



January 2, 2022

The Honorable Pete Buttigieg  
Secretary  
U.S. Department of Transportation  
1200 New Jersey Ave, SE  
Washington, D.C. 20590

Stephen Dickson, Administrator  
Federal Aviation Administration  
U.S. Department of Transportation  
800 Independence Avenue, SW  
Washington, D.C. 20591

Dear Secretary Buttigieg and Administrator Dickson:

We are writing in response to your letter sent to us the evening of December 31 regarding C-Band spectrum.

As you know, the U.S. Government's auction of the C-band spectrum almost a year ago was heralded by this Administration as a major policy victory and one of the most successful auctions ever conducted in the United States. From a financial perspective, the auction raised more than \$80 billion for the U.S. Treasury. Moreover, the U.S. Government had determined that the United States was "lagging behind China" and other countries in 5G deployment and that a major cause for this was "the lack of some carriers' access to the radio frequencies best suited for 5G coverage." The C-Band spectrum auction was vital in addressing this national security vulnerability and was necessary to provide the connectivity for millions of American families and businesses to work, learn, and run their lives and businesses. With continued COVID crises, it has never been more important that our country's critical communications infrastructure have the spectrum needed to handle escalating traffic demands from our customers.

The auction of the C-Band spectrum was the culmination of years of study by the Federal Communications Commission, which is the expert agency of the U.S. Government on spectrum.

Among other things, the FCC conducted an extensive public rulemaking process in which submissions from hundreds of parties, including from the aviation industry, were considered. At the end of that process in February 2020, the FCC adopted its lengthy and comprehensive C-Band Order, which found, among other things, that its rules would fully “protect aeronautical services in the 4.2-4.4 GHz band.”

The FCC had compelling reasons for this conclusion. Spectrum interference disputes typically involve simultaneous transmissions on the same frequencies. But radio altimeters do not operate on, or anywhere near, the C-Band frequencies. Rather, they operate in a frequency band (4.2-4.4 GHz) that is separated by at least 400 megahertz from the C-Band frequencies (3.7-3.8 MHz) that AT&T and Verizon will begin using in 2022 and at least 220 megahertz from any C-Band frequency authorized for use in the future. This helps explain why C-Band 5G service and aviation operations already coexist in nearly 40 other countries where C-Band spectrum has been deployed without any negative impact on aviation.

We care deeply about the safety of our customers, employees, and families, all of whom fly domestically and internationally for business and pleasure. Our two companies are deeply committed to public safety and national security, and fortunately, the question of whether 5G operations can safely coexist with aviation has long been settled.

\* \* \*

Relying on the FCC’s comprehensive rulemaking process and the C-Band Order, AT&T, Verizon, and others bid more than \$80 billion on C-Band spectrum. With the FCC’s encouragement, we then paid billions of dollars more to accelerate the migration of the satellite companies that had been using these frequencies specifically so that we could begin using the spectrum in some geographic areas by December 5, 2021.

AT&T and Verizon spent most of 2021 preparing to put the C-Band spectrum into service. In addition to the tens of billions of dollars we paid to the U.S. Government for the spectrum and the additional billions of dollars we paid to the satellite companies to enable the December 2021 availability of the spectrum, we have paid billions of dollars more to purchase the necessary equipment and lease space on towers. Thousands of our employees have worked non-stop for months to prepare our networks to utilize this spectrum. Thousands more have been trained to engage with customers as the new spectrum is put to use.

Amid all this activity, we were told for the first time late last year that the Federal Aviation Administration (FAA) and parts of the aviation community had concerns about the timing of our use of C-Band under the FCC’s February 2020 order. The aviation community participated in the C-Band proceeding, and the FCC considered all their input and found that the use of the spectrum would cause no harmful interference to altimeters. Nonetheless, the FCC encouraged the aviation community to use the nearly two years before C-Band deployment to upgrade any altimeters that might not be properly designed to filter out frequencies far removed from the 4.2-4.4 GHz altimeter band. Inexplicably, the FAA and the aviation industry apparently did nothing following the February 2020 order or even after the C-Band auction closed in January 2021. In fact, it was not until November 2, 2021 that the FAA even issued a notice to begin collecting data about altimeters from the aviation industry.

As a result of this inaction, the U.S. Government approached AT&T and Verizon in November to ask us to delay using the C-Band spectrum in order to avoid potential disruption to the aviation industry, which had been in its own power to avoid. Despite the thousands of people who had been working for almost a year towards a December 5 C-Band deployment, despite the billions of dollars of capital we have invested in our networks in 2021 to prepare for C-Band, and despite the \$80 billion that the wireless industry paid last year for use of the C-Band spectrum, AT&T and Verizon agreed to wait until January 5, 2022 to begin using the C-Band and to implement additional restrictions on our use of the spectrum through July 5, 2022, over and above the operational restrictions the FCC already had found sufficient to protect radio altimeters. Although there was no requirement for us to adopt these measures, we did so voluntarily in the spirit of cooperation and good faith.

Now, on the evening of New Year's Eve, just five days before the C-Band spectrum will be deployed, we received your letter asking us to take still more voluntary steps - to the detriment of our millions of consumer, business and government customers - to once again assist the aviation industry and the FAA after failing to resolve issues in that costly 30-day delay period, which we never considered to be an initial one.

\* \* \*

As you know, the FCC is the expert agency designated by our government to make decisions governing the use of our nation's scarce spectrum resources. Its ability to set and administer policy has been rightfully respected and carefully followed by policymakers around the globe. Its task is a hard one – not to serve the interests of any one industry or stakeholder, but to ensure that finite spectrum resources are deployed intelligently against a careful balance of industries (e.g., communication, satellite, aviation, automotive, consumer electronics, defense) and in consideration of innovation and economic development, public interest, and the protection of the interests of the United States.

At its core, your proposed framework asks that we agree to transfer oversight of our companies' multi-billion dollar investment in 50 unnamed metropolitan areas representing the lion's share of the U.S. population to the FAA for an undetermined number of months or years. Even worse, the proposal is directed to only two companies, regardless of the terms of licenses auctioned and granted, and to the exception of every other company and industry within the purview of the FCC. Agreeing to your proposal would not only be an unprecedented and unwarranted circumvention of the due process and checks and balances carefully crafted in the structure of our democracy, but an irresponsible abdication of the operating control required to deploy world-class and globally competitive communications networks that are every bit as essential to our country's economic vitality, public safety and national interests as the airline industry. We are, however, committed to continue our cooperation with your Department and all interested parties, including the offer of further mitigations described below, on the condition that the FAA and the aviation industry are committed to doing the same without escalating their grievances, unfounded as they are, in other venues.

On December 31, we filed with the FCC again reiterating that we will abide by the considerable mitigation measures we announced in November and that we are voluntarily implementing for six months as your Department and the aviation industry take whatever steps you think appropriate to ensure that all aircraft are properly equipped. These are voluntary steps we are taking, over and above what is required by our FCC licenses, in the spirit of cooperation. For your convenience, we are attaching a copy of the December 31 filing to this letter.

In addition, despite the extraordinary and unprecedented nature of your further request, we will again volunteer, in the spirit of cooperation and good faith, to alter our use of the C-Band spectrum during the same six-month period (unless we and the FAA determine that these voluntary limits should be relaxed sooner). Specifically, for six months, until July 5, 2022, we will adopt the same C-Band radio exclusion zones that are already in use in France, with slight adaptation to reflect the modest technical differences in how C-band is being deployed in the two countries. That approach – which is one of the most conservative in the world – would include extensive exclusion zones around the runways at certain airports. The effect would be to further reduce C-band signal levels by at least 10 times on the runway or during the last mile of final approach and the first mile after takeoff. This is over and above the protections we already committed to put in place around airports that were detailed in the letter to the FCC on November 24th, 2021 – protections that the FCC referred to as among “the most comprehensive efforts in the world to safeguard aviation technologies.” As you know, U.S. aircraft currently fly in and out of France every day with thousands of U.S. passengers and with the full approval of the FAA. As a result, France provides a real-world example of an operating environment where 5G and aviation safety already co-exist. The laws of physics are the same in the United States and France. If U.S. airlines are permitted to operate flights every day in France, then the same operating conditions should allow them to do so in the United States, as we propose in the technical details attached to this letter.

These additional voluntary measures will give the FAA and the aviation industry ample opportunity to conduct any further studies and remediate any altimeters that might not meet current standards, as was originally recommended by the FCC in February 2020. We trust they are sufficient to allay any remaining concerns expressed in your December 31 letter.

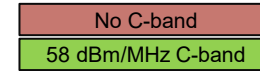
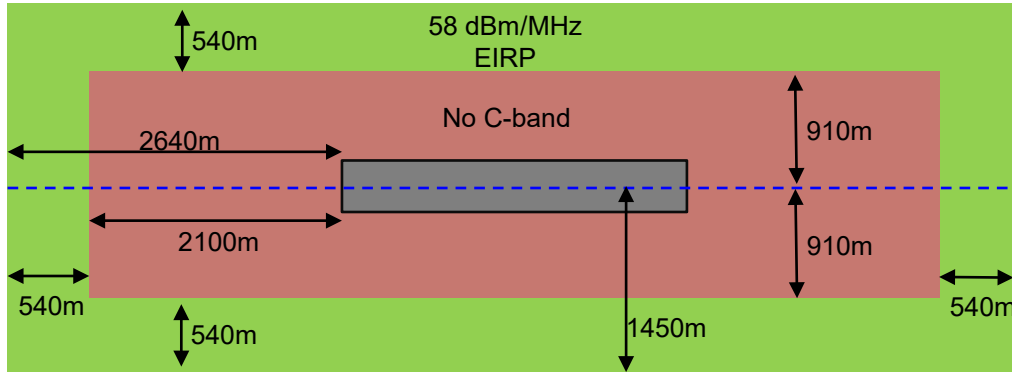
Sincerely,

/s/ John Stankey

Chief Executive Officer  
AT&T, Inc.

/s/ Hans Vestberg

Chairman and Chief Executive Officer  
Verizon Communications, Inc.



Notes on C-band max EIRPs:  
 78dBm/100MHz = 58dBm/MHz (France)  
 82dBm/100MHz = 62dBm/MHz (US)

- France Exclusion Zone (red area): 910m x 2100m
- Power Reduction Zone (green area): Extends outside the exclusion zone an additional 540m on all four sides to accommodate 4 dB EIRP difference between France (78dBm/100MHz) and US (82dBm/100MHz)
- 540m is the calculated distance to generate 4 dB of free space loss



12/31/2021

**VIA ELECTRONIC FILING (ECFS)**

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

Re: Notice of *Ex Parte* Presentation, *Expanding Flexible Use of the 3.7-4.2 GHz Band*,  
GN Docket 18-122

Dear Ms. Dortch:

On November 24, 2021, AT&T and Verizon voluntarily committed to certain precautionary measures regarding their C-Band operations through July 5, 2022, over and above the technical restrictions and spectrum buffer the Federal Communications Commission (“Commission”) had already found sufficient to protect radio altimeters in the *C-Band Order*.<sup>1</sup> AT&T and Verizon today also formally certified those commitments, making them enforceable by the Commission. AT&T and Verizon committed to those six-month precautionary measures to quell any remaining objections from aviation interests about the imminent launch of their respective C-Band networks. But undeterred by facts or logic, the Aerospace Industries Association (“AIA”) predictably attacked these new precautionary measures, calling them “inadequate and far too narrow to ensure the safety and economic vitality of the aviation industry.”<sup>2</sup> In its petition for a stay, Airlines for America repeats this same assertion.<sup>3</sup> That claim is utterly unfounded, as discussed below.

As an initial matter, AT&T and Verizon welcome AIA’s long-overdue acknowledgment that its concern relates as much to the “economic vitality of the aviation industry” as to any supposed safety issue.<sup>4</sup> That phrase lays bare AIA’s real agenda. It wants to hold the C-Band

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<sup>1</sup> Report and Order and Order of Proposed Modification, *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, 35 FCC Rcd. 2343 (2020) (“*C-Band Order*” or “*Order*”).

<sup>2</sup> Letter from AIA at 1, GN Docket No. 18-122 (“AIA 12/6/21 Ex Parte”).

<sup>3</sup> Airlines For America, Emergency Petition for Stay at 11, GN Docket No. 18-122 (Dec. 30, 2021). AT&T and Verizon will be separately opposing this baseless petition.

<sup>4</sup> AIA 12/6/21 Ex Parte at 1.

hostage until the wireless industry agrees to cover the costs of upgrading any obsolete altimeters that, in the view of some aviation interests, do an abnormally poor job of filtering signals in bands far removed from the 4.2-4.4 GHz aeronautical altimetry band. But this Commission made clear almost two years ago that it “expect[ed] *the aviation industry* to take account of” the C-Band operations that would launch at scale nearly two years later “and take appropriate action, if necessary, to ensure protection” of these altimeters.<sup>5</sup> In all events, as AIA surely knows, this Commission’s responsibility is not to “ensure . . . the economic vitality of the aviation industry,”<sup>6</sup> but to optimize the value of the electromagnetic spectrum for the benefit of the American public. That is what the Commission did in the *C-Band Order*. AIA is still complaining about that *Order* only because its interests are diametrically opposed to the Commission’s core statutory mission.

AIA’s professed “safety” concerns are no more persuasive, as discussed below. The Commission was right when it found that the operational restrictions and spectrum separation set forth in the *C-Band Order* already fully protect the safety of the flying public, private aircraft, and air transport.<sup>7</sup> But in the spirit of compromise, AT&T and Verizon committed, as a voluntary matter, to additional precautionary measures for the first six months of 2022—not because they are remotely necessary to protect safety, but simply to go the extra mile to resolve any remaining controversy about the imminent launch of their C-Band networks.

The Commission aptly described this set of voluntary new precautionary measures as “one of the most comprehensive efforts in the world to safeguard aviation technologies.”<sup>8</sup> That is an extraordinary endorsement, particularly in context: nearly 40 other countries in which U.S. aircraft routinely operate—including Canada, the U.K., Spain, France, Finland, Denmark, Japan, and China—have opened the same 3.7 GHz band to commercial operations without a single reported case of interference with altimeters operating in the same 4.2-4.4 GHz band.<sup>9</sup> Against that backdrop, AIA’s complaints about the “adequacy” of these precautionary measures are frivolous.

1. It is first important to place this interference dispute in context. Radio interference typically involves simultaneous transmissions on the same frequencies—for example, licensed

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<sup>5</sup> *C-Band Order* ¶ 395 (emphasis added).

<sup>6</sup> AIA 12/6/21 Ex Parte at 1.

<sup>7</sup> *C-Band Order* ¶ 395.

<sup>8</sup> Matt Daneman, *AT&T, Verizon Limit C-Band Deployments Near Airports, Helipads Through July 6*, at 2, *Comm’ns Daily*, (Nov. 26, 2021) (quoting FCC spokesperson).

<sup>9</sup> See Letter from AT&T and Verizon at 2, GN Docket No. 18-122 (Nov. 24, 2021) (“AT&T-Verizon 11/24 Ex Parte”); see also Letter from CTIA, GN Docket No. 18-122 (Nov. 3, 2021) (“At least two hundred thousand 5G base stations are already operating today in at least a dozen countries with technical rules and proximity to radio altimeter operations that [the aviation industry’s modeling assumptions] would suggest should be seeing harmful interference, yet no known reports of interference exist.”).

and unlicensed uses in the same band.<sup>10</sup> Of course, radio altimeters do not operate in the same C-Band frequencies as the planned wireless operations. They operate instead in a frequency band (4.2-4.4 GHz) that is separated by *at least 400 megahertz* from the C-Band frequencies that AT&T and other licensees plan to use in 2022 (3.7-3.8 GHz) and by at least 220 megahertz from any C-Band frequency licensed for wireless use. The *C-Band Order* concluded that this enormous “spectral separation” between C-Band operations and radio altimeters, combined with “the technical rules on power and emission limits” set forth in that *Order*, “are sufficient to protect aeronautical services in the 4.2-4.4 GHz band.”<sup>11</sup>

That conclusion was plainly correct. Modern radio transmitters are very effective in limiting out-of-band emissions to a small fraction of “in band” emissions. Here, the FCC’s C-Band rules mandate that emissions outside the mobile broadband portion of the C-Band are less than -13 dBm/MHz<sup>12</sup>—which is *sixty million times* lower than the maximum power per megahertz allowed for C-Band 5G operations. Leading equipment vendors have stated on the record that C-Band transmissions will be -30 dBm/MHz or less at 4.2 GHz (the edge of where radio altimeters are authorized to operate)—which is *one and one-half billion times* lower than the maximum power per megahertz allowed for C-Band 5G operations.<sup>13</sup> Likewise, even the most rudimentary radio receivers, if functioning properly, can adequately filter out emissions from other bands to focus on relevant in-band signals. For example, the cheapest transistor radio can discriminate between FM stations less than 0.4 megahertz apart.

The *C-Band Order*’s no-interference finding is even more obviously correct today than it was in March 2020. As noted, wireless carriers in nearly 40 countries throughout Europe and Asia now use the C-Band for 5G, with no reported effects on radio altimeters that operate in the same internationally designated 4.2-4.4 GHz band.<sup>14</sup> Each day U.S. aircraft, carrying thousands of U.S. citizens, land in these countries without incident (and with no expression of concern by the Federal Aviation Administration (“FAA”)). Likewise, two different Navy radars operate on frequencies just below the C-Band at power levels that are 10,000 or more times greater than those 5G base stations will use, again with no reports of interference to aviation altimeters.<sup>15</sup>

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<sup>10</sup> See, e.g., *AT&T Servs. Inc. v. FCC*, No. 20-1190, 2012 WL 6122734 (D.C. Cir. Dec. 28, 2021) (challenge to FCC rules authorizing unlicensed devices to operate in the 6 GHz band without mechanisms to keep them from using the same frequencies at the same time as licensed 6 GHz operations).

<sup>11</sup> *C-Band Order* ¶ 395.

<sup>12</sup> *Id.* ¶ 343.

<sup>13</sup> Letter from Nokia at 1, GN Docket No. 18-122 (Sept. 21, 2021); Letter from Ericsson at 1-2, GN Docket No. 18-122 (Sept. 13, 2021).

<sup>14</sup> Notably, Japan has established a smaller guard band than the FCC and Spain, Denmark, and Finland allow permitted power limits higher than permitted in U.S. urban areas by the FCC. AT&T-Verizon 11/24/21 Ex Parte at 2.

<sup>15</sup> *Id.* at 3.



This real-world evidence amply confirms that 5G operations in the C-Band and altimeters can safely coexist.

2. Nonetheless, in the spirit of compromise, AT&T and Verizon have voluntarily committed to additional precautionary measures for six months while the FAA studies the interference issues this Commission resolved nearly two years ago. In the Commission’s words, these new safeguards rank among “the most comprehensive efforts in the world to safeguard aviation technologies.”<sup>16</sup>

The new precautionary measures reflect the geometric dimensions of any possible interaction between C-Band base stations and radio altimeters. Modern cell towers are generally designed to direct radio energy at some angle towards the ground, not at the sky, because mobile customers are usually located at or near ground level. Aircraft, of course, fly in the sky. As a result, any cell site signals that might reach the altimeters placed on the bottom of airplanes would be massively attenuated. And any theoretical potential for such interference is limited mainly to situations where aircraft fly very close to the ground, including taking off and landing. Thus, to eliminate any possible concern about this interference, the new safeguards (1) lower the power of C-Band transmissions in all areas above the horizon (as well as lowering power in rural areas below the horizon) and (2) effectively curtail C-Band operations in broadly defined areas near public airports and heliports.

First, AT&T and Verizon committed to operate their 5G base stations for six months at even lower power levels than permitted by the *C-Band Order*.<sup>17</sup> Generally speaking, AT&T and Verizon have committed to limit power radiated *below* the horizon to no more than 62 dBm/MHz. In rural areas, this equates to about 50% less power than permitted by the *C-Band Order*.<sup>18</sup> AT&T and Verizon further agreed to limit radiated power for all of their 5G C-Band base stations directed skyward *above* the horizon to even lower levels.<sup>19</sup> Generally speaking, as the angle above the horizon increases, AT&T and Verizon must ensure further reductions in emitted power.<sup>20</sup> This condition will thus result in significantly lower emissions in navigable airspace than permitted by the *C-Band Order*.

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<sup>16</sup> Matt Daneman, *AT&T, Verizon Limit C-Band Deployments Near Airports, Helipads Through July 6*, at 2, *Comm’n’s Daily*, (Nov. 26, 2021) (quoting FCC spokesperson).

<sup>17</sup> AT&T-Verizon 11/24/21 Ex Parte at 6 (Commitments 1, 2).

<sup>18</sup> *C-Band Order* ¶ 335 & n.756.

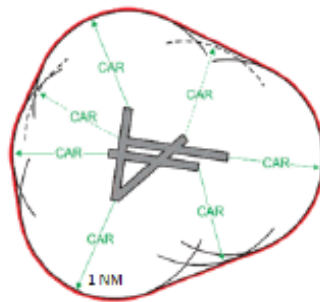
<sup>19</sup> AT&T-Verizon 11/24/21 Ex Parte at 6 (Commitment 1).

<sup>20</sup> *Id.*

Second, although the existing restrictions of the *C-Band Order* are more than sufficient to address concerns about aircraft operations at public airports,<sup>21</sup> the new safeguards will surround those airports with large three-dimensional zones that go well beyond those restrictions:

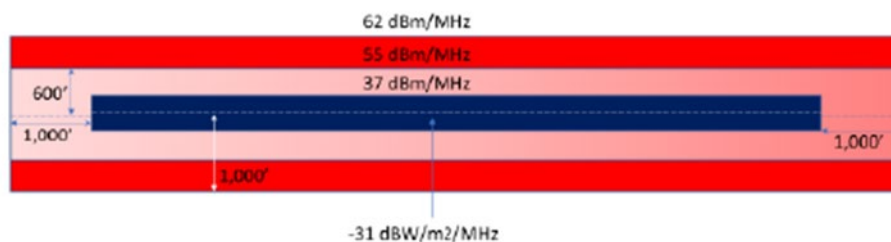
- The safeguards will yield low measured power levels on all airport surfaces, up to 300 feet above airports, and more than one mile from airport runways:<sup>22</sup>

Depiction of the perimeter of a horizontal plane surface, at 300' above the established airport elevation, (i.e., 300' above the Height Above Airport (HAA)), where the PFD shall not exceed -30 dBW/m<sup>2</sup>/MHz.



This commitment addresses not only conventional takeoff and landing scenarios, but also worst-case scenarios where aircraft are diverted from landing at the last minute.

- AT&T and Verizon also agreed to limit radiated power from 5G base stations to even lower levels when those base stations are located in line with airport runways. This commitment can apply to base stations located as far as 1000 feet from a runway, as illustrated here:<sup>23</sup>

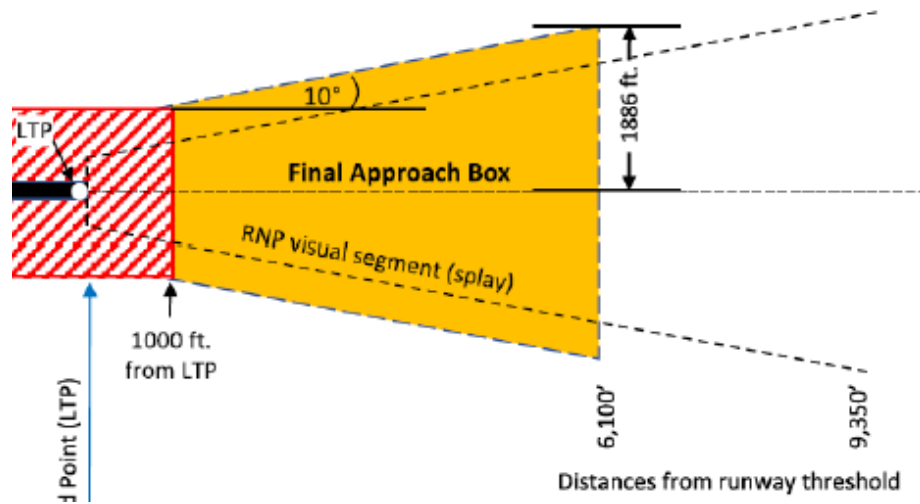


<sup>21</sup> See, e.g., Letter from CTIA & Tech. Annex., GN Docket No. 18-122 (Sept. 3, 2021).

<sup>22</sup> AT&T-Verizon 11/24/21 Ex Parte at 6 (Commitments 3.1-3.3). This commitment includes limitations on radiated 5G signals above an airport as well as strictly limiting radiated 5G signals along airport taxi lanes and all airplane transit areas (aprons, gates, etc.) within airports. *Id.* This protects planes not only in the air, but also ensures radio altimeters will not experience harmful interference when activated during pre-flight checks.

<sup>23</sup> *Id.* at 6-7 (Commitments 3.4-3.5).

- AT&T and Verizon also agreed to limit the height of C-Band antennas and the amount of radiated power for structures located in a designated “Final Approach Box.”<sup>24</sup> This commitment addresses the theoretical possibility of interference when airplanes are making their final approach for landing. AT&T and Verizon agreed to this commitment even though this “final approach box” will extend beyond a mile from the end of a runway:



Third, AT&T and Verizon have also agreed to limit radiated 5G power at public heliports.<sup>25</sup> In particular, they committed to ensure that measured power over the primary surface of all helipads is no more than -16 dBW/m<sup>2</sup>/MHz. Unlike airplanes, helicopters take off vertically and there is no need to account for an approach box around a helipad. But by ensuring low power levels at helipad surfaces, this commitment will also necessarily result in reduced power levels above those surfaces in the areas that helicopters use to take off and land.

\* \* \*

These voluntary precautionary measures, which AT&T and Verizon have committed to keep in effect until July 5<sup>th</sup>, 2022, come at a substantial cost. These precautionary measures are particularly likely to impair C-Band operations in commercial areas near airports and helipads. Nonetheless, AT&T and Verizon agreed to these precautionary measures for a limited period to accommodate the FAA’s desire for more time to conduct further study. The suggestion that these extra precautions are “inadequate” is meritless.

<sup>24</sup> *Id.* at 7 (Commitment 3.6).

<sup>25</sup> *Id.* (Commitment 4).

Respectfully submitted,

AT&T SERVICES, INC.

VERIZON

/s/ Joan Marsh

/s/ William H. Johnson

Executive Vice President of Federal  
Regulatory Relations

Senior Vice President – Federal Regulatory &  
Legal Affairs