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September 10, 2019

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street, SW  
Washington, DC 20554

Re: Written *Ex Parte* Presentation Regarding 1 dB Standard and Certified Aviation Devices, **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-20180531-00044; SAT-AMD-20180531-00045; and SES-AMD-20180531-00856**

Dear Ms. Dortch:

Garmin International, Inc. (“Garmin”) respectfully comments upon the *ex parte* presentations filed by Ligado Networks, LLC (“Ligado”) on August 6, 2019, and August 26, 2019 in the above-captioned dockets and files.<sup>1</sup>

As Garmin has long noted, it supports efforts to deploy additional broadband capacity in this nation, but not at the expense of the Global Positioning System (“GPS”). Since late 2015, consistent with its settlement agreement with Ligado, Garmin has also taken the position that it does not object to modification applications filed by Ligado on December 31, 2015.<sup>2</sup> Garmin

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<sup>1</sup> Letter from Gerald J. Waldron, Counsel to Ligado Networks LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 *et al.* (Aug. 22, 2019) (“Ligado Aug. 22, 2019 *Ex Parte*”); Letter from Gerald J. Waldron, Counsel to Ligado Networks LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 *et al.* (Aug. 6, 2019) (“Ligado Aug. 6, 2019 *Ex Parte*”).

<sup>2</sup> See Settlement Agreement and Releases, by and between Garmin International, Inc. and New LightSquared LLC and LightSquared Subsidiary LLC (dated Dec. 16, 2015) (“Settlement

Marlene Dortch  
September 10, 2019  
Page 2

submits this *ex parte* letter to supplement the record on two narrow points: (i) use of a 1 dB decrease in the Carrier-to-Noise Power Density Ratio (“C/N<sub>0</sub>”) as a metric to measure interference to an affected GPS receiver (the “1 dB Standard”), as mentioned in Ligado’s August 6, 2019 *ex parte* filing; and (ii) the extent to which issues related to Garmin’s certified aviation products remain unresolved by the presentations in the August 6 and August 26, 2019 *ex parte* filings.<sup>3</sup>

### **I. The 1 dB Standard Remains the Only Reliable Means for Assessing Harmful Interference to GPS**

In its latest advocacy, Ligado again rejects use of the 1 dB Standard as a determinant of harmful interference to a GPS receiver’s operation as applied in the DOT Adjacent Band Compatibility Report, contending that standard does not measure “harmful interference;” instead suggesting “harmful interference” should be determined by studying “key performance indicators,” or KPIs.<sup>4</sup> As Garmin has noted multiple times on the record, Ligado’s position overlooks the critical differences between navigation and communication systems and ignores that the internationally accepted 1 dB Standard aggregates increases in the noise floor from out-of-band-emissions (“OOBE”) alongside degradation from overload interference. The 1 dB Standard represents a more efficient, reasonable, and accurate regulatory approach to resolving interference concerns than other piecemeal regimes, such as Ligado’s preferred KPI testing that requires development and testing of thousands of use cases each requiring an equally extensive number of devices to yield adequate data sufficient to support any determinations; the KPI approach requires untold administrative resources to attempt to measure, analyze, and extract conclusions from volumes and volumes of empirical tests.<sup>5</sup>

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Agreement”), attached to Letter from Gerard J. Waldron to Marlene H. Dortch, IB Docket Nos. 12-340 *et al.* (filed Dec. 17, 2015).

<sup>3</sup> This filing is consistent with the Settlement Agreement. *See id.* at Paragraphs 9(a) and 10(a).

<sup>4</sup> Ligado Aug. 6, 2019 *Ex Parte* at 2-5. For the DOT Adjacent Band Compatibility Report, *see* U.S. Department of Transportation, *Global Positioning System (GPS) Adjacent Band Compatibility Assessment*, (Apr. 2018) (“DOT/ABC Report”), <https://www.transportation.gov/sites/dot.gov/-files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf>.

<sup>5</sup> Comments of Garmin International, Inc., IB Docket Nos. 11-109 *et al.*, at 9-13 (July 9, 2018) (“Garmin Comments”); Reply Comments of Garmin International, Inc., IB Docket Nos. 11-109 *et al.*, at 2-4 (July 26, 2018) (“Garmin Reply Comments”); Letter from M. Anne Swanson, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 *et al.*, at 1-6 (May 16, 2018) (“Garmin May 16, 2018 *Ex Parte*”). In fact as Garmin explained, the test data compiled by the National Advanced Spectrum and Communications Test Network (“NASCTN”), upon which

Marlene Dortch  
September 10, 2019  
Page 3

Ligado's latest contentions regarding appropriate metrics for interference invoke a sweeping statement from Roberson and Associates, LLC to contend that the probability of interference to non-precision GPS receivers from its proposed downlink operations is effectively zero.<sup>6</sup> This conclusion is based, however, on measurements of the effect of interfering signals on selected KPIs of GPS devices from the same NASCTN testing that both Garmin and the GPS Innovation Alliance ("GPSIA") have discredited on this record.<sup>7</sup> Unlike the universal nature of the 1 dB Standard, KPI's measure selective characteristics and fail to reflect the full effect of interference. To arrive at the conclusion that the probability of interference was virtually zero, Roberson had to reject the more appropriate 1 dB Standard recognized by DOT and instead rely on the very limited and inconclusive NASCTN results.

## **II. Concerns About Harmful Interference to Certified Aviation Devices, Already Documented Extensively in the Record, Remain Unaddressed**

As Garmin has also said repeatedly on this record, Ligado's proposed power reduction to 9.8 dBW does not, by itself, resolve concerns over interference to Garmin's certified aviation devices. This power decrease needs to be accompanied by corollary consideration and commitments regarding restrictions on tower and transmitter spacing and antenna parameters (specifically height, downtilt, and polarization).<sup>8</sup> If tower density were to increase beyond the level assumed in the DOT/ABC Report without any compensating adjustment to the 9.8 dBW power level it recommended, certified aviation devices would still experience harmful interference.<sup>9</sup> Any variation in antenna assumptions made in the DOT/ABC Report would similarly require evaluation of the adequacy of a power level restriction.

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Ligado relies as support for using KPIs, actually provides both direct and indirect support for use of the 1 dB Standard to measure interference to GPS services. *See* Garmin May 16, 2018 *Ex Parte* letter at 4-6.

<sup>6</sup> Ligado Aug. 6, 2019 *Ex Parte* at 4-5.

<sup>7</sup> *See* Letter from Dennis A. Roberson, Roberson and Associates, LLC, to Marlene S. [sic] Dortch, IB Docket Nos. 11-109 *et al.*, at 7-8 & Appendix D (July 9, 2018) (attached to Ligado Aug. 6, 2019 *Ex Parte*). For Garmin and GPSIA discussion, *see, e.g.*, Garmin May 16, 2018 *Ex Parte* at 4-6; Letter from F. Michael Swiek, Executive Director, GPS Innovation Alliance, IB Docket Nos. 12-340 *et al.* (July 13, 2017).

<sup>8</sup> Garmin July 9, 2018 *Ex Parte* at 4-9.

<sup>9</sup> DOT assumed ancillary terrestrial component ("ATC") base stations, like Ligado's, arranged in a hexagonal grid formation with 433 meter and 693 meter inter-site distances ("ISDs"). DOT/ABC Report at Tables 5-5 & 5-9; 152-53.

Marlene Dortch  
September 10, 2019  
Page 4

Garmin is concerned about the following reference to “further [tower] densification” in the Nokia material submitted with Ligado’s August 6, 2019 *ex parte* letter: “[T]o improve the performance of the network at higher inter-site distance, a combination of antenna tilts, heights, power optimization and further network densification would be performed.”<sup>10</sup> Such modification of key antenna parameters and network density are precisely why Garmin and others in the aviation community, not to mention DOT, have repeatedly requested more details and commitments regarding Ligado’s proposed ISDs.<sup>11</sup> Any grant of Ligado’s application needs to be preceded by commitments about antenna spacing and parameters, and any commitment or consideration related to a 9.8 dBW power level is insufficient – in fact, meaningless – without that. While Garmin recognizes that it is generous of Ligado to offer to replace federal government devices effected by its proposed network,<sup>12</sup> any such program does not address the massive expense required to ensure aviation safety through retrofitting or replacing certified aviation devices that will be unable to accommodate Ligado’s terrestrial transmissions.

In its latest filings, Ligado makes broad statements about filter adoption and improvements,<sup>13</sup> yet these discussions miss the mark when it comes to certified aviation devices and do not address lingering concerns over ensuring aviation safety. Every certified aviation device has long used filters in the signal path; this has never been in doubt.

Further, Ligado’s discussion of the ability of uBlox technology to overcome the jamming of signals 25 dB stronger than conventional filters<sup>14</sup> does not begin to address the facts or concerns related to Ligado’s effect on certified aviation devices. uBlox’s representations of its devices’ effectiveness at combatting jamming relates to in-band jamming signals,<sup>15</sup> and not the type of overload interference from adjacent bands that could result from Ligado’s proposed operation; moreover, the uBlox technique is only effective on narrow band jammers, not broad band jammers, making all these claims useless in evaluating the prospects of Ligado interference to certified aviation devices. In short, anti-jamming claims in a consumer marketing presentation

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<sup>10</sup> See Nokia, *Nokia’s Study on Ligado Spectrum Deployment*, at 11 (Feb. 2019) (“Nokia Report”) (attached to Ligado Aug. 6, 2019 *Ex Parte*).

<sup>11</sup> DOT/ABC Report at 148; Garmin Reply Comments at 4.

<sup>12</sup> Ligado Aug. 6, 2019 *Ex Parte* at 8-9.

<sup>13</sup> Ligado Aug. 22, 2019 *Ex Parte*.

<sup>14</sup> *Id.* at n.4.

<sup>15</sup> A. Thiel and M. Ammann, *u-blox Anti-Jamming techniques in u-blox GPS receivers*, 5-6 (Oct. 2009), available at [https://www.u-blox.com/sites/default/files/products/documents/u-bloxAntiJamming\\_WhitePaper\\_%28GPS-X-09008%29.pdf](https://www.u-blox.com/sites/default/files/products/documents/u-bloxAntiJamming_WhitePaper_%28GPS-X-09008%29.pdf).

Marlene Dortch  
September 10, 2019  
Page 5

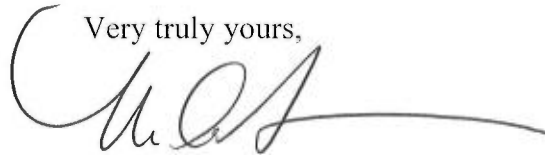
do little to assuage real safety-of-life concerns faced by those depending upon certified aviation receivers.

**III. Conclusion**

Garmin remains committed to its settlement agreement with Ligado, which was intended to settle civil litigation and does not pertain to any parties beyond Garmin. Ligado's latest filings do not, however, satisfy the concerns Garmin has about how its certified aviation devices will function following deployment of Ligado's proposed service. Neither do they offer persuasive reasons to evaluate harmful interference in the GPS context, including at power levels specified in the settlement agreement, through any method other than application of the 1 dB Standard.

Please let me know if you have any questions.

Very truly yours,

A handwritten signature in dark ink, appearing to read 'M. Anne Swanson', with a long horizontal flourish extending to the right.

M. Anne Swanson