Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, DC 20230

In the Matter of	)	
	)	
Development of a National Spectrum Strategy	)	Docket No. 230308-0068
	)	
	)	

COMMENTS OF T-MOBILE USA, INC.

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T-Mobile USA, Inc. ("T-Mobile")[1/] submits these comments in response to the above-referenced Request for Comments issued by the National Telecommunications and Information Administration ("NTIA") on the development and implementation of a National Spectrum Strategy ("NSS").[2/] T-Mobile applauds NTIA's initiation of the process to develop an NSS. As NTIA observes, access to more spectrum will help the U.S. continue to lead the world in advanced technology and enhance U.S. national and economic security.[3/] The most critical part of the NSS should be the identification of spectrum bands that can be repurposed for commercial wireless services on a high-power, exclusive-use basis.

I. INTRODUCTION AND SUMMARY

Commercial mobile services continue to be the backbone of our Nation's wireless ecosystem. Providers' ability to expand their wireless networks to accommodate ever-growing demands relies on spectrum being made exclusively available for high-power use. In contrast, an over-reliance on sharing repurposed spectrum will not allow the U.S. to continue its world leadership. That is especially true if a sharing framework relegates a commercial wireless

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1/ T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

2/ *See Development of a National Spectrum Strategy*, Request for Comments, NTIA, 88 Fed Reg. 16244 (Mar. 16, 2023) ("Request for Comments").

3/ *See id*. at 16245.

provider to what is effectively a secondary spectrum user – permitting the provider to access spectrum only some of the time and only in some parts of the country.

T-Mobile therefore encourages NTIA to focus the NSS on clearing and repurposing spectrum and implementing a clear timeline to refill the spectrum pipeline. NTIA should particularly focus its evaluation on spectrum bands that can be combined with existing commercial wireless networks, including the 3.1-3.45 GHz ("Lower 3 GHz") band, the 4.4-4.94 GHz ("4 GHz") band, and the 7.125-8.4 GHz ("7/8 GHz") band.

If a framework is nonetheless implemented for Federal and non-Federal spectrum sharing, it must meaningfully supplement commercial wireless networks – meaning that the spectrum is available most of the time for commercial use with the maximum amount of power and geographic coverage possible. Similarly, any use of "spectrum management technologies," like an incumbent informing capability ("IIC"), must accommodate the use of high-power, exclusive-use spectrum by wireless carriers. Further, Federal entities must work proactively with non-Federal entities to raise any concerns in a timely manner.

II. THE NSS MUST IDENTIFY ADDITIONAL SPECTRUM FOR REPURPOSING TO SATISFY CURRENT AND FUTURE DEMAND

A. Commercial Wireless Providers Need Additional Spectrum to Meet Increasing Consumer Demand

To inform its development of a spectrum pipeline, NTIA seeks comment on the projected future spectrum requirements for commercial wireless networks.[4/] Specifically, it asks if the amount of spectrum available now for commercial wireless networks will be sufficient to deliver

4/ *See id*.

current or future services.[5/] NTIA also asks if the NSS should be informed by the work performed by standards-setting bodies.[6/]

Opening additional spectrum bands for commercial wireless services must be a national priority. It is well-documented that the U.S. was the leader in making spectrum available for 4G networks.[7/] Doing so allowed the U.S. to be the worldwide wireless economic and technological leader that it is today. In order to continue to replicate that success, additional spectrum must be available for future generations of wireless networks.

Americans increasingly rely on wireless networks to access the internet, which, in turn, allows them to learn, work, access health care, and connect with loved ones remotely. The COVID-19 pandemic has accelerated a permanent shift for many Americans who now engage in many everyday activities remotely.[8/] For example, 53.6 percent of subscribers to the FCC's Affordable Connectivity Program have subscribed to mobile broadband.[9/] Cisco found that by the end of this year, 70 percent of the global population will have mobile network based connectivity.[10/] That means that spectrum requirements will continue to expand. Indeed, Compass Lexecon recently reported that mobile data traffic in the U.S. grew nearly 50-fold from

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5/ *See id*.

6/ *See id*.

7/ *See, e.g.*, Recon Analytics, *How America's 4G Leadership Propelled the U.S. Economy* (2018), https://api.ctia.org/wp-content/uploads/2018/04/Recon-Analytics_How-Americas-4G-Leadership-Propelled-US-Economy_2018.pdf; Press Release, *North America Region a World Leader in 4G and Smartphone Adoption, According to New GMSA Report*, GMSA (Sept. 12, 2017), https://www.gsma.com/newsroom/press-release/north-america-region-world-leader-4g-smartphone/.

8/ *See Communications Marketplace Report*, 2022 Communications Marketplace Report, FCC 22-103, ¶ 420 (rel. Dec. 30, 2022).

9/ *See Additional ACP Data*, USAC, https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/additional-acp-data/ (last visited Apr. 17, 2023).

10/ *See* Cisco, *Annual Internet Report (2018-2023)*, at 5 (2020), https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.pdf.

867 billion megabytes ("MB") in 2011 to over 42 trillion MB in 2020.[11/] And it is estimated that by 2027, consumers will use nearly 240 trillion MB of data.[12/]

T-Mobile is working hard to meet these evolving and expanding consumer demands. Its 5G network is enabling applications across nearly all sectors of the U.S. economy, including agriculture, healthcare, manufacturing, public safety, and transportation.[13/] T-Mobile's 5G network is also making new advancements in business and technology development. For example, last year, T-Mobile collaborated with Pano AI – a disaster preparedness technology solutions provider – and Portland General Electric to deploy an artificial intelligence platform that detects a wildfire in its earliest stages.[14/] Because of this 5G-enabled platform, firefighters are alerted to wildfires within minutes, allowing them to control and contain fires before they spread.[15/] All of these innovative applications require significant spectrum resources.

T-Mobile is also finding new and innovative ways to use its network and spectrum resources to meet customer demands. Fixed wireless access services, which use the same spectrum as mobile networks, will also continue to grow. In 2022, fixed wireless access services

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11/ *See* Aren Megerdichian, Ph.D., *The Importance of Licensed Spectrum and Wireless Telecommunications to the American Economy*, COMPASS LEXECON, at 9 (2022), https://api.ctia.org/wp-content/uploads/2022/12/Compass-Lexecon-Licensed-Spectrum-Report.pdf ("Compass Lexecon Report").

12/ *See* CTIA, *2022 CTIA Annual Survey Highlights*, at 4 (Sept. 13, 2022), https://www.ctia.org/news/2022- annual-survey-highlights.

13/ *See, e.g.*, Press Release, *Lucid Drone Technologies Taps T-Mobile to Power Commercial Cleaning Drones*, T-MOBILE (Apr. 25, 2022), https://www.t-mobile.com/news/network/lucid-drone-technologies-taps-t-mobile; *AR/VR Heartland Developer Challenge Demo*, T-MOBILE (Mar. 10, 2022), https://www.t-mobile.com/news/network/ar-vr-heartland-challenge; *5G Sets the Pace at Autonomous Racecar Competition*, T-MOBILE (Jan. 12, 2022), https://www.t-mobile.com/news/network/5g-sets-the-pace.

14/ *See* Press Release, *Fighting Fire with 5G, T-Mobile 5G Powers Pano AI Wildfire Detection System*, T-MOBILE (Sept. 21, 2022), https://www.t-mobile.com/news/network/t-mobile-5g-powers-pano-ai-wildfire-detection-system.

15/ *See id*.

accounted for 90 percent of new broadband internet subscribers in the U.S.[16/] T-Mobile has been leading the way in this space, providing fixed wireless home broadband services that have brought true competition to market. Its 5G Home Internet, which currently has over two million subscribers and is available to more than 40 million homes across the country and businesses nationwide, has provided a much-needed alternative to the offerings from traditional internet service providers, driving down prices and increasing quality.[17/] To continue to support consumer and business requirements, additional spectrum capacity is also needed to meet the demand for this growing service.[18/]

T-Mobile has also agreed to lease spectrum to Space Explorations Holdings, LLC to allow it to transmit on T-Mobile's nationwide PCS G Block spectrum.[19/] This arrangement will result in novel direct-to-cellular capabilities that will allow T-Mobile's wireless subscribers to use their phone to access satellite service in areas where terrestrial networks are unavailable. As

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16/ *See* Press Release, *About 3,500,000 Added Broadband From Top Providers in 2022*, LEICHTMAN RESEARCH GROUP (Mar. 2, 2023), https://www.leichtmanresearch.com/about-3500000-added-broadband-from-top-providers-in-2022/. By the end of 2028, there are expected to be over 300 million fixed wireless access connections worldwide. *See* Ericsson, *Mobility Report*, at 13 (Nov. 2022), https://www.ericsson.com/4ae28d/assets/local/reports-papers/mobility-report/documents/2022/ericsson-mobility-report-november-2022.pdf.

17/ *See 2022 The State of Fixed Wireless Access*, T-MOBILE, https://www.t-mobile.com/news/_admin/uploads/2022/12/2945098_CCD_State-of-Fixed-Wireless-Access_Infographic-Report_REVW_v19_RGB-2.pdf.

18/ *See* Rysavy Research, LLC, *5G Mid-Band Spectrum: The Benefits of Full Power, Wide Channels, and Exclusive Licensing*, at 6 (2022), https://api.ctia.org/wp-content/uploads/2022/11/Rysavy-5G-Midband-Spectrum.pdf ("Rysavy Report").

19/ *See* Application for Modification of Space Exploration Holdings LLC, IBFS File No. SAT-MOD-20230207-00021 (filed Feb. 7, 2023); Description of Transaction and Public Interest Statement, FCC Form 608, Space Exploration Technologies Corp., ULS File No. 0010303032 (filed Dec. 6, 2022), *amended by* Amended Description of Transaction and Public Interest Statement, FCC Form 608, Space Exploration Holdings, LLC, ULS File No. 0010303032 (filed Feb. 7, 2023); *see also* News Release, *T-Mobile Takes Coverage Above and Beyond With SpaceX*, T-MOBILE (Aug. 25, 2022), https://www.t-mobile.com/news/un-carrier/t-mobile-takes-coverage-above-and-beyond-with-spacex.

the wireless industry continues to respond to innovative use cases, it will extend the virtuous cycle of continued network demands for spectrum.

New generations of wireless technology will also certainly prompt the development of applications that create even more demand on wireless networks.[20/] Today's 5G networks, for example, "connect 100x more devices" than 4G, "driv[ing] more data use."[21/] In fact, T-Mobile's 5G customers are using over 2.3 times as much data as an LTE customer.

Developing a spectrum pipeline should be informed principally by the type of demand analyses noted above. While NTIA asks about the role that standards-setting bodies may have in the development of the pipeline, those entities typically react to, and do not drive, wireless providers' anticipated spectrum needs. Therefore, the demand for spectrum and the identity of the specific bands needed for future network growth should be compelled instead by commercial wireless service providers.

B. The Lower 3 GHz, 4 GHz, and 7/8 GHz Bands Should Be Prioritized for Repurposing

NTIA seeks comment on the specific spectrum bands that should be assessed for potential repurposing.[22/] It should consider several factors in identifying spectrum. As the FCC has observed, providers need a mix of high-, mid-, and low-band spectrum for their networks.[23/]

20/ For example, with the deployment of 2G, consumers were introduced to digital technologies, which enabled text messages for communications. *See The Evolution to 5G*, CTIA, https://www.ctia.org/the-wireless-industry/the-5g-economy (last visited Apr. 17, 2023). The deployment of 3G networks spurred additional applications, like video calls and streaming, with the introduction of wireless data and mobile internet access. *See id.* 4G networks introduced high-speed wireless broadband and applications that have fueled the "app economy," which are now adopted worldwide. *See id.*

21/ *See Spectrum Policy*, CTIA, https://www.ctia.org/spectrum (last visited Apr. 17, 2023) ("CTIA Spectrum Policy").

22/ *See* Request for Comments at 16246.

23/ *See Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Proposed Modification, 35 FCC Rcd 2343, ¶¶ 1-3 (2020) ("*C-band Order*"); *see also* 5G Americas, *Mid-Band*

Providers require sufficient amounts of each type of spectrum to operate a 5G network because each category satisfies different network requirements.[24/] A sufficient amount of each should therefore be made available to help keep up with consumers' skyrocketing demand for wireless services. Where possible, NTIA should target spectrum bands that are adjacent to or near spectrum already in use for commercial wireless services. Doing so may lower equipment development costs.[25/] Where feasible, spectrum should also be internationally harmonized. Identifying internationally harmonized spectrum can create even greater economies of scale and scope, producing consumer benefits.[26/]

The three bands that offer the most promise for current and future commercial wireless networks are the Lower 3 GHz, 4 GHz, and 7/8 GHz bands.[27/] The Lower 3 GHz band, which is adjacent to the recently repurposed and auctioned 3.45-3.55 GHz ("3.45 GHz") band, provides a large bandwidth and reliable range of coverage, making it ideal for 5G use.[28/] In addition, the 2021 Infrastructure Investment and Jobs Act identified the Lower 3 GHz band for reallocation

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Spectrum Update, at 5 (Mar. 2023), https://www.5gamericas.org/wp-content/uploads/2023/03/Mid-Band-Spectrum-Update-2023-Id.pdf ("5G Americas Report").

24/ *See, e.g.*, *C-band Order* ¶¶ 1-3 (explaining that low-band spectrum is "ideal for providing coverage in rural areas and inside buildings," mid-band spectrum provides "desirable coverage, capacity, and propagation characteristics," and high-band spectrum is "ideal for low-latency, high-capacity operations"); 5G Americas Report at 5 ("Access to all three frequency ranges is essential . . . because they allow operators to optimize their networks based on environmental and network coverage, and capacity targets.").

25/ *See, e.g.*, *WTB & OET Seek Comment on Ericsson Waiver of Sections 27.53 and 2.947*, Order, DA 23-142, ¶ 7 (rel. Feb. 22, 2023); *Facilitating Shared Use in the 3100-3550 MHz Band*, Second Report and Order, Order on Reconsideration, and Order of Proposed Modification, 36 FCC Rcd 5987, ¶ 16 (2021) ("*3.45 GHz Order*").

26/ *See* Accenture, *Spectrum Allocation in the United States*, at 11 (2022), https://api.ctia.org/wp-content/uploads/2022/09/Spectrum-Allocation-in-the-United-States-2022.09.pdf ("Accenture Report").

27/ *See id*. at 3.

28/ *See id*. at 35.

and directed the Department of Defense ("DoD") to study the band for shared use.[29/] The 4 GHz band is also well-suited for 5G use. Because of its width, the 4 GHz band would enable many 5G use cases, including smart cities and autonomous vehicles.[30/] Because other nations have already allocated the 4 GHz band for commercial use, repurposing the band would result in international harmonization.[31/] One FCC official has explained the importance of the 4 GHz band for commercial wireless networks "from an international perspective," and they urged the Federal government to make 4 GHz spectrum available for auction.[32/] The 7/8 GHz band is likewise ideal for repurposing because the band's higher capacity could help serve densely populated areas with 5G use cases.[33/] Since 2018, Federal agencies have been assessing their operations in the 7/8 GHz band, following a directive from a Presidential Memorandum.[34/] FCC Chairwoman Rosenworcel has pointed out that it is necessary to identify spectrum in the 7 to 15 GHz range now for future wireless networks.[35/]

29/ *See* Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, § 90008 (2021) (codified at 47 U.S.C. § 921 note).

30/ *See* Accenture Report at 36.

31/ *See id*.

32/ *See, e.g., Keynote Remarks of FCC Commissioner Brenden Carr at the American Enterprise Institute, Washington, DC, "Extending Americas' 5G Leadership,"* FCC (Mar. 15, 2021), https://docs.fcc.gov/public/attachments/DOC-370781A1.pdf.

33/ *See* Accenture Report at 37.

34/ *See, e.g., Presidential Memorandum on Developing a Sustainable Spectrum Strategy for America's Future*, WHITE HOUSE (Oct. 25, 2018), https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-developing-sustainable-spectrum-strategy-americas-future/; *NTIA Studying Sharing in 7.125-8.4 GHz Band; Controversy Expected*, COMM. DAILY (Oct. 2, 2019), https://communicationsdaily.com/article/view?search_id=663449&p=1&id=808296&BC=bc_643056549e445.

35/ *See Remarks of Chairwoman Jessica Rosenworcel, Mobile World Congress, "New Frontier Of Partnerships," Barcelona, Spain*, FCC (Mar. 1, 2022), https://docs.fcc.gov/public/attachments/DOC-380838A1.pdf.

NTIA should explore whether these bands can be repurposed for exclusive, high-power terrestrial use on a licensed basis. While, as noted above, the FCC has correctly observed that carriers need a mix of low-, mid-, and high-band spectrum to complete their networks, targeting these bands in particular is especially important because the U.S. has significantly less licensed mid-band spectrum available for commercial wireless use in comparison to other countries.[36/] In contrast, as discussed further below, "spectrum access methods" would not make the most efficient use of this spectrum and would not likely expedite the timeline or streamline the process of repurposing these bands.[37/]

C. Spectrum Sharing Mechanisms Will Be Successful Only Under Specified Conditions

NTIA seeks comment on the various mechanisms currently available to facilitate spectrum sharing.[38/] NTIA asks whether spectrum sharing and exclusive-use licensing are mutually exclusive and if a non-Federal exclusive-use licensee could share spectrum with a Federal government user.[39/] NTIA also asks whether any sharing mechanisms have successfully promoted more intensive spectrum use while also adequately protecting incumbent operations.[40/]

As noted above, NTIA should focus on making spectrum available on a licensed, high-power, exclusive-use basis. That is because licensed, exclusive-access spectrum provides the

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36/ *See* Janette Stewart, Chris Nickerson & Juliette Welham, *Comparison of Total Mobile Spectrum in Different Markets*, ANALYSYS MASON, at 10 (Sept. 2022), https://api.ctia.org/wp-content/uploads/2022/09/Comparison-of-total-mobile-spectrum-28-09-22.pdf; *see also* Accenture Report at 18 ("The US currently ranks 13th of 15 countries in amount of spectrum allocated to commercial wireless in the lower mid-band range.") (internal citations omitted). On the other hand, the U.S. has more unlicensed mid-band spectrum available for wireless use than any other country. *Id.*

37/ *See* discussion *infra* Section IV.

38/ *See* Request for Comments at 16246.

39/ *See id*.

40/ *See id*.

certainty necessary for commercial wireless carriers to provide the high-quality, consistent, interference-free services that consumers and businesses have come to expect and require.[41/] In order to ensure efficient network planning and operations, providers must know precisely when and where spectrum will be available. An *ad hoc* approach to spectrum access will not permit useful network planning.

Indeed, today's U.S. wireless networks have been built on licensed, exclusive-access spectrum, which has provided substantial benefits to the U.S. economy. From 2011 to 2020, commercial wireless providers and resellers contributed about $270 billion annually in gross output to the U.S. economy and over $1.3 trillion in gross domestic product.[42/] The use of U.S. wireless networks is an economic force multiplier. From 2011 to 2020, the application and mobile industries added nearly $1.5 trillion in gross output to the U.S. economy.[43/] Repurposing Federal spectrum now for licensed, exclusive use by non-Federal entities will help meet increased demand for commercial wireless network capacity and continue to fuel the Nation's economy.[44/] It is therefore important for NTIA to continue to support the further growth of those networks.

41/ *See* Recon Analytics, *CBRS: An Unproven Spectrum Sharing Framework*, at 6 (Nov. 2022), https://api.ctia.org/wp-content/uploads/2022/11/CBRS-Recon-Analytics.pdf ("Recon Analytics CBRS Report") ("[C]ommercial users, by necessity, expect that their network of choice [will] be available at the performance characteristics they expect on a consistent basis."); *see also CTIA Spectrum Policy*. As CTIA has explained, the wireless industry does not maintain that "all spectrum must be exclusive-use licensed spectrum." *See* Letter from Meredith Attwell Baker, President and CEO, CTIA, to the Honorable Jessica Rosenworcel, Chairwoman, FCC and the Honorable Alan Davidson, Assistant Secretary and Administrator, NTIA, at 5 (Dec. 12, 2022), https://www.fcc.gov/ecfs/document/1212015633657/1. Rather, the wireless industry "support[s] innovative uses of spectrum [like sharing mechanisms] where it is appropriate and makes sense given technical and operational constraints." *Id.*

42/ *See* Compass Lexecon Report at 15.

43/ *See id*. at 20-21.

44/ *See* Joe Kane and Jessica Dine, *Building on Uncle Sam's "Beachfront" Spectrum: Six Ways to Align Incentives to Make Better Use of the Airwaves*, ITIF, at 7 (2023), https://www2.itif.org/2023-federal-spectrum.pdf.

While spectrum may support many Federal mission-critical operations, the criticality of those operations need not dictate whether the spectrum that supports them can be cleared and repurposed for licensed, exclusive use. These critical operations can often be supported in other bands at reasonable costs, or in smaller portions of a band, particularly as new and more efficient technologies are deployed. The Federal government should better assess how spectrum is being employed, whether the spectrum is being employed efficiently, and whether there are alternative bands or technologies that can support those operations with the goal of repurposing as much Federal spectrum as possible. Nevertheless, if spectrum sharing is employed, it must result in meaningful use for providers. That means wireless carriers must have access to spectrum on an exclusive basis, with high-power, to the maximum extent possible.

There are several important caveats NTIA should consider in order to ensure that sharing is *practical* for commercial wireless providers and provides the greatest benefit to the public. *First*, sharing must allow providers to operate at full power. T-Mobile and other national carriers' networks operate at high-power,[45/] which enables them to maximize geographic coverage, particularly in less-densely populated areas.[46/] Not only do high-power operations permit stronger signals that provide an expansive, yet robust service, but they also reduce the number of cell sites needed, easing the coordination of operations and making deployment economically efficient. High-power use also results in increased spectral efficiency, which provides the network capacity that is required for high-bandwidth applications.[47/] Access to

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45/ Low-power can be used to fill in high-density requirements, but that is not how most commercial wireless networks are structured.

46/ *See* Rysavy Report at 11.

47/ *See id*. at 12, 15.

spectrum that can only be used on a low-power basis, however, does little to expand basic network capacity and coverage, particularly in rural areas.

Second, sharing must permit spectrum use most of the time throughout most of the country. Carriers and equipment manufacturers – of both base stations and handsets – cannot invest in network and device changes to incorporate spectrum in their equipment to access spectrum that is not consistently and extensively available. A "sometimes available" network is simply not desirable and, in some cases, potentially dangerous because of consumer reliance on a network that they may not always be able to access. In order to avoid these consequences and realize economies of scale and scope in the equipment market, shared spectrum must be available to the greatest extent possible.

There are instances where sharing has followed these guidelines and has been successful and others where the guidelines have not been followed and, therefore, sharing has not been successful. For example, T-Mobile and other commercial wireless providers have successfully shared spectrum in the 1710-1755 MHz and 2110-2155 MHz ("AWS-1") bands with Federal entities.[48/] That is because, prior to the start of the AWS-1 auction, providers had clear expectations about the spectrum they could win. The FCC worked collaboratively with NTIA and the DoD to adopt precise technical parameters under which commercial systems could operate, while ensuring effective coexistence with Federal entities.[49/] Moreover, commercial access to the spectrum was consistent throughout a geographic area, and the spectrum could be used for high-power operations.

48/ *See Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, Report and Order, 18 FCC Rcd 25162, ¶¶ 117-23 (2003) (promoting commercial access to the 1710-1755 MHz band while also protecting incumbent federal operations from harmful interference).

49/ *See id*. ¶¶ 87-111.

In contrast, the Citizens Broadband Radio Service ("CBRS") sharing mechanism adopted for the 3550-3700 MHz ("3.5 GHz") band has not proven successful to meet the needs of many commercial wireless networks because of the band's restrictions. In the 3.5 GHz band, access to the spectrum is managed and dynamically controlled by a Spectrum Access System, which determines which channel can be used and when; Priority Access License users cannot predict whether they will continue to have access to the same frequencies. In addition, the band is divided into small, county-sized geographic areas and has restrictive, low power levels. All of these operating conditions are inconsistent with how most commercial wireless providers manage their networks and provide service. In fact, recent studies demonstrate that the 3.5 GHz band would be more widely utilized if the band had been made available for high-power, exclusive-licensed use.[50/]

The sharing mechanism recently adopted for the 3.45 GHz band may produce better results, but its implementation is in its early stages. The framework, however, was intended to achieve results appropriate for commercial wireless networks – enabling those networks to serve a significant percentage of the population a significant percentage of the time because DoD's use of the band is limited.[51/] Moreover, DoD's use of the band may be reduced over time, permitting even greater use by commercial licensees.[52/] But the success of the 3.45 GHz band framework remains uncertain as DoD and licensees learn about the protection that DoD will require on a long-term basis. The better approach is to utilize sharing mechanisms only when exclusive-use

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50/ *See* Recon Analytics CBRS Report at 1, 7.

51/ *See 3.45 GHz Order* ¶ 21.

52/ *See The Federal Communications Commission and the National Telecommunications and Information Administration: Coordination Procedures in the 3.45-3.55 GHz Band,* Public Notice, 36 FCC Rcd 9225, 9227 (2021).

spectrum cannot be made available and under conditions that will support the needs of commercial wireless networks and their users.

D. Spectrum Repurposing Must Provide Certainty to New Users

Whether spectrum is made available on a licensed, exclusive-use basis or under a sharing framework, the identification of spectrum bands for repurposing must be guided by sound engineering practices to provide certainty to users of repurposed spectrum. Adjacent operations must be adequately protected. But potential future spectrum use cannot be thwarted by overly-conservative frequency protection, out-of-date technology, or political pressure. Neither Federal nor non-Federal entities should be permitted to claim the need for protection from interference where sound engineering does not support those claims, especially when investment in a new technology can make Federal operations more interference resilient to the introduction of new and innovative services in immediately adjacent or nearby spectrum. As the FCC is expected to recognize, the introduction of new services should not be stymied by services in adjacent bands, particularly when those services use legacy devices that have not been updated.[53/] In fact, as the FCC will likely observe, "[a] range of engineering and design techniques are presently available to help satisfy the performance and reliability expectations of receiver equipment."[54/] Advances in technology can allow the introduction and operation of new services without impairing uses in neighboring bands.[55/] Moreover, as discussed below, where reasonable steps are required to protect incumbent operations, the Commercial Spectrum Enhancement Act ("CSEA"), as it may

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53/ *See Principles for Promoting Efficient Use of Spectrum and Opportunities for New Services*, Draft Policy Statement, ET Docket Nos. 23-122 and 22-137, FCC-CIRC2304-01 (draft rel. Mar. 30, 2023).

54/ *Id*. ¶ 34.

55/ *See id*. ¶¶ 2, 33-35.

be improved, can be used to reimburse the reasonable costs of making changes to Federal equipment, including upgrading technology, if necessary, to become more resilient.

If there are concerns by Federal entities about bands that are identified for repurposing, those concerns must be timely raised to ensure investment-backed expectations of non-Federal users are not upset. NTIA should work with the FCC to address any concerns well prior to licensing of the spectrum. An efficient and effective mechanism for Federal entities to identify concerns is critical to providing certainty for licensees to be able to invest. For example, in April 2020, the FCC released an Order authorizing Ligado Networks, LLC to deploy a low-power terrestrial, nationwide network in the 1526-1536 MHz, 1627.5-1637.5 MHz, and 1646.5-1656.5 MHz bands, which is spectrum that is adjacent to Federal and non-Federal Global Positioning System operations.[56/] Shortly thereafter, members of Congress and NTIA raised concerns about this authorization.[57/] While concerns from Federal entities are important, they should be raised in a timely manner so that all parties can plan and work together to resolve them.

In addition to ensuring that new spectrum users are not subject to after-the-fact assessments of potential interference, they must also have assurance that spectrum for which they are a high bidder in an auction is promptly licensed to them to serve the public. Reasonable investment-backed expectations include receiving rights for which payment is made. Unfortunately, that is not the case today. The FCC's authority to conduct spectrum auctions

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56/ *See LightSquared Technical Working Group Report, et al.*, Order and Authorization, 35 FCC Rcd 3772 (2020).

57/ *See, e.g.*, Letter from James M. Inhofe, United States Senator, *et al.*, to The Honorable Ajit Pai, Chairman, FCC, *et al.*, IBFS File No. SAT-MOD-20120928099169, *et al.* (filed May 15, 2020); Petition for Stay of the National Telecommunications and Information Administration, IB Docket No. 11-109 (filed May 22, 2020); *LightSquared Technical Working Group Report, et al.*, Order Denying Motion for Stay, 36 FCC Rcd 1262 (2021); Petition for Reconsideration or Clarification of the National Telecommunications and Information Administration, IB Docket Nos. 11-109, *et al.* (filed May 22, 2020).

under Section 309(j) of the Communications Act expired on March 9, 2023.[58/] While T-Mobile timely submitted its long-form applications covering its winning bids in FCC Auction 108 and paid the U.S. Treasury $304,325,290**,** it remains the only entity to submit a post-auction application that has not received its licenses. As a key member of the spectrum management ecosystem, NTIA must work with Congress to help reinstate the FCC's auction authority and help prevent future lapses that prevent winning bidders from timely obtaining authorizations to serve the public.[59/]

E. Repurposing Spectrum is Feasible Because Federal Incumbents are Compensated for Relocation Expenses

NTIA asks whether current processes for reimbursement of relocation expenses adequately incentivize the analysis of the spectrum frequencies for potential repurposing.[60/] The CSEA has been a valuable tool for repurposing spectrum.[61/] The Spectrum Relocation Fund ("SRF"), authorized by the CSEA, in particular, provides a useful mechanism for covering the costs incurred by Federal entities for repurposing spectrum.[62/] But the CSEA also requires that an auction of recaptured spectrum must be able to cover 110 percent of incumbents' relocation or sharing costs.[63/] That makes bands where relocation costs are high potentially undesirable as

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58/ *See* 47 U.S.C. 309(j). FCC spectrum auction authority has served as a foundation of the U.S. competitive model, and it is essential that these auctions continue with confidence in the process.

59/ Similarly, uncertainty regarding the potential use of repurposed spectrum can be created by lack of agreement with Canada and Mexico regarding the use of repurposed spectrum (or spectrum in adjacent bands). While T-Mobile appreciates that international negotiations are complex and time-consuming, they should be a priority when making new spectrum available for commercial operations. Otherwise, providers will be prevented or impeded from using that spectrum to provide service to the public in both densely-populated and rural areas in border regions.

60/ *See* Request for Comments at 16246.

61/ *See* Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, 118 Stat. 3991 (2003) (codified at 47 U.S.C. § 901 note).

62/ *See* 47 U.S.C. § 928(g)(2)(B).

63/ *See id*. § 309(j)(16)(A)-(B).

repurposing targets. Therefore, NTIA must be mindful of the ability to achieve relocation at reasonable costs.

The CSEA also permits Federal agencies to use SRF funds to pay for certain research and related activities.[64/] While this funding has been helpful for Federal agencies to evaluate ways to increase spectrum efficiency, Congress can further improve the CSEA and the SRF by making additional changes. As FCC Chairwoman Rosenworcel suggested, the CSEA should be expanded to provide "[F]ederal agencies adequate incentives and assistance, including up-front planning, technology development, and staffing to support the relocation effort."[65/] The SRF should also be expanded to permit funding for pre-auction costs after frequencies have been identified for reallocation, but before the FCC announces it will auction that spectrum.[66/] This would allow for the relevant Federal agency to have its costs covered and promote greater use of Federal spectrum for commercial networks.

F. Commercial Networks May Be Used to Satisfy Federal Needs

NTIA seeks comment on the approaches, such as market-based, system-performance based, or others, that would enable Federal agencies to more easily share spectrum or make spectrum available.[67/] Use of commercial spectrum to meet Federal users' requirements should be further explored to meet these requirements. As T-Mobile previously explained to NTIA and

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64/ *See, e.g.*, *id.* § 928; *Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, 29 FCC Rcd 4371, ¶¶ 6-7 (2014) (transitioning federal operations that were able to recover the relocation costs and requiring collaboration between Federal and non-Federal users); CTIA, *Repurposing Government Spectrum for Licensed Commercial Use: A Win-Win for Wireless Providers and Federal Agencies*, at 5 (2020), https://api.ctia.org/wp-content/uploads/2020/08/Win-win_8-06.pdf.

65/ Letter from Jessica Rosenworcel, Chairwoman, FCC, to the Honorable John Thune, Ranking Member, Subcomm. on Commc'n, Media, and Broadband, U.S. Senate (Mar. 30, 2022) .

66/ *See id*.

67/ *See* Request for Comments at 16246.

DoD, Federal entities can use the capacity of commercial networks to meet their objectives and promote more efficient spectrum use.[68/] Through the use of techniques like network slicing, which occurs when a 5G network is subdivided into several different virtual networks,[69/] commercial providers can provide bespoke private networks to Federal entities that will allow them to optimize the network for their mission-critical needs while providing safe and secure communications services.[70/] Indeed, these virtual networks are created on the same physical infrastructure, "enabling isolation of traffic supporting highly secure applications."[71/]

III. LONG-TERM SPECTRUM PLANNING MUST INCLUDE INDUSTRY STAKEHOLDERS

NTIA seeks comment on parties besides the FCC – groups or affected stakeholders – with whom NTIA should coordinate and how to accomplish this process.[72/] T-Mobile applauds the spectrum management efforts in which NTIA and the FCC have been recently engaged, including updating the Memorandum of Understanding between the two agencies.[73/] Members

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68/ *See, e.g.*, Federal Mobility Group, *5G Framework to Conduct 5G Testing*, at 17 (Nov. 2020), https://www.cio.gov/assets/files/Framework-to-Conduct-5G-Testing-508.pdf (stating that "[c]arriers are a source for temporary use of licensed 5G spectrum."); *2021 & 5G's Expansion*, CTIA BLOG (Jan. 14, 2021), https://www.ctia.org/news/blog-2021-and-5g-expansion; Comments of T-Mobile USA, Inc., Docket No. 210105-0001 (filed Feb. 10, 2020).

69/ *See* Ericsson, *Network Slicing*, https://www.ericsson.com/en/network-slicing (last visited Apr. 17, 2023) (defining a "sliced network" as a "set of logical networks on top of a shared infrastructure" where "[e]ach logical network is designed to serve a defined business purpose and comprises of all the required network resources, configured and connected end-to-end.").

70/ *See* T-Mobile for Business, *Network Slicing Promises Optimized 5G Bandwidth for Business-Critical Specialized Services*, T-MOBILE, https://www.t-mobile.com/business/resources/articles/5g-network-slicing (last visited Apr. 17, 2023); *see also* Press Release, *T-Mobile Lights Up Standalone Ultra Capacity 5G Nationwide*, T-MOBILE (Nov. 14, 2022), https://www.t-mobile.com/news/network/t-mobile-lights-up-standalone-ultra-capacity-5g-nationwide.

71/ Jeff Verrant, *Building Digital Trust With 5G*, GCN (Nov. 13, 2020), https://gcn.com/articles/2020/11/13/5g-advanced-security.aspx.

72/ *See* Request for Comments at 16246.

73/ *See* Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration (Aug. 1, 2022), https://docs.fcc.gov/public/attachments/DOC-385867A1.pdf.

of Congress have also introduced legislation requiring Federal and non-Federal stakeholders to coordinate to improve Federal spectrum management. Specifically, the Spectrum Coordination Act, if enacted, would require NTIA to publicly file comments expressing any concerns it has with a proposed spectrum reallocation, and it would require the FCC to publicly disclose how it is addressing those concerns.[74/]

But long-term spectrum planning must also involve industry representatives who can best inform Federal representatives about the amount and location of spectrum required for commercial use. At a minimum, representation from industry trade groups should be required as part of the long-term strategic planning process. Representation from individual companies would also benefit the process. Those representatives can provide information about spectrum usage and other data necessary to protect spectrum needs.

Similarly, Federal representatives, equipped with the type of information noted above regarding incumbent operations,[75/] must promptly provide accurate information about potential repurposing targets and the costs for doing so. Federal representatives should provide as much information as possible about the spectrum bands in which Federal users are operating, when they are operating, what their future plans are for use of their spectrum, and the technologies and applications for which they are using the spectrum. Federal agencies should make this information available to commercial entities as far in advance as possible to ensure that all parties can meaningfully assess spectrum availability and any foreseeable issues.[76/] That process

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74/ *See* Spectrum Coordination Act, H. R. 1341, 118th Cong. (2023).

75/ *See* discussion *supra* Section II.

76/ *See, e.g.*, *Department of Defense Workbook in Support of AWS-3 Transition Planning for 1755-1780 MHz Band*, DoD, at 2 (2014), https://www.ntia.doc.gov/files/ntia/ publications/dod_workbook_ readmefinal.pdf; *Department of Defense Workbook Information File in Support of the 3450-3550 MHz Band*, DoD, at 1-3 (2021), https://www.ntia.gov/sites/default/files/publications/dod_3.45_ghz_

will help avoid replication of past, unwarranted eleventh-hour objections to commercial spectrum use.[77/] NTIA must ensure that all relevant Federal entities are fully engaged in the process and, when they are not, make sure that Federal entities understand that they may forfeit their right to object to spectrum repurposing.

As NTIA notes, there are several existing industry and Federal groups that are examining issues related to spectrum repurposing.[78/] The scope of several of those can be expanded to cover long-term spectrum planning, to the extent they are not already engaged in that activity. Any other groups should only be permitted with the explicit understanding that they will not duplicate processes covered by existing entities. The Federal government should clearly delineate the agency and group responsible for the process of identifying spectrum to be repurposed.[79/]

IV. INDUSTRY SHOULD DRIVE TECHNOLOGY DEVELOPMENT

NTIA asks about new or emerging technologies that could be used to ensure that the U.S. remains at the forefront of innovation for spectrum-based services.[80/] In particular, NTIA asks what innovations and next-generation capabilities for spectrum management models are expected

workbook_explanation_letter_210723_0.pdf; *3.45 GHz Workshop*, DoD, at 9-24 (2021), https://ntia.gov/sites/default/files/publications/dod_3.45_ghz_workshop_0.pdf.

77/ *See* discussion *supra* Section II(D).

78/ *See* Request for Comments at 16246-47 (mentioning the FCC's Technological Advisory Council, NTIA's Commerce Spectrum Management Advisory Committee, and NTIA's annual Spectrum Policy Symposium).

79/ *See* Joe Kane, Garett Shrone, *et al.*, *Filling Gaps in US Spectrum Allocation: Reform for Collaborative Management*, ITIF, at 25 (2023), https://www2.itif.org/2023-spectrum-allocation-reform.pdf (recommending the observation from the GAO report that NTIA should "clarify the methods by which it considers various agencies' spectrum concerns before arriving at a cohesive view for the executive branch.").

80/ *See* Request for Comments at 16247.

to improve spectrum access.[81/] As noted above, T-Mobile is concerned that "spectrum management technologies" will be used to inhibit access to high-power, exclusive-use spectrum for wireless carriers.[82/] Using dynamic spectrum sharing in mid-band spectrum, in particular, will put the U.S. out of step with the other countries, driving up costs for consumers and businesses.[83/] Any such spectrum management tools and technologies should therefore be rejected unless they are able to demonstrate that they can support the quality of service and coverage necessary for high-power mobile services.

If any technologies that enhance spectrum use are adopted, they should be, as they have been, driven by industry.[84/] Industry has ample incentives to develop these techniques to promote spectrum use. While the Federal government can serve as an important partner to evaluate whether technologies protect Federal operations, evaluation of spectrum management techniques must focus on the potential adverse impacts of carriers' ability to provide service or use spectrum efficiently.

81/ *See id*.

82/ *See supra* Section II.

83/ *See, e.g.*, David Abecassis, *et al.*, *International Comparison: Licensed, Unlicensed, and Shared Spectrum, 2017-2020*, at 3 (Jan. 2020), https://api.ctia.org/wp-content/uploads/2020/02/report-International-Comparison-Licensed-Unlicensed-and-Shared-Spectrum-2017-2020.pdf.pdf; GSMA, *5G and the 3.3-3.8 GHz Range in Latin America* (Nov. 20, 2020), https://www.gsma.com/spectrum/wpcontent/uploads/2020/11/5G-and-3.5-GHz-Range-in-Latam.pdf; GSA, *Spectrum Auctions: Calendar*, at 2-3 (July 2020), https://uk5g.org/media/uploads/resource_files/GSA-Spectrum-Auction-Calendar-July2020.pdf.

84/ *See, e.g.*, *Keynote Speech of Commissioner Nathan Simington to October 2021 CTIA GSMA Mobile World Congress*, FCC (Oct. 28, 2021), https://docs.fcc.gov/public/attachments/DOC-377338A1.pdf ("[I]ndustry should collectively chart a path forward to superior overall receiver performance. I have every confidence that industry, trade associations, and standards bodies are up to addressing this challenge more nimbly and thoughtfully than any heavy-handed regulation could."); *Remarks of Commissioner Nathan Simington to the Free State Foundation's Fifteenth Anniversary Gala Lunch*, FCC (Oct. 15, 2021), https://docs.fcc.gov/public/attachments/DOC-376618A1.pdf.

For the same reasons, T-Mobile questions the need for the development of an IIC to promote sharing between Federal and non-Federal users. An IIC, operated by a Federal agency, would notify non-Federal users when they need to cease operations in all or portions of the band to protect Federal operations.[85/] But an IIC is still a nascent technology; it is a "long-term project, not even funded at this time, and not likely to become available until the second half of this decade."[86/] Instead of using an IIC, licensees and Federal users should individually negotiate when and how to shut down operations, allowing for more customization to ensure that each parties' unique needs are met.[87/]

V. THE IMPLEMENTATION PLAN SHOULD PROVIDE DETAILS ON A TIMELINE TO IDENTIFY THE SPECTRUM THAT MAY REPURPOSED

Finally, NTIA seeks comment on the implementation plan for the NSS.[88/] It is increasingly important that the NSS identify spectrum that can support the services that T-Mobile and other carriers offer now and in the future. As noted above, a mix of low-, mid-, and high-band spectrum is necessary for providers' networks. But, currently, the commercial wireless industry only has access to only five percent of all spectrum in the U.S.[89/] The demands for commercial wireless network capacity cannot be met by the spectrum that is currently available, and there is very little additional spectrum for commercial wireless networks on the

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85/ *See* Michael DiFrancisco, *et al.*, *Incumbent Informing Capability (IIC) for Time-Based Spectrum Sharing* (2021), https://www.ntia.doc.gov/files/ntia/publications/iic_for_timebased_spectrum_sharing.pdf.

86/ Peter Rysavy, *Lessons Learned from the CBRS Spectrum Experiment – Rysavy*, FIERCE WIRELESS (Apr. 28, 2022), https://www.fiercewireless.com/tech/lessons-learned-cbrs-spectrum-experiment-rysavy; *see also* Joe Kane, *Spectrum Sharing: Holy Grail or False Hope?*, ITIF, at 5 (July 5, 2022), https://www2.itif.org/2022-spectrum-sharing.pdf.

87/ *See* Reply Comments of T-Mobile, WT Docket No. 19-348, at 9 (filed Dec. 7, 2020) (citing Comments of Verizon, WT Docket No. 19-348, at 7 (filed Nov. 20, 2020)).

88/ *See* Request for Comments at 16247.

89/ *See* Accenture Report at 2.

horizon. Repurposing as much spectrum as possible, as quickly as possible, will best equip providers to accommodate the growing needs of their networks.[90/]

Accordingly, the NSS should first specify the spectrum bands that will be evaluated for clearing and repurposing, focusing on the Lower 3 GHz band, the 4 GHz band, and the 7/8 GHz band. Doing so within a defined timeline will ensure that commercial wireless providers can continue to build their networks and services.

VI. CONCLUSION

To meet the increasing demand for commercial wireless network capacity, the NSS can and should identify low-, mid-, and high-band spectrum that can be repurposed for exclusive, high-power licensed use. When that is not feasible, repurposed spectrum may be shared, provided it is on an equitable basis and modeled on past successful frameworks. Any long-term spectrum planning should involve sound engineering principles with input from industry representatives as well as Federal representatives. T-Mobile looks forward to working with NTIA and other Federal entities to produce an NSS that will continue to enable U.S. commercial wireless networks to provide the world-class service for which they are recognized today.

90/ *See* discussion *supra* Section II(B).

Respectfully submitted,

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