Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Promoting the Deployment of 5G Open Radio Access Networks	)	GN Docket No. 21-63
	)	
	)	

COMMENTS OF T-MOBILE USA, INC.

Steve B. Sharkey
John Hunter
Christopher Wieczorek

T-MOBILE USA, INC.
601 Pennsylvania Avenue, N.W.
Suite 800
Washington, DC 20004
(202) 654-5900

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T-Mobile USA, Inc. ("T-Mobile")[1/] submits these comments in response to the Notice of Inquiry ("*NOI*") in the above-referenced proceeding that seeks information on the status of Open Radio Access Networks ("Open RAN").[2/] While Open RAN may hold promise, its timing, implementation and deployment should be industry-driven and not the result of regulatory mandates. Indeed, some open interface technologies have already been developed by industry-based standards organizations and are in use. But additional issues remain for industry to resolve before Open RAN can be more widely deployed. Departing from the successful long-standing policy on technology neutrality by imposing any regulatory obligations will potentially freeze immature technology in place instead of permitting the natural technological evolution that has created the current world-class U.S. wireless networks.

I. INTRODUCTION AND SUMMARY

The potential use of networks that take advantage of Open RAN architecture has generated significant interest. T-Mobile therefore recognizes the value in the Commission

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1/ T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company. T-Mobile and Sprint are now one company operating under the name T-Mobile. The merger closed on April 1, 2020.

2/ *See Promoting the Deployment of 5G Open Radio Access Networks*, Notice of Inquiry, FCC 21-31 (rel. Mar. 18, 2021) ("*NOI*").

initiating this proceeding to assess whether and how the deployment of Open RAN can advance Commission goals and bring value to American consumers. As T-Mobile has observed elsewhere, there can be benefits to open network architectures.[3/] They can, for instance, create a larger and more diverse product ecosystem, increase competition and reduce the over-reliance on any one vendor – particularly vendors that the U.S. has found pose significant national security risks.[4/] They can also promote vendor diversity and potentially create price and feature competition.

However, just as it has historically taken a hands-off approach to technology specifications in general, the Commission should not mandate the use of Open RAN networks in particular. Technology mandates freeze development and stifle innovation. Rather than choose technology winners and losers, the Commission should permit Open RAN systems to naturally develop as an outgrowth of existing and future industry-driven activities, including those in which 3GPP is engaged. The U.S. government can appropriately encourage those activities by funding research and development without mandating particular outcomes. It can also facilitate the current and future use of test beds by making unallocated spectrum available.

That approach is particularly appropriate here, as Open RAN systems are in their formative stages and have shortcomings that must be overcome by industry. Imposing Open RAN obligations may also increase burdens on operators, particularly smaller providers, including Universal Service Fund and rip-and-replace support recipients who may be unprepared

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3/ *See* Comments of T-Mobile USA, Inc., NTIA, 5G Challenge Notice of Inquiry, Docket No. 210105-0001, RIN 0660-XC049 (filed Feb. 10, 2021).

4/ *See Protecting Against National Security Threats to the Communications Supply Chain Through FCC Programs – Huawei Designation*, Memorandum Opinion and Order, 35 FCC Rcd 14435 (2020); *Protecting Against National Security Threats to the Communications Supply Chain Through FCC Programs – ZTE Designation*, Memorandum Opinion and Order, 35 FCC Rcd 13146 (2020).

to create a network from Open RAN components.[5/] Further, while implementation of Open RAN may ultimately be feasible in "greenfield" deployments, deployment of Open RAN in existing networks will be challenging. Finally, while intended to decrease security risks, Open RAN may do the opposite. All of these issues require further industry development – not Commission mandates – before providers implement Open RAN on a wide-scale basis.

II. THE COMMISSION SHOULD PRESERVE TECHNOLOGY OPTIONS

The Commission seeks comment on whether it should enact rules to promote Open RAN systems.[6/] Specifically, it seeks comment on the role the Commission should have in the promotion, development, and testing of Open RAN equipment and whether the pace of Open RAN adoption should influence policies the Commission adopts.[7/] It also asks whether regulatory intervention would ease any costs or barriers to adoption and whether it should make changes to its rules to ensure that they remain technologically and competitively neutral.[8/]

The Commission should take a "hands off" approach to Open RAN, neither mandating its use nor attempting to facilitate its development by regulatory fiat. The Commission has historically refrained from requiring the use of particular technologies and has consistently

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5/ *See* 47 C.F.R. § 54.9.

6/ *See NOI* ¶ 60.

7/ *See id.* ¶¶ 34, 64.

8/ *See id.* ¶¶ 35, 71.

structured its rules to be technology and service neutral.[9/] As the Commission has recognized,[10/] adopting strict technology mandates "could undermine operator flexibility . . . , especially as use-cases and technologies change over time."[11/] In contrast, a hands-off approach facilitates the development of new, innovative technologies and services. This approach has led to the world-class wireless networks that characterize the U.S. telecommunications ecosystem.[12/]

While industry-driven Open RAN may promote a flexible multi-vendor environment that is capable of evolving over time, the precise opposite may occur if the Commission specifies how Open RAN should be implemented. Commission involvement in Open RAN would likely mean the specification of RAN interfaces. But any government-led specification is difficult to change, and once-current Open RAN interfaces may become outdated and frozen in place. That

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9/ *See, e.g.*, *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852, ¶ 225 (2020) ("The Commission has historically adopted rules that are technologically neutral and remains committed to this policy."); *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959, ¶ 228 (2015) (explaining that the Commission's "longstanding policies promot[e] technological neutrality and competition in emerging bands"); *Expanding Access to Broadband and Encouraging Innovation Through Establishment of an Air-Ground Mobile Broadband Secondary Service for Passengers Aboard Aircraft in the 14.0-14.5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd 6765, ¶ 101 (2013) (stating that the Commission "strive[s] to establish technology neutral rules that allow for competing technologies and changes in technology over time without the need to change our rules").

10/ *See, e.g.*, *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Proposed Modification, 35 FCC Rcd 2343, ¶ 75 (2020) (declining to adopt a strict coordination mandate in the C-band); *Facilitating Shared Use in the 3100-3550 MHz Band*, Second Report and Order, Order on Reconsideration, and Order of Proposed Modification, FCC 21-32, ¶ 67 (rel. March 18, 2021) (declining to adopt a strict coordination mandate in the 3.45-3.55 GHz band) ("*3.45-3.55 GHz Order*").

11/ *3.45-3.55 GHz Order* ¶ 67.

12/ Indeed, U.S. 5G speeds are among the fastest in the world, and the U.S. is "the largest country with three nationwide 5G networks." CTIA, BUILDING THE 5G ECONOMY 6 (Jan. 2021), https://api.ctia.org/wp-content/uploads/2021/01/2021-Wireless-Briefing-2_2.pdf ("CTIA Building the 5G Economy Report"). Over the last year alone, in the wake of COVID-19, U.S. telecommunications networks have connected 2.4 million students as they began learning from home for the first time, and carriers strengthened their networks, increasing median wireless speeds in the U.S. nearly 50 percent. *See* Meredith Attwell Baker, *Wireless in the Time of COVID-19*, CTIA BLOG (Mar. 15, 2021), https://www.ctia.org/news/blog-wireless-in-the-time-of-covid-19.

will ultimately disadvantage consumers and put U.S.-based firms at a competitive global disadvantage.

In addition, mandating use of specific interfaces inside the RAN would reduce flexibility for providers and equipment vendors, which could lead to reduced performance and less effective use of scarce spectrum resources. And if the government changes the required mandated interface, it may produce stranded investment, which will be particularly burdensome for small providers.[13/] The Commission should avoid these costs and complications by allowing providers to migrate to new technologies when marketplace forces dictate, not when the government changes a technology mandate.

Finally, if the Commission adopts Open RAN specifications that deviate from what is being deployed today, that may weaken trusted vendors that do not conform to those specifications on which providers rely today. That, in turn, will *reduce*, not strengthen, supplier diversity.

In any case, any Open RAN mandate may be seeking to address a problem that is not as meaningful as the Commission assumes. Importantly, the equipment that providers purchase from network equipment vendors is just a fraction of the total cost of building and operating a network.[14/] Other implementation costs incurred by providers include labor, power, backhaul,

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13/ Even with government support for that effort, in the context of implementing a Congressional mandate, directing the removal and replacement of equipment has required the Commission to adopt complicated rules and a reimbursement program. *See Protecting Against National Security Threats to the Communications Supply Chain Through FCC Programs*, Report and Order, Further Notice of Proposed Rulemaking, and Order, 34 FCC Rcd 11423 (2019); *Protecting Against National Security Threats to the Communications Supply Chain Through FCC Programs*, Second Report and Order, 35 FCC Rcd 14284 (2020); *Protecting Against National Security Threats to the Communications Supply Chain Through FCC Programs*, Third Further Notice of Proposed Rulemaking, FCC 21-26 (rel. Feb. 17, 2021).

14/ *See* Joe Madden, *Industry Voices-Madden: Is ORAN Really Cheaper?*, FIERCEWIRELESS (Sept. 17, 2020 10:20 AM), https://www.fiercewireless.com/tech/industry-voices-madden-oran-really-cheaper ("ORAN does not provide the performance of a 'vendor optimized' network in a high-density

site lease, and spectrum costs. Any reductions in equipment cost may be so insignificant as to be meaningless to consumer costs, but will complicate and likely slow network implementation.

III. ANY OPEN NETWORK SPECIFICATIONS SHOULD BE DEVELOPED BY INDUSTRY

The Commission seeks comment on how it can harness industry experts to better understand any regulatory constraints impeding Open RAN deployment and the most appropriate regulatory approach for Open RAN deployments moving forward.[15/] The Commission also seeks comment on the state of domestic Open RAN deployments, the factors that are limiting or discouraging Open RAN deployments, and what the Commission, federal partners, industry, or others can do to address and resolve these concerns.[16/]

Instead of implementing a government-directed Open RAN approach, the Commission should permit industry to develop and implement open interfaces. T-Mobile is not aware of any regulatory constraints on that development and implementation. The wireless industry has historically invested hundreds of billions of dollars to build and continually upgrade wireless networks. Since 2010, the wireless industry has invested over $286 billion in wireless networks.[17/] And over the past four years, the wireless industry has invested over $100 billion in U.S. 5G deployment – $29 billion of which was invested in 2020 alone, exceeding investments made by the Nation's global 5G rivals.[18/] By 2030, 5G deployment in the U.S. will add between

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environment. When we apply our cost models . . . we find that ORAN networks are actually more expensive than a single-vendor scenario.").

15/ *See NOI* ¶ 60.

16/ *See id.* ¶ 27.

17/ *See* CTIA, 2020 ANNUAL SURVEY HIGHLIGHTS 2 (Aug. 2020), https://api.ctia.org/wp-content/uploads/2020/08/2020-Annual-Survey-final.pdf.

18/ *See* CTIA Building the 5G Economy Report at 17-18.

$1.4-1.7 trillion to the country's gross domestic product, and it will create between 3.8-4.6 million jobs.[19/]

Providers will always seek the best cost/performance ratio when considering network solutions, and multiple providers – including T-Mobile – operate a multi-vendor end-to-end network today. They should therefore be entrusted with developing any useful technology features for Open RAN. In fact, the wireless industry is already implementing open network architectures. Just as it has already invested hundreds of billions of dollars in technology development generally, the wireless industry, with 3GPP, has developed protocols and standards for mobile services that include open interfaces for that technology.[20/] 3GPP standards enable multi-vendor deployments across different sites and multi-vendor deployments by different vendors on the same site, promoting network interoperability.[21/] 3GPP has also specified several open interfaces, like the F1 interface between a distributed unit and central unit in the RAN, which is the primary interface for 5G RAN architecture.

Similarly, while, as discussed in further detail below, the O-RAN ALLIANCE's open radio access network standards and specifications are still being developed, that organization has also been evaluating specifications that complement 3GPP standards by defining interface

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19/ *See* BOSTON CONSULTING GROUP, 5G PROMISES MASSIVE JOB AND GDP GROWTH IN THE U.S. 5 (2021), https://api.ctia.org/wp-content/uploads/2021/01/5G-Promises-Massive-Job-and-GDP-Growth-in-the-US_Feb-2021.pdf.

20/ *See* Rene Summer, *Mobile Radio Access Networks: What Policy Makers Need to Know*, ERICSSON BLOG (Sept. 17, 2020), https://www.ericsson.com/en/blog/2020/9/ran-what-policy-makers-need-to-know ("Ericsson Mobile Radio Access Networks Blog").

21/ *See id.*; *see also* Remarks of Commissioner Geoffrey Starks at the FCC & NCSC National Supply Chain Integrity Joint Workshop, at 2 (Apr. 26, 2021), https://docs.fcc.gov/public/attachments/DOC-371914A1.pdf (noting that it is critical that Open RAN vendors participate in organizations like 3GPP "so security protocols become standard" and because "a single network may now have equipment and software from multiple vendors").

profiles, additional new open interfaces, and new nodes.[22/] Accordingly, in addition to being contrary to Commission precedent, imposition of Commission-mandated Open RAN standards is unnecessary – they are being developed and deployed by industry today.

While industry should develop any protocols that lead to Open RAN interfaces, the government can have a role to play in advancing technology development. It can, for example, help fund private research and development efforts that can lead to industry-led protocols. That is precisely what the Endless Frontier Act envisions.[23/] The Endless Frontier Act would strengthen U.S. innovation by increasing funding for research conducted by the National Science Foundation and establish university technology centers and regional technology hubs to advance American competitiveness in technology.[24/] The Commission can also assist by making spectrum available for test beds that evaluate network interfaces, whether funded through government programs, as envisioned by the Endless Frontier Act, or by other industry groups.

IV. BEFORE THERE IS FULL USE OF OPEN RAN INTERFACE TECHNOLOGY, ADDITIONAL ISSUES MUST BE ADDRESSED BY INDUSTRY

The Commission seeks comment on the extent to which Open RAN would address supply chain risk management and promote the deployment of safe and reliable networks.[25/] The Commission also asks whether Open RAN architecture would introduce security risks that would

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22/ *See* Ericsson Mobile Radio Access Networks Blog.

23/ *See* Endless Frontier Act, S. 1260, 117th Cong. (2021); Endless Frontier Act, H.R. 2731, 117th Cong. (2021).

24/ *See id.*

25/ *See NOI* ¶ 40.

not exist in a more closed architecture.[26/] In addition, the Commission asks whether the potential benefits of Open RAN can be found only in a greenfield deployment.[27/]

Relying on industry-driven features are particularly important in the context of Open RAN because these and many other important issues remain unresolved. As 5G Americas points out, "Open RAN architecture is still evolving and realistic expectations should be considered on the time frame Open RAN can be realized."[28/] Because implementation of Open RAN by industry is still years away, any regulatory mandate would be premature. Indeed, some estimate that it will take several more years for the O-RAN ALLIANCE's open radio access network standards and specifications (collectively "O-RAN") to be fully deployed.[29/] T-Mobile and other providers have confirmed this observation.[30/] During the FCC's Forum on 5G Open Radio Access Networks, for example, Verizon and AT&T expressed concerns about the timing of its adoption.[31/] Noting that '"O-RAN is still developing specifications,"' a representative from AT&T explained that O-RAN would be "gradual[ly] introduc[ed]" into AT&T's existing

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[26/] *See id.* ¶ 51. Specifically, it seeks comment on whether Open RAN would cause a network to become more vulnerable to cyber threats in comparison to a traditional mobile network. *See id.* ¶ 53.

[27/] *See id.* ¶ 58.

[28/] 5G AMERICAS, TRANSITION TOWARD OPEN & INTEROPERABLE NETWORKS 27 (Nov. 2020), https://www.5gamericas.org/wp-content/uploads/2020/11/InDesign-Transition-Toward-Open-Interoperable-Networks-2020.pdf.

[29/] *See* Diana Goovaerts, *Blog: North American Operators Opine on Open RAN*, MOBILE WORLD LIVE (Dec. 16, 2020), https://www.mobileworldlive.com/blog/blog-north-american-operators-opine-on-open-ran (noting that Open RAN specifications in the U.S. have not yet matured).

[30/] *See, e.g.*, Monica Alleven, *AT&T Moves Forward on Open RAN While T-Mobile Takes Cautious Approach: Special Report*, FIERCEWIRELESS (Nov. 25, 2020, 9:00 AM), https://www.fiercewireless.com/wireless/at-t-moves-forward-open-ran-while-t-mobile-takes-cautious-approach-special-report#:~:text=T-Mobile's%20President%20of%20Technology,to%20when%20things%20go%20wrong.&text=%E2%80%9CWith%20an%20open%20approach%20you,system%20integrator%2C%E2%80%9D%20Mansfield%20said.

[31/] *See* Sean Kinney, *AT&T and Verizon Call Out Scale, Maturity and Integration as Open RAN Challenges*, RCR WIRELESS (Sept. 21, 2020), https://www.rcrwireless.com/20200921/open_ran/att-and-verizon-scale-maturity-integration-are-open-ran-challenges.

network.[32/] A representative from Verizon likewise explained that as "an early adopter" of O-RAN, Verizon is "at the first step" of incorporating the technology into its network.[33/]

Fully deployed Open RAN-based mobile networks in the U.S. in the near-term are only speculative at best. While the Commission cites to DISH's proposed plans for an Open RAN-based 5G broadband network,[34/] it must recognize the nascent stage of development of DISH's network. In fact, to date, DISH has only conducted a test of the network using O-RAN-compliant radios from its vendor, MTI.[35/] Even Rakuten, to which the Commission cites as "one of the first companies to utilize Open RAN as part of its new fully virtualized cloud network,"[36/] has experienced the challenges of Open RAN implementation. Rakuten has faced network deterioration, slow subscriber growth, and poor performance.[37/]

Open RAN is not ready for full commercial deployment for several reasons. For example, methods must be developed for implementing regulatory mandates, like 911, across a multi-vendor environment. Moreover, while Open RAN may be feasible in "greenfield" networks, it may not be possible to implement the technology in existing "brownfield" networks, where deployed RAN components were not intended to operate in a multi-vendor environment. And it is likely to be more costly to do so.[38/] Many network operators have already deployed 5G

32/ *See id.*

33/ *See id.*

34/ *See NOI* ¶ 27.

35/ *See* Linda Hardesty, *Dish Tests 5G O-RAN Radios from Obscure Vendor MTI*, FIERCEWIRELESS (Dec. 8, 2020, 1:00 PM), https://www.fiercewireless.com/operators/dish-tests-5g-o-ran-radios-from-obscure-vendor-mti.

36/ *See NOI* ¶ 29.

37/ Matt Kapko, *Rakuten Challenges Portend Trouble for Dish Network*, SDX CENTRAL (Jan. 23, 2021, 8:00 AM), https://www.sdxcentral.com/articles/news/rakuten-challenges-portend-trouble-for-dish-network/2021/01/.

38/ Naima Hoque Essing *et al*., *The Next Generation Radio Access Network: Open and Virtualized RANs are the Future of Mobile Networks - Technology, Media, and Telecommunications Predictions*

networks in the U.S. that are tightly integrated with 4G networks. These systems are typically not based on or compatible with Open RAN standards. Providers that switch to Open RAN would be required to replace existing equipment, which significantly increases the overall burdens and cost of Open RAN deployment.[39/] Additionally, for Open RAN deployment, providers may need more *total hardware* for the same functionality, and they may need to build more network nodes.

Any Open RAN implementation must also address the especially impactful burdens on smaller and rural providers. In addition to the costs associated with equipment upgrades or replacement, there are ongoing costs and risks related to Open RAN implementation. Traditional one-provider RANs require operators to designate a single vendor responsible for network integration. But a multi-vendor environment places burdens on operators to ensure interoperability and perform integration. Different product lifecycles are also produced. Vendor fragmentation resulting from integration challenges may cause network operation, performance, and security inconsistencies given that certain features may be supported by one vendor but not by another. Open RAN deployments will require providers to coordinate and develop multiple feature roadmaps and make multiple choices regarding the different options available from vendors for different parts of the RAN. Many operators, particularly smaller and rural providers, are not currently equipped to conduct this type of coordination and analysis. Imposing Open RAN obligations on those providers, most of which are directly affected by the "rip and replace" requirement, now will only add to implementation issues. As Commissioner Starks recently

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2021, DELOITTE (Dec. 7. 2020), https://www2.deloitte.com/xe/en/insights/industry/technology/technology-media-and-telecom-predictions/2021/radio-access-networks.html (noting that most of the studies that conclude that O-RAN can reduce capex and opex cite Rakuten, which operates in a greenfield environment).

39/ *Id.*

observed, rural carriers need assistance to shift from their legacy network equipment to Open RAN without disrupting service and cannot afford to experiment, particularly with federal dollars.[40/]

Finally, in addition to recognizing the potential *benefits* of Open RAN to network security,[41/] the Commission should recognize that Open RAN may, in fact, create *security risks*. Open networks are more prone to cyber security threats because they introduce additional interfaces, additional functions, and functional splits, which expand the surface for potential threats. The fact that Open RAN relies on open source software increases the number of potential entry points for security breached. Moreover, there is no overall security assessment or requirement – whatever security mechanism exists are distributed and may not effectively flow through a network. Because industry groups will work to address all of these issues over time, a government mandate to impose Open RAN at this time is not appropriate

V. CONCLUSIONS

While the Commission's consideration of open network architectures, specifically Open RAN, may be responsive to ongoing technology development, the Commission must impose no mandates. Instead, service providers must be allowed to continue to choose technology and architecture that best suits their needs and the industry should be permitted to continue its work on, and implementation of, Open RAN as issues relevant to its deployment are addressed.

40/ *See* Remarks of Commissioner Geoffrey Starks at the FCC & NCSC National Supply Chain Integrity Joint Workshop, at 2 (Apr. 26, 2021), https://docs.fcc.gov/public/attachments/DOC-371914A1.pdf.

41/ *See NOI* ¶ 2.

Respectfully submitted,

/s/ *Steve B. Sharkey*

Steve B. Sharkey
John Hunter
Christopher Wieczorek

T-MOBILE USA, INC.
601 Pennsylvania Avenue, N.W.
Suite 800
Washington, DC 20004
(202) 654-5900

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