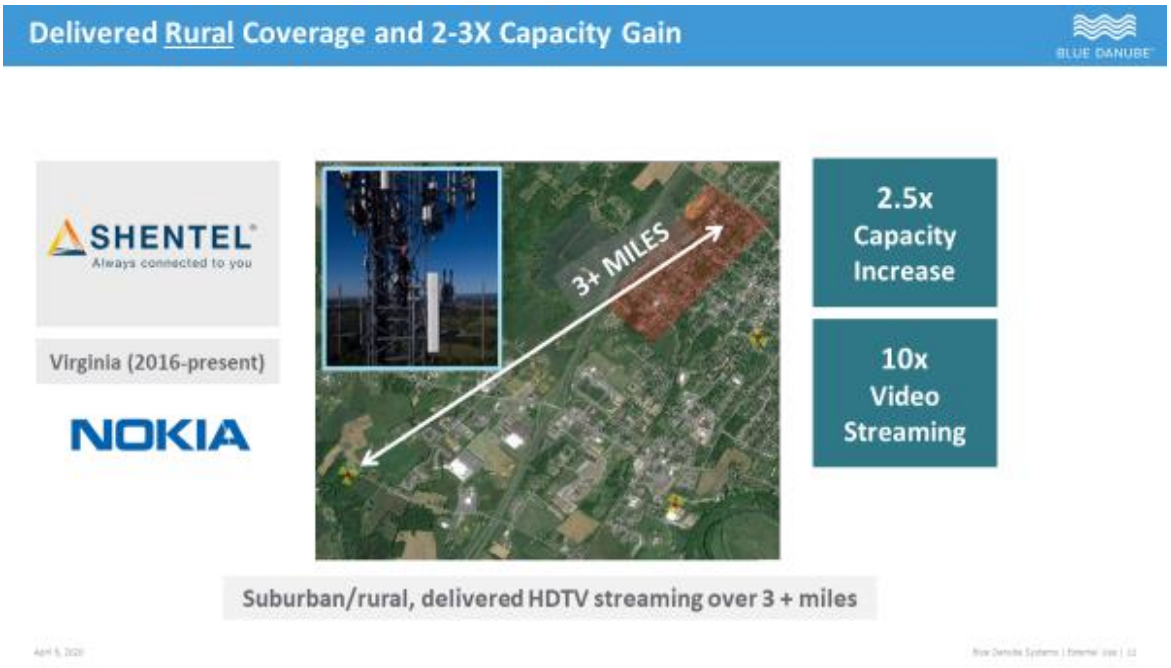
The Blue Danube solution has been proven on multiple carrier networks. It is the only MaMIMO system to improve FDD bands, representing the majority of the sub-6GHz spectrum holdings by U.S. operators using equipment designated as a National Security Threat to the Communications Supply Chain.



Blue Danube's phased array Radio antenna systems have been in commercial operation in the U.S., Mexico, Australia, and India for over 3 ½ years. In each case, the products have improved the performance and reliability of the existing cellular system. Specifically, the products have increased capacity and coverage in each mobile cellular network where equipment has been provided.

Blue Danube has deployed its network technology in dense urban deployments and solved specific coverage problems, such as the top floors of high-rise buildings and offloading low band carriers (600-800MHz). Also, the products have been used in **rural** deployments to improve coverage and increase data speeds at a distance from the cell towers. The Blue Danube products deliver R.F. energy where it is needed and when it is required.

In 2016, Blue Danube deployed its 3D beamforming MaMIMO technology in rural Virginia via the telecommunications provider SHENTEL. Working through Nokia core network equipment, the capacity was increased by 2.5x, as shown below.



Increasing the effectiveness of the existing spectrum can alleviate the pressure to free up other currently allocated spectrum, and can multiply shared capacity to minimize the effect on incumbent owners. Additionally, new network operators can deploy at vastly lower upfront costs because of improved coverage from beamforming. The MaMIMO radios can transform the way mobile network operators use their spectrum, saving money and resources, and providing a better quality of service through beamforming. This technique focuses on wireless signals toward high data traffic users, rather than having the signal spread in all directions like a conventional broadcast system normally would. This more direct connection is faster, but more importantly, the same spectrum can be reused in each beam.

II. Line of Effort One: Facilitate Domestic 5G Rollout.

1. The U.S. Government can facilitate the national 5G rollout via several steps. Initially, the U.S. should continue to make spectrum available in the low band, mid-band, and millimeter waves. This effort is supported by all wireless operators, the Federal Communications Commission (FCC), and other industry groups. As a radio antenna provider, Blue Danube is very interested in the useable spectrum bands for 5G that support spectrum sharing and duel use platforms to facilitate the maximum use and flexibility with the existing spectrum. Second, the replacement of insecure equipment (sometimes referred to as 'rip and replace') should occur. (Please see section VI below). Third, the use of open interfaces between wireless equipment must be supported. (Please see section VII below). Fourth, the national development of industry should be supported, and specifically, small and startup companies that are developing technology for 5G. Large U.S. telecom companies, through various mergers and acquisitions, are now controlled by offshore companies. There are several small companies such as Blue Danube that are developing high tech solutions for 5G.
2. For instance, the U.S government can best foster and promote research and development, testing, and evaluation of new technologies by providing direct investment to small companies working on advanced technologies for 5G. For instance, Blue Danube started with a series of grants from the National Science Foundation (NSF) and recently has received investment from In-Q-Tel. We have also participated in the recent National Spectrum Consortium (NSC) Request for Proposals. These programs should be expanded and focused on the critical pieces of 5G technology, including chipsets, radio and

beamforming technology, advanced applications in Machine Learning and Artificial Intelligence, software, and security.

3. An additional step the U.S. government can take is the support of Academia. There are several universities with wireless programs that should be expanded with greater access to testing equipment and internships for advanced students.
4. What areas of research and development should the U.S. government prioritize? All aspects of a 5G wireless system are ripe for development and advanced technologies. These include the core network, backhaul, latency, interfaces, software applications, IoT devices, end-user devices, antennas, radios, tower technology, and other platforms such as High Altitude Platforms (HAPs) and satellites. NTIA will receive comments on a number of these technologies, and Blue Danube will focus on the radio. What makes a wireless system, in the end, is the radio and antenna system. The U.S government should prioritize all aspects of the antenna system, including the antenna and materials for antennas. Beamforming and advanced beamforming techniques will be required to get maximum use out of all spectrum bands and provide the highest level of service. For instance, network components such as radio, amplifiers, filters, and digital coders should be required to be developed in the U.S. Specific goals should be required, such as 50% or greater of all radio/antenna components should be designed and built in the U.S.

III. Line of Effort Two: Assess Risks to and Identify Core Security Principles of 5G Infrastructure.

1. In regards to security, again, our comments will focus on the radio antenna system. The primary concerns about radio antenna systems include interception of signals, jamming, and destruction. Design and management of the radio antenna system and the entire wireless network architecture should focus on these concerns.

2. Advanced beamforming can reduce the capability to intercept signals and minimize the potential of jamming. A network architecture that includes many nodes and various frequency bands can reduce the potential for interference, jamming, and mitigate the impact of destruction. With advanced beamforming, if a site is destroyed, surrounding sites can ensure there is no complete loss of coverage. As mentioned in Section II, the supply chain for the radio antenna system should be primarily U.S. based.
3. All operators and operations should have a contingency plan for interference, jamming, or destruction situations. It can occur because of natural catastrophes, terrorist attacks, or other instances of destructive force. Each node should have a plan that can be implemented immediately if a node is lost.
4. To promote the adoption of radio antenna security, each filing for a radio location should include potential contingency plans for loss due to interference, jamming, or destruction. All radio nodes have to be filed with the FCC, as part of the filing, a contingency plan in case of loss should be included.

IV. Line of Effort Three: Address Risks to U.S. Economic and National Security during Development and Deployment of 5G Infrastructure Worldwide.

1. As evidenced by the recent requirement to quarantine and work at home, wireless systems are a critical piece of the U.S. economy and the global economy. This technology is ubiquitous and impacts our lives every day. The next-generation 5G technology will be used for communication, manufacturing, banking, driving, and tracking most everything. The opportunity for U.S. companies is enormous. Every

industry has a part to play, and the U.S. must continue to lead the world in 5G applications.

2. The need for secure networks and privacy protection is critical. There is an overwhelming risk that someday, the network will entirely go down and stop the billions of applications and services provided by the network. It could occur due to a software bug or a cyber attack. Just like the capability to ‘ground’ all the airplanes on 9/11, there needs to be the capability to ‘self isolate’ parts of the network.
3. Section VII, open interfaces, requires vendor diversity, and market competition with primary network interfaces open. It will allow companies both large and small to compete for business.
4. The U.S. has always been a hotbed of technology innovation, and this must continue. Large companies realize that they need to innovate to compete. Likewise, small companies understand the same but have many challenges. One challenge is the current patent process. For a small company, the burden of filing, processing, and paying patent fees (including international filing) is sizeable. It would have to be managed carefully, but a means to help 'fund' the patent process for small companies should be developed. Possibly a 'success fee' could be used so frivolous patents would not be filed. Also, assistance with the international filing of accepted U.S. patents would be beneficial.

V. Line of Effort Four: Promote Responsible Global Development and Deployment of 5G.

1. Today, technology development is happening on a global scale. The U.S. government can best lead this effort by pushing and using technology at all levels. A good example is a recent request for proposals from the National Spectrum Consortium.

The projects requested are for real-world situations with problems. Problems and challenges spur innovation. Industries and government contractors should be incented to use technology to improve their operation.

2. The area of standards, like the area of patents, is very difficult for small businesses. The standards bodies require a 'membership fee' and a considerable amount of time from the participant. Often standards meetings are at locations around the world, which requires time and travel by supporting organizations. Because of this, the standards bodies are more or less driven by large corporations. It is unfair and limits the ideas for new capabilities from small companies. One option would be to sponsor a group that supports small companies in standards bodies.
3. Equipment from other countries needs to be carefully screened and tested. For critical areas, the design documents should be archived in the U.S. in case of any supply chain interruption.
4. The U.S. should encourage cooperation and investment from trusted suppliers from other countries to invest in the U.S. This should include development and manufacturing facilities.
5. See section VII on Open Interfaces.
6. The U.S. should ensure a foundry, factory, or manufacturing capability in the U.S. for all critical infrastructure equipment. It would include all materials used and components such as integrated circuits, PCB boards, and cables.

VI. The U.S. plan to replace unsecured infrastructure equipment must provide up-to-date capabilities that, at a minimum, should be upgradeable to 5G.

The insecure equipment that is currently installed in the U.S. is of various ages and vintages. This replacement effort must include two key objectives: 1) all installed replacements

should be the newest available equipment, and 2) all gear should be LTE-compatible, and at a minimum, be upgradeable to 5G. It means that all equipment can be upgraded to 5G and not require a "tower climb" or "truck roll" to accomplish the upgrade. The products should be capable of performing 3D beamforming for capacity and coverage (including **rural** areas) where required. Also, the products should use standard open interfaces (as discussed in Section VII) or be upgradeable to open interfaces, again without a requirement for a "tower climb" or "truck roll."

VII. Open Radio Access Interfaces should be mandatory; at a minimum, all products should be remotely upgradeable to Open Interfaces.

Many of the core cellular network interfaces are open. It has given several companies the ability to develop and implement products in this space. Open interfaces have driven the whole "virtualization effort." It has led to the use of standard computing platforms to perform functions that were once delivered on individual purpose-built platforms. However, there is one primary system interface that is still not "open," the radio access interface.

To date, the industry has almost universally implemented the Common Public Radio Interface (CPRI) to link the radio to the baseband part of the core network. While CPRI is a standard, the implementation details are not. As a result, the large OEMs have each implemented the CPRI with hundreds of different control messages, packet sequences, and timing methods. In essence, this has the effect of making this interface proprietary to each OEM. The major operators have pushed for years to have this interface documentation open, with only modest results. It has limited the ability of small companies such as Blue Danube to enter the market successfully. It has slowed the implementation of advanced technologies being developed by innovative companies in the U.S.

Key industry stakeholders are pushing once again to establish an open interface to the radio. The Open Radio Access Network (ORAN) Committee has excellent support in the industry and is working to develop a more robust open interface to the radio. Most significant OEMs participate in this effort, as well as many smaller companies, including Blue Danube. One concern that has already surfaced is the number of "optional" features in the standard. There are many "mandatory" features, but if the committee cannot agree on a feature, it is optional. This practice creates the potential that a vendor could still have a "proprietary" interface to the radio, defeating the goal of open access. Vendors must be required to provide clear and accessible documentation of any feature using the radio interface. It will allow a broader supply chain, more significant innovation, and new business models.

VIII. Conclusion

Blue Danube strongly supports the U.S, roll out of 5G and the need for U.S. technology leadership in 5G. Advanced technology is available in the U.S. Some of this technology is being developed by small companies that need to be supported and helped with standards bodies, patents, and open interfaces. Insecure equipment replacement should include current advanced products and be fully upgradeable to support 5G. Advanced capabilities such as 3D beamforming should be implemented, and all equipment should have open interfaces to the radio equipment or be remotely upgradeable to open interfaces.

This will drive U.S. investment and innovation and allow American companies and investors to develop advanced technology and business models to keep the U.S. leading the world in wireless technology for next-generation 5G broadband networks and beyond.

Respectfully submitted,

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