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August 22, 2016

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

**Re: Written *Ex Parte* presentation in RM-11681; IB Docket No. 11-109; IBFS
File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-
MOD-20151231-00091**

Dear Ms. Dortch:

Ligado Networks, LLC (“Ligado”) submits this letter to update the Commission and interested parties on important progress in Ligado’s ongoing efforts to codify the procedures by which Ligado will ensure its proposed terrestrial operations are at all times compatible with the certified GPS functions used for aviation operations. The Public Notice seeking comment on the above-captioned applications directly asked for “specific relevant technical information about affected GPS receivers” from all affected stakeholders raising issues about the license modifications.¹ This filing adds to the substantial technical information that Ligado has submitted to the docket. We also take the opportunity to identify significant areas of agreement between the views expressed by the aviation commenters and Ligado.

In particular, the methodical, performance-based process Ligado has proposed for ensuring its operations protect certified aviation GPS receivers overlaps in key respects with the proposals raised by the aviation comments, as described below.

1. “Rigorous License Conditions.” ASRI recently stated that the license modifications Ligado has requested should be subject to “rigorous license conditions protecting all receivers operating under existing and future Minimum Operational Performance Standards (‘MOPS’).”² We agree.

¹ *Comment Sought on Ligado’s Modification Applications*, IB Docket Nos. 11-109 & 12-340, DA 16-442, at 7 (April 22, 2016) (“Public Notice”).

² See ASRI July 29 *Ex Parte* at 2.

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As we have made clear at every step in this process, Ligado fully agrees with the view that GPS makes critical contributions to air safety and to the efficiency of aviation and aerospace operations.³ Ligado's License Modification Applications stressed that the company "recognizes the paramount importance of safety issues related to certified aviation GPS receivers."⁴ The License Modification Application continued: "Because aviation GPS receiver certification and operations standards have an existing, well-established, and robust process, and because [Ligado's] work with the aviation community and that process is ongoing, [Ligado] requests that the Commission impose a license condition with reference to current and any future FAA/RTCA standards."⁵ Accordingly, the license modification proposed by Ligado provides robust protections to GPS operations generally, and includes additional safeguards specifically intended to ensure that Ligado's proposed network does not interfere with certified *aviation* GPS receivers. As Ligado described in its License Modification Applications⁶ and further detailed in its June comments in this proceeding,⁷ these conditions would require Ligado to reduce the power of its transmitters operating in the 1526-1536 MHz channel to whatever power level ensures that Ligado's operations at all times protect certified aviation receivers operating in accordance with any MOPS incorporated into an active Technical Standard Order ("TSO"), including legacy receivers authorized to continue operating under prior FAA TSOs.

2. "Active Upfront and Ongoing Involvement of the FAA." The Joint Aviation Parties and ASRI recently stated the importance of "rigorous license conditions protecting all receivers operating under existing and future Minimum Operational Performance Standards ("MOPS") with the active upfront and ongoing involvement of the Federal Aviation Administration's ('FAA') and the Commission"⁸ We agree.

Ligado has used the term "operational deference" as shorthand for a performance-based conformance condition, reflecting the fact that Ligado's operations will completely conform to

³ See, e.g., Letter from Edward A. Yorkgitis, Jr., counsel for Aviation Spectrum Resources, Inc., to Marlene H. Dortch, FCC Secretary, IB Docket No. 11-109 *et al.*, at 2 (filed July 29, 2016) ("ASRI July 29 *Ex Parte*"); Letter from Edward A. Yorkgitis, Jr., counsel for Aviation Spectrum Resources, Inc., to Marlene H. Dortch, FCC Secretary, IB Docket No. 11-109 *et al.*, at 2 (filed Aug. 17, 2016) ("ASRI August 17 *Ex Parte*").

⁴ IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091 (collectively, the "License Modification Applications"), Description of Proposed Modification at 10 (Dec. 31, 2015).

⁵ *Id.*

⁶ Modification Applications at 7.

⁷ Reply Comments of Ligado Networks LLC, IB Docket No. 11-109, at 4-10 ("Ligado June Reply").

⁸ ASRI July 29 *Ex Parte* at 2.

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the FAA's requirements for protecting certified aviation receivers. The proposed condition always contemplated the active, upfront, and ongoing involvement of the Commission and the FAA in confirming the methodology by which Ligado's compliance with this condition will be measured and assured.⁹

Over the past several months, the company has seen exactly that active and upfront involvement of the FAA urged by the commenters. Since filing the License Modification Applications, Ligado has been in regular discussions with FAA staff, including with respect to the procedures for implementing the proposed performance-based conformance condition. In Ligado's most recent meeting with FAA staff earlier this month, Ligado further described how its proposed license condition would operate. Specifically, Ligado explained that it should be required by the FAA and the Commission to assess the technical parameters of each proposed base station individually, prior to deployment, to determine the power limit required to ensure such base station's conformance with FAA requirements. This performance-based analysis of each tower would be consistent with existing FAA-approved models, and would enable RTCA to be involved in assessing the proposal. Ligado will provide detailed information about how it will ensure conformance in this record once the FAA has had an adequate opportunity to review the model and the compliance plan Ligado has proposed.

3. "A Three-Phase Process to be Planned, Agreed, and Partially Implemented Before Any Grant of the Ligado Applications." ASRI recently called for a "a three-phase process to be planned, agreed, and partially implemented before any grant of the Ligado applications can take place."¹⁰ We agree.

Importantly, the performance-based conformance condition that Ligado proposed in December 2015 and has been actively pursuing with the FAA is consistent with ASRI's approach and is similar in many respects to the specifics of the three-phase deployment process called for by ASRI. In particular, Ligado has proposed a three-step process. *First*, the FAA (with input from RTCA) would approve a theoretical model Ligado would use to predict the propagation of Ligado's signals from each proposed base station. The efforts in that regard are ongoing and will be described in detail soon. *Second*, if the FAA and RTCA believe that field testing is necessary then the compliance of actual emissions with the model-defined limits could be validated through field testing. *Third*, Ligado's network deployment would be subject to a tower-by-tower assessment to confirm that each individual base station is limited to the power level that ensures (in accordance with the FAA-approved theoretical model) the received power from Ligado's operations remains below the FAA's applicable interference tolerance mask. The Commission has extensive experience with other frameworks requiring similar site-by-site assessments, such as with respect to the licensing of broadcast stations and environmental assessments of certain cell phone towers. The framework proposed by Ligado would be

⁹ See ASRI July 29 *Ex Parte* at 2; ASRI August 17 *Ex Parte* at 3-4.

¹⁰ ASRI August 17 *Ex Parte* at 3.

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similarly effective in ensuring that each of Ligado's base stations fully protects certified aviation receivers.

We agree with ASRI's suggestion that the License Modification Applications can be granted before all three steps are completed.¹¹ Like all Commission licensees, Ligado will be required to satisfy all of the Commission's conditions (including obtaining FAA concurrence to the interference analysis model) before Ligado brings any portion of its proposed terrestrial network online. And like all Commission licenses, no further Commission action is needed on these points beyond enforcing the conditions. There is therefore no reason to delay modifying Ligado's licenses subject to the conditions. This process of granting a license or license modification with conditions follows a long and consistent pattern at the Commission, especially in areas requiring large upfront capital investments and long technology and network planning lead times.¹²

4. *“Aviation and Aerospace Representatives Would Anticipate the Ligado Studies [on Uplink Bands] be Sent to RTCA.”* ASRI and the Joint Aviation Parties recently said that “the aviation and aerospace representatives would anticipate the Ligado studies be sent to RTCA as part of an appropriately complete assessment of handset interference issues before any conclusions be made.”¹³ We agree.

At its recent meeting with the FAA, Ligado and FAA staff discussed Ligado's analysis of its proposed uplink operations¹⁴ and the appropriate steps for confirming in the coming weeks

¹¹ *Id.* (“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”).

¹² *See Amendment of Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services*, 3rd R&O, 3rd NPRM, and 2nd Mem. Op. & Order, 18 FCC Rcd 2223, 2230 (2003) (noting that, with respect to 2 GHz MSS, the Commission “established milestones for system implementation and conditioned the authorizations on achievement of these milestones”); *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, 2nd R&O and 2nd Mem. Op. & Order, 155 FCC Rcd 12315, 12331 (2000) (allowing for MSS licensees in newly allocated spectrum to negotiate with incumbent users regarding relocation, and if necessary to involuntarily relocate incumbent users at the MSS licensee's expense); *Amendment to the Commission's Rules Regarding a Plan for Sharing the Costs of Microwave Relocation*, 2nd R&O, 12 FCC Rcd 2705, 2707-08 (1997) (refining process by which licensees of spectrum reallocated to PCS would negotiate for the relocation of microwave incumbents, and if necessary involuntarily relocate incumbent users at the PCS licensee's expense).

¹³ July 29 *Ex Parte* at 5.

¹⁴ *See* Ligado June Reply at 9-10 and Attachment A.

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that all questions relating to the uplinks' potential effect on certified aviation receivers have been resolved. Ligado supports the FAA seeking RTCA's input on this point.

* * *

One area where we may differ with the aviation community is that in their recent Commission meetings various aviation parties have raised questions regarding issues outside the context of certified aviation GPS receivers.¹⁵ Ligado, unlike every other party submitting comments in this proceeding, has filed extensive data and analysis demonstrating the compatibility of Ligado's proposed network with a range of GPS devices.¹⁶ This empirical data confirms that Ligado's proposed operations are compatible with GPS, a conclusion that is further bolstered by the existence of the agreements Ligado has entered into with leading GPS companies including Garmin, Deere, Trimble and NovAtel. In addition, Ligado has discussed above in detail the additional safeguards Ligado has proposed for certified aviation receivers through its lengthy consultations with the FAA. To be clear: the *only* receivers the FAA permits to be used for safety-critical functions are certified receivers.¹⁷ Thus, the Commission can grant the License Modification Applications with confidence that aviation GPS operations will be well protected.

¹⁵ See ASRI August 17 *Ex Parte* at 1.

¹⁶ See, e.g., Roberson and Associates, LLC, "Results of GPS and Adjacent Band Co-Existence Study," IB Docket No. 11-109 (filed May 11, 2016). Certain parties continue to question these conclusions based on their preference for defining compatibility in terms of whether Ligado's proposed operations would cause a 1 dB decrease in the carrier-to-noise density ratio, but Ligado has explained in detail why this metric cannot serve as a reliable measure of harmful interference. See Ligado June Reply at 11-13 and Attachment B.

¹⁷ The FAA's Aeronautical Information Manual states unequivocally that "[Visual Flight Rules] and hand-held GPS systems are not authorized for [Instrument Flight Rules] navigation, instrument approaches, or as a primary instrument flight reference. During IFR operations they may be considered only an aid to situational awareness." FAA, "Aeronautical Information Manual," at 1-1-27 n.4 (Dec. 10, 2015), available at https://www.faa.gov/air_traffic/publications/media/aim.pdf. The Manual further specifies that "GPS navigation equipment used for IFR operations must be approved in accordance with the requirements specified in Technical Standard Order (TSO) TSO-C129(), TSO-C196(), TSO-C145(), or TSO-C146()." *Id.* at 1-1-18. See also FAA, "ADS-B Broadcast Services," at 2, available at https://www.faa.gov/nextgen/library/media/getSmart_ADSB.pdf (last visited Aug. 19, 2016) ("Uncertified equipment, including uncertified GPS units, should not be installed on aircraft with standard airworthiness certificates. Uncertified GPS units do not meet the equipment requirements associated with the mandate and do not qualify for ATC services using ADS-B data.").

