Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Modernizing and Expanding Access to the	)	
70/80/90 GHz Bands	)	WT Docket No. 20-133
	)	
To: The Commission	)	

COMMENTS OF TECHFREEDOM

TechFreedom hereby files these Comments in response to the *Public Notice*, issued October 8, 2021, seeking additional comments in the above-referenced proceeding.[1] The *Public Notice* was issued to supplement the record concerning whether the 70/80/90 GHz Band can accommodate additional usages, including High Altitude Platform Stations (HAPS), as proposed in the *70/80/90 GHz NPRM.*[2] TechFreedom submits:

1. About TechFreedom

TechFreedom is a non-profit think tank dedicated to promoting the progress of technology that improves the human condition. To this end, we seek to advance public policy that makes experimentation, entrepreneurship, and investment possible, and thus unleashes the ultimate resource: human ingenuity. Wherever possible, we seek to empower users to make their own choices online and elsewhere.

[1] *Public Notice,* DA 21-1263, released October 8, 2021. The *Public Notice* was published in the Federal Register on November 2, 2021. 86 Fed. Reg. 60436 (November 2, 2021). The Federal Register Notice set the comment date as December 2, 2021 and reply comment date of January 3, 2022. These comments are timely filed.

[2] Modernizing and Expanding Access to the 70/80/90 GHz Bands, WT Docket No. 20-133, Notice of Proposed Rulemaking, 35 FCC Rcd 6039 (2020) (*70/80/90 GHz NPRM*).

TechFreedom and undersigned counsel have a long history advocating for innovative uses of outer space.[3] The instant proceeding sits at the intersection of spectrum policy and space law, a place we've inhabited for decades. We are uniquely suited to provide commentary.

2. The 70 GHz Band is the Last Great Spectrum for Space Uses

TechFreedom commends the FCC for revisiting the 70 GHz band[4] and seeking approaches to allow multiple users access to this spectrum. Through a quirk of physics, the 70 GHz Band represents the last great stretch of spectrum that we currently can engineer for high-throughput data (up to 1 Gbps) because of the amount of contiguous spectrum

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[3] *See, e.g., Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space: Before the Senate Committee on Commerce, Science, & Transportation Subcommittee on Space, Science, and Competitiveness*, 115th Cong. (2017) (written testimony of James E. Dunstan & Berin Szoka), available at https://www.commerce.senate.gov/services/files/A9AD88B2-9636-4291-A5B0-38BC0FF6DA90, video of hearing available at https://www.commerce.senate.gov/2017/5/reopening-the-american-frontier-exploringhow-the-outer-space-treaty-will-impact-american-commerce-and-settlement-in-space; *Artemis Accords: One Small Step for NASA, Not So Giant a Leap for Space Law*, TECHFREEDOM (May 15, 2020), https://techfreedom.org/artemis-accords-one-small-step-for-nasa-not-sogiant-a-leap-for-space-law/; *Revived National Space Council Could Mean Space Policy Rethink*, TECHFREEDOM (July 7, 2017), https://techfreedom.org/revived-national-spacecouncil-mean-space-policy-rethink/; J. Dunstan, "*Space Trash:" Lessons Learned (and Ignored) from Space Law and Government*, 39 J. OF SPACE L. 23 (2013).

[4] While the NPRM addresses the "70/80/90 GHz Band," it also recognizes that there are significant challenges in allowing multiple users into the 90 GHz portion of the band. *See* NPRM, ¶ 41 ("Earth Exploration-Satellite (passive) and Space Research (passive) services operate in the adjacent 86–92 GHz band. The Commission seeks comment on whether Aeronet's proposed uses and technical rules would increase the potential for harmful interference to these adjacent band vehicular radars and passive services, and if there is a potential for interference, what technical or operational mechanisms should be considered to mitigate it?"). In using the term "70 GHz Band" throughout these comments, TechFreedom is referring to the portions of the 70 and 80 GHz spectrum that the FCC has previously identified as capable for sharing. We don't use the terms "E-Band," *see* Editorial Team, *What is the E Band?*, (Aug. 27, 2019), https://www.everythingrf.com/community/e-band, or "W-Band," *see* NASA, https://www.nasa.gov/directorates/heo/scan/communications/outreach/funfacts/txt_band_designators.html (last visited Dec. 2, 2021), in these comments because these designations generally are overinclusive and include nearly all the spectrum between 60 and 90 GHz.

available,[5] and doesn't suffer from debilitating oxygen and water absorption.[6] This is especially true for use with satellite gateway links.[7] There are both federal and commercial allocations for space uses in the band, including "fixed satellite, mobile satellite, broadcasting satellite, Earth Exploration-Satellite (passive) and radio astronomy.[8] Because of the unique qualities of this band as applied to the space services, the 70 GHz Band must be protected from interference.

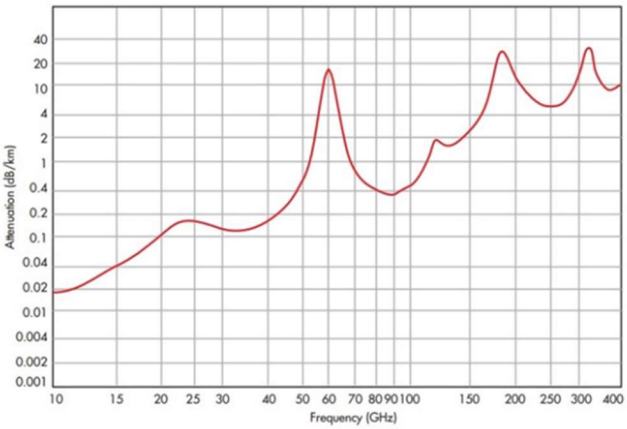

Figure 1 Source: L. Frenzel "Millimeter Waves Will Expand Future Wireless"

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[5] *See Understanding MMWave Spectrum for 5G Networks*, 5G AMERICAS (Dec. 2020), https://www.5gamericas.org/wp-content/uploads/2020/12/InDesign-Understanding-mmWave-for-5G-Networks.pdf ("The E band (71-76 GHz/81-86 GHz) has been made available for point-point microwave usage, enabling multi-gigabit per second data rates given the huge amount of spectrum available (10 GHz), with much less oxygen absorption (compared with 60 GHz), allowing longer distances compared with V band.").

[6] *See* Louis E. Frenzel, *Millimeter Wavies Will Expand the Wireless Future*, Tech. Rep. (Apr. 4, 2013), available at https://cdn.baseplatform.io/files/base/ebm/electronicdesign/document/2019/03/electronicdesign_9611_millimeterwaves_expandwirelessfuture.pdf; *See also,* R. Abecassis, et. al., *Review of Spectrum Management Approaches for E-Band (70/80 GHz) in Selected Markets* at 5, ANALYSIS MASON (Jan. 5, 2016), available at https://www.analysysmason.com/globalassets/x_migrated-media/media/report_spectrum_management_e-band_analysysmason20163.pdf ("An interesting feature of E-band is that, although located high in the millimetre-wave region of the radio spectrum, where signal absorption levels are high, E-band is located above the oxygen absorption peak occurring at around 60GHz and hence the usefulness of the band (in terms of the operating ranges that are possible) is more similar to fixed services bands around 30–40GHz.").

[7] *See* Dynamic Spectrum Alliance Comments on Modernizing and Expanding Access to the 70/80/90 GHz Bands at 4, Docket 20-113 (Aug. 5, 2020) ("Indeed, we see no technical reason why the 70/80 GHz database could not serve as a comprehensive repository of all non-Federal links, whether they are traditional fixed point-to-point links; links to, from, and between antennas in motion on ships or aircraft; or gateway links in a nongeostationary satellite network."). *See also* Letter from SpaceX to Marlene H. Dortch, FCC, WT Docket No. 20-133, at 2(Nov. 8, 2021) ("Like the terrestrial links in the band that initially motivated the Commission's innovative light-licensing approach, satellite gateway sites leverage high-gain, directional "pencil" beam antennas.").

[8] 70/80/90 GHz NPRM ¶ 28.

3. Unlike Other Bands, There is Optimism That Many Users Can Compatibly Occupy The 70 GHz Band

The one thing that has emerged from this proceeding is that, unlike in many other spectrum bands, because of the tightly focused, "pencil-thin" beams associated with transmissions in this band,[9] the opportunity to host a variety of users is possible in the 70 GHz Band.[10] In several "head-to-head" studies in the record, the ability of the 70 GHZ Band to house seemingly incompatible usages has been demonstrated.[11] We couldn't have stated it any better than did the Dynamic Spectrum Alliance:

> Accommodating each of the proposed new uses would also align with a fundamental philosophy of this Commission: regulatory humility. The record reflects a number of highly innovative prospective and planned uses of the 70/80 GHz bands, all of which are designed to address critical needs, including rural broadband, disaster preparedness, enterprise IoT connectivity, and in-flight passenger connectivity. Rather than erect regulatory barriers to innovation by excluding promising new services from the bands, the Commission should build

[9] *See* FCC, Wireless Bureau Opens Filing Window for Proposals to Develop and Manage Independent Database of Site Registrations by Licensees in the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands, Public Notice (Mar. 12, 2004) ("Highly directional, 'pencil-beam' signal characteristics permit systems in these bands to be engineered in close proximity to one another without causing interference.").

[10] *See* Abecassis, supra note 6, at 2 ("The physical properties of E-band spectrum also result in reduced potential for interference between systems (compared to lower-frequency bands), ensuring that multiple users can access the spectrum without constraint on the capacity or quality of links.").

[11] *See, e.g.,* Aeronet Comsearch Coexistence Study, submitted May 10, 2019 (showing Maritime uses can coexist with current federal and commercial allocations); Loon Comsearch Coexistence Study, submitted January 14, 2021 (showing HAPS compatibility with current allocations); Aeronet-SpaceX Coexistence Study, submitted October 4, 2021 (showing compatibility between aviation and satellite services in the 70 GHz Band. "Aeronet has also described how its proposed system is compatible with fixed satellite services. Specifically, as explained in its reply comments, due to the very narrow beams used in the 70/80/90 GHz bands, two links can only interfere if they are collinear. A ground-air link and a ground-space link cannot be collinear as long as there is at least some geographic separation between the ground ends of the links. This creates an environment where interference can be prevented by the existing coordination mechanisms in the bands.").

> upon its existing framework, leveraging dynamic spectrum access to promote coexistence and connectivity for all.[12]

This proceeding, and this spectrum, therefore, stands in sharp contrast to the Commission's ill-advised NPRM in the 12 GHz spectrum, where study after study show an inherent incompatibility between terrestrial and satellite usages, which the FCC even admitted in the 12 GHz NPRM.[13] So while TechFreedom vehemently opposes reallocating spectrum in the 12 GHz Band for terrestrial uses, it favors the proposed expanded use of the spectrum here because of the very different nature of this spectrum band.

4. The FCC Must Not "Eat the Seed Corn" of Satellite Spectrum to Feed the Hungry 5G Beast

While we are optimistic about the future use of the 70 GHz Band for multiple users and types of uses, we must once again caution the Commission from abandoning its decades of spectrum policy and hand everything over for terrestrial 5G use. There is a reason why we have a Table of Allocations in Part 2 of the FCC's rules,[14] and there is a reason why the FCC, in originally establishing the Table of Allocations, set aside some frequencies for future uses: to ensure that with the inevitable march of technology, there would be spectrum available for future uses, some completely unimaginable then and even today. In the rush to embrace the newest communications protocol, it seems, however, that

[12] Comments of the Dynamic Spectrum Alliance at 7.

[13] *See* Expanding Flexible Use of the 12.2-12.7 GHz Band, Notice of Proposed Rulemaking, 86 Fed. Reg. 13226 (March 8, 2021), ¶ 13 ("In conjunction with its Petition, the Coalition provided two Coexistence Studies that it claimed illustrate that the new rules it was proposing would protect DBS operators in the band but that they would be incompatible with NGSO FSS."); *see also Comments of TechFreedom in* WT Docket No. 20-443, filed May 7, 2021, at 14 ("More fundamentally, the fact that proponents of terrestrial use of the 12 GHz spectrum would even suggest [requiring NGSO satellites to operate in highly elliptical orbits] tells the Commission all it needs to know as to whether there are any workable solutions to the incompatibility problems. There are none.").

[14] 47 C.F.R. Part 2.

5G is ***it.*** It is the end of technology, it is, and will be forever, the highest and best use of spectrum. That is woefully short-sighted. We must not forget the "Negroponte Switch," which posits that we have the current communications delivery methods we have not due to some fundamental law of physics, but rather by the "accidents of engineering history."[15] Engineering changes, history changes, and we can't afford to go "all in" on 5G it if means robbing all other users of spectrum.

Space users have seen this happen time and again over the past few decades, always with the refrain that the spectrum can be put to higher use immediately, or more money received in auction, if it is repurposed for terrestrial purposes.[16] The undersigned author wrote about this more than 20 years ago, when NTIA handed over 15 MHz of spectrum from NASA's Deep Space Network (DSN) as well as frequencies used for flight test and vehicle launch range safety to create the Wireless Communications Service. This included a complete rejection of International Footnote S5.394 to Part 2, calling for aeronautical telemetry to have priority over other users in the band.[17]

The argument for protecting space spectrum, for not eating our "seed corn," is even more compelling today, when several companies are investing billions of dollars in building and now flying mega constellations of NGSO satellites that promise to provide, at

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[15] *See,* N. NEGROPONTE, *BEING DIGITAL* (1996).

[16] *See, e.g.*, NASA, SPECTRUM 101: AN INTRODUCTION TO NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SPECTRUM MANAGEMENT at 39-40 (Feb. 2016), available at https://www.nasa.gov/sites/default/files/atoms/files/spectrum_101.pdf (discussing various frequency bands that have been reallocated requiring NASA users to relocate).

[17] *See* J. Dunstan, "Earth to Space: I can't Hear You – Selling Off Our Future to the Highest Bidder," Space Manufacturing 11, The Challenge of Space: Past & Future, Proceedings of the Thirteenth SSI/Princeton Conference on Space Manufacturing, 1997, pp. 247-253; reprint available at https://techfreedom.org/wp-content/uploads/2020/10/SSI-1997-Earth-to-Space-I-cant-Hear-You.pdf.

last, high speed, and more critically, low-latency, broadband to every corner of the planet. While these systems have been science fiction fantasies for decades, today they are real, and are being deployed as we watch.[18]

5. The Commission Should Extend the "Light-Licensing" Approach and Use the 70 GHz Band as a Testbed for Extending the "Database-Driven" Approach to Coordination

Probably the most exciting thing about the 70 GHz spectrum band from a regulatory perspective is how the FCC has chosen to license the spectrum. It's "light-licensing" framework calls for nationwide non-exclusive licenses, implemented through a government and third-party database managers on a first in priority basis.[19] Comments in this proceeding almost universally support this database-driven licensing approach.[20] The

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[18] Starlink continues to launch its Starlink constellation, launched its latest 60 satellites, bringing its constellation to almost 1750 satellites. *See* Jeff Foust, *SpaceX continues Starlink deployment with latest launch*, SPACENEWS (May 4, 2021), https://spacenews.com/spacex-continues-starlink-deployment-with-latest-launch/. And of course, SpaceX keeps it costs low by landing its first stage boosters and reusing them, something that truly was science fiction just a few years ago. *See* Attila Károly Nagy, *The Sky Calls (1959 Soviet Sci Fi Movie) rocket landing scene*, YouTube (May, 2017), https://www.youtube.com/watch?v=TdSxDNnqRlo (landing scene from Soviet 1959 science fiction movie "The Sky Calls"). SpaceX says that it will start beta service in the very near future. Liam Tung, *Elon Musk: SpaceX's Starlink broadband public beta ready to go after latest launch*, ZDNET (Oct. 7, 2020), https://www.zdnet.com/article/elon-musk-spacexs-starlink-broadband-public-beta-ready-to-go-after-latest-launch/.

[19] Allocations and Service Rules for 71–76 GHz and 92–95 GHz Bands, WT Docket No. 02–146, Report and Order, 18 FCC Rcd 23318, 23322, ¶ 5 (2003) (70/80/90 GHz Report and Order). *See also 70/80/90 GHz NPRM* ¶ 2 ("a licensee may operate links after completing coordination with Federal operations through NTIA's database and after providing an interference analysis to one of the third-party database managers. Licensees are afforded first-in-time priority for successfully registered links relative to subsequently registered links.").

[20] *See, e.g.,* Reply Comments of Loon, 18 ("Commenters broadly support expanding the existing link registration database to serve as a comprehensive clearinghouse for links within the band, including antennas in motion, stratospheric Internet platforms, and nongeostationary fixed satellites. CommScope argues that "the Commission should authorize a comprehensive framework that can accommodate various use cases" rather than take an iterative approach that requires "major modifications in response to each new spectrum use proposal it receives." 70 DSA, whose membership has designed and implemented several spectrum sharing frameworks (including a 70/80 GHz database), "see[s] no technical reason why the 70/80 GHz database could not serve as a comprehensive repository of all non-Federal links").

Dynamic Spectrum Alliance correctly analogizes this approach to the evolution of call routing:

> The reliance on automated databases to facilitate more advanced and low-cost telecommunications has a long and storied history that extends from the replacement of manual switchboard operators to the Domain Name Service (DNS) databases that serve as the essential circulatory system of the Internet itself. These advances have proven so beneficial in promoting universal and affordable communication they are taken for granted today. Although the use of databases as a tool for spectrum management is a more recent development, it has proven no less compelling as a means of achieving large-scale, low-cost, and virtually real-time access to communications capacity that would otherwise go unused.
>
> The use of databases to coordinate spectrum assignments has evolved but is nothing new. The basic steps are exactly the same as in a manual coordination process. What is new is (1) surging consumer demand for wireless connectivity and hence the need to intensively share underutilized frequency bands; (2) significant improvements in the computation power to efficiently and rapidly run advanced propagation analysis and coordinate devices and users in near real-time; and (3) more agile wireless equipment that can interact directly with a dynamic frequency coordination database.[21]

The *NPRM* seeks comments on whether it can take this approach even further, into the realm of "3D":

> Different systems or services operating at different altitudes or unique locations could create opportunities for expanded use (or reuse) of spectrum frequencies as between traditional terrestrial locations and unique altitudes and locations. Stated another way, ''3D'' spectrum management techniques could allow for the deployment of new broadband products and services while helping to alleviate growing demands for spectrum resources. Innovative products and services are being developed specifically to improve broadband access on-board airplanes, ships, and other methods of transport. A 3D model of spectrum management, however, presents not only potential opportunities but also potential challenges, as managing potential harmful interference between systems becomes more complicated.[22]

[21] Comments of the Dynamic Spectrum Alliance at 2.

[22] 70/80/90 GHz NPRM, ¶ 23.

Comments in the record support this approach,[23] including using this "light-licensing" approach to future uses of the band as well.[24]

TechFreedom fully supports this approach and urges the FCC to use the 70 GHz band as a true testbed of the future of near-real-time database spectrum management. If the past decade has told us anything, it is that Moore's Law applies to more than just computer chips. The pace of communications innovation is far outstripping the FCC's ability to establish licensing regimes and process license applications. To obtain a more "frictionless" regulatory process, the FCC must look to regulatory approaches such a "light-licensing" regimes coupled with sophisticated database coordination schemes to speed deployment, as this proceeding offers. If we get the regulatory processes correct, if multiple

[23] *See* Dynamic Spectrum Alliance, "Automated Frequency Coordination: An Established Tool for Modern Spectrum Management" at 12-13, available at http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf (describing the benefits of Automatic Frequency Coordination (AFC) ("whereas a more manual or even database-assisted coordination process can be expensive, slow, limited in its granularity, and prone to inconsistent results, an automated calculation engine can produce near-real-time and consistent outcomes at very low marginal cost.").

[24] *See* Dynamic Spectrum Alliance Comments at 4 (Aug. 5, 2020) ("DSA understands that software-defined networking platforms with temporospatial features (Temporospatial SDN) have already been deployed in production that can orchestrate and facilitate coexistence between static point-to-point links and networks of moving antennas, whether they are on land, at sea, in the sky, or in space. These systems can be used to model the movement of antennas in motion and both anticipate and avoid potential in-line events by adopting interference mitigation techniques or preventing interfering links from being formed in the first place." *Citing* Brian Barritt and Vint Cerf, "Loon SDN: Applicability to NASA's Next-Generation Space Communications Architecture," 2018 IEEE Aerospace Conference, available at https://research.google/pubs/pub47138/; *see also* SpaceX *ex parte* of October 21, 2021 ("A common licensing and link registration framework would provide a technologically neutral solution that promotes administrative efficiency, facilitates coordination, respects co-primary allocations in the band, and most importantly enables rapid deployment of critical backhaul networks to connect unserved and underserved Americans.").

uses can be made of spectrum, the FCC can get out of the business of choosing winners and losers; instead, the market can decide how spectrum can best be used.[25]

CONCLUSION

TechFreedom is all for technological innovation. We have championed it since our inception, and it is, indeed, ***in our name***. The 70 GHz Band provides a unique opportunity for accommodating diverse uses with close geographic separation. Even more exciting, however, is the "light-licensing framework" the FCC wisely adopted for this band in 2003. The current proceeding provides the FCC with the opportunity to leverage this licensing with "3D spectrum management techniques" allowing for more robust spectrum management which facilitates rapid deployment of equipment in this band. TechFreedom applauds these efforts and supports the stated goals of the *70/80/90 GHz NPRM.*

Respectfully submitted,

_____/s/_____
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Dated: December 2, 2021

[25] TechFreedom is not particularly interested in "whether HAPS or other stratospheric-based platform services are likely to be commercially viable." *Public Notice* at 3. Rather than allocating spectrum based on whether the FCC thinks a particular service will be accepted in the marketplace, the Commission instead should focus on developing rules that allow for the rapid licensing and deployment of innovative systems so that the market can decide what is viable. We would note, for example, that the original petitions seeking to use the 70 GHz Band for HAPS was filed more than three and a half years ago. That's simply too long to wait for regulatory authority to proceed. An extension of the "light-licensing" regime to allow for such uses could have already resolved the market viability question, and not with regulatory crystal ball gazing, but actual market feedback.