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June 6, 2022

***BY ELECTRONIC FILING***

Marlene Dortch  
Secretary  
Federal Communications Commission  
45 L Street NE  
Washington, DC 20554

**Re: Expanding Flexible Use of the 12.2-12.7 GHz Band, WT Docket No. 20-443, GN Docket No. 17-183; IBFS File Nos. SAT-LOA-20200526-00055, SAT-AMD-20210818-00105; ULS File No. 0008735875**

Dear Ms. Dortch:

DISH Network Corporation (“DISH”) responds to recent letters filed by SpaceX in the above-captioned proceedings.<sup>1</sup> Despite SpaceX’s attempts to cloud the record, two expert engineering analyses demonstrate that higher-power terrestrial operations in the 12.2-12.7 GHz (“12 GHz”) band can readily co-exist with non-geostationary orbit (“NGSO”) satellite systems. The 500 megahertz of 12 GHz spectrum is well-suited for terrestrial, two-way 5G use cases, and these terrestrial services can be configured to ensure ample protection for satellite operations.

***Broad support for 5G.*** There is broad support for opening up the 12 GHz band for two-way terrestrial, 5G mobile service. SpaceX’s claim that “DISH has only been able to muster a paid-for, inside-the-beltway ‘coalition’”<sup>2</sup> does not withstand the slightest scrutiny. The 5G for 12 GHz Coalition is a multilateral coalition of thirty-five stakeholders, including public interest organizations, trade associations, and private companies.<sup>3</sup>

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<sup>1</sup> Letter from Jameson Dempsey, SpaceX, to Marlene Dortch, FCC, WT Docket No. 20-443; GN Docket No. 17-183; ULS File No. 0008735875 (June 1, 2022) (“SpaceX June 1, 2022 Letter”); Letter from Brett Tarnutzer, SpaceX, to Marlene Dortch, FCC, WT Docket No. 20-443; GN Docket No. 17-183 (May 23, 2022) (“SpaceX May 23, 2022 Letter”); Letter from Brett Tarnutzer, SpaceX, to Marlene Dortch, FCC, WT Docket No. 20-443; GN Docket No. 17-183 (May 19, 2022) (“SpaceX May 19, 2022 Letter”); Letter from David Goldman, SpaceX, to Marlene Dortch, WT Docket No. 20-443, GN Docket No. 17-183 at 1 (May 12, 2022) (“SpaceX May 12, 2022 Letter”).

<sup>2</sup> SpaceX May 23, 2022 Letter, Attachment B at 3.

<sup>3</sup> The 35 members of the Coalition are: INCOMPAS, Public Knowledge, DISH, Computer & Communications Industry Association, RS Access, Benton Institute for Broadband & Society, Open Technology Institute at New America, Federated Wireless, Airspan, A-Side Technology, AtLink,

***Manufacturer Support for 12 GHz.*** SpaceX claims that “no major wireless association, standards body, or equipment manufacturer has expressed any interest in using the band for 5G.”<sup>4</sup> This is false, as three wireless associations—INCOMPAS, RWA and CCIA—are part of the 5G for 12 GHz Coalition, and standard-setting work has already been undertaken.<sup>5</sup> There is also support from the vendor/manufacturing community for unleashing 12 GHz for 5G, including Dell, VMWare, Mavenir, Airspan, and Cambridge Broadband Networks. More broadly, standards bodies and manufacturers are generally induced to devote significant resources only by a critical mass of regulatory action. SpaceX may be content with a vicious circle where agency inaction leads to inaction by standard-setting organizations and manufacturers alike. But this is the equivalent of stepping on the brake just when U.S. 5G needs to get into seventh gear. The U.S. needs the *virtuous* circle of Commission allocation of the band to higher-power, two-way services, and then prompt incorporation of the band in standards and equipment.

***Engineering Studies Confirm Coexistence.*** SpaceX’s May 19, 2022 ex parte meeting was held on the same day that RKF Engineering submitted its second study into the record.<sup>6</sup> This report reinforced the results of RKF’s prior study in this proceeding, and showed that terrestrial wireless service using the 12 GHz band can coexist with NGSO systems even more readily than previously established. In fact, even as SpaceX was criticizing 5G proponents for “refus[ing] to correct”<sup>7</sup> the first RKF study, the new RKF study considered several factors identified as lacking in SpaceX’s criticisms. Among other things, the 2022 RKF Report accounts

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Cambridge Broadband Network Groups, Center for Educational Innovation, Ceragon, Center for Rural Strategies, Dell Technologies, Etheric Networks, GeoLinks, Globtel Holding, GoLong Wireless, Granite Telecommunications, Mavenir, Mixcomm, mmWave Tech, MVD Number 53 Partners, NextLink, Resound Networks, Rise Broadband, Rural Wireless Association, Tilson, VMWare, WeLink, White Cloud, Xiber and X-Lab.

<sup>4</sup> SpaceX May 23, 2022 Letter at 1.

<sup>5</sup> See Reply Comments of DISH Network Corp., WT Docket No. 20-443, GN Docket No. 17-183, at 28-32 (July 7, 2021) (“DISH 12 GHz Reply Comments”).

<sup>6</sup> See RKF Engineering Solutions, LLC, *The Effect of 5G Deployment on NGSO FSS Downlink Operations in the 12.2-12.7 GHz Band* (“2022 RKF Report”), attached to Letter from V. Noah Campbell, RS Access, to Marlene Dortch, FCC, WT Docket No. 20-443, (May 19, 2022).

<sup>7</sup> SpaceX May 23, 2022 Letter, Attachment B at 5.

for shared use of the band,<sup>8</sup> placement of satellite antennas,<sup>9</sup> elevation angles,<sup>10</sup> and interference metrics<sup>11</sup>—all of them listed by SpaceX as not having been considered.<sup>12</sup> All of these items, however, are more than offset by improvements made by RKF, including use of “horizon nulling,” and marshaling the capability that method gives terrestrial antennas to avoid interference. The result? *RKF found that a very small 0.15% of NGSO consumer terminals—down from 0.89% in the 2021 RKF Report—would experience even the potential for interference.*<sup>13</sup> SpaceX, for its part, has still not submitted any technical or engineering studies into the record.

**2016 Studies.** SpaceX has now filed its third letter<sup>14</sup> in this proceeding focusing on studies submitted six years ago by the MVDDS Coalition about sharing in the 12 GHz band between NGSO satellites and terrestrial service.<sup>15</sup> This single-note advocacy—which focuses on analysis prepared long before a single commercial NGSO satellite using the band was orbiting the Earth—is an attempt to divert attention from the total absence of any technical evidence in support of SpaceX’s position on the two main issues involving its use of the 12 GHz band. SpaceX has continuously failed to acknowledge the following: (1) that the introduction of

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<sup>8</sup> 2022 RKF Report at 3 (“RKF places nearly 2.1 million 5G devices, comprising 1,499,910 simultaneously active macro-cell UEs, 49,997 fixed macro-cell base stations, 89,970 fixed small-cell base stations, 6,999 point-to-point backhaul links, and 449,850 simultaneously active small-cell UEs, capturing the diverse ways a nationwide 5G network could utilize the 12 GHz band.”).

<sup>9</sup> *Id.* at ii (“[T]his study now assumes that more than half of Starlink terminals would have a rooftop deployment. A rooftop NGSO terminal would not be shielded by clutter that might otherwise block 5G emissions.”).

<sup>10</sup> *Id.* (“[T]his study now assumes Starlink terminals more frequently use lower elevation angles closer to the minimum elevation angle of 25°.”).

<sup>11</sup> *Id.* at 26 (“Although some commentators have suggested an exceedance threshold of -12.2 dB I/N, that value would not materially affect this study’s findings: A -12.2 dB I/N increases the noise level by 0.3 dB relative to -8.5 dB I/N, and therefore only marginally increases the percentage of additional Starlink terminal exceedances.”).

<sup>12</sup> See SpaceX May 23, 2022 Letter, Attachment B at 5. SpaceX falsely claims that DISH has recognized that SpaceX terminals are typically installed on rooftops. SpaceX May 19, 2022 Letter at 2. DISH has recognized nothing of the kind—DISH merely reproduced a SpaceX graphic showing a rooftop. By no means is this a recognition that rooftops are the Starlink dishes’ typical home.

<sup>13</sup> 2022 RKF Report at 25-28.

<sup>14</sup> See SpaceX May 12, 2022 Letter; Letter from David Goldman, SpaceX, to Marlene Dortch, WT Docket No. 20-443, GN Docket No. 17-183 (Mar. 18, 2022); Letter from David Goldman, SpaceX, to Marlene Dortch, WT Docket No. 20-443, GN Docket No. 17-183 (Nov. 29, 2021).

<sup>15</sup> See Tom Peters, *MVDDS 12.2-12.7 GHz Co-Primary Service Coexistence* (“First Peters Study”), attached to Comments of MVDDS 5G Coalition, Docket No. RM-11768 (June 8, 2016); Tom Peters, *MVDDS 12.2-12.7 GHz Co-Primary Service Coexistence II* (“June 23, 2016 Peters Study”), attached to Reply Comments of the MVDDS 5G Coalition, Docket No. RM-11768 (June 23, 2016) (collectively, “2016 Studies”).

higher-power terrestrial services in the band would not cause even the potential for interference except to a very small percentage of NGSO consumer terminals; and (2) that SpaceX's existing system exceeds the power levels applicable to the 12 GHz band for the protection of satellite television, and its proposed second-generation system would, if approved, exceed these limits by far more.

Astonishingly, SpaceX has not submitted a single declaration conducted by expert engineers on either issue. In contrast, with respect to NGSO/terrestrial service sharing in the 12 GHz band, RKF Engineering submitted two detailed statistical Monte Carlo analyses, in May 2021 and May 2022.<sup>16</sup> The Commission,<sup>17</sup> the courts,<sup>18</sup> and the Chairwoman<sup>19</sup> in recent communications with Congress have all cited Monte Carlo analysis as the gold standard in assessing interference. But SpaceX has still not submitted any expert analysis of its own, statistical or otherwise. With respect to SpaceX's proposed second-generation system, as soon as DISH received SpaceX's data about the SpaceX satellites' power levels, DISH submitted a comprehensive technical study showing SpaceX's violation of the rules.<sup>20</sup> It has been three months since DISH's submission and SpaceX has not provided a single response.

While it has become repetitive to rebut the same allegations, dressed each time in a different cloak, SpaceX nonetheless continues to misstate the conclusions of the 2016 Studies, which have been overtaken by subsequent technical advances.

***NGSO/Terrestrial Service Sharing.*** As DISH has explained, the 2016 Studies used a worst-case approach, meaning that they were based on worst-case assumptions of several factors occurring simultaneously, including no propagation loss and near-zero NGSO satellite elevation angles.<sup>21</sup> As Mr. Peters explained, "we generally sought to rely upon worst-case assumptions to address uncertainty. Our preference for worst-case assumptions tended to overstate the risk of

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<sup>16</sup> See RKF Engineering Solutions, LLC, *Assessment of Feasibility of Coexistence between NGSO FSS Earth Stations and 5G Operations in the 12.2 – 12.7 GHz Band* ("2021 RKF Report"), attached to Comments of RS Access, LLC, WT Docket No. 20-443, GN Docket No. 17-183 (May 7, 2021); 2022 RKF Report.

<sup>17</sup> See *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd. 3852 (2020).

<sup>18</sup> See *AT&T Services, Inc. v. FCC*, 21 F.4th 841, 853 (2021).

<sup>19</sup> The Honorable Jessica Rosenworcel, Chairwoman, Federal Communications Commission, Additional Questions for the Record, Subcommittee on Communications and Technology Hearing on Connecting America: Oversight of the FCC, at 17 (Mar. 31, 2022).

<sup>20</sup> *Second Technical Study on SpaceX Second-Generation System* ("Second Gen2 Study"), Exhibit 1 to Reply of DISH Network Corp., File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105, (Mar. 8, 2022) ("DISH Gen2 Reply").

<sup>21</sup> See Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene Dortch, FCC, WT Docket No. 20-443, GN Docket No. 17-183, at 7 (Jan. 13, 2022); see also Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene Dortch, FCC, WT Docket No. 20-443, GN Docket No. 17-183, at 7-8 (Apr. 21, 2022) ("DISH April 21, 2022 Letter").

potential interference, but we adopted this posture intentionally to help demonstrate how much additional margin for coexistence would exist if more realistic operating assumptions were used.”<sup>22</sup> In response, SpaceX takes a statement in the later study out of context, asserting that Mr. Peters “identified interference to potential future NGSO FSS operations in the 12.2-12.7 GHz as probable even using best-case assumptions for MVDDS operations.”<sup>23</sup> But this was a reference to one parameter—the transmit power of a terrestrial antenna. By contrast, the “general[]” rule, a “preference for worst-case assumptions,” was stated in the First Peters Study, the net result of which was to “overstate” interference.<sup>24</sup> These assumptions included angles as low as effectively zero degrees, as well as free-space propagation of terrestrial signals. In communications with Congress about this proceeding, Chairwoman Rosenworcel effectively recognized that free-space propagation is an unrealistic assumption when she pointed to the importance of clutter in attenuating the terrestrial transmit signals: “we are determining what propagation model should be used to assess how the radiofrequency energy from 5G transmitters will travel and dissipate in rural, suburban, urban, and dense urban environments.”<sup>25</sup>

SpaceX compounds its flawed reasoning by referring to an earlier Peters Study in its attempt to cast doubt on the fact that the 2016 Studies used a near-zero elevation angle. DISH’s April 21, 2022 letter cited to the August 15, 2016 Peters Study in support of this proposition.<sup>26</sup> SpaceX states in response, “the citation purportedly supporting that statement says nothing about elevation angles or boresight—in fact, it is to the Second Peters Study, which only analyzes interference to DBS (not NGSO) systems.”<sup>27</sup> But SpaceX defines the “Second Peters Study” as the June 23, 2016 Study, not the August 15, 2016 Study that DISH actually cited.

SpaceX continues to assert that it “operate[s] at lower elevation angles”<sup>28</sup> without offering any proof that it does so, showing why it needs to do so, or explaining how low angles are compatible with quality service anyway. Further, SpaceX fails to address any of DISH’s criticisms of its elevation angle distribution curve<sup>29</sup> and is completely silent on the effect of the clustering of its satellites serving North America at 53°N (which causes SpaceX’s satellites to

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<sup>22</sup> First Peters Study at 2.

<sup>23</sup> SpaceX May 12, 2022 Letter at 4 (citing June 23, 2016 Peters Study at 2) (emphasis omitted).

<sup>24</sup> First Peters Study at 2.

<sup>25</sup> The Honorable Jessica Rosenworcel, Chairwoman, Federal Communications Commission, Additional Questions for the Record, Subcommittee on Communications and Technology Hearing on Connecting America: Oversight of the FCC, at 17 (Mar. 31, 2022).

<sup>26</sup> See DISH April 21, 2022 Letter at 8 (citing *MVDDS 12.2-12.7 GHz NGSO Coexistence Study* at 10-11, 17, attached to Petition to Deny of the MVDDS 5G Coalition, File No. SAT-LOI-20160428-00041 (Aug. 15, 2016)).

<sup>27</sup> SpaceX May 12, 2022 Letter at 4 n.20.

<sup>28</sup> *Id.* at 2.

<sup>29</sup> DISH April 21, 2022 Letter at 4-5.

stay at a high elevation angle for much of the U.S. population).<sup>30</sup> SpaceX is correct that horizon nulling is not a “talisman” that resolves all problems.<sup>31</sup> But the 2022 RKF Report shows with significant precision the extent to which horizon nulling can mitigate interference potential—it can help decrease the already-small percentage of NGSO consumer terminals serving the potential for interference from 0.89% to 0.15%.<sup>32</sup> In other words, it reduces the potential for interference to less than a fourth of the already small number. As to the difficulties of “targeting”<sup>33</sup> which section to null, SpaceX has it backwards. As the 2022 RKF Report explains, “5G beamforming antennas can use sidelobe suppression and antenna nulling toward the horizon to mitigate inadvertent interference that might occur outside the intended path of the signal.”<sup>34</sup> In other words, nulling mitigates the potential for interference by suppressing energy in *all* directions other than the intended precise direction. All sections can be nulled except the section that is targeted.

SpaceX also misstates the Commission’s request for comment on the 12 GHz band. SpaceX states that DISH has “not answered the Commission’s call for proposed rules”<sup>35</sup> but does not include a cite to such a request in the *12 GHz Notice of Proposed Rulemaking*. This is because none exists.<sup>36</sup> In the *12 GHz NPRM*, the Commission requested information on various aspects of the MVDDS Coalition’s proposal, all of which has been supplied by DISH and others. RKF Engineering submitted a detailed engineering analysis explaining that coexistence between terrestrial 5G and NGSO operations is possible.<sup>37</sup> Thus, it is SpaceX that has not responded to the Commission’s requests by failing to submit *any* engineering studies of its own when the NPRM clearly called for technical analysis.

***SpaceX Interference into Satellite Television.*** While SpaceX has now filed its third letter delving into minute details of six-year old studies, it has simultaneously ignored the serious problems with its proposed second-generation system application.<sup>38</sup> DISH submitted a detailed

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<sup>30</sup> *See id.* at 6.

<sup>31</sup> SpaceX May 12, 2022 Letter at 3.

<sup>32</sup> *See* 2022 RKF Report at 25-28.

<sup>33</sup> SpaceX May 12, 2022 Letter at 3.

<sup>34</sup> 2022 RKF Report at ii; *see also id.* at 12 (“Equipment manufacturers like Nokia, Ericsson, and Samsung will use advanced antenna systems, which support interference mitigation technologies, including nulling beams and antenna downtilts that focus the beam toward the coverage area and reduce the impact of sidelobe interference.”).

<sup>35</sup> SpaceX May 12, 2022 Letter at 4.

<sup>36</sup> *Expanding Flexible Use of the 12.2-12.7 GHz Band*, Notice of Proposed Rulemaking, 36 FCC Rcd. 606 (2021).

<sup>37</sup> *See* 2021 RKF Report.

<sup>38</sup> *See* Space Exploration Holdings, LLC, Application for Satellite Space Station Authorizations, File No. SAT-LOA-20200526-00055 (filed May 26, 2020) (“Gen2 Application”); Space Exploration Holdings,

technical report from an expert satellite engineer analyzing SpaceX's own data files.<sup>39</sup> They revealed that the Gen2 system will exceed applicable equivalent power flux density ("EPFD") limits designed to protect DBS systems from interference in the 12 GHz band. To circumvent the power limits, SpaceX arbitrarily split the Gen2 constellation into 18 separate pieces.<sup>40</sup> This effort is not credible or legally supportable. As DISH explained, it is like saying that each counsel for DISH has broken Usain Bolt's world record for the 100-meter dash based on their time for the first 5.6 meters. DISH also uncovered additional significant substantive and procedural defects with SpaceX's Gen2 application, all of which have remained unaddressed, let alone cured.<sup>41</sup> SpaceX's silence on these issues in the three months since reply comments in the Gen2 proceeding were submitted is deafening.

***DISH's use of MVDDS.*** A three-paragraph letter submitted by SpaceX<sup>42</sup> repeats false allegations about DISH's MVDDS licenses that SpaceX had already made at length a year ago, that DISH had thoroughly rebutted then, and that were already too late when they were first made. Mysteriously, the letter does not add one iota to what SpaceX had argued then, and appears to be another attempt to change the subject, this time from SpaceX's compliance with Commission rules. To avoid compounding the repetition, DISH will summarize its response: SpaceX's attempt at a sting operation to prove that it was hard to sign up for DISH's service in fact showed the opposite.<sup>43</sup> The attempt by SpaceX's undercover agents to get DISH customer service representatives to disparage DISH's service failed, as it was obviously aimed at putting words in other people's mouths, and failed to accomplish even that facile objective. SpaceX also claims, one more time, that "consumers cannot purchase DISH's MVDDS service without subsidizing DISH's infrastructure build-out to their homes."<sup>44</sup> Of course, SpaceX itself charges customers a deposit for going on a waitlist for a service that the customer may not receive for months or even a year.<sup>45</sup> And SpaceX was silent when DISH certified its MVDDS buildout commitments some three years ago.<sup>46</sup> The timing of SpaceX's duplicative argument is not a

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LLC, Application for Space and Earth Station Modification, File No. SAT-AMD-20210818-00105 (filed Aug. 18, 2021) ("Gen2 Amendment").

<sup>39</sup> See Second Gen2 Study.

<sup>40</sup> DISH Gen2 Reply at 12-14.

<sup>41</sup> See *id.* at 11 (summarizing the Gen2 Application's inaccuracies).

<sup>42</sup> See SpaceX June 1, 2022 Letter.

<sup>43</sup> See DISH 12 GHz Reply Comments at 46-47.

<sup>44</sup> SpaceX June 1, 2022 Letter at 1.

<sup>45</sup> See, e.g., Kate Duffy, 'Scammed by Starlink': Customers are frustrated with price hikes for uplink kits they still haven't received months after paying \$100 deposits, Business Insider (Apr. 24, 2022), <https://www.businessinsider.com/spacex-starlink-customers-frustrated-price-hikes-deposits-customer-services-2022-4>.

<sup>46</sup> See, e.g., DISH Network LLC, WQAR665, ULS File No. 0008735865, Build-Out Demonstration (July 24, 2019); South.com LLC, WQAW335, ULS File No. 0008736076, Build-Out Demonstration (July 22, 2019).

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coincidence, coming only a day after DISH alerted the Commission to statements made by SpaceX and its CEO strongly suggesting that SpaceX is violating Commission rules relating to use of the Starlink user terminals while in motion.<sup>47</sup>

Given that the enormous benefits of allowing 5G operations in the 12 GHz band can be realized without harmfully interfering with existing operations, the Commission should act expeditiously to unlock the power of 5G in this band. As Chairwoman Rosenworcel stated, “freeing up more spectrum, and especially mid-band spectrum, for 5G” is one of the “key principles to help guide our 5G future.”<sup>48</sup> DISH agrees.

Respectfully submitted,

/s/ Pantelis Michalopoulos  
Pantelis Michalopoulos  
*Counsel to DISH Network Corporation*

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<sup>47</sup> See Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene Dortch, FCC, File No. SES-LIC-20210803-01361, Call Sign E210310, *et seq.* (May 31, 2022).

<sup>48</sup> Questions for the Record (Majority), Jessica Rosenworcel, Senate Commerce, Science, and Transportation Committee, at 5 (Nov. 24, 2021), <https://www.commerce.senate.gov/services/files/A853CE11-3D3C-4747-ADFC-817E6959B6F6>.