

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)	
)	
LightSquared Technical Working Group Report)	IB Docket No. 11-109
)	
LightSquared License Modification Application, IBFS Files Nos. SAT-MOD-20120928-00160, - 00161, SES-MOD-20121001-00872)	IB Docket No. 12-340
)	
New LightSquared License Modification Applications IBFS File Nos. SES-MOD-20151231- 00981, SAT-MOD-20151231-00090, and SAT- MOD-20151231-00091)	IB Docket No. 11-109; IB Docket No. 12-340
)	
Ligado Amendment to License Modification Applications IBFS File Nos. SES-MOD-20151231- 00981, SAT-MOD-20151231-00090, and SAT- MOD-20151231-00091)	IB Docket No. 11-109
)	

**PETITION FOR RECONSIDERATION OF
THE AEROSPACE INDUSTRIES ASSOCIATION,
THE AIRCRAFT OWNERS AND PILOTS ASSOCIATION,
AIRLINES FOR AMERICA,
AVIATION SPECTRUM RESOURCES, INC.,
THE CARGO AIRLINE ASSOCIATION,
THE GENERAL AVIATION MANUFACTURERS ASSOCIATION,
THE HELICOPTER ASSOCIATION INTERNATIONAL,
THE INTERNATIONAL AIR TRANSPORT ASSOCIATION,
THE NATIONAL AIR TRANSPORTATION ASSOCIATION, AND
THE NATIONAL BUSINESS AVIATION ASSOCIATION**

May 22, 2020

Table of Contents

I. INTRODUCTION: THE ORDER OVERLOOKS MAJOR GAPS IN THE RECORD, AND THE CONDITIONS IT ADOPTED GIVE RISE TO NEW QUESTIONS AND UNCERTAINTIES 2

II. THE FAA’S ANALYSIS OF THE POTENTIAL FOR INTERFERENCE TO CERTIFIED AVIATION RECEIVERS WAS INCOMPLETE ON ITS FACE, SOMETHING THE ORDER RECOGNIZED BUT INEXPLICABLY IGNORED..... 5

A. The Order Misused the FAA’s Analysis of Interference Potential 250 Feet from a Ligado Base Station..... 5

B. The Condition Establishing a Set-Off Distance for Deployment of Ligado Base Stations from Obstacle Clearance Surfaces Does Not Address Operational Realities 8

C. The Order’s Consideration of UAS Ignores Record Evidence and Undermines the Important Role That GPS Will Play in Their Operations 11

D. The Base Station Database Condition Is Vague, Impermissibly Imposes Burdens on Non-Parties, and Is Otherwise Flawed..... 14

E. The Condition Requiring Responsiveness to, and Notifications of, Interference Complaints Is Insufficient to Ensure Interference Complaints Will Be Addressed 16

III. THE ORDER’S CONCLUSIONS REGARDING NON-CERTIFIED GPS AVIATION RECEIVERS ARE BASED ON AN INCORRECT INTERPRETATION OF FACTS AND INADEQUATE ANALYSIS BY LIGADO 18

IV. THE ORDER RECOGNIZES THE NEED TO PROTECT SATCOM USED BY AVIATION, BUT FAILS TO PROVIDE ADEQUATE SOLUTIONS 22

A. Inmarsat Retrofits..... 23

B. Iridium Adjacent Band Interference 25

V. CONCLUSION 25

ATTACHMENT 1: Description of Joint Petitioners

ATTACHMENT 2: Examples of Participation by Joint Petitioners in Proceeding

SUMMARY

Joint Petitioners, participants in the lengthy proceedings considering Ligado's ancillary terrestrial component ("ATC") proposals, are aviation industry organizations whose members have a strong interest in a robust Global Positioning System ("GPS") environment and reliable access to satellite communications ("SATCOM"). Their members rely upon GPS and SATCOM to support safe, efficient aviation that delivers myriad benefits to the U.S. economy.

The Commission's Order and Authorization ("Order"), which grants Ligado's license modification applications, recognizes that GPS receivers and SATCOM terminals are entitled to protection from interference caused by Ligado. The record in this proceeding does not substantially support the decisions the Commission made. As a result, the Order does not impose technical and operational parameters that will deliver appropriate protection to GPS and SATCOM. In an attempt to make up for this failing, the Order adopts a long list of license conditions. But these have numerous deficiencies and arbitrarily shift much of the burden for protection upon the aviation industry itself, putting air safety and aviation operations at risk. For these reasons, the Order should be reconsidered and the Ligado applications denied.

- For its decision on how to protect Federal Aviation Administration ("FAA") certified aviation GPS receivers, the Order relies heavily on an FAA analysis of the potential for Ligado to cause harmful interference to certified safety-of-life GPS receivers at the boundary of a 250-foot radius cylinder around Ligado base stations, and a boundary 30 feet above those stations (the "250/30 Cylinder"). But that analysis, by the FAA's own recognition, did not conduct a full assessment of operational considerations within the 250/30 Cylinders or among a dense deployment of Ligado base stations such as low-altitude operations of helicopters and Unmanned Aircraft Systems ("UAS"). Nonetheless, the Order inexplicably relies on that very analysis (without supplementation), and a mischaracterization of an FAA rule, to find that all operational scenarios concerning certified receivers have been addressed. In so doing, the Order ignores the large body of evidence the aviation community provided showing that FAA-certified GPS devices would be regularly used in close proximity to Ligado base stations. As a consequence, the technical and operational parameters adopted by the Order applicable to Ligado's base station operations in 1526-1536 MHz do not protect aviation's use of certified receivers near Ligado base stations.

- The Order's conditions do not make up for the flaws of this insufficient technical analysis. The notification provisions require Ligado to establish a database for pilots' use outside the normal FAA processes on which pilots rely for information about obstacles. This directive is seriously vague and raises numerous significant questions. This new notification mechanism is also beyond the Commission's authority to adopt. The interference complaint condition places too much authority and discretion in the hands of Ligado offering little certainty that interference situations will be adequately and timely addressed. The Order also makes unfounded assumptions about how UAS currently and in the future will use GPS for operations in low-altitude environments, putting at risk new growth industries.
- With regard to non-certified receivers, the Order discounted the interference assessment standard based on a 1 dB change in the carrier signal-to-noise ratio that has been supported consistently by the relevant federal agencies, the major GPS manufacturers, and the aviation industry and which the record evidence showed is the best objective predictor of interference to GPS devices. Exacerbating the error of this rejection, the Order relied on Ligado-sponsored studies that are insufficiently narrow. For example, these studies looked at only two of many important functions performed by non-certified GPS receivers on which critical aviation systems rely. In addition, the studies only looked at a single non-certified GPS receiver used by aviation and did so in a non-aeronautical test set-up. And again, the conditions imposed by the Order in an attempt to make up for the expected interference from Ligado are insufficient to shore up the other deficiencies of the Order which fail to protect non-certified receivers.
- Finally, the Order recognizes the need for measures to protect SATCOM from interference caused by Ligado. But the Order unjustifiably relies upon resolution of long-open negotiations between Ligado and Inmarsat – which have occurred without aviation industry involvement – to develop terms for a major retrofit of aircraft using Inmarsat SATCOM. Regarding potential interference to Iridium SATCOM, the Order's encouragement of Ligado and Iridium to keep talking hardly passes for sound spectrum management and a similarly flawed response to demonstrated interference concerns. The Order's inadequate treatment of the SATCOM issues amounts to the Commission adopting no protective measures whatsoever.

Because the acknowledged potential for interference from Ligado will endanger life and property, the Commission should resolve this matter promptly, before Ligado is permitted to deploy and operate its terrestrial network under the flawed operational and technical parameters adopted by the Order, *i.e.*, by June 20, 2020, ninety (90) days after the Order's release.

Alternatively, the Commission should suspend the license modifications while it considers this Petition. In either event, the Commission should ultimately reconsider the Order and deny Ligado's applications.

PETITION FOR RECONSIDERATION

The Aerospace Industries Association (“AIA”), the Aircraft Owners and Pilots Association (“AOPA”), Airlines For America (“A4A”), the Aviation Spectrum Resources, Inc. (“ASRI”), the Cargo Airline Association (“CAA”), the General Aviation Manufacturers Association (“GAMA”), the Helicopter Association International (“HAI”), the International Air Transport Association (“IATA”), the National Air Transportation Association (“NATA”), and the National Business Aviation Association (“NBAA”) (together, “Joint Petitioners”) hereby petition the Commission for reconsideration of its April 22, 2020, Order and Authorization (“Order”) in the above-referenced matters.¹ This Petition is timely filed pursuant to Section 1.106(b)(1) of the Commission’s Rules. 47 C.F.R. § 1.106(b)(1).²

In the Order, the Commission grants Ligado’s 2015 and 2018 license modification applications, issues certain rule waivers, and “authorizes Ligado to deploy a low-power terrestrial nationwide network in the 1526-1536 MHz, 1627.5-1637.5 MHz, and 1646.5-1656.5 MHz bands” subject to numerous conditions (Order ¶ 1). In so doing, however, while recognizing that Global Positioning System (“GPS”) receivers and satellite communications (“SATCOM”) terminals relied upon by aviation must be protected from interference caused by Ligado, the Commission largely arbitrarily shifted the burden for that protection upon the aviation industry itself. The Order, at bottom, puts air safety and aviation operations at risk for the benefit of a private company with dubious claims on providing the benefits of advanced communications in a small amount of spectrum. Joint Petitioners, for the reasons explained

¹ *LightSquared Tech. Working Grp. Report, et al.*, IB Docket No. 11-109, *et al.*, Order and Authorization, FCC 20-48 (Apr. 22, 2020) (“Order”).

² A description of Joint Petitioners is found in Attachment 1. A selection of the submissions in the above-referenced proceedings made by Joint Petitioners individually or collectively is in Attachment 2.

herein, ask the Commission to reverse the Order and terminate these proceedings, or otherwise order such other proceedings as may be necessary and appropriate to address the errors and omissions set forth herein. 47 C.F.R. §§ 1.106(k)(1)(i), (iii).³

I. INTRODUCTION: THE ORDER OVERLOOKS MAJOR GAPS IN THE RECORD, AND THE CONDITIONS IT ADOPTED GIVE RISE TO NEW QUESTIONS AND UNCERTAINTIES

Ligado’s proposed terrestrial operations, under the ancillary terrestrial component (“ATC”) rules, constitute the introduction of a disparate mode of radio communications within a set of frequency ranges –1526-1536 MHz, 1627.5-1637.5 MHz, and 1646.5-1656.5 MHz – in an L-Band spectrum environment that has been set aside for decades to support satellite services, including GPS and SATCOM, both of which are critical to safe and efficient aviation. As such, as the proponent of such a new service, Ligado has the burden to demonstrate that it can be a good neighbor, and indeed the Order is predicated upon this notion. The Order addresses the basic question of whether Ligado’s proposals pose a harmful interference threat to GPS receivers and SATCOM terminals and, if so, how to prevent that interference.

Unfortunately, a close reading of the Order reveals that the record in this proceeding does not substantially support the decisions the Commission made. The Order relied on a Federal Aviation Administration (“FAA”) analysis that the agency itself stated was limited and incomplete for operational scenarios near the ground, including over dense urban areas, where

³ The Order was adopted by the Commission on circulation. While adoption in this manner is permitted, it meant that the public did not have the chance to see a draft Order, something which has become *de rigeur* for decisions of broad significance, such as this one, under this Commission. This is not quibbling about the procedural choices at the Commission’s disposal because, as noted herein, the Order fails to address fully the issues and facts presented to the Commission and contains material errors, omissions, and faulty rationales which warrant reconsideration and denial of Ligado’s modification applications. These matters could have been brought to light if a draft Order had been released for public inspection before the Commission rushed to decision.

interference to aircraft would jeopardize life and property. Moreover, Ligado’s own studies, in addition to their other flaws, did not address performance of all the principal GPS functions that aviation relies on (and reviewed only a limited number of devices at that, including only one non-certified aviation device in a static, two-dimensional setting, *i.e.*, a non-aeronautical context).⁴

The Order sought to assure that there will be no harmful interference to GPS and SATCOM. Because the record evidence demonstrated that Ligado’s proposed operations would cause harmful interference to incumbent operations, the Commission adopted a number of what it terms “strict conditions” to try to remedy the situation (Order ¶ 6).⁵ Unfortunately, the conditions are insufficient and reflect the Commission’s selective focus on only parts of an incomplete record, a state of affairs about which Joint Petitioners and others had repeatedly warned, as well as its reliance on flawed interference analyses that lie at the heart of the Order. The conditions are premised on erroneous notions of the actual interference threat Ligado’s proposed operations create and generate as many issues as they allegedly sought to resolve. The conditions assign enforcement responsibility vis-à-vis third-party victim interference complaints *to Ligado itself*, they impose ill-defined future burdens on third-parties that shift much of the burden of interference protection to the aviation industry and other users of GPS receivers (rather than the applicant Ligado, on whom such burdens legally and squarely should fall). In short, the conditions confirm the arbitrary and capricious nature of the Order.

⁴ Joint Petitioners treat any GPS receiver not being certified to an FAA Technical Standards Order as a non-certified device.

⁵ Underscoring the grave threat to GPS and SATCOM that Ligado’s proposed operations represent, the conditions are spelled out in the final twenty-three (23) paragraphs of the Order prior to its Conclusion. Order ¶¶ 133-155.

Finally, rather than resolve issues concerning interference from Ligado to SATCOM, on which aviation depends, issues the Order acknowledges should be addressed, the Order relies on the conclusion of negotiations not yet completed or even begun. This is an unsound and ultimately arbitrary and capricious resolution of the issues of SATCOM interference presented in these proceedings.

As a consequence of the Order, taken as a whole, the public should expect adverse and serious nationwide impacts on aviation and safety-of-flight, in particular, as well as on national and homeland security, agriculture, ground transportation, maritime users, and other sectors of the U.S. economy. For the reasons stated herein, the public interest, and the safety of the nation's pilots, air crews, passengers, and people on the ground, as well as the efficiency of the National Airspace System ("NAS"), require that the Commission reverse the Order and deny the Ligado license modification applications. In addition, because the acknowledged potential for interference from Ligado will endanger life and property, the Commission should either (i) resolve this matter promptly, *before* Ligado is permitted to deploy and operate its terrestrial network, *i.e.*, June 20, 2020, ninety (90) days after the Order's release, or (ii) suspend the effectiveness of the Order while it considers this Petition.

In Section II of this Petition, Joint Petitioners address how the Order expressly recognizes the limits of the FAA's analysis of the potential for Ligado to cause harmful interference to certified aviation safety-of-life GPS receivers. The Order, however, inexplicably relies on that very analysis (without supplementation), as well as Ligado's mischaracterization of an FAA rule, to find that all operational scenarios are addressed by the adopted technical and operational parameters and by a corresponding series of conditions which do not stand up to scrutiny. Joint Petitioners, in Section III, show that, setting aside the use of the wrong standard to assess the

interference potential from Ligado to non-certified GPS receivers (a central error in itself), the Order relies on Ligado-sponsored studies that are insufficiently narrow to support the conclusion that the potential for interference to non-certified aviation receivers is addressed by the Order's conditions. Finally, in Section IV, Joint Petitioners demonstrate that, although the Order recognizes the need for additional measures to protect SATCOM used by aviation and others from interference by Ligado, the Order relies upon resolution of negotiations between Ligado and Inmarsat to address them. This amounts to the Commission adopting no protective measures whatsoever. Regarding potential interference to Iridium SATCOM, the Order's encouragement of the parties to keep talking does not pass for sound spectrum management and is similarly flawed.

II. THE FAA'S ANALYSIS OF THE POTENTIAL FOR INTERFERENCE TO CERTIFIED AVIATION GPS RECEIVERS WAS INCOMPLETE ON ITS FACE, SOMETHING THE ORDER RECOGNIZED BUT INEXPLICABLY IGNORED

A. The Order Misused the FAA's Analysis of Potential Interference 250 Feet from a Ligado Base Station

The Order acknowledges that “[c]ertified aviation receivers are critical to air safety” (Order ¶ 65). Noting that “it would be a significant matter if [certified GPS receivers on] aircraft would need to be retrofitted in any way” (*id.*), the Order attempts to avoid that outcome. It “accept[s]” – and, crucially, relies virtually exclusively on – an incomplete FAA analysis relating to certified aviation devices submitted into the record (Order ¶ 71),⁶ noting that the FAA is the “expert agency with a critical interest in ensuring the reliability” of certified aviation devices and

⁶ See U.S. Department of Transportation, “Global Positioning System (GPS) Adjacent Band Compatibility Assessment,” Final Report, at VI-VII (April 2018) (“DOT ABC Report”), available at <https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf>.

“condition[s] Ligado’s ATC operations accordingly” (*Id.*).⁷ While the FAA is indisputably the central stakeholder in ensuring the safety of operations in the NAS, the failure of the Commission to account for the significant gaps undermines its reliance on the FAA’s analysis.

Moreover, the Order, claiming that its technical and operating conditions for base stations are “consistent with the finding in the FAA’s certified aviation device analysis,” overlooks the fact that the FAA offered no endorsement in the DOT ABC Report of the sufficiency of Ligado’s assessment zone concept from an operational perspective. Indeed, the FAA specifically called attention to the insufficiency of its own analyses: “[the FAA] has not completed an exhaustive evaluation of the operational scenarios in developing this assessment zone.”⁸ The FAA merely studied the potential for interference at the surface of a cylinder (a “250/30 Cylinder”) defined by a 250-foot lateral radius around and a top surface 30-feet above a Ligado base station *because this was what Ligado posited*. Accordingly, the FAA stated that its analyses in question “do not include an operational assessment of the impact of the assessment zone in densely populated areas, which may present additional variables, including the risk posed to people and property for

⁷ The conditions included the following: “(1) base station EIRP will be limited to 9.8 dBW (10 W) with a +/- 45 degree cross-polarized base station antenna; (2) no Ligado base station antenna in this downlink band may operate at any location less than 250 feet laterally or less than 30 feet below an obstacle clearance surface established by the FAA, with a minimum inter-station separation distance of 433 meters (1420.6 feet) in a hexagonal grid; (3) Ligado must comply with specified reporting requirements to the Commission and FAA, and with other notification and monitoring obligations; and (4) handset EIRP above 1626.5 MHz will be limited to -7 dBW.” Order ¶ 71. Notably, the Order did not adopt operational conditions in a manner wholly consistent with the FAA’s analysis of interference potential at the border of and outside the 250-foot assessment zone, as the FAA observed that “antenna height and downtilt angle” as well as “system-wide limitations (such as additional reductions to account for aggregation)” may also be required. *Id.* ¶ 66. Yet there is no indication in the record that the Commission even considered such additional mitigations as suggested by the FAA’s analyses which it purports to endorse, undermining the soundness of the Order’s decisions.

⁸ DOT ABC Report at 120 (Section 5.1.1).

operations such as Unmanned Aircraft Systems (“UAS”) using certified avionics which may be required to operate within the assessment zone.”⁹

In short, while describing the FAA as the “expert agency” when it comes to “ensuring the reliability of certified aviation devices,” the Commission nevertheless ignored the FAA’s own cautions regarding the scope of those analyses and, by acting as it did without supplementing those analyses, effectively concluded that developing evidence about the unaddressed operational implications of Ligado’s application was unnecessary to ensure the operational safety of entire classes of aircraft – including smaller general aviation aircraft, helicopters and UAS – that regularly will fly within the 250-foot assessment zones surrounding Ligado base stations.¹⁰ Indeed, many Joint Petitioners presented evidence that critical law enforcement, homeland security, and medical operations conducted in urban areas will encounter such operational scenarios on a regular basis while relying on GPS even while operating under visual flight rules.

By accepting, and relying upon, the FAA’s incomplete assessment, the Order proceeds to adopt conditions that similarly fail to consider real world operational considerations. Although adopting an across-the-board maximum base station power level with polarization requirements,¹¹ set-off distances from Part 77 obstacle clearance surfaces,¹² and minimum inter-

⁹ *Id.* at VII.

¹⁰ The Order erroneously asserts that the FAA “came to [its] conclusions based on the most restrictive scenarios involving helicopter flight.” Order ¶ 72. Indeed, and unfortunately for the Order’s reasoning, the FAA came to no final conclusion regarding flight operations inside prospective 250/30 Cylinders because it did not assess all of them.

¹¹ Joint Petitioners appreciate that the Order did not accede to Ligado’s request that Ligado have future flexibility to increase the maximum power level above 9.8 dBW as new active FAA MOPS are adopted. This action is appropriate because existing certified GPS receivers under inactive MOPS would continue to be used, manufactured, and deployed. Nonetheless, the mix of operating conditions is still unacceptable from the perspective of aviation safety.

¹² Moreover, although appropriately mindful of avoiding interference to GPS within Part 77 airspace, *i.e.*, obstacle clearance surfaces established by the FAA, the base station deployment condition is incomplete. The Order provides no clear direction what Ligado must do if new or

base station distances, the Commission leaves unaddressed thousands, or even tens of thousands, of eventual 250/30 Cylinders where GPS will be utilized regularly by numerous airspace users trying to avoid not only Ligado base stations, but other structures, trees, and the ground itself. As explained in DOT's ABC Report, pilots and other aviation associations have a number of serious operational concerns with the 250/30 Cylinder, including:

- “technical and human factors issues associated with re-initialization of GPS after loss of the signal or when the signal reception is intermittent;”¹³
- “workload and human factors impacts on pilots to monitor and track [250/30 Cylinder] locations;”
- “the possibility that pilot workload, confusion, or error could lead to aircraft inadvertently entering [a 250/30 Cylinder] and losing needed GPS functionality;” and
- “impacts to onboard and ground systems that are dependent upon GPS, such as Automatic Dependent Surveillance (ADS) Broadcast . . . or fixed-wing and helicopter terrain awareness warning system including obstacle alerting.”¹⁴

B. The Condition Establishing a Set-Off Distance for Deployment of Ligado Base Stations from Obstacle Clearance Surfaces Does Not Address Operational Realities

By prohibiting the deployment of Ligado towers within 250 feet of FAA-recognized obstacles, but not accounting for the 250/30 Cylinders around the Ligado base stations

existing Part 77 volumes are added or are modified. Joint Petitioners are left wondering if the Order intends to prohibit operation, and not just deployment, within 250 feet of a Part 77 airspace. If so, it would appear that Part 77 clearances change such that if a Ligado base station is within 250 feet laterally or 30 feet horizontally of the new or modified obstacle clearance surface, it must stop operating. The Commission should deny the application, but, if it does not, it should confirm this presumption or modify the Ligado conditions to confirm such requirement.

¹³ In particular, this point arises from the concern, realized in the Order with the adopted operating conditions, about the potential permitted deployment of Ligado base stations within 433 meters of each other, which will result in significant portions of the potential operational environment for low-flying operations being peppered with 150 meter diameter circles where GPS interference may occur. The potential repeated loss of GPS and difficulties in regaining acquisition while operating near the ground amplify the dangers a single Ligado tower would engender.

¹⁴ DOT ABC Report at VII. *Accord* Letter of Capt. Tim Canoll, President, Air Line Pilots Association, International, *et al.*, to Daniel K. Elwell, Acting Administrator, FAA, IB Docket Nos. 11-109, 12-340, at 2 (June 15, 2018) (many Joint Petitioners were signatories to this letter).

themselves, the Order wholly misunderstands the operating conditions pilots face. While not completely clear from the Order’s discussion regarding certified aviation receivers, it appears that the Order may have been relying on Ligado’s ill-informed argument that “any potential degradation of GPS signals within 250 feet of a tower would not present a safety of flight issue” on the incorrect premise “that FAA regulations provide that aircraft generally may not be operated closer than 500 feet to any person, vessel, vehicle, or structure except in limited circumstances, and that operations within 500 feet of an object require flight by visual reference” (Order ¶ 70 (citing Reply Comments of Ligado Networks LLC, IB Docket No. 11-109, at 6 (July 19, 2018) (citing 14 C.F.R. § 91.119))).

However, Section 91.119(d)(1) of the Federal Aviation Regulations, cited by Ligado for its presumption, expressly *does permit* operations closer than 500 feet by helicopters. Indeed, Joint Petitioners submit that there are many low-altitude operators that fly under the Title 14, Part 91 regime that will involve flying within 250/30 ft cylinders and facing the threat of harmful interference from base station signals. These critical operations include helicopter air ambulance missions (and ambulance landing and take-off), precision agriculture operations, pipeline and power-line patrols, flight training, and UAS operations.¹⁵ Such operations, even if conducted under visual flight rules, rely on GPS-dependent systems for obstacle and terrain alerting systems; such enhancements have proven to be effective at alerting pilots of potential conflicts and been shown to significantly improve flight safety. These GPS-based enhancements are especially valuable during operations at night or in suboptimal weather conditions or at

¹⁵ The Order contends that its operational conditions allegedly protecting certified receivers – power, polarization, 250/30 foot setoffs, and maximum base station density in a horizontal grid were “based on the most restrictive scenarios involving helicopter flight near Ligado’s base stations.” Order ¶ 72. But this is without justification as the FAA had not fully considered all operational scenarios.

locations in which aircrews are not familiar with local terrain. These GPS-dependent systems, including the Terrain Awareness and Warning System (“TAWS”), alert pilots of a conflict with an obstruction or terrain sufficiently in advance so that the pilot can maneuver to avoid it.

In short, the flight rules under which an aircraft is operating have no bearing on the criticality of navigational accuracy that GPS delivers when free from interference. AOPA’s, HAI’s, and IATA’s members, for example, have informed their respective associations that many obstructions can be difficult to see when flying, particularly towers, and that the loss of a GPS signal can cause distraction and disorientation during a high workload phase of flight, near the ground and physical obstructions. Consequently, to the extent the Order is based on a conclusion that GPS is not used within 250 feet of a tower, *e.g.*, when visual flight is allowed, it is based on an entirely erroneous and unfounded understanding of actual flight operations, which has been repeatedly established in the Commission’s record.¹⁶

For its other flaws, the base station deployment condition is woefully incomplete because there are more than ten thousand airfields in the United States not subject to Part 77 clearances;¹⁷ these areas must, however, still be protected from Ligado interference with GPS. The Order’s condition limiting Ligado deployments in the proximity of Part 77 clearances provides no protection at all to the airspace near these airfields, further demonstrating how the Commission’s

¹⁶ See, *e.g.*, Comments of Aviation Spectrum Resources, Inc. on the Amendment to the Applications of Ligado Networks Subsidiary LLC, IB Docket Nos. 11-109, *et al.*, at 3-5 (July 9, 2018); Letter from Capt. Tim Canoll, President, Air Line Pilots Association, International, *et al.*, to Daniel K. Elwell, Acting Administrator, FAA, IB Docket Nos. 11-109, 12-340, at 1 (June 15, 2018); Letter from Edward A. Yorkgitis, Jr., Counsel to ASRI, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, at 2-3 (June 20, 2017).

¹⁷ In 2018, for example, the FAA Administrator’s Fact Book reveals that there were 4,567 non-Part 139 civil public airports in the U.S. in 2018 and 14,249 additional civil private use airports. FAA, Administrator’s Fact Book, at 16 (June 2019), available at https://www.faa.gov/news/media/2019_Administrators_Fact_Book.pdf

conditions are insufficient to protect entire categories of aircraft operations, including emergency helicopters that may land anywhere.

C. The Order’s Consideration of UAS Ignores Record Evidence and Undermines the Important Role That GPS Will Play in Their Operations

The Order also directly and adversely impacts the aviation industry’s active development of next-generation UAS operations and the development and operation of Urban Air Mobility (“UAM”) platforms.¹⁸ The missions that these platforms will execute will surely alter the way in which people and goods move—and services are provided—but one critical element will remain unchanged: there will be a requirement for uninterrupted access to GPS in order to safely operate with the appropriate levels of integrity, continuity, and accuracy.¹⁹ The Order (§ 72) makes many sweeping assumptions about how UAS – and, by extension, UAM – use GPS and how this reliance on GPS will be impacted by the approval of the Ligado proposal, without any apparent supporting information or evidence to justify these claims. For example, the Order states that “[t]he form factor (size and weight) as well as power requirements for certified aviation devices may not be conducive to small UAS (less than 55 lbs.)” and that “[i]f certified aviation devices are used on larger UAS, it is reasonable to expect those UAS would respect the

¹⁸ UAM operations will occur in the same airspace used by both general aviation and UAS in order to carry passengers and smaller cargo to their destinations in both urban and rural environments.

¹⁹ There are currently 1,563,263 registered Part 107 UAS in the U.S. and that number is anticipated to continue to grow annually. See FAA, “UAS by the Numbers” (Mar. 10, 2020), available at https://www.faa.gov/uas/resources/by_the_numbers/. \$2.2 billion has been invested in UAS technology since 2012. See Teal Group Corporation, “Teal Group Predicts Worldwide Civil Drone Production Will Almost Triple Over Next Decade” (June 16, 2019), available at <https://www.tealgroup.com/index.php/pages/press-releases/60-teal-group-predicts-worldwide-civil-drone-production-will-almost-triple-over-the-next-decade>. Likewise, over \$2 billion has been invested in UAM since 2018 and it is projected to deliver over \$600 billion in indirect economic output by the year 2040. See NEXA Advisors and the Vertical Flight Society, “NEXA Advisors Completes Landmark Urban Air Mobility Study” (Aug. 15, 2019), available at <https://vtol.org/news/press-release-nexa-advisors-completes-landmark-uam-study>.

same obstacle clearance surfaces identified by FAA for manned aircraft” (*Id.*). No sources are cited in the Order to support these assumptions, and Joint Petitioners submit that they are, in fact, baseless. Indeed, the Order’s statements conflict with evidence provided by the DOT in the ABC Report, as well as with previous filings submitted in the Commission’s record about existing manned aviation usage.²⁰

The DOT ABC Report states that UAS operations will depend on GPS navigation signals for numerous applications. These will include public safety and crop monitoring for “[l]ateral distances down to 10 feet from the base stations” and “vertical heights up (and above) the base station height.”²¹ Increasing numbers of UAS, both large and small, will operate under 400 feet above ground level or within 400 feet of infrastructure. To operate safely, these UAS will rely upon both certified and non-certified GPS receivers to perform safely in the airspace; such critical access to the GPS network must be free from interference throughout the course of flight and will meet a variety of needs from safe navigation to geofencing and even anticipated compliance with remote identification requirements.

The Order suggests that UAS operating in this low-level environment “will use less expensive, smaller form factor, lighter weight non-certified devices” (Order ¶ 72). However, even presuming this applies to some small UAS, the DOT ABC Report explained that current non-certified GPS receivers for general aviation application are even more susceptible to Ligado’s interference than certified devices, experiencing harmful interference at over 3000 feet away and over 300 feet in the air.²² Several of the member companies of Joint Petitioners are

²⁰ See, e.g., Letter from Dr. Joel N. Myers, Founder, President and Chairman, AccuWeather, *et al.*, to Ajit Pai, Chairman, Federal Communications Commission, IB Docket No. 11-109, *et al.* (July 18, 2018).

²¹ DOT ABC Report at Appendix H.

²² See *id.* at Appendix I.

currently involved in obtaining UAS and UAM type certification from the FAA and can report to the Commission that these will require certified GPS equipment in order to fly in close proximity to terrain and obstacles, which may include flying within 250/30 Cylinders, before transitioning into controlled airspace.

Presuming the location of the Ligado towers will be known, despite a lack of absolute clarity on this point in a close reading of the Order's conditions (the deficiencies of which are discussed above in Section II.B), the Order states that the Commission "will assist the FAA and aviation community when considering waivers to FAA UAS regulations to enable the use of certified aviation devices on UAS" for affected operations (Order ¶ 72). Without foundation, the Commission simply presumes that the FAA, which is solely responsible for maintaining safety within the NAS, would be willing to waive critical safety requirements for a given operation to accommodate the Commission's decision on Ligado's behalf. The Commission also disregards the fact that the uses of GPS by UAS for terrain avoidance and navigation purposes will not be optional, considering existing FAA mandated uses of uninterrupted GPS for such purposes in commercial manned flight.

In short, the Commission makes baseless assumptions about certified GPS usage by UAS that do not meet the evidence provided by industry or the DOT.²³ The Commission then mistakenly presumes that UAS will use non-certified receivers, which have been proven by the DOT to experience even greater impact from Ligado's harmful interference than aircraft equipped with current GPS receivers.

²³ *Id.* at VII.

D. The Base Station Database Condition Is Vague, Impermissibly Imposes Burdens on Non-Parties, and Is Otherwise Flawed

In addition to the inadequacy of the operational conditions described above, the Order's notification, reporting, and monitoring obligations are ambiguous and flawed (*See* Order ¶¶ 144-149, 151-155). Most fundamentally, the Order, exceeding Commission authority, purports to create an entirely new source of obstacle information for pilots outside the normal existing processes without any attempt at justification. The Commission lacks any authority to do so, as such action falls exclusively within the domain of the FAA. The FAA, as the authoritative source for pilot information regarding navigable airspace and obstructions to flight, currently provides obstacle information to pilots via charts, FAA NOTAMS, and digital information files.²⁴ Pilots know and are accustomed to accessing such information through FAA databases. While knowledge of information regarding Ligado deployments is important given the GPS interference threat, the Commission's unauthorized creation of standalone, private databases (or graphical depictions) of nationwide airspace hazards resulting from Ligado's deployments is without precedent.

Access to this critical information would require an entirely new and burdensome set of additional procedures and mechanisms necessary to notify aircrew of hazards outside of the FAA normal processes. Even if such a database could be implemented, and that is dubious, this situation would almost certainly cause confusion for pilots, disrupting the efficient and currently predictable flow of FAA-disseminated information, and increasing the potential for pilots to fly near a Ligado-enabled tower and experience GPS disruption.

²⁴ *See, e.g.*, FAA, "Aeronautical Information Services AJV-A" (Jan. 23, 2020), available at https://www.faa.gov/air_traffic/flight_info/aeronav/.

Rather than impose on non-parties such as ASRI an obligation to “work with” Ligado to establish a new database, the Commission should have coordinated on an inter-agency basis with the FAA to develop a process by which relevant Ligado information could be provided and integrated with current systems administered by the FAA and used by pilots for obstacle information. The FAA already charts areas of interference or ocular glare, and it should likewise be the source for any information on sustained areas of GPS interference due to future Ligado deployments. In short, the creation of a system for pilot notification of air safety information, while a cornerstone of the Commission’s decision to grant Ligado’s applications, is outside the Commission’s authority. This fatally flawed condition is another reason why the Order should be reconsidered.

The Order creates new burdens on parties other than Ligado. The Order provides that “Ligado must work with relevant stakeholders, including ASRI, to establish a database available to the affected aviation community and include the base station information at least 30 days before commencing transmission at a base station site” (Order ¶ 147).²⁵ It is unclear who the “relevant stakeholders” are or what are the parameters of database availability. Moreover, by obligating Ligado to work with “relevant” stakeholders, the Order purports to impose obligations on such relevant stakeholders, and especially Petitioner ASRI, to “work with” Ligado to establish a database. Joint Petitioners question whether the Commission has the authority to compel a non-party to “work with” Ligado to establish a database. Even if it has that authority, this requirement represents more of a rule than a license condition, and the Commission has not

²⁵ The requirement that such a database be created is a recognition that the Ligado base station towers are an interference threat to aviation, despite the other operational conditions. Accordingly, if the notification system is flawed, the operating conditions are insufficient, and the order should be reversed.

met the Administrative Procedure Act requirements of notice and comment that would apply. Moreover, the Order is wholly devoid of any directive ensuring that Ligado pays for the establishment of such a database and its operational upkeep.

E. The Condition Requiring Responsiveness to, and Notifications of, Interference Complaints Is Insufficient to Ensure Interference Complaints Will Be Addressed

In presenting its 2018 Modification Applications, Ligado proposed procedures by which it would respond to “credible” complaints of interference from its operations (*See* Order at ¶¶ 67, n. 232, 92). The Order requires Ligado, as a condition to the license modification it seeks, to respond to *all* complaints of interference and imposes an obligation on Ligado to resolve them after investigation (*Id.* ¶ 146). However, this condition, upon closer inspection, has significant gaps which cast doubt on whether the Commission’s decision will actually resolve and eliminate, in a prompt manner, future interference, following Ligado’s receipt of a complaint.

First, the condition is limited to interference caused to GPS receivers by base stations operating in 1526-1536 MHz and does not apply to interference caused to SATCOM terminals, as it should. *Second*, the condition gives Ligado an unprecedented amount of authority to determine whether it must address an interference complaint – and, incredibly, how. While Ligado must notify the Commission’s Operations Center of any interference complaint received within one hour of receipt, the Order contains no commitment that the Commission’s staff will investigate or address the complaint of interference, except perhaps in undefined instances of large-scale disruption to GPS (*Id.*).²⁶

²⁶ In such a case, the FCC Operations Center may request that Ligado cease all operations within the radio horizon using a required “stop-buzzer” capability. Order ¶ 146. The Order also provides that the FCC Operations Center “may” ask Ligado to “validate its operation in and around the area of the GPS disturbance and provide relevant technical information to the FCC Operation Center within one hour of the request.” *Id.* This appears to simply be a requirement

Third, short of a large-scale disruption, which may result in a Commission request to cease operations in and near the affected area, Ligado retains complete discretion to investigate the interference and, “if Ligado verifies it is the source of interference” (Order ¶ 146) to resolve such interference within 24 hours. This requirement ignores that interference events to GPS on aircraft may be very short-lived – yet potentially dangerous – and difficult to replicate without another flight in the same vicinity with the same type of GPS receiver. That may be difficult, costly, and even perilous to arrange. While the Order acknowledges that Ligado base stations constitute a threat of interference to GPS receivers, even when Ligado is operating within the technical parameters set out in paragraph 71 of the Order, as a practical matter Ligado may be able, under the terms of the Commission’s order, to do nothing more within 24 hours than determine if it is operating in compliance with those parameters.

Fourth, the condition is flawed because it assumes that interference will be a geographically-, and time-, limited event – even if a “large-scale” one. In reality, if one helicopter encounters interference while operating less than 250 feet laterally from a Ligado base station at low-altitude, any helicopter that uses the same type of GPS receiver and operates a similar mission will face similar interference from Ligado base stations *nationwide*. The Commission, upon reconsideration of the Order (if it does not reverse and deny the Ligado applications, as it should) must clarify that Ligado may not presume interference did not occur simply because a base station in the vicinity of the reported interference is operating consistent with the technical parameters of the Order. Moreover, it should be made clear upon reconsideration that any complaint of interference, to be resolved, may require a nationwide, not

to determine whether the base station is operating within the technical parameters under the Order. As noted above, adherence to those parameters does not assure non-interference with aviation or other users of GPS.

just a local, response, even if interference occurred while Ligado was operating within its permitted technical parameters.

III. THE ORDER’S CONCLUSIONS REGARDING NON-CERTIFIED GPS AVIATION RECEIVERS ARE BASED ON AN INCORRECT INTERPRETATION OF FACTS AND INADEQUATE ANALYSIS BY LIGADO

The Order’s determinations regarding non-certified GPS devices are based on so-called “co-existence agreements” with GPS manufacturers such as Garmin International (“Garmin”), Trimble, Inc. (“Trimble”), and Deere & Company (“Deere”). The second touchstone to the Commission’s decision regarding non-certified devices is a reliance on Ligado’s sponsored testing rather than the government’s testing conducted under the auspices of DOT, *i.e.*, the ABC Report. In both cases, the Order makes sufficiently significant errors to warrant reconsideration.

First, there are no “co-existence agreements” with GPS manufacturers; instead, there are only litigation settlement agreements. Garmin, in response to the Order, only a week ago, was insistent in clarifying “for the record that it never entered into a co-existence agreement with Ligado.”²⁷ As Garmin goes on to assert, consistent with filings it has made throughout this proceeding, its settlement agreement “does not constitute support for or an endorsement of Ligado or its proposed services or technologies,” or its “license modification applications”²⁸ Garmin has “maintain[ed] its ability to advocate for the use of a standard based on a 1 dB decrease in the Carrier-to-Noise Power Density Ratio or C/N₀ (“1 dB Standard”) in evaluating harmful interference to all GPS devices,”²⁹ a position in opposition to the key performance indicator approach Ligado took and the Order endorsed (Order ¶ 86); it and other major GPS

²⁷ Letter from Scott Burgett, Director, GNSS and Software Technology, Garmin, *et al.*, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, at 2 (May 15, 2020) (“Garmin May 15, 2020 Letter”).

²⁸ *Id.*

²⁹ *Id.*

manufacturers have repeatedly advocated for the use of the 1 dB Standard.³⁰ The Order itself recognized that the National Telecommunications and Information Administration, the Department of Transportation (“DOT”), the Department of Defense, and many other relevant federal agencies were all aligned with the GPS manufacturers that the 1 dB Standard is the correct one to use in assessing the potential for harmful interference, especially to non-certified receivers.³¹ The GPS Innovation Alliance (“GPSIA”), whose members include GPS manufacturers, explained to the Commission that “[e]ven a small increase in the noise floor may affect a GPS signal’s accuracy, integrity, continuity, or availability in unexpected or dramatic ways.”³² In short, as propounded by the expert federal agencies and the GPS equipment

³⁰ Garmin May 15, 2020 Letter at 2; Letter from Catherine Wang, Counsel to Deere & Company, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, 2 (April 21, 2020); Letter from Russell H. Fox, Counsel for Trimble, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, 1 (July 26, 2019) (“Trimble . . . has not supported use of the 1526-1535 MHz band as described in [Ligado’s modification] applications. For that, and other spectrum nearby to frequencies designated for the global positioning system (1559-1610 MHz), the Commission should continue to evaluate proposals based on whether the proposed service would result in a 1 dB increase in the noise floor.”).

³¹ See Letter from Douglas W. Kinkoph, Deputy Assistant Secretary for Communications and Information (Acting), NTIA, to Ajit Pai, Chairman, Federal Communications Association, IB Docket No. 11-109, *et al.* (Dec 6, 2019). The Order rightly recognizes, and Joint Petitioners fully supports, the need to protect federal GPS users from harmful interference. The Order adopts as a license condition that “Ligado shall expeditiously replace or repair as needed any U.S. Government GPS devices that experience or are likely to experience harmful interference from Ligado’s operations” and details how that is to be achieved. (Order ¶ 144). Non-federal precision and other GPS receivers will be as susceptible to similar potential levels of interference from Ligado’s federal government users, since both use many overlapping GPS equipment solutions. Because failure to protect GPS receivers used by commercial and general aviation, as well as helicopters, would adversely impact the national objectives of safety of flight and efficient air travel and aviation operations, Ligado, if its modification applications are not denied on reconsideration – as they should be – should be required to institute a program to upgrade or replace non-federal GPS receivers identical to Ligado’s obligations under the Order to accommodate federal GPS users.

³² Letter of J. David Grossman, Executive Director, GPSIA, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, at 2 (Dec. 20, 2019) (“GPSIA December 2019 Letter”).

manufacturers, “C/N₀ is a direct measurement of receiver performance rather than a downstream measurement of use-case dependent parameters”³³ like those proposed by Ligado.

Despite overwhelming opposition from GPS manufacturers, the aviation industry, and relevant expert Federal agencies who depend on GPS regarding propriety of the 1 dB Standard, the Order inexplicably relied exclusively on the Ligado-sponsored testing, which examined only a limited number of devices and reviewed only two performance indicators: position only in the case of Roberson and Associates (“RAA”) and position and timing in the case of the National Advanced Spectrum and Communications Test Network (“NASCTN”).

The Order recognized that in the RAA and NASCTN studies, “the number of receivers tested [was] limited,” but concluded, that because, “the testing approaches incorporate sound engineering methodologies and practices,” the narrow scope of devices RAA and NASCTN tested can be forgiven (Order ¶ 86). This reasoning simply does not hold up. As an initial matter, setting aside the 1 dB change v. key performance indicator (“KPI”) degradation testing debate, the Order overlooked fundamental shortcomings in both of the RAA and NASCTN studies which only examined position and timing KPIs. But the GPS system supports many different functions, primarily Position, Velocity and Timing (collectively referred to as “PVT”), as well as acceleration, frequency, attitude, heading, and other parameters (*e.g.*, atmospheric delay, reflected signal strength). These are used in many applications, from fully integrated panels for smaller aircraft that provide key GPS-generated information, including altitude above ground level, ground speed, terrain proximity awareness, and nearby airspace alerts during flight.

In light of this, GPSIA noted in the record that “Ligado’s mono-focus on KPIs, and position error in particular, also ignores that position measurement is only one aspect of GPS

³³ *Id.* at 2.

receiver operations.”³⁴ While Ligado claimed that its tests are comprehensive, none of its submissions advised how it tested its proposed network’s effect on parameters fundamental to safe aviation such as GPS acceleration, attitude, and heading. Nor did the Order either acknowledge or assess these deficiencies in the Ligado sponsored studies or find other compensation in the record. As such, the record was inadequate to support a finding that Ligado’s proposed operations would not seriously degrade the functioning of non-certified receivers.

The Order’s reliance on the Ligado-sponsored studies is especially flawed with respect to the non-certified aviation GPS receivers for a second reason. Taking both Ligado-sponsored tests together, only a single non-certified aviation GPS receiver was examined, and by one of the two studies.³⁵ Not only is a single device (manufactured by Garmin) far from representative of the current range of manufacturers and models used in smaller aircraft, but the test also only assessed whether interference would result in a two-dimensional, horizontal-plane position error, *i.e.*, excluding altitude. Many current non-certified devices used by smaller aircraft for situational awareness provide essential data to the pilot, including position (both horizontal and vertical) and velocity while in flight. Given that flight is, by its nature, a three-dimensional matter, a two-dimensional test of only one GPS device is inadequate for any conclusions at all about non-certified aviation GPS receivers’ susceptibility to interference from Ligado’s planned operations. The Order’s conclusion that the Ligado studies addressed such concerns lacks any credible evidence in the record and should be reconsidered.³⁶

³⁴ GPSIA December 2019 Letter at 6.

³⁵ See Roberson and Associates, LLC - Results of GPS and Adjacent Band Co-Existence Study, Appendix F: non-certified aviation device, 329 (May 11, 2016).

³⁶ Recognizing that the testing sponsored by Ligado was based on a thin representation of devices, the Order reasons as follows: “lacking opposition from GPS receiver manufacturers

While the Order allowed that the Commission’s “analysis should not be construed to say that there is no potential for harmful interference to any GPS [non-certified] device currently in operation or in the marketplace,” and recognized that Ligado’s testing actually showed “that there is potential for harmful interference to some devices, particularly high-precision devices,” the Commission once again relied on license conditions to try to cover for the record support needed for its decision (Order ¶ 91). As shown earlier, the license conditions regarding interference resolution are inadequate, and the required notification regarding base station deployments to the aviation industry and establishment of a new database of Ligado base stations are flawed. Consequently, the license conditions do not in any way compensate for the incomplete and flawed studies sponsored by Ligado.

IV. THE ORDER RECOGNIZES THE NEED TO PROTECT SATCOM USED BY AVIATION, BUT FAILS TO PROVIDE ADEQUATE SOLUTIONS

The Order recognizes the potential for interference to SATCOM operations performed by both Inmarsat and Iridium, a situation which Inmarsat itself has acknowledged³⁷ and Iridium has asserted throughout the Ligado proceedings. In both cases, however, the Order does not adopt specific requirements to address these concerns, but instead leaves them to voluntary

about whether the devices tested [by RAA and NASCTN] effectively cover receiver market segments, we draw the conclusion that they are representative of the various types of deployed GPS receivers.” Order ¶ 86. However, regardless of whether GPS manufacturers voiced such opinions, bound as they were by litigation settlements, the objections of the aviation industry concerning the testing’s inadequate scope is sufficient opposition to put into doubt that the testing was representative of non-certified aviation receivers. Moreover, as noted above, the GPS manufacturers Garmin, Trimble, and Deere were direct in their criticism of RAA’s and NASCTN’s rejection of the 1 dB Standard. Therefore, it is unwarranted to draw inferences supporting reliance on the RAA and NASCTN studies simply because these opponents of their methodology did not take the extra step of addressing the representativeness of the device sample in those studies.

³⁷ See Inmarsat Group Limited - Inmarsat Group Limited Interim Results 2016 – Supplemental Disclosure 14 September 2016, at 5 (Sep. 14, 2016) (“[T]he provision of integrated MSS/ATC services could interfere with our satellites and user terminals, which may adversely impact our services, costs and revenues”).

negotiations between the parties. This is unwarranted, but also especially troubling since, to the understanding of Joint Petitioners, the two satellite companies have had a number of discussions with Ligado thus far without apparent success. In addition, the aviation industry, which has numerous members represented by Joint Petitioners, and as customers of both of the SATCOM services, have not been provided a seat at the table, but they should be, consistent with the Commission's recent encouragement of multi-stakeholder groups in the 3.7-4.2 GHz and 6 GHz proceedings. Because any sort of arrangement reached between the Ligado and the SATCOM providers could have a significant impact on aviation operations, for example if a retrofit of aircraft avionics is required, the Order should be reconsidered to involve representatives of the aviation industry, including airlines, owners, and manufacturers.

A. Inmarsat Retrofits

The Order notes that currently protection of Inmarsat's aeronautical receivers is ensured under Section 25.253(d)(5) of the Commission's rules. By meeting the power flux density limit of -56.8 dBW/m²/200 kHz contained in section 25.253(d)(5), "at the edges of airport runways and aircraft stand areas," the rule presupposes that Inmarsat's co-band downlink operations will be protected. Ligado hopes to increase power, and thus raise the power flux density limit by 30 dB (Order ¶ 111). The Order states that this will be permitted only after a waiver of section 25.253(d)(5) is received, which has a precondition that, first, "Inmarsat receivers [be] upgraded through the process agreed to between the parties," a matter subject to current negotiations.

The aviation industry, understands, however, that such an upgrade would require a full fleet retrofit for Inmarsat receivers on aircraft and may require separation zones around aircraft operating areas while that retrofit remains incomplete.³⁸ Retrofits have a major impact on

³⁸ See Reply Comments of Aviation Spectrum Resources, Inc., IB Docket No. 11-109, *et al.*, at 16-18 (July 24, 2018).

airlines and aviation operations generally,³⁹ as the Order recognizes: “it would be a significant matter if aircraft would need to be retrofitted in any way” (Order ¶ 65 (discussing retrofit of certified GPS receivers)). In any such undertaking, the aviation industry itself should be involved, for example through a multi-stakeholder group, to ensure disruption of aviation operations are impacted as little as possible.

Unfortunately, as the aviation industry has informed the Commission on several occasions in the proceeding,⁴⁰ Ligado/Inmarsat have ignored aviation’s many requests for details and dialogue on how this is to be achieved. Just as it has been impossible for aviation and other stakeholders to comment on the proposed (and speculative) Ligado/Inmarsat arrangements, including issues of cost, implementation, allocations of responsibility, or a timeline, it would seem, without knowing how, or even in what timeframe, this matter of interference to Inmarsat SATCOM would be addressed, the Commission simply did not have information sufficient to support approval of the Ligado applications. Such a transition, even under the best of circumstances, as the Order notes, could be several years long even after assuming committed available manufacturing capacity and all other issues, including FAA certification and installation, are readily resolved. For this reason, the Order should be reconsidered, and the Commission should direct Ligado to permit the aviation industry to participate in any such discussions.

³⁹ Order ¶ 65 (stating it could take at least a decade to retrofit aircraft with new equipment and have them recertified by the FAA).

⁴⁰ Letter from Edward A. Yorkgitis, Jr., Counsel to ASRI, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 11-109, *et al.*, 5 (April, 21, 2020). *See* Inmarsat Group Limited - Inmarsat Group Limited Interim Results 2016 – Supplemental Disclosure 14 September 2016, at 5 (Sep. 14, 2016).

B. Iridium Adjacent Band Interference

In the Order, the Commission declines to afford Iridium any particular relief to protect its SATCOM, a service on which many airlines and helicopter users rely (Order ¶¶ 117-118). Joint Petitioners are particularly concerned about Ligado handsets causing interference into Iridium downlinks while handsets are used onboard helicopters, or as performance checks by airline pilots are performed on jetways and on runways, to ensure the SATCOM systems will operate properly while in the air, especially over oceans. The Order does however recognize “Ligado’s obligation to resolve harmful interference if caused to other services, such as MSS downlink operations, and without any distinction between MSS and AMS(R)S” (*Id.* ¶ 118 (citing 47 C.F.R. § 25.255)). However, given the reasonable concerns about potential interference from Ligado handsets to Iridium SATCOM, Joint Petitioners are concerned that, rather than evaluating whether such concerns are warranted, the Order simply encourages Iridium and Ligado to engage in further discussions to “address any use cases that may present unique interference concerns due to deployment patterns or operational considerations” (*Id.*). Because the interference issues would potentially impact aviation safety, leaving this matter to possible unsupervised discussions between the parties does not discharge the Commission’s responsibility, which it recognizes in the Order, but instead leaves great uncertainty whether there will be any resolution regarding interference that Iridium anticipates will occur. Accordingly, the Commission should reverse the Order and address the Iridium concerns directly and adopt any mitigations as needed to protect the SATCOM used by aviation.

V. CONCLUSION

For the foregoing reasons, the Commission should reconsider the Order, withdraw it, and deny the Ligado license modification applications.

Respectfully submitted,

AEROSPACE INDUSTRIES
ASSOCIATION

AIRCRAFT OWNERS AND
PILOTS ASSOCIATION

By: /s/

By: /s/

David Silver
Vice President, Civil Aviation
Aerospace Industries Association
1000 Wilson Boulevard, Suite 1700
Arlington, VA 22209
(703) 358-1080
david.silver@aia-aerospace.org

Jim Coon
Senior Vice President, Government
Affairs and Advocacy
Aircraft Owners and Pilots
Association
50 F Street NW, Suite 750
Washington, DC 20001
(202) 905-0975
jim.coon@aopa.org

AIRLINES FOR AMERICA

AVIATION SPECTRUM RESOURCES,
INC.

By: /s/

By: /s/

Douglas K. Mullen
Vice President and Deputy General
Counsel
Airlines for America
1275 Pennsylvania Avenue, NW, Suite
1300
Washington, DC 20004
(202) 626-4177
dmullen@airlines.org

Andrew Roy
Director of Engineering
Aviation Spectrum Resources, Inc.
180 Admiral Cochrane Drive, Suite
300
Annapolis, MD 21401
(443) 950-0340
acr@asri.aero

CARGO AIRLINE ASSOCIATION

By: /s/ _____

Stephen A. Alterman
President
Cargo Airline Association
1620 L Street, NW, Suite 610
Washington, DC 20036
(202) 293-1031
salterman@cargoair.org

GENERAL AVIATION
MANUFACTURERS ASSOCIATION

By: /s/ _____

Jens C. Henning
Vice President, Operations
General Aviation Manufacturers
Association
1400 K Street, NW, Suite 801
Washington D.C. 20005
(202) 393-1500
jhennig@GAMA.aero

HELICOPTER ASSOCIATION
INTERNATIONAL

By: /s/ _____

Cade Clark
Vice President of Government Affairs
Helicopter Association International
1920 Ballenger Avenue
Alexandria, VA 22314-2898
(703) 302-8457
cade.clark@rotor.org

INTERNATIONAL AIR TRANSPORT
ASSOCIATION

By: /s/ _____

Douglas Lavin
Vice President, Member and External
Relations – North America
International Air Transport Association
1201 F Street, NW, Suite 650
Washington, DC 20004
(202) 628-9443
lavind@iata.org

NATIONAL AIR TRANSPORTATION
ASSOCIATION

By: /s/

John McGraw
Vice President, Regulatory Affairs
National Air Transportation Association
818 Connecticut Avenue, NW
Washington, DC 20006
(202) 774-1525
jmcgraw@nata.aero

NATIONAL BUSINESS AVIATION
ASSOCIATION

By: /s/

Steven J. Brown
Chief Operating Officer
National Business Aviation
Association
1200 G Street, NW, Suite 1100
Washington, DC 20005
(202) 783-9350
sbrown@nbaa.org

CERTIFICATE OF SERVICE

I, Edward A. Yorkgitis, Jr., hereby certify that on May 22, 2020, a copy of the foregoing Petition for Reconsideration of Aerospace Industries Association, Aircraft Owners and Pilots Association, Airlines For America, Aviation Spectrum Resources, Inc., Cargo Airline Association, General Aviation Manufacturers Association, Helicopter Association International, International Air Transport Association, National Air Transportation Association, and National Business Aviation Association was served by e-mail on the following representative of Ligado Networks LLC (“Ligado”) pursuant to arrangement with him, according to which he agreed that any requirements concerning service upon Ligado would be satisfied:

Gerard J. Waldron
COVINGTON & BURLING LLP
One CityCenter
850 Tenth Street, NW
Washington, DC 20001-4956
(202) 662-5360



Edward A. Yorkgitis, Jr.
KELLEY DRYE & WARREN, LLP
3050 K Street, NW
Suite 400
Washington, DC 20007
(202) 342-8540

ATTACHMENT 1

Description of Joint Petitioners

The Aerospace Industries Association (“AIA”) and our over 300 members are on the cutting edge of innovation and leading the development of emerging technologies, including Unmanned Aircraft Systems (“UAS”) and Urban Air Mobility (“UAM”), that will revolutionize the way in which our world moves, connects, and explores. Access to interference-free spectrum, including for the Global Positioning System (“GPS”) and L-Band satellite communications (“SATCOM”), is critical to everything that we manufacture, operate, and develop to safely perform its intended mission.

The Aircraft Owners and Pilots Association (“AOPA”) is a not-for-profit individual membership organization of general aviation pilots and aircraft owners. AOPA’s mission is to effectively serve the interests of its members and establish, maintain, and articulate positions of leadership to promote the economy, safety, utility, and popularity of flight in general aviation aircraft. Our members rely upon certified and non-certified GPS receivers and SATCOM to ensure safe and efficient operations. Representing two-thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

Airlines for America (“A4A”) is the nation’s oldest and largest airline trade association, representing the leading passenger and cargo airlines of the United States. A4A member airlines and their marketing partners account for more than 90 percent of U.S. airline passenger and cargo traffic. A4A advocates on behalf of its members to shape crucial policies and measures that promote a safe, secure, and healthy U.S. airline industry, including a broader, interference-free use of GPS and SATCOM.

Aviation Spectrum Resources, Inc. (“ASRI”) is the communications company of the U.S. air transport industry and is owned by U.S. airlines and other airspace users. This enables ASRI to gather expertise from across the U.S. aviation sector, promoting the safe and efficient operation of aviation radio communications and navigation systems, including SATCOM and GPS.

The Cargo Airline Association (“CAA”) is the nationwide organization representing the interests of the all-cargo air carrier industry. Members include all-cargo airlines as well as other members of the air cargo supply chain, all of which will be adversely impacted by interference with GPS services and SATCOM.

The General Aviation Manufacturers Association (“GAMA”) is an international trade association representing over 110 of the world’s leading manufacturers of general aviation airplanes and rotorcraft, engines, avionics, components, and related services which rely upon, among other capabilities, both GPS and SATCOM systems. GAMA’s members also operate repair stations, fixed based operations, pilot and maintenance training facilities, and they manage fleets of aircraft.

Helicopter Association International (“HAI”) is the professional trade association for the international helicopter industry. HAI members represent more than 3,000 aviation

businesses and individuals who safely operate more than 4,500 helicopters approximately 2.3 million hours each year in more than 73 nations. HAI is dedicated to the promotion of the helicopter as a safe, effective method of commerce and to the advancement of the international helicopter community. Interference-free GPS receivers are central to safe and reliable vertical flight, including helicopters, UAS, and UAM operations, especially in low-altitude maneuvers near structures, terrain, and other obstacles.

The International Air Transport Association (“IATA”) is the trade association for the global airline industry, representing some 290 passenger and cargo airlines or 82 percent of total air traffic. IATA supports many areas of aviation activity and helps formulate industry policy on critical aviation issues. The safe and efficient operations of IATA’s members are dependent on robust Global Navigation Satellite Systems (“GNSS”), including GPS, as well as effective SATCOM.

The National Air Transportation Association (“NATA”) represents airport Fixed Base Operators, Part 135 and 91K charter and fractional ownership operators, fuel suppliers, Maintenance, Repair, and Overhaul stations, flight training centers, and others. Our members depend on a robust navigation and communication infrastructure, including both GPS and SATCOM, to provide not only safe travel, but also to provide access to smaller airports that have moved away from ground based equipment to space based technology and could be affected by the proposed terrestrial operations of Ligado.

The National Business Aviation Association (“NBAA”) is the leading organization for companies that rely on general aviation aircraft to help make their businesses more efficient, productive, and successful. The association represents more than 12,000 companies and professionals, and provides more than 100 products and services to the business aviation community. Access to reliable GPS systems and SATCOM is critical to the operation of our members’ general aviation aircraft.

ATTACHMENT 2

Examples of Participation by Joint Petitioners in Proceedings

- Notice of Ex Parte Presentation, Aviation Spectrum Resources, Inc., Air Line Pilots Association, International, Aircraft Owners and Pilots Association, Airlines for America, Alaska Airlines, Bristow Group Inc., Delta Air Lines, Frontier Airlines, Helicopter Association International, International Air Transport Association, National Business Aviation Association, Southwest Airlines, United Airlines, and United Parcel Service, IB Docket Nos. 11-109, 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-AMD-2018531-00856, SES-AMD-2018531-00044, SES-AMD-2018531-00045 (Apr. 21, 2020)
- Written Ex Parte Presentation of Aviation Spectrum Resources, Inc., IB Docket Nos. 11-109, 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-AMD-20180531-00856 (Sep. 24, 2018)
- Reply Comments of Aviation Spectrum Resources, Inc., IB Docket Nos. 11-109, 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-AMD-20180531-00856 (July 24, 2018)
- Comments of Aviation Spectrum Resources, Inc., IB Docket Nos. 11-109, 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-AMD-20180531-00856 (July 9, 2018)
- Notice of Ex Parte Presentation, Aviation Spectrum Resources, Inc., Airlines for America, Helicopter Association International, and Aerospace Industries Association, IB Docket Nos. 11-109, 12-340; RM-11681; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091 (June 20, 2017)
- Notice of Ex Parte Presentation, Aerospace Industries Association, Airlines for America, American Airlines, American Helicopter Society (AHS) International, Aviation Spectrum Resources, Inc., Boeing, Bristow Group Inc., Harris Corporation, Helicopter Association International, Honeywell, International Air Transport Association, Iridium, Lockheed Martin, National Air Transportation Association, Rockwell Collins, Inc., United Airlines, and United Parcel Service, IB Docket Nos. 11-109, 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, SAT-MOD-20151231-00091 (July 29, 2016)
- Reply Comments of Aircraft Owners and Pilots Association, Airlines for America, Aviation Spectrum Resources, Inc., Bristow Group, Inc., Helicopter Association International, International Air Transport Association, National Air Transport Association, National Business Aviation Association, Southwest Airlines, and United Parcel Service, IB Docket Nos. 11-109, 12-340; IBFS File Nos. SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-MOD-20151231-00981 (June 21, 2016).
- Reply Comments of Aerospace Industries Association, IB Docket Nos. 11-109, 12-340 (June 21, 2016)

- Comments of Aircraft Owners and Pilots Association, Airlines for America, Aviation Spectrum Resources, Inc., Bristow U.S., LLC, Cargo Airline Association, Delta Airlines, Helicopter Association International, International Air Transport Association, National Air Transport Association, Rockwell Collins IMS, Southwest Airlines, and United Parcel Service, IB Docket Nos. 11-109, 12-340; IBFS File Nos. SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, SES-MOD-20151231-00981 (May 23, 2016).
- Comments of Aerospace Industries Association, IB Docket Nos. 11-109, 12-340 (May 23, 2016)
- Comments of Airlines for America, IB Docket Nos. 11-109, 12-340 (May 23, 2016)
- Notice of Ex Parte Presentation, Aviation Spectrum Resources, Inc., Airlines for America, Bristow Group Inc., Cargo Airline Association, Federal Express, Helicopter Association International, International Air Transport Association, National Air Transportation Association, Rockwell Collins Information Management Services, and United Parcel Service, IB Docket No. 12-340; IBFS File Nos. SAT-MOD-20101118-00239; SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SES-MOD-20121001-00872 (Dec. 12, 2015)
- Comments of General Aviation Manufacturers Association, IB Docket Nos. 11-109, 12-340; WT Docket No. 12-327; IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, SAT-MOD-20101118-00239, SES-MOD-20121001-00872, RM-11681 (Sep. 6, 2013)
- Comments of International Air Transport Association, IB Docket No. 11-109 (July 28, 2011)
- Comments of National Business Aviation Association, IB Docket No. 11-109 (July 28, 2011)