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Before the
DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, DC 20230
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In the Matter of	)	
	)	
Public Wireless Supply Chain Innovation Fund	)	Docket No. 221202-0260
Implementation	)	RIN 0693-XC05
	)	

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COMMENTS OF SAMSUNG ELECTRONICS AMERICA, INC.

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I.   INTRODUCTION

Samsung Electronics America, Inc. (Samsung) submits these comments in response to the above-captioned Request for Comment (RFC)[1] seeking public input on the implementation of the Public Wireless Supply Chain Innovation Fund (Wireless Innovation Fund), which was established by the CHIPS and Science Act of 2022. Samsung welcomes this opportunity to support the efforts of the National Telecommunications and Information Administration (NTIA) to facilitate the promotion and deployment of open, interoperable, and standards-based radio access networks (RAN) at scale.

Samsung has made major investments in the United States and has become a global leader in 5G, across network equipment, semiconductor chips, mobile devices, services, and planning tools, from a trusted and secure supply chain. As Samsung and others across industry work toward standardizing interoperability in the RAN and beyond, NTIA can support this evolution by advancing a diverse global market of trusted suppliers in the U.S. and allied countries. To promote this global marketplace, NTIA should allow trusted and allied-

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[1] NTIA, *Public Wireless Supply Chain Innovation Fund Implementation*, Request for Comment (Dec. 13, 2022), Docket No. 221202-0260, https://www.federalregister.gov/documents/2022/12/13/2022-26938/public-wireless-supply-chain-innovation-fund-implementation.

headquartered entities with significant U.S. presence to compete for funding for projects as well as to partner on projects. In order to accelerate the adoption of Open RAN, NTIA should prioritize funding projects for integration, pilots, trials, and deployments.

II.   SAMSUNG'S 5G, OPEN RAN, AND VIRTUALIZED RAN LEADERSHIP

Samsung continues to be an instrumental contributor and partner in the U.S. effort to rapidly deploy 5G – including important advances in Open RAN and virtualized RAN (vRAN). Samsung provided equipment for the launch of Verizon 5G Home, a fixed wireless broadband offering that launched in October 2018 as the world's first commercial 5G service.[2] In September 2020, Samsung and Verizon signed a five year, $6.6 billion strategic agreement to supply network equipment and services for Verizon's next-generation network.[3] Our 5G equipment for Verizon, which is fully virtualized (vRAN) using commercial off-the-shelf (COTS) servers, is now operational in markets around the country.[4] Last May, we announced an agreement with DISH to supply 5G Open RAN equipment.[5] That agreement involves over $1 billion of radio units and software and supports all of DISH's low-band and mid-band spectrum. In October, Samsung announced a contract with Comcast to supply 5G RAN gear to power their

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[2] Press Release, Samsung, *Samsung Supports Verizon's 5G Home Launch with 5G End-to-End Solutions* (Sept. 13, 2018), https://news.samsung.com/us/samsung-supports-verizons-5g-home-launch-5g-end-end-solutions/.

[3] Press Release, Samsung, *Samsung Electronics Announces Third Quarter 2020 Results* (Oct. 29, 2020), https://news.samsung.com/global/samsung-electronics-announces-third-quarter-2020-results.

[4] Press Release, Samsung, *Verizon Starts C-Band Equipment Deployment* (April 21, 2021), https://www.samsung.com/global/business/networks/insights/press-release/0419-verizon-starts-c-band-equipment-deployment/.

[5] Press Release, Samsung, *DISH Wireless Selects Samsung Electronics for 5G Open Radio Access Network Rollout* (May 3, 2022), https://www.samsung.com/global/business/networks/insights/press-release/0502-dish-wireless-selects-samsung-electronics-for-5g-open-radio-access-network-rollout/.

5G buildout.[6] We also have partnerships to supply 5G equipment to AT&T[7] and U.S. Cellular.[8] Globally, Samsung is supplying 5G network equipment to major carriers in key markets like Korea, Japan, Canada, New Zealand, India, and the UK.

Samsung manufactures mmWave modem chips for our 5G equipment at Samsung Austin Semiconductor in Austin, Texas. Our telecom R&D center in Plano, Texas, has been one of the leading centers for 5G research and development and is now working on 6G. Our commitment to R&D has led to a strong patent position in 5G and resulted in Samsung's becoming the U.S. patent leader in 2022 for new innovations and inventions.[9]

Samsung has long been a supplier of traditional purpose-built RAN equipment, and we are now also a leading and disruptive innovator committed to delivering vRAN and Open RAN equipment that aligns to the needs of our customers. In fact, Dell'Oro Group's 2022 Second Quarter report names Samsung the world's top Open RAN supplier.[10] Samsung is the only major vendor with experience in the stages and processes of wide-scale vRAN/Open RAN commercial deployment with Tier One operators in North America (U.S.- DISH and Verizon), Europe (U.K.-

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[6] Press Release, Samsung, *Samsung Tapped to Support Comcast's 5G Connectivity Efforts* (Sept. 22, 2022), https://www.samsung.com/global/business/networks/insights/press-release/0921-samsung-tapped-to-support-comcasts-5g-connectivity-efforts/.

[7] Press Release, Samsung, *AT&T Selects Samsung as a Technology Supplier for CBRS and 5G Initiatives* (Sept. 10, 2018), https://news.samsung.com/us/att-selects-samsung-technology-supplier-cbrs-5g-initiatives/.

[8] Press Release, Samsung, *U.S. Cellular Selects Samsung 5G and 4G LTE Network Solutions* (Feb. 21, 2020), https://news.samsung.com/us/us-cellular-selects-samsung-5g-4g-lte-network-solutions/.

[9] John Koetsier, *Samsung Beats IBM, Apple, Intel, Google For 2022 Patent Crown; 56% Of U.S. Patents Go To Foreign Firms* (Jan. 26, 2023), https://www.forbes.com/sites/johnkoetsier/2023/01/14/samsung-beats-ibm-apple-intel-google-for-2022-patent-crown-56-of-us-patents-go-to-foreign-firms/?sh=4acd5e2e1891.

[10] Press Release, Dell'Oro Group, *Open RAN Crushes Expectations in 1H22, According to Dell'Oro Group; Samsung, Fujitsu, and NEC Are The Top Vendors* (Sept. 8, 2022), https://www.delloro.com/news/open-ran-crushes-expectations-in-1h22/.

Vodafone[11]), and Asia (Japan- NTT Docomo[12] and KDDI[13]). Our vRAN network deployments leverage strong partnerships with U.S. companies like Dell and HPE, who use processor chips from Intel in the computer servers that vRAN software runs on, and software partners like Red Hat and Wind River.[14] We have also established partnerships with other U.S. companies, such as Ciena[15] and Marvell[16], in the effort to accelerate Open RAN and vRAN performance and adoption.

In the standard-setting arena, Samsung is a leader in the O-RAN Alliance. We pioneered cross-vendor RAN fronthaul interoperability – i.e., between the equipment at the top and base of a cell tower - even before the founding of the O-RAN Alliance in 2018 and the subsequent development of O-RAN specifications.

We are among the founders and board members of the Open RAN Policy Coalition (ORPC). The ORPC was formed in May 2020 to support policies and initiatives that will advance the adoption of open and interoperable solutions in the RAN and to promote innovation,

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[11] Press Release, Samsung, *Samsung to Bring Open RAN to Europe with Vodafone UK* (June 14, 2021), https://www.samsung.com/global/business/networks/insights/press-release/0611-samsung-to-bring-open-ran-to-europe-with-vodafone-uk/.

[12] Press Release, Samsung, *Samsung Collaborates With NTT DOCOMO on 5G* (Mar. 22, 2021), https://news.samsung.com/global/samsung-collaborates-with-ntt-docomo-on-5g.

[13] Press Release, Samsung, *KDDI Successfully Turns On the World's First 5G Standalone Open RAN Site Powered by vRAN in Japan* (Feb. 18, 2022), https://www.samsung.com/global/business/networks/insights/press-release/0216-kddi-successfully-turns-on-the-worlds-first-5g-standalone-open-ran-site-powered-by-vran-in-japan/.

[14] Press Release, Samsung, *Samsung Joins Forces with Industry Leaders to Advance 5G vRAN Ecosystem* (Feb. 28, 2022), https://www.samsung.com/global/business/networks/insights/press-release/0228-samsung-joins-forces-with-industry-leaders-to-advance-5g-vran-ecosystem/.

[15] Press Release, Samsung, *Samsung and Ciena Join Forces To Offer 5G Network Solutions* (Oct. 27, 2021), https://news.samsung.com/global/samsung-and-ciena-join-forces-to-offer-5g-network-solutions.

[16] Press Release, Samsung, V*odafone and Samsung Cooperate with Marvell to Accelerate Open RAN Performance and Adoption* (Oct. 25, 2022), https://www.samsung.com/global/business/networks/insights/press-release/1024-vodafone-and-samsung-cooperate-with-marvell-to-accelerate-open-ran-performance-and-adoption/.

spur competition, and expand the supply chain for advanced wireless communications technologies.

III.   STATE OF THE INDUSTRY

The introduction of Open RAN/vRAN is bringing tremendous value to leading operators around the world in areas such as flexibility, scalability, performance, and supplier competitiveness. Both greenfield and brownfield operators are either deploying or considering the deployment of Open RAN/vRAN, but these scenarios differ in the breadth of technical and business evaluations that operators must perform.

For greenfield operators who are building networks from scratch, the initial architectural evaluation is between a traditional purpose-built baseband unit and a virtualized one based on open standards. Axes of evaluation include performance, reliability, and total cost of ownership (TCO). Leading RAN suppliers like Samsung have now demonstrated that vRAN is at parity with a traditional implementation in all three of these axes, although results will of course vary based on factors such as an operator's particular deployment environment and transport availability. Once a greenfield operator has selected a vRAN implementation, there are important questions to be answered around the detailed architecture. For example, the geographic location of different network elements can vary and should be designed optimally. In a 5G vRAN, the baseband functionality is divided into two elements – the virtualized Central Unit (vCU) and virtualized Distributed Unit (vDU). The vDU can be placed at the cell site or in an aggregation hub. The vCU can be co-located with the vDU, placed in a regional data center, or even run from the public cloud. NTIA should consider using the Public Wireless Innovation Fund to assist

operators in making these decisions through lab and field trials, in order to measure the performance and operational efficiency implications of these architectural choices.

Brownfield operators must consider the above factors and two more: (1) the need to minimize impact to their existing customers, and (2) the complexity associated with integrating new Open RAN/vRAN products into an existing infrastructure platform. These operators will require a more exhaustive set of lab tests, field trials, and pilot projects before they can plan the careful introduction of the new technologies at scale. The TCO of Open RAN/vRAN may also be quite different for brownfield operators versus greenfield given the existing, legacy network assets in place and their support for open interfaces. NTIA could advance the pace of Open RAN/vRAN commercial introduction in brownfield networks by supporting testing, trials, and even commercial launch in order to help carriers address these factors.

IV. TECHNOLOGY DEVELOPMENT AND STANDARDS

The existing RAN standards environment, led by 3GPP, O-RAN Alliance, and other industry organizations, is already driving open and interoperable systems into commercial operation with leading operators around the world. As noted above, these systems achieve performance and reliability comparable to that of traditional purpose-built hardware. The O-RAN Alliance, in which Samsung is a leading participant, has established a strong set of technical interface standards thanks to active participation from a wide range of companies, including operators and suppliers. For the most important interface at present, the fronthaul link between radio units and the vDU, industry has coalesced around the Option 7-2x functionality split.[17] The ecosystem of radio and baseband suppliers who support Option 7-2x is growing

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[17] *See* O-RAN Alliance, Specifications, https://www.o-ran.org/specifications (last visited Jan. 26, 2023).

quickly and in a healthy manner. One area of potential risk is that too many other fronthaul specification variants could be approved by the O-RAN Alliance, thereby splintering the ecosystem from achieving wide interoperability. NTIA should therefore support continued development of the Option 7-2x ecosystem and not use its funding in any attempts to second-guess industry by pursuing other fronthaul split options. For other interface standards that are not yet so settled, NTIA could play a valuable role by funding trials and testing to help industry validate technical choices for performance and efficiency.

V. TRIALS, PILOTS, USE CASES, AND MARKET DEVELOPMENT

Widespread deployment of open, interoperable, and virtualized RAN will unlock new use cases that benefit from the flexibility of these new architectures. The software-based implementation of a vRAN makes it possible to move processing easily to the network's edge, add capacity in the cloud, and/or quickly activate slices of the network to meet a specific set of performance criteria for the needs of a subset of the user base. This operational flexibility can enable operators, for example, to bring spot coverage to areas that have been impacted by natural disasters.

In any new Open RAN/vRAN project, RAN suppliers and operators must exercise the new network in a broad range of ways before commercial deployment can take place. This range includes:

- Lab integration testing of the telco server, accelerator card, virtualization software layer, and software network functions

- Initial lab validation of Option 7-2x fronthaul interface across vendors

- Ongoing lab validation of Option 7-2x fronthaul interface when radio or baseband software/firmware/hardware is upgraded

- Lab performance, capacity, and reliability testing of each subsystem and full RAN, including integration with legacy RAN for brownfield operators

- Integration of each RAN component supplier into operator network management system

- Field trial performance, capacity, and reliability testing

- Ongoing field trials as vendors update software/firmware/hardware

- Pilot deployment carrying limited user traffic

Outcomes of these trials must be positive in terms of technical performance, operational manageability, and budget in order to move the program toward commercialization. NTIA can accelerate adoption of O-RAN compliant vRAN technologies by providing support for some or all of the above required testing investments.

VI. SECURITY

Open RAN/vRAN need not increase the vulnerability of 5G networks to attacks by various threat actors, and in some ways it may reduce the vulnerability. Samsung served as a contributor to the FCC Communications Security, Reliability, and Interoperability Council (CSRIC) VIII December 2022 report entitled "Promoting Security, Reliability, and Interoperability of Open Radio Access Network Equipment." We recommend that report to NTIA as a reference on this important topic. Notably, CSRIC VIII found that with the continued evolution of Open RAN, security and reliability continues to be addressed by appropriate

standards groups such as O-RAN Alliance and 3GPP.[18] Given the substantial efforts to strengthen Open RAN security through standards groups, NTIA need not prioritize projects in this area.

VII. PROGRAM EXECUTION AND COLLABORATION

A healthy global supply chain has long been critical to the success of the mobile ecosystem, and this continues to be the case for open and virtualized networks. Aligning on a single set of standards and maximizing the size of the market that can be served by trusted and secure suppliers is the best way to ensure that US consumers have access to high-performing, cost-effective, open, and interoperable wireless networks.

The RFC asks how the Wireless Innovation Fund can ensure that programs promote U.S. competitiveness in the 5G market.[19] However, viewing Open RAN and the Wireless Innovation Fund through a narrow U.S.-only lens would in fact be detrimental to U.S. competitiveness and national security interests. To supply their rapidly developing U.S. domestic 5G and next generation networks, U.S. carriers will need a diversity of trusted, competitive, and innovative suppliers at global scale – including innovative and disruptive multinationals like Samsung that have a large presence in the United States. Samsung's substantial contributions to U.S. competitiveness shows that this concept should not be limited solely to U.S.-headquartered vendors. At the same time, widespread deployment of Open RAN around the world will present beneficial opportunities for a broader range of U.S.-based companies to engage in the global

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[18] Communications Security, Reliability, and Interoperability Council VIII, *Report on Challenges to the Development of ORAN Technology and Recommendations on How to Overcome Them*, at 4 (Dec. 2022), https://www.fcc.gov/file/24520/download.

[19] *RFC* at 76185.

communications marketplace. A competitive global market for the trusted, standards-based ecosystem benefits U.S.-based companies abroad and will serve U.S. economic and security interests much more than siloed national markets. Thus, U.S. policy should expressly advance a diverse, trusted market of suppliers based in the United States and allied countries. Only a global market of trusted suppliers competing to deliver standards-based solutions has the scale and diversity to support a resilient telecom supply chain.

Similarly, NTIA should not impose trusted supply chain sourcing requirements that mandate solely domestic production. The global telecommunication technology supply chain is highly interconnected. Any burdensome "Buy American" sourcing requirements would drastically reduce, if not completely eliminate, NTIA's ability to expeditiously fund meritorious projects that can help accelerate Open RAN deployments from trusted sources.

Additionally, to promote Open RAN most effectively while remaining consistent with the Wireless Innovation Fund's statutory design, applicants should be able to partner on projects. For example, applicant operators should be able to team with trusted vendors when seeking funding, and NTIA should apply the statutory $50 million cap per grant recipient in a project, treating each applicant's activity as a distinct focus area.

III.   CONCLUSION

The market-driven momentum around Open RAN is real, it is strong, and it will continue to expand quickly in commercial networks in response to the demand of carriers. By ensuring that trusted and allied vendors are eligible to participate and focusing on impactful projects, NTIA's Wireless Innovation can supercharge the adoption and deployment of Open RAN at scale.

Respectfully submitted,

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