

**KELLEY DRYE & WARREN LLP**

A LIMITED LIABILITY PARTNERSHIP

WASHINGTON HARBOUR, SUITE 400

3050 K STREET, NW

WASHINGTON, D.C. 20007-5108

(202) 342-8400

FACSIMILE

(202) 342-8451

www.kelleydrye.com

EDWARD A. YORKGITIS, JR.

DIRECT LINE: 202-342-8540

EMAIL: cyorkgitis@kelleydrye.com

NEW YORK, NY  
LOS ANGELES, CA  
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AFFILIATE OFFICE  
MUMBAI, INDIA

August 17, 2016

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

Re: **Notice of Ex Parte Presentation Regarding the Modification Applications of Ligado Networks, LLC: IB Docket Nos. 11-109 and 12-340; IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091**

**Notice of Ex Parte Presentation Regarding the Petition for Rulemaking of Ligado Networks, LLC regarding the 1675-1680 MHz band: RM-11681**

Dear Ms. Dortch:

On August 15, 2016, Andrew Roy, Executive Secretary of the Aeronautical Frequency Committee and Director, Engineering Services, Aviation Spectrum Resources, Inc. ("ASRI"); Gregory Baker, also of ASRI; Chris Martino, Vice President, Operations, Helicopter Association International ("HAI"); Robert Ireland, Managing Director, Engineering and Maintenance, Airlines for America ("A4A"); Cortney Robinson, Director, Civil Aviation Infrastructure, Aerospace Industries Association ("AIA"); and the undersigned (collectively, the "aviation/aerospace industry representatives") met with Philip Verveer, Senior Counselor to Chairman Wheeler, to discuss the potentially serious impact of Ligado's license modification proposals on certified aviation Global Positioning System ("GPS") receivers, non-certified GPS receivers (especially as used by aviation), and AMS(R)S satellite communications ("SATCOM"). The aviation/aerospace industry representatives noted the adverse impact of Ligado's proposed operations in the 1675-1680 MHz band, as set forth in its pending Petition for Rulemaking ("Petition") (RM-11681), on the receipt and use of Geostationary Operational Environmental Satellite ("GOES") system weather data that is downlinked in, and adjacent to,

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that band. The attached slides were used during the meeting and presented to Ambassador Verveer.

In discussing the four areas identified above affected by the Ligado proposals, the aviation/aerospace industry representatives explained that a substantial number of outstanding issues across all areas have yet to be addressed in detail by Ligado. The lack of procedural and technical information submitted with Ligado's proposals has both direct and indirect safety implications for airspace users and manufacturers, creating considerable uncertainty and concern. Therefore, the aviation/aerospace industry representatives asked that Ligado's applications should be shelved as premature until these can be fully resolved in the public forum before the Commission, rather than postponing addressing these issues until after a favorable grant on Ligado's proposal. The aviation/aerospace industry representatives reiterated the need for an adequate opportunity for interested parties to evaluate and comment on important studies before the Commission takes action, including but not limited to the anticipated Department of Transportation Adjacent Band Compatibility study examining the potential for interference to non-certified GPS receivers and the Iridium technical analysis describing the potential for interference to SATCOM. The aviation/aerospace industry representatives underscored that if in the end there is not an effective solution to the aviation safety issues identified in the comments and reply comments which their organizations have submitted or were signatories to, then the Commission should not grant the Ligado license modifications or issue a Notice of Proposed Rulemaking in response to its Petition.

The aviation/aerospace industry representatives emphasized the safety culture within the aviation community for protection of passengers and crews, and the high burden of proof for systems involved in safety of life. They explained that GPS already forms a key component of Performance-Based Navigation ("PBN") which increases the safety and efficiency of aircraft by increasing airport arrival capacity, decreased noise, and reducing fuel consumption all of which represent real gains in public benefits. Furthermore, the Federal Aviation Administration ("FAA") has mandated that all aircraft report their position using the Automatic Dependent Surveillance-Broadcast system ("ADS-B") by 2020, which uniquely depends upon the GPS position data from certified aviation receivers. The FAA and aviation industry have already committed to these programs in amounts exceeding \$40 billion across all aviation users in response to the Congressional mandate.

Particular mention was made in the meeting of the increasing importance of GPS to helicopter operations across the U.S. Mr. Martino explained that a large number of unplanned missions take place below 500 feet altitude where there is a greater exposure to physical hazards. For helicopters operating at these altitudes, such as medical evacuation ambulances, GPS is often the only navigational data available to pilots. The helicopter industry, like aviation generally, will increasingly rely upon GPS to further enhance PBN as more aircraft will be capable of operation under the instrument flight rule ("IFR") in the U.S. airspace. Use of advanced PBN

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will permit helicopters increasingly to leverage low altitude route structures, shoot Point-in-space (“PinS”) approaches to targeted locations, and conduct point to point navigation, all of which will expand helicopter utility and crew and passenger safety. Thus, the concerns regarding Ligado’s proposed operations, serious for all aviation users, are particularly acute for helicopter operations because of their operating altitudes and their use of unplanned as well as planned landing sites.

Mr. Robinson pointed out the swiftly emerging unmanned aircraft systems (“UAS”) market, which will bring to the nation’s airspace hundreds of thousands of new aircraft—small and large—in the near future that will depend on GPS for safe, efficient operations. Indeed, the FAA forecasts 600,000 commercial UAS deployed in the United States in 2016 (US), with more than a four-fold increase projected for 2020 (2.7 million). *See* Federal Aviation Administration. (n.d.). FAA Aerospace Forecast, Fiscal Years 2016-2036, at 31, *found at* [https://www.faa.gov/data\\_research/aviation/aerospace\\_forecasts](https://www.faa.gov/data_research/aviation/aerospace_forecasts) .

To determine whether there is a solution that protects certified aviation receivers, the aviation/aerospace industry representatives described their support for a three-phase process to be planned, agreed, and partially implemented before any grant of the Ligado applications can take place. This approach would be supported at each stage by active Commission involvement, with an understanding that the Ligado license could be put on hold or revoked if aviation safety conditions are not met:

- Theoretical investigating of Ligado interference potential to certified GPS receivers, with the Federal Aviation Administration (“FAA”) taking a leadership role, using RTCA’s Special Committee 159 for multi-stakeholder review of data and proposed protection requirements.
- Following this theoretical technical assessment, in the event problems fatal to the Ligado proposal are not found, field testing should be conducted using the actual equipment Ligado will deploy.
- Again assuming that the physical testing results do not identify any insurmountable obstacles to Ligado’s proposals, a grant may be appropriate with license conditions approved by the FAA and the Commission (provided other issues have been addressed as well concerning non-certified GPS receivers and SATCOM); Ligado network deployment could then proceed under a safe and managed process with Commission, FAA, and aviation involvement, under which Ligado’s rollout would be suspended in the event any interference issues are become manifest during the actual deployment despite the passage of the earlier gates.

Once deployment of any portion of the Ligado system occurs and it is operational (assuming all of the gates are successfully passed) there should be a continuous interference management

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and enforcement process allowing Ligado and aviation users to resolve any interference quickly and safely. This process, with the involvement of the FAA and the Commission as necessary, would include a procedure to also address incidents that may require system-wide Ligado remediation beyond situational fixes. The license conditions under which Ligado operates should be subject to ongoing change as necessary as determined by the FAA in order to preserve and protect aviation safety and as implemented and enforced by the Commission.

The representatives welcomed any further questions the Chairman's office and the Commission might have and stated that they stood ready to provide any assistance as the Commission considers the proper action in response to the Ligado applications and Petition and the record developing in response to them.

This *ex parte* notice and its attachment are being filed with the Office of the Secretary of the Commission as required by Section 1.1206 of the Commission's rules.

Please direct any questions to the undersigned.

Respectfully submitted,



Edward A. Yorkgitis, Jr.  
Counsel for Aviation Spectrum  
Resources, Inc.

Attachment

Cc: Ambassador Philip Verveer



# **JOINT AVIATION/AEROSPACE *EX PARTE* PRESENTATION ON LIGADO LICENSE MODIFICATION APPLICATIONS AND LIGADO PETITION FOR RULEMAKING REGARDING THE 1675-1680 MHZ BAND**

IB Docket No. 11-09 and RM-11681

Aerospace Industries Association  
Airlines for America  
Aviation Spectrum Resources, Inc.  
Helicopter Association International

August 15, 2016



# Aviation Reliance on GPS

- Reliance on GPS for Performance Based Navigation (PBN) benefits
  - 2,747 airports depend on GPS-enhanced position for precision approaches as of February 2016.
  - Efficiency and low cost is enabling GPS to replace existing ground based navigation aids
- “2020 Mandate”: essential first part of FAA’s NextGen, a \$40B public initiative
  - FAA is directed by Congress. Federal Aviation Regulations (FARs) require GPS-based Automatic Dependent Surveillance – Broadcast (ADS-B Out) for operations from January 1, 2020.
  - Eventual future expansion of ADS-B to autonomous navigation: the criticality of reliable GPS will only be greater over time.
  - ADS-B will be used by almost all air- and rotary-craft
- Unpredictable harmful interference from ground systems would be a safety of flight issue.
  - Compromise of GPS signal, especially on approach, causes aircraft and flight disruptions.
  - GPS is critical for safety systems: ground proximity warning, autopilot, etc.



# Protection of Certified Aviation GPS Receivers

- Any Ligado terrestrial operating conditions must be studied by FAA with RTCA expertise before any FCC action on the Ligado applications
  - All active and future certified receivers must be protected
  - Approved by FAA and supported by real-world testing and analysis before taking effect
- Ligado deployments must be fully coordinated with the FCC, FAA, and the aviation industry
  - Any rollout should be in stages, with set milestones and acceptance-type testing
  - There should be clear conditions under which to suspend the roll-out if interference occurs.
- A joint FCC/FAA process for enforcement and modification of any approved conditions must be in place before Ligado terrestrial operations begin
  - The process must provide for steps to ensure immediate cessation of Ligado operations when interference to aviation use of GPS is experienced, and subsequent full site assessments must take place before Ligado operations can recommence in the area of concern
  - The process must also provide a mechanism for more comprehensive modification of Ligado operating conditions if systemic issues arise



# Non-Certified Aviation Receivers also Merit Protection

- Used heavily by aviation in aircraft and ground infrastructure
- Degradation in  $C/N_0$  is the only appropriate method for assessing non-certified GPS devices interference tolerance
  - Unlike Ligado position error-focused testing, the 1 dB change in  $C/N_0$  metric focuses on *all* elements of GPS receiver performance, including timing and velocity.
  - The change in  $C/N_0$  methodology conforms to existing international standards, is supported by all three GPS manufacturers that have settled with Ligado, and accounts for aggregate interference (in and out of band).
  - The DOT Adjacent Band Compatibility (ABC) Study being completed now is based on this criterion
- Ligado's GPS-receiver-specific KPI position error testing does not consider other GNSS systems that will emit in the U.S.
  - The FCC should wait until the DOT ABC Study is completed and parties have an opportunity to analyze and comment before acting on the Ligado modification applications



# Serious Concerns of Interference to SATCOM Must Be Addressed

- AMS(R)S SATCOM is used by almost all long range aircraft for enhanced connectivity and data services in remote areas
  - Inmarsat and Iridium SATCOM terminals are part of the FAA's Minimum Equipment List (MEL) for aircraft to operate in optimized oceanic routes
  - Aircraft SATCOM is used 'gate-to-gate,' operating extensively not only in-flight but while on the ground for pre-flight connectivity checks, and enhanced data connectivity services
- No public technical assessment of interference effects to fully understand the effect on SATCOM terminals (including potential change-out costs) and impact on safety and efficiency of operations
  - Ligado's private agreement with Inmarsat has not been made public, thereby denying any peer review or impact assessment by the Commission or other aviation interests
  - No assessment has yet been completed on the effects to the Iridium system from the Ligado system but is expected before long based on recent *ex partes*
- Mitigation of the potential interference from proposed terrestrial Ligado operations to the SATCOM systems, a major safety and operational concern for aviation customers, must be addressed before proceeding with any decision on the Ligado modification applications



## Important Issues Must Be Resolved before the Commission Can Commence a Rulemaking to Reallocate 1675-1680 MHz

- Timely weather products generated by both the federal government and non-federal providers from accurate and real-time meteorological data made possible by the Geostationary Operational Environmental Satellite (GOES) system is a key enabler for aviation safety and operational efficiency.
- Ligado's current proposal to develop exclusion zones for Ligado base stations only around certain federal, i.e., National Oceanic and Atmospheric Administration (NOAA), sites is flawed.
  - The operations Ligado envisions would permanently preclude non-NOAA users receiving GOES system data directly from the satellites at their own ground stations.
  - The establishment of proper protection for federal earth station sites, but also for non-federal sites, requires additional analysis and should be done through a multi-stakeholder process.
- Ligado ignores a number of deficiencies when contending that a content delivery network (CDN) is an adequate substitute for direct read-out capability from the NOAA satellites.
  - It is by no means clear that this arrangement will provide the same throughput and coverage capabilities as direct readout from the GOES system; latency, reliability, and financial responsibility are also key concerns.
- The Commission should not proceed to grant Ligado's Petition based on the record generated by the Commission's April 22, 2016, Public Notice but should consider acting only after the foregoing key concerns are addressed.