

July 18, 2018

The Honorable Ajit Pai  
Chairman  
Federal Communications Commission  
445 12<sup>th</sup> Street S.W.  
Washington, DC 20554

**Re: Ligado Networks LLC (“Ligado”)**

**Written *ex parte* Submission**

*IB Dockets No. 11-109, 12-340; RM-11681; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-AMD-20180531-00856, SAT-AMD-20180531-00044, SAT-AMD-20180531-00045*

Dear Chairman Pai:

The undersigned organizations, representing entities that provide and rely upon critical GPS, satellite communications (“SATCOM”) services, and essential weather and other environmental data, write to inform you that the threat of harmful interference from Ligado’s proposed ancillary terrestrial component (“ATC”) service continues to pose a significant risk of harmful interference despite Ligado’s May 31, 2018, amendments to its license modification applications in the above-referenced file numbers.<sup>1</sup> The record, augmented by recent government reports, makes clear that the interference will be particularly impactful to the countless government and commercial entities that rely on GPS and SATCOM services for aviation safety and other critical services and the many groups that receive and depend upon real-time weather and related environmental information from National Oceanic and Atmospheric Administration (“NOAA”) satellites.

We recognize the importance of ensuring that there is sufficient spectrum for mobile broadband, and the Commission has recently taken many steps to address that challenge. However, at a time in which the Administration has placed so much emphasis on the critical importance of space-based communications – through the revival of the National Space Council and other policy initiatives – the FCC should not undermine the nation’s critical space leadership.<sup>2</sup> Granting Ligado’s request would harm the nation’s satellite industry and the broad sectors of the country that benefit from American space leadership every day in at least three

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<sup>1</sup> Ligado Networks LLC, Amendment to License Modification Applications, IBFS File Nos. SES-AMD-20180531-00856, SAT-AMD-20180531-00044, SAT-AMD-20180531-00045, SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091, IB Docket No. 11-109 (filed May 31, 2018) (“Ligado Amendment Applications”).

<sup>2</sup> See Vice President Mike Pence, REMARKS 34<sup>TH</sup> SPACE SYMPOSIUM, Colorado Springs, CO, <https://www.whitehouse.gov/briefings-statements/remarks-vice-president-pence-34th-space-symposium-colorado-springs-co> (Apr. 16, 2018); Secretary Wilbur Ross, A BRIGHT FUTURE FOR U.S. LEADERSHIP OF SPACE COMMERCE, NATIONAL SPACE COUNCIL 2<sup>ND</sup> MEETING, <https://www.commerce.gov/news/secretary-speeches/2018/02/secretary-ross-bright-future-us-leadership-space-commerce> (Feb. 21, 2018); Assistant Secretary of Commerce for Communications and Information David Redl, AFFIRMING OUR PARTNERSHIP FOR GROWTH AND INNOVATION IN SPACE, SATELLITE 2018, <https://www.ntia.doc.gov/speechtestimony/2018/remarks-assistant-secretary-redl-satellite-2018> (Mar. 14, 2018).

ways. First, it would threaten the reliability of critical position, navigation and timing (“PNT”) services, including GPS and also an emerging satellite time and location (“STL”) capability augmenting GPS.<sup>3</sup> Second, it would undermine the investment-backed expectations of those who operate commercial satellite systems by fundamentally altering the interference environment decades after licensing. And third, it would convert 40 MHz of increasingly rare satellite spectrum away from satellite use, rewarding a company for underutilizing its satellite spectrum rather than investing in new satellite technologies.

Nearly one year ago, a group of twenty-two national organizations and companies wrote to you raising their shared concerns with Ligado’s proposal.<sup>4</sup> Those concerns have only intensified given additional information published since then. Since June 2017, several developments further call in to question the viability of Ligado’s proposal and validate the interference concerns previously raised. While we appreciate Ligado’s recent acknowledgment that its license modification request as originally filed is insufficient to protect certified aviation GPS receivers, the aviation community continues to have concerns about the impact to aviation safety from harmful interference to GPS despite Ligado’s recent application amendment filings. Moreover, no changes to its proposal have been offered to address interference to uncertified GPS systems, SATCOM services that are also a critical element of aviation safety, or the concerns of the weather data community.

As a recent letter from eleven national aviation organizations to Federal Aviation Administration Acting Administrator Daniel Elwell put it, “[t]here remain outstanding issues that call into question the impacts such a system would have on airspace safety, specifically as it relates to both certified and uncertified GPS systems, continuity of navigational accuracy at low levels, and effects on other safety of flight systems to include satellite communications.”<sup>5</sup> The letter reiterated operational concerns with Ligado’s 500 foot cylinder concept that has been opposed by many aviation organizations since it was first proposed in 2016,<sup>6</sup> stating that “[t]he concerns and safety issues of the industry have NOT been addressed, particularly when considering the lack of testing in key areas.”<sup>7</sup> Evaluating Ligado’s recent amendment to ensure protection of uncertified GPS receivers and protection of GPS receivers from aggregate interference will be necessary.

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<sup>3</sup> See e.g., Gregory Gutt, Chief Technical Officer & President, Satelles, CURRENT OPERATIONAL STATUS OF LOW EARTH ORBIT (LEO) SATELLITE-BASED TIME AND LOCATION, NATIONAL SPACE-BASED POSITIONING NAVIGATION AND TIMING ADVISORY BOARD 21<sup>ST</sup> MEETING, <https://www.gps.gov/governance/advisory/meetings/2018-05/gutt.pdf> (May 16, 2018) noting that “Satelles STL service depends on Iridium operating free from harmful interference.” *Id.* at slide 10.

<sup>4</sup> Letter from Coalition of Aviation, SATCOM, and Weather Information Users to The Honorable Ajit Pai, Chairman, FCC, IB Docket Nos. 11-109, 12-340; RM-11681; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091 (filed Jun. 27, 2017) (“June 27, 2017 Coalition Letter”).

<sup>5</sup> Letter from Eleven Aviation Organizations to Daniel K. Elwell, Acting Administrator, Federal Aviation Administration, IB Docket No. 12-340, 11-109 (filed Jun. 18, 2018) (“Elwell Letter”).

<sup>6</sup> Letter from Gerard J. Waldron, Counsel to Ligado, to Marlene H. Dortch, Secretary, FCC, RM-11681; IB Docket No. 11-109; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091, at 2, Attachment A (filed Sept. 8, 2016).

<sup>7</sup> Elwell Letter at 2.

A number of data points underscore the flaws in the way in which Ligado has attempted to measure interference to GPS from its proposed terrestrial operations. On March 1, 2018 the National Space-Based Positioning, Navigation, and Timing Systems Engineering Forum (“NPEF”) released a “gap analysis” assessing the methodologies used in multiple tests analyzing the impacts of adjacent band interference on GPS receivers.<sup>8</sup> That analysis validated recent tests conducted under the leadership of the Department of Transportation (“DOT”) and two earlier tests. In contrast, the report concluded that the methodologies used in two different tests paid for by and at the direction of Ligado were found lacking. Ligado has suggested that the NPEF study is at odds with the major GPS manufacturers because they have reached settlements agreeing not to object to Ligado’s proposed terrestrial operations and that the 1 dB degradation interference protection criterion is “neither accurate nor reliable.”<sup>9</sup> Responding to Ligado’s claims, Garmin recently set the record straight indicating that “the 1 dB standard is the appropriate determinant of harmful interference to GPS and other Radionavigation Satellite Service (“RNSS”) receivers” and also reminded the Commission that it does not endorse Ligado’s proposal.<sup>10</sup> Numerous other manufacturers have said the same.<sup>11</sup>

Additionally, in April 2018, after concluding an open and transparent public process, DOT released the Final Report of its Adjacent Band Compatibility (“ABC”) assessment which examined the maximum transmitted power levels of adjacent band systems that can be tolerated

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<sup>8</sup> See National Space-Based Positioning, Navigation, and Timing Systems Engineering Forum, “Assessment to Identify Gaps in Testing of Adjacent Band Interference to the Global Positioning System (GPS) L1 Frequency Band” (Mar. 5, 2018), <https://www.gps.gov/spectrum/ABC/2018-03-NPEF-gap-analysis.pdf> (“NPEF Gap Analysis”). The analysis was done at the request of the National Executive Committee for Space-Based Positioning, Navigation, and Timing (PNT EXCOM). Notably, in July of 2017 the PNT Advisory Board recommended to the PNT EXCOM that it “reaffirm the conclusion in the 2012 letter” to NTIA “stating the unanimous conclusion of the PNT EXCOM agencies that [Ligado’s] proposed mobile network would cause harmful interference to many GPS receivers.” See Letter from John Stenbit, Chair, National Space-based PNT Advisory Board, to Deputy Secretary of Defense Robert O. Work and Deputy Secretary of Transportation Jeffrey A. Rosen, at 1-2 (Jul. 5, 2017), <https://www.gps.gov/governance/advisory/recommendations/2017-07-letter-to-excom.pdf>.

<sup>9</sup> Letter from Gerard J. Waldron, Counsel to Ligado Networks LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109; RM-11681, IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091, at 1-2 (filed Apr. 12, 2018).

<sup>10</sup> See Letter from Anne Swanson, Counsel to Garmin International, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 and 12-340, IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, SAT-MOD-20101118-00239, SES-MOD-20121101-00872, at 2-3 (filed May 16, 2018). See also Letter from Anne Swanson, Counsel to Garmin International, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340, IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, SAT-MOD-20101118-00239; SES-MOD-20121101-00872 (filed Mar. 19, 2018); Letter from F. Michael Swiek, Executive Director, GPS Innovation Alliance, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 12-340; IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, SAT-MOD 20101118-00239, SES-MOD-20121001-00872 (filed Jul. 13, 2017).

<sup>11</sup> Letter from Edward A Yorkgitis, Jr., Counsel for Aviation Spectrum Resources, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091 at 2, Attachment B at 2 (filed Jul. 16, 2016); Comments of Trimble Navigation Limited, IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091; DA 11-642 at 15 (filed May 23, 2016); Reply Comments of Deere & Company, IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091; DA 11-642 at 7 (filed Jun. 21, 2016); Letter from F. Michael Swiek, Executive Director, GPS Innovation Alliance, IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091; DA 11-642, at 1-2 (filed Jul. 13, 2017).

by GPS receivers.<sup>12</sup> Contrary to Ligado’s advocacy, the ABC study endorsed and strictly applied the 1 dB degradation interference protection criterion, what DOT calls the “accepted, world-wide standard for PNT and many other radiocommunication applications.”<sup>13</sup> The ABC study verified interference for all classes of GPS receivers, finding among other things, that high precision receivers would exceed a 1 dB C/N<sub>0</sub> interference protection criteria at a distance beyond 14 km from a Ligado transmitter, making the GPS receiver “unpredictable in its ability to meet the accuracy, availability, and integrity requirements of its intended application.”<sup>14</sup> Indeed, it is clear that certified aviation GPS receivers are not the most affected by interference, with the ABC study finding that received interference power levels that can be tolerated by certified aviation could still “cause interference with, or degradation to, most other categories of GPS/GNSS receivers including those used for General Aviation and drones.”<sup>15</sup> Ligado’s proposal appears to ignore these other GPS devices, the protection of which must be ensured by the Commission.

Each of these government efforts supports one conclusion – the proposed Ligado operations, even after the recently proposed amendments, will harmfully impact a wide range of GPS receivers and thus should not be permitted.

Independent of the substantial remaining GPS interference issues, interference to mobile satellite systems from Ligado operations at 1627.5-1637.5 MHz also remain a serious concern. Multiple *ex parte* letters and engineering analyses have been filed by industry leaders that detail the impact Ligado’s proposed services will have on a particular SATCOM provider’s customers, including the operations of the aviation community, federal government agencies, and commercial subscribers.<sup>16</sup> A particular SATCOM system is also affected by tower emissions at 1525-1555 MHz, and may lead to a full international aircraft fleet retrofit of all receivers to be compatible with such emissions in the US.<sup>17</sup> Ligado has yet to acknowledge this requirement or otherwise comment on its ramifications. In addition, NENA – The 911 Association – has told the Commission that “the importance of protecting responder access to [SATCOM] services cannot be overstated.”<sup>18</sup> NENA noted that “the Commission has previously recognized the critical role played by orbital MSS services by promulgating rules to protect these services from MSS ATC uses” and “urge[d] the Commission to proceed again with extreme caution, only after careful consideration of all potential impacts that could result from approving Ligado’s

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<sup>12</sup> See U.S. Department of Transportation, “Global Positioning System (GPS) Adjacent Band Compatibility Assessment,” Final Report, at IV (Apr. 2018), <https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf> (“ABC Study”).

<sup>13</sup> Karen Van Dyke, Director, PNT Program, Office of the Secretary, DOT, U.S. DEPARTMENT OF TRANSPORTATION (DOT) UPDATE, CIVIL AGENCY LEAD & EXTENDED POS NAV PERSPECTIVE, NATIONAL SPACE-BASED POSITIONING NAVIGATION AND TIMING ADVISORY BOARD 21<sup>ST</sup> MEETING, Slide 4, <https://www.gps.gov/governance/advisory/meetings/2018-05/vandyke.pdf> (May 16, 2018).

<sup>14</sup> ABC Study at IV.

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

<sup>16</sup> Iridium operates at 1617.775-1626.5 MHz; see e.g. June 27, 2017 Coalition Letter.

<sup>17</sup> Inmarsat operates at 1525-1559 MHz and 1626.5-1660.5 MHz.

<sup>18</sup> Letter from Telford E. Forgety, III, Director of Government Affairs & Regulatory Counsel, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 12-340 & 11-109, at 1 (filed Dec. 6, 2017).

application.”<sup>19</sup> Whether the interference is to public safety communications, systems relied on by planes, helicopters, drones, ships or weather buoys, interference with SATCOM systems must not be permitted.

A broad swath of weather data users from government and industry continue to raise concerns about Ligado’s proposal to operate in the 1675-1680 MHz band as well.<sup>20</sup> NOAA Geostationary Operational Environmental Satellite (“GOES”) satellites operate in the 1675-1695 MHz band – including the next generation GOES-R satellite just launched in November 2016 – and provide real-time environmental data via its direct broadcast and data collection systems, which provide important early-warning to numerous state/local emergency officials who inform citizens of major weather hazards, as well as to multiple industries and academia.<sup>21</sup> The public, private and academic entities that use this weather data have demonstrated that introducing Ligado’s operations in the 1675-1680 MHz band under the guise of spectrum sharing would handicap access to satellite weather data.<sup>22</sup> Additionally, weather related economic losses may significantly increase due to diminished short-term weather forecast accuracy. Ligado’s proposal would not so much share spectrum as endanger the downlink of spectrum from the GOES satellites, threatening the ability of “major components of the U.S. weather, water and related environmental forecasting enterprise that provide crucial information to citizens for life and safety and the economy.”<sup>23</sup>

Each of the undersigned organizations continues to have serious unresolved concerns with Ligado’s proposed operations for one or more of the reasons summarized above. The existing services provided by the GPS, SATCOM, aviation and real-time environmental satellite data communities, which depend upon interference-free operations in spectrum adjacent to or co-channel to spectrum central to Ligado’s plans, are too important to jeopardize, especially for the speculative benefits of Ligado’s constantly evolving proposals, details of which continue to be lacking. Therefore, we urge the Commission to deny Ligado’s pending license modification application as proposed unless Ligado can show it has addressed the substantive GPS, aviation, SATCOM, and weather data interference concerns still outstanding in the record.

Pursuant to Section 1.1206(b) of the Commission’s rules, this letter is being filed electronically.

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<sup>19</sup> *Id.*

<sup>20</sup> Letter from Members of the Hydrometeorological Community to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 12-340, 11-109; RM-11681 (filed May 9, 2018) (“May 9, 2018 letter”).

<sup>21</sup> *See* June 27, 2017 Coalition Letter.

<sup>22</sup> May 9, 2018 letter at 2.

<sup>23</sup> *Id.* at 3.

Sincerely,

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Dr. Joel N. Myers  
Founder, President and Chairman  
AccuWeather

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David Silver  
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Steven A. Ackerman  
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