

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

In the Matter of	)	
	)	
Ligado's Modification Applications	)	IB Docket No. 11-109
	)	
	)	IB Docket No. 12-340
	)	

**COMMENTS OF PUBLIC KNOWLEDGE, NEW AMERICA'S OPEN TECHNOLOGY  
INSTITUTE, & COMMON CAUSE**

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May 23, 2016

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## I. INTRODUCTION AND SUMMARY

Public Knowledge files these Comments in response to the Federal Communications Commission's ("Commission" or "FCC") Public Notice<sup>1</sup> regarding Ligado's applications to modify the ancillary terrestrial component ("ATC") of its L-band mobile-satellite service ("MSS") networks. Ligado's applications would place additional operating limits, in the form of license conditions, on Ligado's ATC authorization to address interference related to Global Positioning System ("GPS") equipment. These conditions are consistent with agreements Ligado has reached with three leading GPS companies, and Commission approval would permit Ligado to begin deployment of its terrestrial network.<sup>2</sup>

The Commission should approve Ligado's applications. Modifying Ligado's license conditions and permitting Ligado to begin deployment of its proposed satellite-terrestrial broadband network should provide multiple public interest benefits and, given the agreements reached between Ligado and GPS stakeholders, satisfactorily address any lingering interference concerns. Additionally, the Commission should consider additional license conditions that will provide further public interest benefits. First, the Commission should permit opportunistic access to unused Ligado spectrum on a use-or-share basis to the extent technically feasible. Second, the Commission should ensure Ligado and its wholesale customers abide by any privacy and network security rules the Commission has established or will establish for similarly situated services.

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<sup>1</sup> See Comment Sought on Ligado's Modification Applications; IB Docket Nos. 11-109; 12-340;

<sup>2</sup> See *Id.* at 1-2, 4-7; Ligado *Ex Parte* Letter; IB Docket Nos. 12-340, 11-109, IBFS File Nos. SAT-MOD-20120928-00160, SAT-MOD-20120928-00161, SES-MOD-20121001-00872; at 1-4, 7 (filed Dec. 31, 2015) ("*Ligado Letter*").

Lastly, the Commission should make a determination regarding the appropriate standard for measuring interference. The correct measure of interference that the Commission should adopt is actual “harmful interference,” which means that the interference materially degrades or disrupts the operation of the service receiving interference. Any other standard will cause valuable, useful spectrum to needlessly lie fallow.

## **II. THE COMMISSION SHOULD APPROVE LIGADO’S APPLICATIONS.**

The Commission should approve Ligado’s applications and accept the proposed operating limits Ligado and the GPS industry have agreed to. Approval of the applications will finally allow for deployment of Ligado’s planned hybrid satellite-terrestrial network and commence operations, which should produce several public interest benefits. Additionally, modifying Ligado’s licenses to comply with the proposed operating limits will eliminate interference concerns from the GPS industry, providing certainty for those who rely on GPS.

### **A. Ligado’s Deployment Will Provide Several Public Interest Benefits.**

The Commission should approve Ligado’s applications because there are likely to be substantial public interest benefits to Ligado’s long-awaited terrestrial deployment. Ligado has argued that approval of its applications (along with grant of its proposal to auction the 1675-1680 MHz band)<sup>3</sup> will allow it to deploy a wireless broadband network on 40 megahertz of prime, green-field, mid-band spectrum that can be utilized as a resource by a variety stakeholders in the

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<sup>3</sup> See Petition for Rulemaking of LightSquared Subsidiary, LLC; RM-11681 (filed Nov. 2, 2012) (the Commission recently issued a Public Notice seeking to update the record on this Petition for Rulemaking. See Comment Sought to Update the Record on Lidago’s Request that the Commission Initiate a Rulemaking to Allocate the 1675-1680 MHz Band for Terrestrial Mobile Use Shared with Federal Use, RM-11681, *Public Notice*, DA 16-443 (rel. Apr. 22, 2016)).

wireless ecosystem during the transition from 4G to 5G networks and technologies.<sup>4</sup> As CTIA’s 2015 Annual Wireless Industry Survey found, mobile device adoption and use continues to grow, with data traffic in 2015 more than doubling the previous record set in 2014, spurring tens of billions of investment a year in wireless infrastructure.<sup>5</sup> Approval of Ligado’s applications will ensure that this valuable L-band spectrum does not lie fallow, which is particularly critical as consumers continue to adopt more bandwidth intensive uses of mobile broadband services.<sup>6</sup>

The Commission and various organizations in the public interest community have long-recognized the benefits to Ligado’s terrestrial deployment. In its 2010 *SkyTerra/Harbinger Order*, the Commission found that the public interest benefits of Ligado’s (then LightSquared) proposed terrestrial deployment in the L-band included its wholesale business model that could provide existing wireless carriers with access to new spectrum resources, enhancing “competition in the terrestrial broadband industry and help meet increasing consumer demands for high-capacity wireless mobility.”<sup>7</sup> Further, the Commission rightly recognized how ubiquitous mobile connectivity was beginning to drive productivity in existing businesses; spawn entirely new industries; and allow entrepreneurs, consumers, non-profits, and government agencies to collaborate and build stronger businesses and communities. The Commission

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<sup>4</sup> See *Ligado Letter* at 2; *Id.*, Attachment: Response to Question 43: Description of Proposed Modification and Public Interest Statement, at 8-10 (filed Dec. 31, 2015) (“*Ligado Public Interest Statement*”).

<sup>5</sup> See CTIA, Annual Wireless Industry Survey, <http://www.ctia.org/your-wireless-life/how-wireless-works/annual-wireless-industry-survey> (last visited May 23, 2016); Press Release, CTIA, Americans’ Data Usage More Than Doubled in 2015 (May 23, 2016), *available at* <http://www.ctia.org/resource-library/press-releases/archive/americans-data-usage-more-than-doubled-in-2015>.

<sup>6</sup> See *Ligado Public Interest Statement* at 4, 8-12.

<sup>7</sup> *SkyTerra Communications, Inc., Transferor, and Harbinger Capital Partners Funds, Transferee, Applications for Consent to Transfer of Control of SkyTerra Subsidiary, LLC*; IB Docket No. 08-184, *et al.*; *Memorandum Opinion and Order and Declaratory Ruling*; 25 FCC Rcd 3059, 3085 ¶ 55 (2010).

explained that the proposed LightSquared network could serve as a platform for innovation and economic growth, and concluded that some of the public interest benefits of the planned satellite-terrestrial network were: additional broadband capacity, enhanced competition, and the potential to be a catalyst for market-changing developments in the use and sale of innovative devices.<sup>8</sup> Additionally, granting Ligado's applications will fulfill a recommendation of the National Broadband Plan to enable terrestrial deployment in the MSS bands.<sup>9</sup>

The public interest community has also consistently called the Commission's attention to the benefits of facilitating deployment of a hybrid satellite-terrestrial network on Ligado's L-band spectrum. In 2010, Public Knowledge, New America, Free Press, and Media Access Project (collectively, the "Public Interest Advocates") explained that a wholesale mobile broadband network could help bring much needed competition to an uncompetitive wireless market and stimulate new investment and innovation.<sup>10</sup> In 2011, the Public Interest Advocates reiterated the competitive benefits a wholesale provider would bring to the mobile broadband market. The Public Interest Advocates also explained that LightSquared's deployment would enable a new ecosystem of software, hardware, and applications that could facilitate the quick and affordable integration of mobile broadband into verticals ranging from utilities, transportation, education, healthcare, and media and entertainment. Lastly, the Public Interest Advocates pointed to the potential for innovation, increased consumer welfare, and job creation as a result of a wholesale

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<sup>8</sup> *See Id.* at 3086-87 ¶¶ 57, 60-62.

<sup>9</sup> *See* Federal Communications Commission, Connecting America: The National Broadband Plan 87-88 (2010).

<sup>10</sup> *See* Comments of Free Press, Media Access Project, The New America Foundation, and Public Knowledge; SAT-MOD-20101118-00239 (filed Dec. 9, 2010).

network's ability to accommodate innovation in the Internet-of- Things ("IoT").<sup>11</sup> The public interest benefits identified by the Commission and Public Interest Advocates remain true today.

**B. Ligado's License Modification Proposals, as Agreed to by GPS Industry Stakeholders, Will Provide Protection and Certainty for GPS.**

Granting Ligado's applications will also provide a significant public interest benefit by ensuring that GPS receivers are protected from harmful interference from Ligado's terrestrial operations. As Ligado explains, it reached an accommodation with three leading GPS manufacturers to abandon its authority to conduct terrestrial operations in the 1545-1555 MHz band. This agreement will provide GPS operations with an additional 10 megahertz of guard band to protect GPS from interference from terrestrial services.<sup>12</sup> Additionally, Ligado has agreed to reduce its power limits and out-of-band emissions ("OOBE"), and includes these agreements as proposed license conditions.<sup>13</sup>

These agreements appear to resolve the interference issues that have long lingered over this proceeding. This is no small feat. Disagreements over Ligado's proposed terrestrial deployment and the permitted power levels and OOBE limits have been central to postponing the conclusion of these proceedings and the realization of the aforementioned public interest benefits. The agreements Ligado has reached with the GPS industry are win-win; they will permit Ligado to commence deployment of its terrestrial network and protect the interests of the GPS industry, consumers, and other stakeholders that rely on GPS.

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<sup>11</sup> See Comments of New America Foundation's Open Technology Institute, Public Knowledge, Free Press, and Media Access Project; SAT-MOD-20101118-00239, IB Docket No. 11-109; at 4-5, 13-15 (filed Aug. 1, 2011).

<sup>12</sup> *Ligado Public Interest Statement* at 8; *Ligado Letter* at 2; *Ligado Modification PN* at 5.

<sup>13</sup> *Ligado Public Interest Statement* at 4-8; *Ligado Letter* at 3-4; *Ligado Modification PN* at 5-6.

### **III. THE COMMISSION SHOULD GRANT LIGADO'S APPLICATIONS WITH LICENSE CONDITIONS FOR SPECTRUM SHARING, PRIVACY, AND SECURITY.**

In addition to the clear public interest benefits of permitting Ligado to commence deployment and operation, the Commission should adopt additional license conditions, including a use-or-share condition and a requirement that Ligado's network and the operations of any wholesale customer using Ligado's spectrum comply with appropriate privacy and cyber security rules.

#### **A. The Commission Should Permit Opportunistic and Unlicensed Access to Unused Ligado Spectrum on a Use-or-Share Basis.**

The Commission should adopt a use-or-share condition that would permit unlicensed users to operate on a non-interfering basis on any unused frequencies and in geographic areas where Ligado has not commenced operations. The condition would align with the most likely use cases for Ligado's network; democratize spectrum access; and promote more intensive spectrum use, permissionless innovation, and economic growth. Widespread opportunistic access can enhance efficient reuse of this mid-band spectrum without any risk to licensee operations by relying on a geolocation database governance mechanism that is either an extension of, or similar to the Spectrum Access System that the Commission will soon certify to manage more intensive sharing of the 3.5 GHz band.<sup>14</sup>

The propagation characteristics of Ligado's L-band spectrum, coupled with the power and OOB limits it has agreed to abide by almost certainly ensure that Ligado will be unable to deploy the nationwide, wholesale mobile broadband network originally proposed by LightSquared. Instead, Ligado's network seems likely to include a combination of uses, such as

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<sup>14</sup> See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 Mhz Band, GN Docket No. 12-354, *Report and Order and Second Further Notice of Proposed Rulemaking*, 30 FCC Rcd 3959, 3985-87 ¶¶ 80-86 (2015).

wholesale; supplemental spectrum access for mobile broadband carriers in densely populated areas; dedicated data-intensive coverage over discrete geographic areas, such as corporate or college campuses; and machine-to-machine connectivity. These likely use-cases dovetail well with opportunistic and unlicensed use of Ligado's spectrum in exurban and rural areas where these frequencies are most likely to be unused, and allowing unlicensed access to unused Ligado frequencies will help democratize access to public airwaves, promote innovation, and spur economic growth.

Unlicensed spectrum plays a key role mobile connectivity. In 2014, U.S. economic activity related to unlicensed spectrum was valued at more than \$220 billion annually.<sup>15</sup> Unlicensed spectrum is critical for a variety of wireless technologies, including Wi-Fi, Bluetooth, near field communication for mobile payments, and other uses such as wireless medical devices and public safety applications.

The need for more unlicensed spectrum and its importance to the U.S. economy will only continue to grow. Cisco reports that by 2020, the IoT will connect 50 billion devices, with an economic impact estimated at \$19 trillion.<sup>16</sup> Similarly, McKinsey has estimated that IoT applications could have an economic impact of up to \$33 trillion by 2025.<sup>17</sup> The vast majority of

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<sup>15</sup> Telecom Advisory Services, LLC, *Assessment of the Economic Value of Unlicensed Spectrum in the United States* 73 (2014), available at <http://www.wififorward.org/wp-content/uploads/2014/01/Value-of-Unlicensed-Spectrum-to-the-US-Economy-Full-Report.pdf>.

<sup>16</sup> Olga Kharif, *Cisco CEO Pegs Internet of Things as \$19 Trillion Market*, Bloomberg Business, Jan. 8, 2014, available at <http://www.bloomberg.com/news/articles/2014-01-08/cisco-ceo-pegs-internet-of-things-as-19-trillion-market>.

<sup>17</sup> Mohana Ravindranath, *Cisco CEO at CES 2014: Internet of Things is a \$19 trillion opportunity*, Wash. Post, Jan. 8, 2014, available at [http://www.washingtonpost.com/business/on-it/cisco-ceo-at-ces-2014-internet-of-things-is-a-19-trillion-opportunity/2014/01/08/8d456fba-789b-11e3-8963-b4b654bcc9b2\\_story.html](http://www.washingtonpost.com/business/on-it/cisco-ceo-at-ces-2014-internet-of-things-is-a-19-trillion-opportunity/2014/01/08/8d456fba-789b-11e3-8963-b4b654bcc9b2_story.html).

IoT traffic travels over unlicensed spectrum, and that will continue to be true.<sup>18</sup> Without significantly more unlicensed spectrum, existing unlicensed frequencies will become overly congested, harming both the IoT and licensed mobile networks that rely on unlicensed bands to offload traffic.<sup>19</sup> Additional unlicensed spectrum is necessary to fully realize the economic promise of a connected world, and the Commission can supplement its ongoing efforts to designate more spectrum for unlicensed use by conditioning its grant of Ligado's applications with a use-or-share requirement. Further, such a condition would be consistent with the FCC's recent use-or-share proposal in the *Spectrum Frontiers Notice of Proposed Rulemaking* ("*Spectrum Frontiers NPRM*"), designed to ensure spectrum is put to productive use.<sup>20</sup>

**B. The Commission Should Require Ligado and its Wholesale Customers Comply with All Relevant and Appropriate Privacy and Security Rules.**

The Commission should also add license conditions that require compliance by Ligado and its wholesale customers with appropriate privacy and security safeguards. In recent proceedings, the Commission has taken note of the importance of privacy and network security. For example, the FCC addressed security vulnerabilities in the technology and systems anticipated to make up next-generation networks in the recent *Spectrum Frontiers NPRM*. The

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<sup>18</sup> Raymond James & Associates; *The Internet of Things: A Study in Hype, Reality, Disruption, and Growth* 1 (2014); Wifi Forward, Playing by the Rules: The Success of Unlicensed Spectrum, <http://www.wififorward.org/playing-by-the-rules-the-success-of-unlicensed-spectrum/> (last visited May 22, 2016).

<sup>19</sup> See e.g., Emily Hong, *We Need More Radio Frequency Spectrum Than Ever. Why Is this Band Going Largely Unused?*, Slate, Jan. 21, 2016, [http://www.slate.com/blogs/future\\_tense/2016/01/21/why\\_is\\_this\\_spectrum\\_band\\_going\\_largely\\_unused.html](http://www.slate.com/blogs/future_tense/2016/01/21/why_is_this_spectrum_band_going_largely_unused.html); Engine, Why Startups Need More Unlicensed Spectrum, And How They Can Get It, <http://www.engine.is/news/issues/infrastructure/why-startups-need-more-unlicensed-spectrum-and-how-they-can-get-it/6816> (Apr. 29, 2016); Broadcom, Why Unlicensed Spectrum Allocation is Critical to the Next Wave of Innovation, <http://www.broadcom.com/blog/wireless-technology/why-unlicensed-spectrum-allocation-is-critical-to-the-next-wave-of-innovation/> (July 15, 2014).

<sup>20</sup> See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, *et al.*; GN Docket No. 14-177, *et al.*; *Notice of Proposed Rulemaking*; 30 FCC Rcd 11878, 11941 ¶¶ 215-16 (2015).

Commission explained that 5G networks will be expected to “provide capabilities for a tremendous variety of new devices and applications, including traditional cellular services, M2M and [] IoT applications, and mission critical and public safety services, among many others,” but a key challenge “is to support numerous distinctly different possible uses in a secure manner.”<sup>21</sup> Use of Ligado’s network that provides connectivity to machine-to-machine and IoT applications, as well as other services, should be required to comply with the appropriate network security rules.

The Commission has also recently initiated a proceeding to ensure that consumer privacy is protected as data is transmitted across telecommunications networks. The *Broadband Privacy Notice of Proposed Rulemaking* focused solely on Title II telecommunications services, specifically broadband Internet access services (“BIAS”).<sup>22</sup> While Ligado’s proposed network will not be a Title II service, it may provide wholesale access to a wide range of enterprise customers, some of whom may be Title II mobile broadband carriers using Ligado’s mid-band spectrum to supplement their network in densely populated areas and in markets where they are spectrum constrained. In instances where wireless carriers use Ligado’s network to provide a retail BIAS service, the Commission’s forthcoming BIAS privacy rules should apply. For other uses of Ligado’s network, the appropriate privacy rules governing the type of service being provided over Ligado’s spectrum should apply.

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<sup>21</sup> *Id.* at 11952 ¶ 260 (2015).

<sup>22</sup> *See* Protecting the Privacy of Customers of Broadband and Other Telecommunications Services, WC Docket No. 16-106, *Notice of Proposed Rulemaking*, 31 FCC Rcd 2500 (2016).

**IV. THE COMMISSION SHOULD FIND THAT THE APPROPRIATE STANDARD FOR MEASURING INTERFERENCE IS “ACTUAL” HARMFUL INTERFERENCE.**

Conflict over the extent to which Ligado’s planned terrestrial operations will cause harmful interference for GPS receivers has long delayed the deployment of Ligado’s network. However, there appears to be light at the end of the tunnel due to the agreements Ligado and three GPS industry stakeholders have reached on operations in the 1545-1555 MHz band, power limits, and OOB limits. Unfortunately, the Department of Transportation (“DoT”) has proposed a 1 dB rise in the carrier-to-noise ratio as the appropriate metric to test whether any interference caused by Ligado’s operations is harmful. The Commission should take this opportunity to clarify and reiterate its policy that the appropriate metric is whether Ligado causes actual harmful interference to GPS since this standard best promotes more intensive, innovative, and efficient use of the public’s spectrum resources.

The problem of how to promote more efficient use of limited spectrum resources, while predicting and preventing interference that is actually harmful, is not new.<sup>23</sup> The Commission’s rules define harmful interference as “[i]nterference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with [the ITU] Radio

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<sup>23</sup> See e.g., FCC Technical Advisory Council, Receivers and Spectrum Working Group; *Interference Limits Policy: The use of harm claim thresholds to improve the interference tolerance of wireless systems* (2013), available at <https://transition.fcc.gov/bureaus/oet/tac/tacdocs/WhitePaperTACInterferenceLimitsv1.0.pdf>; IEEE-USA, *Clarifying Harmful Interference Will Facilitate Wireless Innovation* 4, 8-10 (2012), available at <https://www.ieeeusa.org/policy/whitepapers/IEEEUSAWP-HarmfulInterference0712.pdf>; R. Paul Margie, *Can You Hear Me Now? Getting Better Reception from the FCC’s Spectrum Policy*, 2003 Stan. Tech. L. Rev. 5 (2003), available at <http://www.hwglaw.com/siteFiles/News/5F63582B07A07460630CB603F28DFBAF.pdf>.

Regulations.”<sup>24</sup> The Commission typically allows interference and prohibits harmful interference.

Interference issues have, at times, impeded or delayed wireless innovation and spectral efficiency. As the Institute of Electrical and Electronics Engineers-United States of America has explained, harmful interference often plays a key role in determining whether new technologies or services are permitted, with conflicts often arising between incumbents and new innovators, and outcomes often disadvantaging new and innovative service providers.<sup>25</sup>

In this instance, DoT has arbitrarily proposed to set an interference limit of 1 dB rise in the carrier-to-noise ratio to determine whether the interference to GPS receivers is acceptable. However, DoT’s 1 dB proposal appears to have no connection to the levels of interference that will actually cause harm to GPS operations. A rise in the noise floor is, by itself, an arbitrary and inappropriate metric to determine whether Ligado’s operations will cause actual and harmful interference to GPS receivers. As a result, DoT’s proposal could unnecessarily delay or stop Ligado from ever being able to commence terrestrial operations on its L-band spectrum. Instead, harmful interference should be defined as the level of interference that actually harms the performance of GPS receivers. This approach would best promote efficient use of the spectrum and maximize social utility.<sup>26</sup>

## V. CONCLUSION

For the foregoing reasons, the Commission should approve Ligado’s modification applications, permitting it to deploy and commence its terrestrial network under the agreements

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<sup>24</sup> 47 C.F.R. § 2.1(c).

<sup>25</sup> IEEE-USA, *supra* note 23 at 4, 8-10 (2012).

<sup>26</sup> *See* Margie, *supra* note 23 at ¶¶ 65-81.

reached with GPS industry stakeholder, while also adopting license conditions that permit unlicensed use of unused spectrum and ensure privacy and security.

Respectfully submitted,

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