



December 21, 2020

**VIA ECFS and IBFS**

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

**Re: Written *Ex Parte* Presentation: IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SAT-AMD-20180531-00045, SAT-AMD-20180531-00044, and SES-AMD-20180531-00856**

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Dear Ms. Dortch:

While there was sufficient reason before, the Technical Memorandum the National Telecommunications and Information Administration (“NTIA”) submitted in the above-referenced proceedings on December 6, 2020 (“Technical Memorandum”) provides compelling justification for the Commission to stay and re-consider its decision permitting Ligado Networks LLC (“Ligado”) to operate a terrestrial wireless network.<sup>1/</sup> The Technical Memorandum was not – and indeed could not have been – submitted earlier.<sup>2/</sup> But now that this critical information,

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<sup>1/</sup> See *Assessment of Compatibility Between Global Positioning System Receivers and Adjacent Band Base Station and User Equipment Transmitters*, Technical Memorandum, NTIA TM-20-536 (Dec. 2020) (“Technical Memorandum”), attached to, Letter from Kathy Smith, Chief Counsel, NTIA, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340, *et al.* (filed Dec. 4, 2020) (“NTIA *Ex Parte* Letter”); *LightSquared Technical Working Group Report, et al.*, Order and Authorization, 35 FCC Rcd 3772 (2020) (“*Ligado Order*”). Consistent with the terms of their litigation settlements with Ligado, GPS Innovation Alliance (“GPSIA”) members Deere & Company (“Deere”) and Garmin International, Inc. (“Garmin”) do not affirmatively endorse or oppose the deployment of Ligado’s proposed communications network. Deere supports the discussion with respect to the appropriateness of using the 1 dB standard to assess potential interference to GNSS receivers. As Garmin has reiterated on a number of occasions, under the settlement, it retains the right to express concerns about the detrimental effect Ligado’s operations may have on its certified aviation devices and maintains its ability to advocate for use of the 1 dB standard. See, e.g., Letter from Scott Burgett, Director, GNSS and Software Technology, Garmin International, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 12-340 and 11-109, *et al.*, at 2-3 (filed May 15, 2020); Letter from M. Anne Swanson, Wilkinson Barker Knauer, LLP, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 and 12-340 (filed Apr. 20, 2020). To the extent that this letter refers to any other issues or matters, GPSIA is not authorized, and is not purporting, to speak for either Deere or Garmin.

<sup>2/</sup> NTIA explains that while it had been coordinating closely with the Departments of Defense and Transportation and other agencies on the Technical Memorandum well before the adoption of the *Ligado*

prepared by the federal government entities most familiar with the susceptibility of the Global Positioning System (“GPS”) to harmful interference, has been submitted, the Commission should, consistent with Section 1.106 of the rules,<sup>3/</sup> make it a central component of its further review of the *Ligado Order*.<sup>4/</sup>

While the data underlying the Technical Memorandum was available to the Commission prior to making its decision in the *Ligado Order*,<sup>5/</sup> the Technical Memorandum demonstrates that the Commission failed to appropriately analyze it, creating a fatal gap in its decision. That gap must now be filled by consideration of the Technical Memorandum. Excluding consideration of the Technical Memorandum, on the other hand, would result in decision-making based on incomplete information and undermine the assertion in the *Ligado Order* that the Commission’s decision was based on an “extensive review of the record.”<sup>6/</sup>

Ligado’s recent request to prevent the Commission from considering the Technical Memorandum is particularly meritless.<sup>7/</sup> Ligado’s Opposition focuses on narrow limitations to Commission acceptance of pleadings in particular circumstances. But it misses the point. The Commission often accepts late-filed supplements to petitions for reconsideration and other pleadings, particularly when materials are submitted by a federal agency.<sup>8/</sup> Further, the Commission has broad authority to accept and consider any type of request or information when doing so is in the public interest, which, as summarized below, it is in this case.<sup>9/</sup>

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*Order*, it was only recently able to garner consensus among the agency members of the Interdepartment Radio Advisory Committee (“IRAC”) on it. *See* NTIA *Ex Parte* Letter at 1.

<sup>3/</sup> *See* 47 C.F.R. § 1.106(b), (c) (stating that the Commission may grant a petition for reconsideration if it “relies on facts or arguments unknown to petitioner until after his last opportunity to present them to the Commission, and he could not through the exercise of ordinary diligence have learned of the facts or arguments in question prior to such opportunity”); *see also id.* § 1.106 (e), (f).

<sup>4/</sup> *See, e.g.*, Petition for Reconsideration or Clarification of the National Telecommunications and Information Administration, IB Docket Nos. 11-109 and 12-340 (filed May 22, 2020) (“NTIA Petition”). Ligado has asked the Commission not to accept or consider the Technical Memorandum.

<sup>5/</sup> *See, e.g.*, Technical Memorandum at 5 (noting that measured interference power levels are from test programs performed by the DOT Adjacent Band Compatibility, Department of Defense, Roberson and Associates, and the National Advanced Spectrum and Communications Test Network).

<sup>6/</sup> *See Ligado Order* ¶¶ 2, 18.

<sup>7/</sup> *See* Opposition to Motion for Leave to File of Ligado Networks LLC, IB Docket Nos. 11-109 and 12-340 (filed Dec. 14, 2020).

<sup>8/</sup> *See, e.g.*, *Communications Assistance for Law Enforcement Act*, Second Order on Reconsideration, 16 FCC Rcd 8959, ¶¶ 13, 30-31 (2001) (accepting a late-filed supplement by the Federal Bureau of Investigation (“FBI”) and also noting that if additional concerns are raised by the FBI, it will consider amending its rules to address those concerns).

<sup>9/</sup> *See, e.g.*, 47 C.F.R. § 1.41 (noting that “[e]xcept where formal procedures are required . . . requests for action may be submitted informally”); *Northstar Wireless, LLC, et al.*, Memorandum Opinion and Order on Remand, FCC 20-160, ¶¶ 46, 51 (rel. Nov. 23, 2020) (explaining that the Commission has “broad discretion to consider the views of such interested parties as informal objections under section 1.41 of the Commission’s rules” – an approach that the D.C. Circuit has described as ‘commendable’ for addressing untimely filed petitions[]” that raise important questions and issues);

### ***The Technical Memorandum Presents Critical New Information***

The Technical Memorandum provides important conclusions about the impact that Ligado’s operations will have on the day-to-day operation of GPS devices in the U.S. For example, the Technical Memorandum demonstrates the following:<sup>10/</sup>

- 64 percent of high precision receivers, 13 percent of general location/navigation receivers, and 17 percent of timing receivers would suffer interference under a micro urban base station deployment;<sup>11/</sup>
- 24 percent of high precision receivers and 2 percent of general location/navigation receivers would suffer interference under a macro rural base station deployment;<sup>12/</sup>
- Between 35 to 58 percent of high precision receivers would experience interference from Ligado’s proposed user equipment;<sup>13/</sup> and
- 41 percent of high precision receivers would suffer a loss of lock under a micro urban base station deployment, and 2 percent of high precision receivers would suffer a loss of lock under a macro rural base station deployment.<sup>14/</sup>

And while the percentages of certain devices may appear small, the absolute number of devices – which Ligado is under no obligation to replace when they experience interference – is substantial. For example, 2 percent of the estimated 64.6 million general location/navigation receivers in use in 2020 is approximately 1.29 million devices.<sup>15/</sup>

The Technical Memorandum also evaluated the distance from a Ligado base station that would be required for a GPS receiver to avoid interference from a Ligado base station. It found that separation distances of:

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*Thomas K. Kurian and AMTS Consortium LLC*, Order, 24 FCC Rcd 4849, ¶¶ 19, 23 (2009) (treating late-filed allegations and arguments as an informal request for action under section 1.41 of the rules, in the interest of a full record).

<sup>10/</sup> Using the accepted 1 dB Carrier-to-Noise Density (“C/N<sub>0</sub>”) criterion.

<sup>11/</sup> See Technical Memorandum at 19. These percentages are based on an Effective Isotropic Radiated Power (“EIRP”) of 40 dBm/10 MHz.

<sup>12/</sup> See *id.*

<sup>13/</sup> See *id.* at 27.

<sup>14/</sup> See *id.* at 28 & n.44 (explaining that a loss of lock occurs when a Global Navigation Satellite System receiver can no longer track the signal accurately, which degrades positional accuracy).

<sup>15/</sup> See Coleman Bazelon, *Putting Mid-Band Spectrum to Work: Sharing Between Ligado Networks and its GPS Neighbors*, The Brattle Group, at A-3, Table 5 (May 23, 2016), attached to, Comments of Ligado Networks LLC, IB Docket No. 11-109 (filed May 23, 2016).

- At least 2,697 meters for high precision receivers, 1,348 meters for general location/navigation receivers, and 168 meters for timing receivers are necessary to preclude interference from a *single* small cell base station;<sup>16/</sup> and
- 62 to 96 meters for high precision receivers would be required to preclude a 1 dB degradation from Ligado’s proposed *user equipment*.<sup>17/</sup>

The Technical Memorandum adds that “there are no practical separation distances between [user equipment]” and high precision, general location/navigation, and timing receivers to preclude a 1 dB degradation in  $C/N_0$ .<sup>18/</sup>

***The Technical Memorandum Finds Harmful Interference Regardless of the Noise Floor Increase***

A linchpin of the *Ligado Order* is the Commission’s rejection of the use of the widely-accepted 1 dB  $C/N_0$  degradation criterion as a measure of when harmful interference would likely occur to GPS devices.<sup>19/</sup> Nevertheless, the Technical Memorandum shows that even assuming the Commission is right, using any reasonable predictive metric demonstrates that there will be interference to GPS. In particular, the Technical Memorandum showed that applying the *less restrictive* criteria 3 dB and 5 dB, harmful interference would still exist. Indeed, it specifically notes “[t]he analysis results (*e.g.*, required separation distances and EIRP) do not significantly change when a 1 dB, 3 dB, or 5 dB  $C/N_0$  degradation criterion is applied for [high precision] and [general location/navigation] receivers.”<sup>20/</sup> Thus, even using less restrictive  $C/N_0$  degradation metrics that the Commission has used in the past,<sup>21/</sup> which GPSIA has

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<sup>16/</sup> Using a 1 dB degradation in  $C/N_0$  metric and an EIRP of 40 dBm/10 MHz. *See* Technical Memorandum at 17.

<sup>17/</sup> Using a 1 dB degradation in  $C/N_0$  metric. *See* Technical Memorandum at 26; *see also id.* at 32 (noting that “[f]or single user equipment operating at an EIRP of 23 dBm/10 MHz (-7 dBW), separation distances to avoid potential  $C/N_0$  degradation for all categories of receivers is: 96 meters for user equipment in the 1627.5-1637.5 MHz band and 62 meters for user equipment in the 1646.5-1656.5 MHz band”).

<sup>18/</sup> *Id.* at 26.

<sup>19/</sup> *See Ligado Order* ¶¶ 47-59.

<sup>20/</sup> Technical Memorandum at 33.

<sup>21/</sup> *See, e.g., Service Rules for Advanced Wireless Services H Block – Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1020 MHz and 1995-2000 MHz Bands*, Report and Order, 28 FCC Rcd 9483, ¶ 145 (2013) (stating that a noise-limited interference criterion (1 dB desensitization) is too restrictive for modern cellular systems, “standards bodies have considered a 3 dB desensitization level as an acceptable level of performance”, and “other parties and the Commission have used a 3 dB desensitization of the receiver in analyzing similar mobile-to-mobile interference scenarios”); *Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, et al.*, Report and Order, 30 FCC Rcd 9551, ¶¶ 128, 143 (2015) (finding that a 1 dB desensitization criterion is too restrictive for modern cellular systems and instead “assuming a 3 dB rise in the noise floor as the appropriate interference criterion”).

explained and the Commission has acknowledged are more appropriate for communications devices,<sup>22/</sup> Ligado’s operations will still produce unacceptable harmful interference. Because the Commission did not work closely with NTIA to review the available technical data, whether or not it was compiled in a formal report, the *Ligado Order* did not consider this critical data, and the *Ligado Order’s* conclusions on interference are therefore fatally flawed.

In addition to its failure to consider relevant data, the Commission was only able to reach its conclusion on interference by departing impermissibly and without reasoned explanation, from its usual practice of conducting an analysis of potential interference employing objective, readily measurable interference metrics based on changes to the noise floor – and relied instead on subjective factors completely incapable of being measured. The Technical Memorandum correctly rejects that approach, more thoroughly analyzing Ligado’s operations under a range of interference metrics.<sup>23/</sup> Now that the Technical Memorandum has been submitted, the Commission must fully consider, and ultimately accept, the sound engineering analysis it presents.

### ***The Technical Memorandum Directly Contradicts Conclusions in the Ligado Order***

The Technical Memorandum also demonstrates why many conclusions reached in the *Ligado Order* are wrong. For example, the Commission argued that while it had used the 1 dB metric in the past, it found that metric to be “extremely conservative,” and it does not correlate to any significant error in a GPS device’s reporting of position or functionality.<sup>24/</sup> But the Technical Memorandum explains that degradations in  $C/N_0$  – whether 1 dB or 5 dB – can be correlated with errors in signal acquisition and positional accuracy, which are the critical operating parameters for GPS-dependent devices.<sup>25/</sup> And while the Commission asserted that there are variations in the 1 dB  $C/N_0$  degradation metric even without any signal from Ligado,<sup>26/</sup> the Technical Memorandum notes that it eliminated the variations that can occur in the reported  $C/N_0$ ,<sup>27/</sup> and it still found interference from Ligado’s proposed operations. Finally, the Commission suggested that “it is technically feasible to design GPS receivers that have relatively

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<sup>22/</sup> See, e.g., Letter from J. David Grossman, Executive Director, GPS Innovation Alliance, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 and 12-340, *et al.* (filed July 21, 2020).

<sup>23/</sup> Moreover, the analyses in the Technical Memorandum were conducted by the federal agencies that are the experts on GPS. See Technical Memorandum at i. As GPSIA has explained, the GPS system was launched over four decades ago by the U.S. Air Force to meet the specific needs of the U.S. military, and federal agencies continue to oversee the critical sectors of our economy that rely on GPS. See RTI International, *Economic Benefits of the Global Positioning System (GPS)*, at 1-3 (June 2019), [https://www.rti.org/sites/default/files/gps\\_finalreport.pdf](https://www.rti.org/sites/default/files/gps_finalreport.pdf). It is therefore the analyses and conclusions of those federal agencies with deep expertise on GPS on which the Commission must rely and evaluate when determining whether Ligado’s network will harm GPS operations.

<sup>24/</sup> See *Ligado Order* ¶¶ 51, 53, 59.

<sup>25/</sup> See Technical Memorandum at iii, 7-10, 32.

<sup>26/</sup> See *Ligado Order* ¶ 52.

<sup>27/</sup> See Technical Memorandum at 7.

strong immunity to signals outside the RNSS allocation.”<sup>28/</sup> However, as the Technical Memorandum observes, while filters may help reduce interference, they “can cause deleterious effects on receiver performance, such as group delay and other distortions that have not been examined in this evaluation but which should be examined before any decisions are made based on antenna filtering techniques.”<sup>29/</sup>

### ***The Technical Memorandum Confirms the Flaws in the Commission’s Decision-Making Process***

The Technical Memorandum highlights that the Commission approved Ligado’s applications without taking advantage of the precise inter-agency process that the Commission’s ill-considered decision was designed to avoid. The Commission – with limited expertise in radionavigation systems – reached its conclusions after conducting its own analysis on the data submitted by the National Advanced Spectrum and Communications Test Network (“NASCTN”),<sup>30/</sup> Roberson and Associates,<sup>31/</sup> and Department of Transportation (“DoT”).<sup>32/</sup> Yet, as the Technical Memorandum makes clear, the Chair of the IRAC – of which the FCC is a member – specifically convened the Technical Focus Group (“TFG”) in 2016 to address the issues raised in Ligado’s applications.<sup>33/</sup> And, as the FCC was aware, the TFG has been working since then to assess the compatibility between GPS receivers and Ligado’s proposed operations.<sup>34/</sup> Indeed, NTIA also notes that FCC staff had access to the draft Technical

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<sup>28/</sup> *Ligado Order* ¶ 56.

<sup>29/</sup> Technical Memorandum at 9.

<sup>30/</sup> See National Advanced Spectrum and Communications Test Network (NASCTN) Report, “LTE Impacts on GPS, Final Test Report” (Feb. 15, 2017), <https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1952.pdf>.

<sup>31/</sup> See Roberson and Associates, Results of GPS and Adjacent Band Co-Existence Study (May 9, 2016), *attached to* Letter from Gerard J. Waldron, Counsel to Ligado Networks LLC, and Dustin Cho, Counsel to Ligado Networks LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 11-109 (filed May 11, 2016).

<sup>32/</sup> See U.S. Department of Transportation, “Global Positioning System (GPS) Adjacent Band Compatibility Assessment,” Final Report, at 118-19, 149, 152-53 (Apr. 2018), <https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf>; *Ligado Order*, ¶¶ 36-40.

<sup>33/</sup> See Technical Memorandum at ii; *see also id.* at 3 (explaining that the TFG consisted of engineers from NTIA’s Office of Spectrum Management, in collaboration with subject matter experts from the United States Air Force GPS Directorate, Department of Energy, DoT, Federal Aviation Administration, the National Aeronautics and Space Administration, the Department of Defense Office of Chief Information Officer, and the FCC).

<sup>34/</sup> For example, the TFG held regular meetings to evaluate the available GPS receiver interference measurement data as well as to perform analyses assessing the compatibility of base station and user equipment emissions, operating with the proposed technical parameters in Ligado’s modified applications. See Technical Memorandum at 3.

Memorandum while the TFG worked on it.<sup>35/</sup> Yet, while it was fully aware that the TFG’s analysis was ongoing, the Commission repeatedly suggested that the information provided by NTIA and the federal agencies “contain[s] no data, analysis, or basis for their conclusion” and that neither NTIA nor the federal agencies provided “any new technical data” in their opposition to Ligado’s proposed deployments.<sup>36/</sup>

Accordingly, as part of the reconsideration process, the Commission must address why it chose *not* to wait until this comprehensive, inter-agency assessment was available particularly, as Ligado consistently pointed out, it had already taken several years to evaluate Ligado’s operations. Instead of prudently waiting for what it knew was coming – the Technical Memorandum from federal entities with radionavigation expertise – the Commission issued its decision without even mentioning the TFG or its work in the *Ligado Order*. But because the Technical Memorandum provides new information, the Commission must correct course and consider the data presented by the TFG in the Technical Memorandum as it continues to evaluate the petitions filed in this proceeding.

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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 the undersigned.

Sincerely,

/s/ J. David Grossman

J. David Grossman  
Executive Director  
GPS Innovation Alliance

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<sup>35/</sup> See NTIA *Ex Parte* Letter at 1. NTIA observes that FCC staff were not included in deliberations on the Technical Memorandum, nor did they express any views on the final product. See also *id.* at 1 n.4. NTIA provides no justification for the lack of participation by FCC staff and critically, neither does the *Ligado Order*.

<sup>36/</sup> See *Ligado Order* ¶¶ 45-46, 125-26.