

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of	)	
	)	
Amendment to License Modification	)	SAT-AMD-20180531-00044
Applications of Ligado Networks Subsidiary LLC	)	SAT-AMD-20180531-00045
	)	
	)	IB Docket No. 11-109
	)	IB Docket No. 12-340□

To: Satellite Policy Branch

**COMMENTS OF  
THE BOEING COMPANY**

The Boeing Company (“Boeing”) provides these comments in response to the Satellite Policy Branch’s Public Notice<sup>1</sup> regarding Ligado’s amendment to its application to further modify the ancillary terrestrial component (“ATC”) of its proposed L-band mobile satellite service (“MSS”) network.<sup>2</sup> Boeing acknowledges Ligado’s continuing efforts to resolve the multiple and significant interference concerns that have been identified by various parties arising from Ligado’s proposal to operate a wireless broadband network in spectrum allocated to satellite communications. Boeing has been actively involved in certain of these negotiated agreements, including the completion of the coordination agreement that was reached in 2016 between the Aerospace and Flight Test Radio Coordinating Council and Ligado to protect

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<sup>1</sup> Public Notice, Satellite Policy Branch Information, Space Station Applications Accepted for Filing, Report No. SAT-01321, at 1 (June 8, 2018).

<sup>2</sup> See Amendment to License Modification Applications of Ligado Networks Subsidiary LLC, IBFS File Nos. SAT-AMD-20180531-00044 and SAT-AMD-20180531-00045.

aeronautical mobile telemetry used for aircraft flight testing.<sup>3</sup> Ligado has also entered into agreements with major GPS equipment manufacturers to address anticipated interference to their products and customers, including Deere & Company, Garmin International, and Trimble Navigation.

Boeing anticipates that Ligado will continue to make progress in addressing other interference concerns raised by its broadband terrestrial wireless proposal. To this end, Boeing herein highlights other important interference concerns that must be addressed. First, the Commission should ensure that GPS/GNSS receivers used in small aircraft will not experience harmful interference. Second, Ligado must reach resolution with the aviation industry regarding the significant modifications that will be needed to Inmarsat transceivers used aboard commercial and governmental aircraft to enable the transceivers to withstand interference from Ligado's proposed broadband transmissions. Third, the Commission needs to ensure that Ligado's operations and Iridium transceivers, particularly those used in aviation, can co-exist.

#### **I. QUESTIONS MUST BE RESOLVED REGARDING POTENTIAL INTERFERENCE TO GPS/GNSS RECEIVERS USED IN GENERAL AVIATION AND DRONES**

As noted above, the Commission should recognize the positive steps that Ligado has undertaken to resolve many of the interference concerns raised by its proposal for a broadband wireless network. Ligado's most recent modification application that is the subject of this Public Notice highlights one such milestone in Ligado's efforts, specifically Ligado has agreed to limit its base station transmissions to 9.8 dBW (10W) (cross-polarized) at 1531 MHz, which is the level recently identified by the Department of Transportation ("DOT") as necessary to

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<sup>3</sup> See Letter from Dan Robinson, President, AFTRCC, and Jeffrey Carlisle, Executive Vice President for Regulatory Affairs, Ligado Networks LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109 & 12-340 (May 23, 2016).

protect certified aviation GPS/GNSS receivers on aircraft flying as close as 250 feet to a Ligado base station.<sup>4</sup> The DOT Report employed conservative assumptions in identifying the 9.8 dBW limit and Ligado’s endorsement of this level highlights its recognition of the importance of ensuring that certified aviation GPS/GNSS systems are not adversely affected.

At the same time, the DOT Report suggested that the protection levels that would be adequate to protect certified aviation GPS/GNSS receivers may not be sufficient to protect other categories of GPS/GNSS receivers, including those used in general aviation and in drones.<sup>5</sup> This concern was highlighted in a recent letter filed by general aviation interests.<sup>6</sup> Further review of this issue would be warranted.

## **II. THE UPGRADE OR REPLACEMENT OF INMARSAT TRANSCEIVERS ON AIRCRAFT MUST BE ADDRESSED**

As Boeing explained in comments that it filed with the Commission in 2011 and 2016, Ligado’s proposed broadband wireless operations will partially overlap with existing Inmarsat L-band operations, including critical communications used to support commercial and governmental aviation.<sup>7</sup> Boeing has acknowledged in each of its comments that the resulting interference to Inmarsat transceivers used for aviation likely can be avoided through the retrofit

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<sup>4</sup> See United States Department of Transportation, “Global Positioning System (GPS) Adjacent Band Compatibility Assessment,” Final Report, at 158 (April 2018), *available at* <https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf> (“DOT Report”).

<sup>5</sup> See *id.*

<sup>6</sup> See Letter from Capt. Tom Canoll, President, Air Line Pilots Association, International, *et al.*, to Daniel K. Elwell, Acting Administrator Federal Aviation Administration (June 15, 2018).

<sup>7</sup> Comments of The Boeing Company, IB Docket Nos. 12-340 and 11-109, at 2 (May 23, 2016); Comments of The Boeing Company, IB Docket No. 11-109, at 7-8 (Aug. 9, 2011).

or replacement of Inmarsat transceivers on aircraft.<sup>8</sup> The retrofit or replacement of transceivers across tens of thousands of in-service aircraft, however, will be both expensive and time consuming, necessitating that this issue be addressed and resolved expeditiously.

In June 2016, Ligado acknowledged this important interference concern, explaining to the Commission that “Ligado, Boeing and Inmarsat have agreed to collaborate in an effort to resolve these issues.”<sup>9</sup> Based on those discussions, the aviation industry is focused on the installation of a new Diplexer/Low Noise Amplifier (“DLNA”) in each aircraft.

Before any work could begin on this replacement process, Boeing would be required to secure a Type Certification from the FAA authorizing the proposed changes to the aircraft from its original design for each model of in-service aircraft that is equipped with an Inmarsat transceiver and for each Inmarsat transceiver configuration within those aircraft models (some models have multiple configurations). The Type Certification process would also have to be completed for in-service aircraft that are no longer manufactured by Boeing (such as McDonnell Douglas aircraft), further increasing the complexity and cost of this often lengthy process.

Once FAA approval has been secured, thousands of commercial and government aircraft would have to be retrofitted on a rolling basis as they become available for routine servicing, resulting in significant installation costs for aircraft servicing centers and lost opportunity costs for aircraft owners, including the airlines and the government.

Boeing understands that Ligado has made certain funds available to Inmarsat for this conversion process. Boeing continues to explore with Ligado how Boeing, aircraft operators, and Inmarsat equipment installers will be reimbursed for their incurred costs.

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<sup>8</sup> *See id.*

<sup>9</sup> Further Reply Comments of Ligado Networks LLC, IB Docket No. 11-109, at 8 (June 21, 2016).

### III. THE POTENTIAL FOR OUT OF BAND EMISSIONS INTO IRIDIUM'S MSS NETWORK MAY NEED TO BE ADDRESSED

As Iridium has highlighted in its filings in this proceeding, the aviation industry is increasingly relying on the Iridium network for satellite-based aircraft communication services, with Iridium providing a reported 61 percent of the MSS transceivers installed on aircraft.<sup>10</sup> The availability and reliability of these aviation communications must be adequately protected to support general aviation and the operation of numerous types of aircraft, including business jets, small planes, helicopters, and drones.

Iridium has argued that Ligado's wireless handsets (both individually and in the aggregate) could cause out of band ("OOB") emissions into Iridium transceivers that would interfere significantly with the reception of transmissions from Iridium's low altitude satellites.<sup>11</sup> Ligado has responded with proposed concessions to Iridium to address this issue<sup>12</sup> and has observed that its proposed OOB emissions would actually be lower than presently allowed for MSS networks operating in the L-band pursuant to Section 25.202 of the Commission's rules.<sup>13</sup> Nevertheless, the critical nature of aeronautical communications necessitates that an appropriate resolution be reached to ensure that harmful interference does not result to aircraft operating

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<sup>10</sup> See, e.g., Iridium Ex Parte Presentation, IB Docket Nos. 11-109 and 12-340, at slide 6 (Sept. 26, 2017).

<sup>11</sup> See Technical Analysis of Ligado Interference Impact on Iridium Aviation Services, at 4-5 (Dec. 14, 2016), filed as an attachment to Letter from Bryan N. Tramont, et al., Wilkinson Barker Knauer LLP, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket Nos. 11-109 and 12-340 (Dec. 14, 2016).

<sup>12</sup> See Letter from Gerard J. Waldron, Covington & Burling LLP, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket Nos. 11-109 and 12-340, at 2 (Jan. 16, 2017) (noting an offer to reduce the OOB emission levels into Iridium's spectrum, although redacting the specified amount of the reduction).

<sup>13</sup> See Further Reply Comments of Ligado Networks LLC, IB Docket 11-109, at 8 (June 21, 2016).

using the Iridium network. With the Commission's active encouragement, this issue hopefully can be resolved through discussions between Iridium and Ligado.

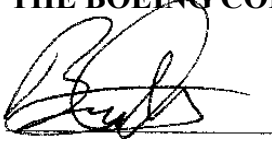
#### IV. CONCLUSION

Ligado continues to make progress toward achieving a comprehensive solution to the challenging coordination problems posed by its ambitious proposal to operate a wireless terrestrial broadband network in spectrum allocated for satellite services. As both a major user of wireless equipment and a world-leading manufacturer of commercial aircraft, avionics, and airborne communications systems, Boeing is pleased to support Ligado's efforts in this regard, and to encourage the Commission to continue to move forward with Ligado's proposal.

Respectfully submitted,

**THE BOEING COMPANY**

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