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October 2, 2019

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: ***Written Ex Parte Communication***

GN Docket No. 18-122, *Expanding Flexible Use of the 3.7 GHz to 4.2 GHz Band*

Dear Ms. Dortch:

On September 29, 2019, John Hunter and I of T-Mobile USA, Inc. ("T-Mobile")[1/] met with Kenneth Baker, Dana Shaffer, Paul Powell, and Matthew Pearl of the Wireless Telecommunications Bureau; Paul Lafontaine, Patrick DeGraba, Giulia McHenry, and Jonathan Campbell of the Office of Economics and Analytics; Jose Albuquerque and Thomas Sullivan of the International Bureau; and Julius Knapp of the Office of Engineering and Technology.

During the meeting, we explained that the primary goal of this proceeding is clear. In order to support U.S. leadership in Fifth Generation ("5G") wireless services, the Commission must make hundreds of megahertz of spectrum in the 3.7-4.2 GHz band ("C-band") available for terrestrial use. T-Mobile has demonstrated that an important component of maximizing the amount of C-band spectrum for 5G services includes the use of an alternative transport mechanism, such as fiber, to ensure the reliable delivery of the content currently carried by satellites using the spectrum.[2/] Some parties continue to suggest that fiber is not a suitable alternative transmission

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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* Letter from Steve B. Sharkey, Vice President, Government Affairs, Technology and Engineering Policy, T-Mobile USA, Inc., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed June 21, 2019) ("T-Mobile June 21 *Ex Parte* Letter"); Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 7-10 (filed Aug. 7, 2019) ("T-Mobile Second Supplemental Comments"); Reply Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 4-13 (filed Aug. 14, 2019) ("T-Mobile Second Supplemental Reply Comments").

mechanism, arguing that it is not widely available and is difficult to deploy.[3/] But, as demonstrated below, recent studies and statements by fiber providers demonstrate that those claims are simply wrong.

While T-Mobile recognizes that there may continue to be earth stations in some or all of the C-band and that those facilities will require protection from terrestrial operations, restrictive protection criteria are unnecessary. The industry has reached consensus that the Commission can and should adopt sensible technical restrictions that protect earth station operators without impairing the deployment of 5G services.

Fiber Deployments Can Easily Accommodate Extensions to Earth Station Sites

Recent studies and analyses have confirmed what T-Mobile previously demonstrated – fiber is widely available in both urban and rural areas, and fiber deployment is only expected to increase.[4/] The Commission, for example, recently reported that during 2018 "broadband providers, both small and large, deployed fiber networks to 5.9 million new homes, the largest number ever recorded."[5/] In conducting its own analysis, the Fiber Broadband Association ("FBA") concluded that the Nation is on pace to deploy all-fiber networks to 90 percent of U.S. households in the next decade.[6/] The FBA has also highlighted that "[o]ver the past five years, the North American fiber cable market has grown at an annual compound annual growth rate ('CAGR') of approximately 12%."[7/] It estimates that over 575,000 route kilometers of fiber cable will be supplied in this market in 2019 and that, if a nationwide video programming

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3/ *See, e.g.*, Comments of Globecast America, Incorporated, GN Docket No. 18-122, *et al.*, at 2 (filed Aug. 7, 2019); Comments of Cumulus Media Inc. and Westwood One, LLC, GN Docket No. 18-122, *et al.*, at 2 (filed Aug. 7, 2019); Comments of the Content Companies, GN Docket No. 18-122, at 5 (filed Aug. 7, 2019); Comments of the North American Broadcasters Association, GN Docket No. 18-122, *et al.*, at 3 (filed Aug. 7, 2019); *see also* Comments of the C-Band Alliance, GN Docket No. 18-122, *et al.*, at 10 (filed Aug. 7, 2019) ("CBA Second Supplemental Comments"); Comments of LinkUp Communications Corporation, GN Docket No. 18-122, at 2 (filed Aug. 3, 2019).

4/ *See* T-Mobile Second Supplemental Reply Comments at 4-7; T-Mobile June 21 *Ex Parte* Letter at 4.

5/ *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 2019 Broadband Deployment Report, 34 FCC Rcd 3857, ¶ 3 (2019); *see also* Press Release, *Fiber Broadband Association Releases Study on Rapid Fiber Growth in North America* (Dec. 11, 2018), https://www.fiberbroadband.org/blog/fiber-broadband-association-releases-study-on-rapid-fiber-growth-in-north-america (finding that "fiber now passes 41 million unique homes in the United States and connects 18.6 million homes" – a 17 percent increase in homes passed by fiber since 2017).

6/ *See* Press Release, *New Study Finds All-Fiber Deployments to 90% of Households Achievable in Next Decade* (Sept. 10, 2019), https://www.fiberbroadband.org/blog/new-study-finds-all-fiber-deployments-to-90-of-households-achievable-in-next-decade?utm_source=sendgrid&utm_medium=email&utm_campaign=Newsletters.

7/ Letter from Lisa R. Youngers, President and CEO, Fiber Broadband Association, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 1 (filed Sept. 13, 2019) ("FBA Sept. 13 *Ex Parte* Letter").

network is deployed as proposed by the ACA Connects Coalition, only 120,000 route miles (192,000 route kilometers) of fiber would need to be deployed.[8/]

Statements by cable operators themselves demonstrate that fiber is increasingly becoming the transmission medium of choice. Altice, for example, has reported that, in much of its service territory in New York, it "receives and transports video through direct fiber connections with programmers" and that it "is executing on an ambitious plan to connect more households – including those in extremely rural, remote areas – to the network through fiber deployment."[9/] Comcast has announced substantial expansions of its fiber-based network in California, Connecticut, Maryland, Michigan, Virginia, and Washington, laying several miles of fiber and connecting thousands of homes and businesses.[10/] And Charter has been investing billions of dollars in new fiber infrastructure to increase the density of its national fiber network.[11/] Rural and regional cable operators have also recognized the benefits of fiber and are increasing their fiber builds.[12/]

[8/] *See* FBA Sept. 13 *Ex Parte* Letter at 1-2 (noting that "[a]ssuming a 144-strand average fiber cable count, such an additional build over a five-year period would increase deployments by 7% per year over the 2019 forecast level" and that it believes, given the current CAGR, that "the additional deployment over that time frame is feasible, assuming there are no other issues, including in accessing rights-of-way, poles, and other infrastructure").

[9/] Reply Comments of Altice USA, Inc., GN Docket No. 18-122, *et al.*, at 4 (filed Aug. 14, 2019).

[10/] *See, e.g.*, Press Release, *Comcast Business Expands Fiber Network in West Hartford* (Apr. 9, 2019), https://cdn.wcdc.business.comcast.com/~/media/business_comcast_com/PDFs/Press%20Releases/2019/040919%20%20West%20Hartford%20Hyperbuild%20Announcement%20FINAL%2049.pdf?rev=9260b622-25ae-4542-9f12-6a841c0a3289; Press Release, *Comcast Invests Nearly $2 Million to Serve Deer Park Residents and Businesses* (Dec. 3, 2018), https://business.comcast.com/about-us/press-releases/2018/comcast-invests-nearly-2-million-to-serve-deer-park; Press Release, *Comcast Business Brings 100-Gig-Capable Network Closer to Shelby Township Businesses* (Aug. 6, 2018), https://business.comcast.com/about-us/press-releases/2018/comcast-invests-nearly-2-million-to-serve-deer-park; Press Release, *Comcast Business Announces Million Dollar Investment to Expand High-Performance Ethernet Network in Baltimore* (Aug. 2, 2018), https://business.comcast.com/about-us/press-releases/2018/comcast-business-announces-million-dollar-investment-baltimore; Press Release, *Comcast Business Invests More Than $300,000 to Expand Fiber Network in Sanger, California* (May 17, 2018), https://business.comcast.com/about-us/press-releases/2018/comcast-business-invests-more-than-300000-to-expand-fiber-network; Press Release, *Comcast Business Announces Multi-Million Dollar Investment to Expand High-Performance Ethernet Network in Arlington and Alexandria* (May 2, 2018), https://business.comcast.com/about-us/press-releases/2018/comcast-business-announces-multi-million-dollar-investment-to-expand-arlington-alexandria.

[11/] *See* Press Release, *Spectrum Enterprise to Invest $1 Billion to Increase the Density of its National Fiber Network and Transform its Approach to the Client Experience* (May 14, 2018), https://newsroom.charter.com/press-releases/spectrum-enterprise-to-invest-1-billion-to-increase-the-density-of-its-national-fiber-network-and-transform-its-approach-to-the-client-experience/.

[12/] *See, e.g.*, Todd Spangler, *N.C. Cable Operator Rolling Out Fiber-To-The-Home Network, Multichannel News* (Mar. 29, 2018), https://www.multichannel.com/news/nc-cable-operator-rolling-out-fiber-home-network-326293 (reporting that Country Cablevision, a small cable operator in North Carolina, has begun deployment fiber in the rural mountain counties of North Carolina); Consolidated Communications, *Consolidated Communications Launches 1 GigaBit Internet Speeds in its Rural New*

Video programmers likewise increasingly view fiber as an alternative to provide their programming. The FBA reports that "video programmers have been transitioning from satellite to fiber delivery" over the last decade.[13/] In addition, as the Commission is aware, some video programmers have stated on the record that they would consider relocating to fiber.[14/] While some broadcasters have expressed reservations about a transition to fiber, others have indicated that they would be willing to utilize fiber for their content and have partnered with others to do so. Zayo Group, for instance, an operator of a 131,000-mile fiber network in the U.S., recently announced that it has been selected by a major news broadcaster to provide a managed video network.[15/] It has observed that "[i]ncreasingly broadcasters, content providers, over-the-top (OTT) platforms and multichannel video programming distributors (MVPDs) are moving to terrestrial fiber networks that provide increased bandwidth and lower latency than satellite."[16/]

It is not just the video industry deploying fiber. Smaller carriers and service providers are deploying fiber in some of the toughest places to serve.[17/] Indeed, T-Mobile recently teamed up

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York Service Areas (Apr. 5, 2019), https://www.consolidated.com/about-us/news/article-detail/id/660/categoryid/27/consolidated-communications-launches-1-gigabit-internet-speeds-in-its-rural-new-york-service-areas (stating that Consolidated Communications has extended fiber-based services to more than 10,000 business and residential locations across underserved and unserved areas in New York).

13/ *See* Fiber Broadband Association, *FBA Statement and Letter on the Future of the C-Band and Fiber Investment* (July 26, 2019), https://www.fiberconnect.org/blog/fba-statement-and-letter-on-the-future-of-the-c-band-and-fiber-investment; *see also* Letter from Joseph C. Cavender, Vice President & Assistant General Counsel, Federal Regulatory Affairs, CenturyLink, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 1-2 (filed Sept. 23, 2019) (noting that many video programmers use fiber today).

14/ *See, e.g.*, Letter from Jason E. Rademacher and Christina Burrow, Cooley, Counsel for The Church of Jesus Christ of Latter-day Saints, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 4-5, 7 (filed July 9, 2019); Comments of the Church of Jesus Christ of Latter-day Saints, GN Docket No. 18-122, *et al.* (filed Aug. 7, 2019); Letter from John B. Simpson, Consultant to RIDE TV, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 *et al.*, at 1 (filed Sept. 25, 2019) (explaining that RIDE TV believes video programming can be transported reliably over fiber optic networks and that it has no objection to an expedited migration of its video programming transport to fiber).

15/ Press Release, *Major News Broadcaster Selects Zayo for Managed Video Network* (June 21, 2019), https://investors.zayo.com/news-and-events/press-releases/press-release-details/2019/Major-News-Broadcaster-Selects-Zayo-for-Managed-Video-Network/default.aspx.

16/ *Id.*

17/ *See, e.g.*, Allison Graham, *Botetourt County enters into contract with Lumos to expand fiber access in Buchanan area*, THE ROANOKE TIMES (June 25, 2019), https://www.roanoke.com/news/local/botetourt-county-enters-into-contract-with-lumos-to-expand-fiber/article_72de7921-724b-5e8f-9aba-8e813aa19d5e.html (announcing that Lumos Networks, an incumbent local exchange carrier in Virginia, has entered into a contract with the Botetourt County Board of Supervisors to bring fiber to 645 locations in rural areas of Virginia); Wilson Guide, *Wilson Communications invests heavily in rural connectivity* (2019), https://wilsonguide.com/stories/511155924-wilson-communications-invests-heavily-in-rural-connectivity.

with Blackfoot, which has been rapidly expanding its fiber backbone,[18/] to build out hundreds of new mobile sites in eastern Montana and Northern Wyoming.[19/] Even rural electric cooperatives, many with support from the Commission, are entering into the fiber market, deploying fiber in several rural and remote areas.[20/]

While some of these fiber builds involve fiber-to-the-home, and clusters of homes present certain economies of scale that may not be present when building fiber to earth station locations, the conclusion from current fiber deployment is inescapable – if fiber can be run to tens of millions of homes, it can certainly be run to a few thousand earth station locations where it is not already available. As T-Mobile previously explained, the median distance between fiber runs and earth stations in urban areas is 272 meters and 465 meters in rural areas.[21/] And those estimates are based on conservative assumptions. To the extent new fiber builds are necessary, they can be promptly deployed as they currently are today.

The costs for deploying new fiber could be covered by proceeds generated from an auction of C-band spectrum.[22/] The Commission therefore has a unique opportunity to expand fiber capacity throughout the Nation using what is effectively private financing. Not only can the Commission use a privately-funded transition to fiber to help future-proof the delivery of content, but it could also use the transition to help close the digital divide. As some parties have observed,[23/] fiber companies would be more willing to look for opportunities to run fiber to residential or enterprise customers or provide redundancy to other providers if cable and broadcast customers serve as anchor tenants for new fiber lines.

18/ *See* BridgeWave Communications, *Blackfoot Extends Fiber Network with BridgeWave Multi-Gigabit, High Value, and Low-Cost Systems* (June 12, 2018), https://bridgewave.com/blackfoot/; Inside Towers, *ACT, Blackfoot Communications Extend Fiber Reach* (Apr. 22, 2019), https://insidetowers.com/cell-tower-news-act-blackfoot-communications-extend-fiber-reach/.

19/ *See* Blackfoot, *Blackfoot and T-Mobile to Bring the Un-Carrier to More Montana and Wyoming Customers* (Oct. 9, 2017), https://www.blackfoot.com/news/blackfoot-t-mobile-bring-un-carrier-montana-wyoming-customers/.

20/ *See, e.g.*, Press Release, *FCC Approves $225 million for 35 Electric Cooperatives to Provide Rural Broadband* (Aug. 28, 2018), https://www.electric.coop/fcc-approves-220-million-33-electric-cooperatives-provide-rural-broadband/; Calix, *Tri-County Rural Electric Cooperative, Pennsylvania's First to Deliver High Speed Broadband, Goes All in on Fiber With Calix* (Sept. 12, 2019), https://www.globenewswire.com/news-release/2019/09/12/1914748/0/en/Tri-County-Rural-Electric-Cooperative-Pennsylvania-s-First-to-Deliver-High-Speed-Broadband-Goes-All-in-on-Fiber-With-Calix.html.

21/ *See* T-Mobile June 21 *Ex Parte* Letter at 4.

22/ The cost for deploying fiber ranges from $167.7 million to $1.42 billion depending on the number of earth station locations and assumptions regarding the extent of existing fiber deployment. *See* T-Mobile June 21 *Ex Parte* Letter at 1-2.

23/ Matt Daneman, *Fiber-for-C-Band Raises Ongoing Cost, Timing Concerns*, COMMUNICATIONS DAILY (Sept. 19, 2019) (discussing remarks from GoNetspeed Chief Operating Officer Tom Perrone).

The Commission Should Adopt Flexible Interference Protection Rules to Protect Remaining Earth Stations

The Commission should ensure that any protection criteria it adopts for earth station operators that will continue to receive C-band signals are reasonable and consistent with 3GPP standards. T-Mobile agrees with others that the primary responsibility of interference management should rest with the wireless operator, not the equipment.[24/] As T-Mobile and other commenting parties have proposed, the Commission should afford new licensees the flexibility to remediate interference concerns with incumbents directly and engage in negotiations that may result in more permissive 5G operations than the technical rules would otherwise allow.[25/] The Commission should reject C-Band Alliance ("CBA") proposals that are overly restrictive and could hinder the deployment of 5G services.

Out-of-Band Emissions ("OOBE") Limits. The Commission should adopt its proposed OOBE limit of -13 dBm/MHz.[26/] Commenting parties widely agree that the Commission's proposed OOBE limit, which has long been used in the Advanced Wireless Service bands to protect adjacent operations from harmful interference, will accommodate equipment for both base stations and user equipment in 3GPP Band Class n77.[27/] Even the CBA agrees. While the CBA previously proposed strict OOBE masks for both base stations and user equipment,[28/] it has since

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[24/] *See, e.g.*, Letter from William H. Johnson, Senior Vice President, Federal Regulatory and Legal Affairs, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at Attachment at 2 (filed Sept. 16, 2019) ("Verizon Sept. 16 *Ex Parte* Letter"); Letter from Jennifer Hindin, Wiley Rein, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 2 (filed Sept. 18, 2019). However, T-Mobile does not support Verizon's proposal to establish a Joint Rapid Response Clearinghouse call center to respond immediately to interference trouble tickets from earth station operators. *See* Verizon Sept. 16 *Ex Parte* Letter at Attachment at 13. Establishing such a call center would be unduly burdensome and unnecessary, particularly if the Commission maximizes clearing of the band and adopts the sensible technical policies outlined herein to protect any remaining earth station operators.

[25/] *See* T-Mobile Second Supplemental Reply Comments at 14; Comments of CTIA, GN Docket No. 18-122, *et al.*, at 11 (filed Aug. 7, 2019) ("CTIA Second Supplemental Comments").

[26/] *See Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, 33 FCC Rcd 6915, ¶ 168 (2018) ("*NPRM*").

[27/] *See, e.g.*, Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 32 (filed Oct. 29, 2018) ("T-Mobile *NPRM* Comments"); Comments of Ericsson, GN Docket No. 18-122, *et al.*, at 12-13, 20-21 (filed Oct. 29, 2018) ("Ericsson *NPRM* Comments"); Comments of Qualcomm Incorporated, GN Docket No. 18-122, *et al.*, at 6 (filed Aug. 7, 2019); Comments of Verizon, GN Docket No. 18-122, *et al.*, at 11 (filed Aug. 7, 2019) ("Verizon Second Supplemental Comments"); Reply Comments of AT&T, GN Docket No. 18-122, *et al.*, at 3-4 (filed Aug. 14, 2019) ("AT&T Second Supplemental Reply Comments"); Reply Comments of Verizon, GN Docket No. 18-122, *et al.*, at 10-11 (filed Aug. 14, 2019) ("Verizon Second Supplemental Reply Comments"); *see also* Reply Comments of Samsung Electronics America, GN Docket No. 18-122, *et al.*, at 6 (filed Aug. 14, 2019) ("Samsung Second Supplemental Reply Comments") (supporting an OOBE limit of -13 dBm/MHz for mobile user equipment).

[28/] *See* Letter from Jennifer D. Hindin, Wiley Rein, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at Attachment at 12-13 (filed May 13, 2019) (explaining that the CBA has proposed maximum base station OOBE levels of -3 dBm/MHz from 0 to 20

recognized that its proposals were excessive, stating that OOBE masks "beyond that which [have] been specified by 3GPP for band n77" are not necessary.[29/] T-Mobile agrees with these parties as well as those that suggest licensees should only be required to limit OOBE when they are operating near a receive-only earth station.[30/]

T-Mobile understands that the CBA has agreed to the Commission's proposed OOBE limit in part because it has proposed rules to measure and enforce aggregate base station and user equipment OOBE limits at the input of the earth station low noise block converter ("LNB") when using the earth station reference antenna mask and filter mask.[31/] Specifically, the CBA has proposed a protection level of -128 dBm/MHz in the aggregate for all base stations and user equipment within 40 kilometers of an earth station, other than Telemetry, Tracking, and Commanding ("TT&C")/Gateway sites, and a protection level of -133 dBm/MHz in the aggregate for all base stations and user equipment within 150 kilometers of a TT&C/Gateway site.[32/] T-Mobile agrees with other commenters that the CBA's revised proposal should be rejected because it would add factors that could increase unnecessarily the level of interference predicted and thus reduce the opportunities for 5G deployment.[33/] T-Mobile also agrees with Verizon that any receiver protection thresholds should be apportioned to multiple licensees based upon each licensee's proportional licensed bandwidth, not divided evenly.[34/]

Blocking. The CBA has proposed that the aggregate RF power spectral density produced by base stations and user equipment within 40 kilometers of an earth station as measured at the output of a reference RF filter and earth station antenna may not exceed a value of -59 -10log10(BW_{MHz}) – 10log10(n1) dBm/MHz.[35/] But the CBA's proposal is based on faulty reasoning. *First*, as Ericsson has explained, the -59 dBm protection level proposed by the CBA is derived from

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megahertz, -40 dBm/MHz between 20 and 40 megahertz, and -50 dBm/MHz beyond 40 megahertz as well as maximum user equipment OOBE levels of -28 dBm/MHz from 0 to 20 megahertz, -55 dBm/MHz between 20 and 40 megahertz, and -65 dBm/MHz beyond 40 megahertz).

29/ *See* CBA Second Supplemental Comments at 34.

30/ *See* Verizon Sept. 16 *Ex Parte* Letter at Attachment at 6.

31/ *See* CBA Second Supplemental Comments at 33 (adding that "[w]here multiple wireless licensees exist, the OOBE limit shall be adjusted by -10log10(n2) where n2 is the number of distinct licensees operating within 40 kilometers of the earth station").

32/ *See id.* at 34 (adding that "[w]here multiple wireless licensees exist, the OOBE limit shall be adjusted by -10log10(n2) where n2 is the number of distinct licensees operating within 150 kilometers of the TT&C/Gateway site").

33/ *See* CTIA Second Supplemental Comments at 9; Verizon Second Supplemental Reply Comments at 2-5.

34/ *See* Verizon Sept. 16 *Ex Parte* Letter at Attachment at 12.

35/ *See* CBA Second Supplemental Comments at Attachment A at 1-2 (adding that BW is the total amount of C-band spectrum, in megahertz (MHz), cleared for flexible-use licensees, and n1 is the number of distinct licensees using the same frequency block in the services areas within 40 kilometers of the earth station).

assuming a required protection level of -55 dBm along with a -4 dB safety margin.[36/] The CBA attempts to dispute Ericsson's claim that it has added a "safety margin," but provides no credible explanation for its calculation – it merely suggests that a lower value is required "to ensure that the received signal performance is not significantly degraded."[37/] While the CBA also asserts that the input power must be -75 dBm so that the satellite link does not suffer any degradation,[38/] it provides no explanation why LNBs that are operating within the linear range of the receiver would experience any link degradation. *Second*, the CBA's proposed protection levels are premised on protecting earth stations with the poorest performing LNBs.[39/] The CBA seemingly acknowledges that -59 dBm (or even -55 dBm) is at the low end of the performance scale as evidenced by its use of the Commission's blocking value of -60 dBm. And NTIA identified C-band LNBs that perform 15 dB better nearly 25 years ago.[40/] New LNBs that operate at the higher end of the performance range should be used, particularly since those LNBs can be easily incorporated into earth stations along with the filters that will be required to repurpose the C-band.

Elevation Angles. The CBA recently revised its proposed "full-arc" protection for earth stations communicating with satellites at elevation angles down to 5 degrees by proposing that antenna elevation angles be defined by a limited orbital arc of between 89° W.L. and 139° W.L.[41/] While T-Mobile appreciates the CBA's re-examination of its conservative proposal, it agrees with others that protection should be accorded only to elevation angles associated with satellites in operation, taking into account real-world information – including the range of actual earth station elevation angles at the particular latitude/longitude of the earth station location – to provide accurate, but not unnecessary, protection.[42/] To the extent possible, earth stations should also be located to maximize physical shielding from terrestrial networks.[43/] For example, earth stations should be located on roof tops for skyscrapers, in courtyards for office buildings, and in alleys/confined spaces for warehouses or churches, etc. so that they are higher than the beamwidth of a terrestrial base station.

36/ *See* Reply Comments of Ericsson, GN Docket No. 18-122, *et al.*, at 8 (filed Dec. 11, 2018) ("Ericsson *NPRM* Reply Comments").

37/ *See* Comments of the C-Band Alliance, GN Docket No. 18-122, *et al.*, at Technical Annex at 5 n.9 (filed Oct. 29, 2018) ("CBA *NPRM* Comments"); Letter from Jennifer D. Hindin, Wiley Rein, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at Further Technical Statement at 11 (filed Mar. 4, 2019) ("CBA Mar. 4 *Ex Parte* Letter").

38/ *See* CBA Mar. 4 *Ex Parte* Letter at Further Technical Statement at 12.

39/ *See* Ericsson *NPRM* Reply Comments at 8.

40/ *See* U.S. Department of Commerce, *Analysis of Electromagnetic Compatibility Between Radar Stations and 4 GHz Satellite Earth Station*, NTIA Report 94-313, at 52 (July 1994).

41/ *See* CBA Second Supplemental Comments at 27-28.

42/ *See* CTIA Second Supplemental Comments at 9; Verizon Second Supplemental Comments at 10; AT&T Second Supplemental Reply Comments at 4.

43/ *See* Ericsson *NPRM* Comments at 13 (explaining that "[e]arth stations operating with satellites that are at low elevation angles (*i.e.*, close to the horizon) are more likely to receive interference from terrestrial sources").

Earth Station Protection Zones. Commenting parties broadly agree that the CBA's initial proposal of 150-meter protection areas around all registered C-band earth station locations would significantly expand predicted interference levels to cover areas where earth stations do not exist and should be significantly reduced to more specifically protect actual antennas.[44/] Recognizing these concerns, the CBA has proposed applying the Commission's existing Section 25.118 rule allowing earth station operators to move antennas operating in shared bands up to one arc second in latitude or longitude from the originally authorized coordinates, up to 30 meters in latitude and 20-28 meters in longitude, *after* the Commission opens one more filing window for registration of receive-only earth stations.[45/] T-Mobile, however, agrees with others that opening an additional filing window would cause unnecessary delays and should not be permitted.[46/]

Antenna Parameters. The Commission should use recorded antenna parameters in lieu of the CBA's proposal to use an antenna diameter of up to 13 meters for receiver protection calculations.[47/]

Earth Station Filters. The majority of commenters agree with T-Mobile that the CBA's proposed antenna filter mask can and should be improved.[48/] The CBA appears to recognize as much, recently conceding that "the FSS antenna filter mask can be significantly improved, which will allow 5G base stations to be built closer to FSS earth stations and operate nearer to the FSS antenna boresight."[49/] The Commission should ensure that earth stations are equipped with high-quality components that provide sufficient resistance to interference and allow flexible 5G operations.

Telemetry, Tracking, and Commanding and Coordination Zones. To protect TT&C/Gateway locations, the CBA has proposed utilizing 150-kilometer radius coordination zones, but reducing TT&C/Gateway locations to four.[50/] T-Mobile joins other commenters that call for further

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44/ *See, e.g.*, T-Mobile Second Supplemental Reply Comments at 13-14; Comments of AT&T, GN Docket No. 18-122, *et al.*, at 8 (filed Aug. 7, 2019) ("AT&T Second Supplemental Comments"); CTIA Second Supplemental Comments at 8-9; Verizon Second Supplemental Comments at 9; AT&T Second Supplemental Reply Comments at 5; Verizon Second Supplemental Reply Comments at 5-7.

45/ *See* CBA Second Supplemental Comments at 28-29.

46/ *See* Verizon Second Supplemental Reply Comments at 6.

47/ *See* CTIA Second Supplemental Comments at 9; Verizon Second Supplemental Comments at 10; AT&T Second Supplemental Reply Comments at 5; *see also* Reply Comments of the Small Satellite Operators (ABS Global Ltd., Hispasat S.A. and Claro S.A.), GN Docket No. 18-122, *et al.*, at 9 (filed Aug. 14, 2019) (asserting that the Commission should consider additional antenna patterns that correspond to smaller antennas).

48/ *See, e.g.*, T-Mobile Second Supplemental Reply Comments at 14; AT&T Second Supplemental Reply Comments at 5 (suggesting that the Commission should assume the deployment of improved satellite filters to further reduce the impact of OOBE); Verizon Second Supplemental Reply Comments at 7 (urging the Commission to continue to evaluate the performance of satellite receive filters).

49/ CBA Second Supplemental Comments at 31.

50/ *See id.* at 29-30.

investigation into the need for these large coordination zones.[51/] The Commission should also limit the number of grandfathered TT&C/Gateway facilities that require protection and relocate those facilities to remote areas.[52/]

Power Limits. The Commission should adopt its proposed base station power limits of 1640 watts Effective Isotropic Radiated Power ("EIRP") (for emission bandwidths less than one megahertz) and 1640 watts per MHz EIRP (for emission bandwidths greater than one megahertz) in non-rural areas and 3280 watts EIRP (for emission bandwidths less than one megahertz) and 3280 watts per MHz EIRP (for emission bandwidths greater than one megahertz) in rural areas.[53/] Several commenters agree.[54/] The Commission should also adopt its proposed power levels for mobiles and portables of 1 Watt (30 dBm).[55/] The Commission, however, should refrain from imposing a 75 dBm EIRP limit on the aggregated total power of a fixed or base station, summed over all antenna elements.[56/] As T-Mobile has explained,[57/] adopting a 75 dBm EIRP total power limit would limit the EIRP of a 100-megahertz channel to 316 watts per megahertz, diminish the coverage area of channels that are greater than 20 megahertz wide, and prevent 5G base stations from supporting the highest possible throughput throughout the cell coverage area.

Field Strength Limit and Market Boundaries. The Commission should adopt its proposed -76 dBm/m2/MHz power flux density limit at the service area boundaries.[58/] As T-Mobile noted and

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51/ *See* T-Mobile Second Supplemental Reply Comments at 13-14; AT&T Second Supplemental Comments at 8.

52/ *See* AT&T Second Supplemental Reply Comments at 5; *see also* Verizon Second Supplemental Reply Comments at 8-9 (arguing that the CBA should work with its members and propose four TT&C locations that reflect the importance of the surrounding areas within that radius, not just the site itself, because the four remote locations suggested by the CBA may have a far greater impact than the CBA recognizes).

53/ *See NPRM* ¶ 164.

54/ *See* T-Mobile *NPRM* Comments at 31-32; Ericsson *NPRM* Comments at 19-20; Comments of Nokia, GN Docket No. 18-122, *et al.*, at 2 (filed Aug. 7, 2019); AT&T Second Supplemental Reply Comments at 3; Samsung Second Supplemental Reply Comments at 4.

55/ *See NPRM* ¶ 167; Comments of Verizon, GN Docket No. 18-122, at 23-24 (filed Oct. 29, 2018) ("Verizon *NPRM* Comments").

56/ *See NPRM* ¶ 165; Reply Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 39-40 (filed Dec. 11, 2018) ("T-Mobile *NPRM* Reply Comments"); Samsung Second Supplemental Reply Comments at 4-5; *see also* Verizon Second Supplemental Reply Comments at 11; Verizon *NPRM* Comments at 23-24.

57/ *See* T-Mobile *NPRM* Reply Comments at 39.

58/ *See* T-Mobile *NPRM* Comments at 35; Ericsson *NPRM* Comments at 22; Verizon *NPRM* Comments at 26; Reply Comments of AT&T Services, Inc., GN Docket No. 18-122, at 22-23 (filed Dec. 11, 2018).

others agree, a -76 dBm/m2/MHz power flux density limit would promote consistency with other 5G bands.[59/]

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Pursuant to Section 1.1206(b)(2) of the Commission's rules, an electronic copy of this letter is being filed in the above-referenced docket. Please direct any questions regarding this filing to me.

Respectfully submitted,

/s/ Steve B. Sharkey

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59/ *See* T-Mobile *NPRM* Comments at 35; *see also* Verizon *NPRM* Comments at 26.