

# COVINGTON

BEIJING BRUSSELS LONDON LOS ANGELES  
NEW YORK SAN FRANCISCO SEOUL  
SHANGHAI SILICON VALLEY WASHINGTON

**Gerard J. Waldron**

Covington & Burling LLP  
One CityCenter  
850 Tenth Street, NW  
Washington, DC 20001-4956  
T +1 202 662 5360  
gwaldron@cov.com

May 25, 2017

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

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

Dear Ms. Dortch:

Ligado Networks LLC (“Ligado”) hereby submits an economic analysis prepared by Harold Furchtgott-Roth, economist and former commissioner of the Federal Communications Commission, entitled “Economic Analysis of the Ligado Petitions to the Federal Communications Commission Regarding Spectrum Flexibility and Spectrum Allocations.”

Sincerely,

/s/

---

Gerard J. Waldron  
*Counsel to Ligado Networks LLC*

Attachment

Economic Analysis of the Ligado Petitions to the Federal Communications Commission  
Regarding Spectrum Flexibility and Spectrum Allocations

Harold Furchtgott-Roth<sup>1</sup>

May 25, 2017

---

<sup>1</sup> Furchtgott-Roth Economic Enterprises. I gratefully acknowledge the support of Ligado Networks, which has underwritten part of this economic analysis. The views expressed in this paper are those of the author and do not necessarily reflect the views of any other party. Any errors in this report are entirely those of the author.

Ligado has before the Federal Communications Commission (FCC) petitions for additional flexibility in the form of an ancillary terrestrial component (ATC) for its licenses in the L band<sup>2</sup> as well as a petition to allocate and assign spectrum in the 1675-1680 MHz band that might be shared with the National Oceanic and Atmospheric Administration (NOAA).<sup>3</sup> From the perspective of an economist and a former FCC commissioner, I have reviewed the documents in related dockets. I reach the following conclusions:

- A. The Ligado petitions create many public benefits for America;
- B. There are few if any public objections to the Ligado plan; and
- C. The public benefits of the Ligado plan exceed any possible costs, if there are any.

Of particular note, the lost value of unused or underutilized spectrum can never be reclaimed in the future. Thus, a year's delay in the Ligado proposal would likely cost American consumers between \$1.3 billion and \$26 billion, or between \$4 and \$80 per capita. Even a month's delay is a loss of between \$100 million and \$2 billion in consumer value.

**A. The Ligado petitions create many public benefits for America**

If approved by the Commission, the Ligado petitions would create many public benefits for America. Among these public benefits are:

- 1. Public benefit 1: If approved, the Ligado petitions would clarify and enhance property rights in spectrum;
- 2. Public benefit 2: Clarifying property rights through resolution of the Ligado petitions would facilitate greater economic activity and growth;
- 3. Public benefit 3: Clarifying property rights through approval of the Ligado petitions would increase consumer benefits and consumer surplus;
- 4. Public benefit 4: If approved, the Ligado petitions would help create jobs for Americans;
- 5. Public benefit 5: Clarifying property rights through the Ligado petitions would facilitate resolution of interference disputes; and

---

<sup>2</sup> See, in particular, IB Docket 11-109 and IB Docket No. 12-340. Letter from Gerard J. Waldron, Counsel to New LightSquared LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 12-340 and 11-109; IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, and SES-MOD-20121001-00872, at 1 (filed Dec. 31, 2015) (Ligado Dec. 31, 2015 Ex Parte); Applications of LightSquared Subsidiary LLC, Narrative, IBFS File Nos. SAT-MOD-20151231-00090, SAT-MOD-20151231-00091, and SES-MOD-20151231-00981 (Applications). The Applications include a "Description of Proposed Modification and Public Interest Statement" (Applications, Description of Proposed Modification). The "L-band" is a general designation for frequencies from 1 to 2 GHz.

<sup>3</sup> See RM 11681, Petition for Rulemaking Filed, RM No. 11681, Public Notice, Report No. 2967 (CGB Nov. 9, 2012).

6. Public benefit 6: If approved, the Ligado petitions would demonstrate continued American leadership in spectrum policy.

Below, I review each of these *public* benefits. No doubt, there are many more. I do not review here the many *private* benefits to the shareholders, debtholders, and others associated with Ligado. As will be seen below, the many public benefits, which are much larger than any possible private benefit, substantially outweigh any possible costs of the order, if there are any.

1. *Public Benefit 1: If approved, the Ligado petitions would clarify and enhance property rights in spectrum*

Since Nobel Laureate Ronald Coase's seminal articles in 1959 and 1960, economists have consistently found that spectrum can be more efficiently allocated by assigning various property rights to spectrum.<sup>4</sup> Among these property rights are the ability to determine the use of spectrum, the ability to benefit from that use, and the ability to transfer those rights to other parties.

In its petitions to the FCC, Ligado seeks the very property rights for spectrum endorsed by economists since Coase. Specifically, Ligado seeks:

1. *More flexibility to determine the most efficient and highest use of the spectrum assigned to Ligado and NOAA.* Currently, Ligado's spectrum is limited to certain uplink and downlink satellite services. The Commission in other proceedings has found economic benefits to providing greater flexibility in the use of spectrum, particularly spectrum currently reserved for satellite services.<sup>5</sup> Ligado seeks greater flexibility in the use of its licenses currently

---

<sup>4</sup> Ronald H. Coase, *The Federal Communications Commission*, 2 *THE JOURNAL OF LAW & ECONOMICS*, 1–40 (1959), <http://www.jstor.org/stable/724927>; Ronald H. Coase, *The Problem of Social Cost*, 3 *The Journal of Law & Economics*, 1-44 (1960), <http://www.jstor.org/stable/724810>. See also H. Furchtgott-Roth, "Open Spectrum: A Major Step for U.S. Innovation and Economic Growth" (Hudson Institute, 2013) available at [http://dev.hudson.org/content/researchattachments/attachment/1134/open\\_spectrum\\_final.pdf](http://dev.hudson.org/content/researchattachments/attachment/1134/open_spectrum_final.pdf).

<sup>5</sup> The Commission has granted Ancillary Terrestrial Component flexibility in at least the following proceedings: *Flexibility for Delivery of Communications By Mobile Satellite Service Providers in the 2 GHz Band, the L Band, and the 1.6/2.4 GHz bands*; and *Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, Report and Order and Notice of Proposed Rulemaking, February 10, 2003; *Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands and Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, Report and Order and

assigned for satellite-related service allocations.

Moreover, the NOAA spectrum in 1675-1680 MHz is currently used for very limited and specific NOAA satellite uses. If spectrum in the band were transferred from federal to shared use at the FCC, and if the FCC were to assign the license for that spectrum through an auction, the result would be substantially greater flexibility in the use of that spectrum. A more flexible use would enable auction winners to use the shared NOAA spectrum for additional potentially higher valued uses, including terrestrial services. Not adopting the Ligado petitions would limit the uses of these bands of valuable spectrum by leaving them subject to the current command-and-control structure that narrowly defines specific permissible uses for the bands.

2. *Benefit from the use of spectrum.* To ensure a more efficient allocation of spectrum requires both flexibility of use and the ability of spectrum users such as Ligado to be able to benefit from that flexible use. Under the Ligado petitions, Ligado would be able to benefit from the more flexible use.
3. *Ability to transfer rights.* A fundamental feature of a property right, beyond use and control is the ability to transfer the right. Ligado and similarly-situated entities should be able to transfer spectrum interests in such a manner that entities that value spectrum more than Ligado can acquire it. If transfer

---

Fourth Report and Order and Further Notice of Proposed Rulemaking, July 16, 2004; *Request for authority to implement an ancillary ) terrestrial component for the Globalstar Big LEO) Mobile Satellite Service (MSS) system*, Order and Authorization, January 20, 2006; *Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO bands*, and *Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, Second Order on Reconsideration, Second Report and Order, and Notice of Proposed Rulemaking, November 9, 2007; *Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO bands and Globalstar Licensee LLC*, *Authority to Implement an Ancillary Terrestrial Component*, Report and Order and Order Proposing Modification, April 10, 2008; Order of Modification, October 10, 2008; Order and Authorization, October 31, 2008; *New ICO Satellite Services GP, Application for blanket authority to operate Ancillary Terrestrial Component base stations and dual-mode MSS-ATC mobile terminals in the 2 GHz MSS bands*, Order and Authorization, January 15, 2009; *SkyTerra Subsidiary LLC Application for Modification Authority for an Ancillary Terrestrial Component*, Order and Authorization, March 26, 2010; *LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component*, Order Authorization, January 26, 2011; *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Network Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service Systems*, Report and Order, December 23, 2016.

rights are limited or prohibited, spectrum will not be put to its highest value use.

These three property rights characteristics are taken for granted and beyond government denial for practically every asset in our economy ranging from real estate to commodities to intellectual property. Each of these property rights characteristics is currently tenuous with respect to spectrum, however, as each is subject to FCC review and denial. To avoid acting as a drag on the economy, the Commission should act with dispatch on requests involving more efficient use of spectrum. Ligado seeks to clarify these property rights characteristics for the spectrum in which the company has interests.

2. *Public Benefit 2: Clearer property rights through approval of the Ligado petitions would facilitate greater economic activity and growth*

Clarifying property rights is not an abstract concept. Since Adam Smith, economists have recognized that clear property rights are part of the foundation for economic activity and economic growth. This foundational principle applies to spectrum. Clearer property rights for Ligado and other parties will enhance economic activity with spectrum and greater economic growth.<sup>6</sup>

Clearer property rights for spectrum would benefit not just Ligado but all parties with economic interests in spectrum. Those parties would be able to put spectrum to better and higher-valued uses, to benefit from those higher-valued uses, and where third parties can find an even higher valued use, to sell or lease spectrum rights to a third party.

The general lack of economic activity attributable to the spectrum assigned to Ligado can be seen in the current light usage of that spectrum and the NOAA spectrum.<sup>7</sup> Putting underutilized spectrum to use is, by itself, a great public economic benefit, a benefit that would flow from clearer property rights.

But putting spectrum—a non-depletable resource—to use yields an even greater economic benefit than putting an exhaustible resource, such as an oil field, to use. Using spectrum today does not reduce its useful capacity tomorrow, or next week, or at any time in the future. That is different with a depletable resource, such as an oil field. Tapping an oil field today reduces available oil tomorrow; the oil can be extracted at one point in time, but the same oil cannot be pumped more than once. Not so with spectrum. Spectrum can be used again and again and again. The corollary is also true: spectrum unused today is lost forever; today's capacity cannot be reclaimed tomorrow. Every day that spectrum is not put to use—every day that the Ligado decision is delayed—is a permanent loss of economic benefit.

---

<sup>6</sup> See, e.g., H. Furchtgott-Roth (2013).

<sup>7</sup> See 2 C.F.R. §2.106 (allocating 5 MHz of mid-band spectrum on a *nationwide* basis to NOAA's use); see also Alion Report (identifying that there are some [two dozen] licensed earth stations nationwide).

I first calculate the likely market value of the spectrum Ligado proposes to use: 40 MHz of mid-band terrestrial spectrum. Spectrum values are usually measured on a price-per-MegaHertz-pop basis, or a \$ per MHz pop. In my opinion, the most comparable spectrum values for the spectrum Ligado proposes to use are for other mid-band spectrum band in the United States.

In Table 1, I present various values of the price of spectrum similar to that of the Ligado proposal in the United States. Based on a standard source for spectrum pricing,<sup>8</sup> the estimated price in the United States in 2015 ranged from \$1.50 -\$2.50 per MHz pop based on mid-band spectrum.

**Table 1**  
**Prices for Paired Full-Power Spectrum Similar to the**  
**Ligado Proposal**  
**Based on Bazelon and McHenry (2015)**

<b>Band</b>	<b>Location</b>	<b>Price/MHz pop</b>
AWS-1	1.7 GHz	\$2.50
PCS	1.9 GHz	\$2.50
G Block	1.9 GHz	\$2.50
H- Block	1.9 GHz	\$1.50
AWS-3, Paired	1.7 GHz	\$2.50

**C. Bazelon and G. McHenry, "Mobile Broadband Spectrum: A Vital Resource for the U.S. Economy," May 2015, Table 2, available at [http://www.ctia.org/docs/default-source/default-document-library/brattle\\_spectrum\\_051115.pdf](http://www.ctia.org/docs/default-source/default-document-library/brattle_spectrum_051115.pdf)**

The price ranges presented in Table 1 are for the total value of full-power spectrum. The Ligado spectrum currently has value for satellite purposes that might fetch from \$0.25-\$0.50 per MHz pop. Thus, the unadjusted net incremental value for Ligado plan, if the terrestrial use were similar to that of other terrestrial applications, would be \$1.00 - \$2.25 per MHz pop. With 325 million Americans and 40 MHz of spectrum in the Ligado plan, every \$0.10 in value of spectrum per MHz pop is worth \$1.3 billion for the entire United States.

---

<sup>8</sup> C. Bazelon and G. McHenry, "Mobile Broadband Spectrum: A Vital Resource for the U.S. Economy," May 2015, Table 2, available at [http://www.ctia.org/docs/default-source/default-document-library/brattle\\_spectrum\\_051115.pdf](http://www.ctia.org/docs/default-source/default-document-library/brattle_spectrum_051115.pdf).

The price for specific bands of spectrum can be affected by many factors, including typical regulatory conditions on the license, power levels, geographic restrictions, unit limits, and similar factors within the Commission's purview. It is impossible to know today exactly how much additional value would be associated an FCC approval of its plans. If the incremental value is \$0.10 per MHz pop, the total value would be \$1.3 billion; if the incremental value is \$1.00 per MHz pop, the total value would be \$13 billion; if the incremental value is \$2.00 per MHz pop, the total value would be \$26 billion.

The increment in the private value of the spectrum is almost certainly much smaller than the public consumer value of the plan. Economists often measure consumer welfare with consumer surplus, the area under a demand curve above the market price. Bazelon and McHenry have noted a regularity in the ratio of the annual consumer surplus for spectrum with the market value of the spectrum.<sup>9</sup> The ratio is between 0.9 and 1.7. To be conservative, I will assume a ratio of 1.0, meaning the annual consumer surplus from the incremental value of the Ligado plan is \$1.3 billion if the incremental value of spectrum is \$0.10 per MHz pop, and \$26 billion if the incremental value of spectrum is \$2.00 per MHz pop.

The lost value of unused or underutilized spectrum can never be reclaimed in the future. Thus, a year's delay in the Ligado proposal would cost American consumers between \$1.3 billion and \$26 billion, or between \$4 and \$80 per capita. Even a month's delay is a loss of between \$100 million and \$2 billion in consumer surplus.

One can also calculate the total net discounted value of current and future surplus. At a 5% discount rate, the ratio of the discounted value of consumer surplus to market value ranges from 18 - 33; at a 10% discount rate, the ratio ranges from 9 - 17. I will conservatively assume a discount rate of 10% and a ratio of 10. Consequently, if the market value of the Ligado proposal is estimated at \$1.3 billion - \$26 billion, the net present value of present and future consumer surplus is correspondingly estimated at \$13 - \$260 billion.

America needs clearer spectrum rights to revitalize the communications sector. My own economic research shows that the broader information sector was a disproportionately major contributor to economic growth in the United States between 1997 and 2007.<sup>10</sup> Investment in the sector has not fully recovered, and the American economy has

---

<sup>9</sup> Ibid.

<sup>10</sup> H. Furchtgott-Roth and J. Li, *The Contribution of the Information, Communications, and Technology Sector to the Growth of U.S. Economy: 1997-2007*, Hudson Institute, 2014, at <http://hudson.org/research/10545-the-contribution-of-the-information-communications-and-technology-sector-to-the-growth-of-u-s-economy-1997-2007>.

languished for a decade. Clearer property rights in spectrum would substantially help the information, communications and technology sector and the American economy.<sup>11</sup>

3. *Public benefit 3: Clearer property rights through approval of the Ligado petitions would increase consumer benefits and consumer surplus*

In addition to the direct economic benefits of value added to the economy, clearer property rights in spectrum will lead to substantial consumer benefits through additional consumer surplus.<sup>12</sup> As a result of more economic activity and economic growth, consumers will have greater choice of services, more innovative services, and available at lower prices. Much of the consumer benefits—to economists, consumer surplus or the area under the demand curve—are not captured in standard governmental measures of output. But they are important public benefits of clearer property rights.

4. *Public benefit 4: If approved, the Ligado petitions would help create jobs for Americans*

Ligado currently has static operations and few employees. If the Ligado petition were approved by the FCC, the company would necessarily employ many Americans to build out a network and initiate operations. Those individuals are not currently employed by Ligado, and thus their employment would be considered a public benefit resulting directly from the approval of the Ligado petitions.

5. *Public benefit 5: Clearer property rights through the Ligado petitions would facilitate resolution of interference disputes*

Clear property rights help resolve interference disputes without resort to government adjudication. Ligado has reached mutually beneficial understandings with the major GPS device manufacturers. Based on my understanding, according to the results of various tests including those conducted by the Commission, the more flexible use and clearer property rights sought by Ligado would not cause harmful interference with users in adjacent spectrum bands.<sup>13</sup> These engineering results reinforce the economic finding of Coase: Clearer property rights will lead not only to greater economic activity and economic growth, but also will help resolve disputes, particularly regarding allegations of harmful interference. This we learn from Coase and the Coase Theorem.<sup>14</sup>

---

<sup>11</sup> H. Furchtgott-Roth, 2013.

<sup>12</sup> Ibid.

<sup>13</sup> This conclusion can be drawn from testing by NASCTN and by testing by Roberson and Associates. See NASCTN, “Impact of LTE Signals on GPS Receivers” (Feb, 15, 2017), available at <http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1952.pdf>; Roberson and Associates, LLC, “Results of GPS and Adjacent Band Co-Existence Study,” IB Docket No. 11-109 (filed May 11, 2016), available at <https://ecfsapi.fcc.gov/file/60001841466.pdf>.

<sup>14</sup> See particularly, R. H. Coase, *The Problem of Social Cost* (1960).

Practically all instances of harmful spectrum interference can be viewed as economic externalities: the choices of one set of spectrum users affect the spectrum choices of other potential spectrum users. Professor Coase addressed this interference in both his 1959 and 1960 papers and developed an analysis that is widely called the “Coase Theorem”: *in the absence of transactions costs, parties will negotiate away externalities, with one party purchasing the other’s rights*. If permitted to do so, private parties with clearer property rights have incentives to resolve—and can and will with low transactions costs actually resolve—the externalities between themselves without government administration.

I understand that most allegations of harmful interference regarding the Ligado business have been resolved. To the extent any remain, one legalistic and bureaucratic approach would be to resolve all harmful interference disputes before allowing Ligado to begin to build its network. A more elegant and economically rational approach, however, would be to assign clearer property rights now and allow the various parties to resolve the disputes among themselves. That is the Coasian approach. And, as I note above, given the unrecoverable economic losses every day without use of this spectrum, this approach is almost certainly economically efficient.

6. *Public benefit 6: If approved, the Ligado petitions would demonstrate continued American leadership in spectrum policy.*

For much of the past century, the United States has been a leader in spectrum policy. Innovations adopted in the United States, such as the use of auctions to transfer spectrum from the public to the private sector and the widespread use of unlicensed devices, are quickly mimicked abroad. Adoption of clearer property rights in spectrum such as those proposed by Ligado would continue the American trend towards greater property rights in spectrum, a trend imitated by other countries as well.

## **B. There are few if any public objections to the Ligado plan**

Since emerging from bankruptcy in 2015, Ligado has made its plan known to both the Commission and the public, and dozens of documents have been filed in the relevant FCC dockets.<sup>15</sup> Aside from possible concerns raised by Iridium, and I do not have sufficient information to evaluate the reasonableness of those concerns, I am not aware of any current formal opposition to the Ligado plan in the relevant FCC dockets. The Commission is required under the Administrative Procedure Act to make decisions based on a public record, and it is difficult to discern from that record why the Ligado petition should not be granted in whole in a timely manner, since delay robs the economy and the American consumer of substantial benefits, quite likely at least \$100 million, every month.

## **C. Benefits of the Ligado plan exceed costs**

---

<sup>15</sup> See FCC ECFS database. Dockets 11-109, 12-340, and RM11681.

Even if there were additional public objections to the Ligado plan—which there are not, the public benefits of moving forward with the Ligado plan would almost certainly outweigh any potential costs.