RESILIENT NAVIGATION and TIMING FOUNDATION

RNT Foundation
4558 Shetland Green Rd
Alexandria, VA 22312

March 15, 2018

The Honorable Ajit Pai
The Honorable Mignon Clyburn
The Honorable Michael O'Rielly
The Honorable Brendan Carr
The Honorable Jessica Rosenworcel

Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *Ex parte* presentation in IB Docket Nos. 11-109 and 12-340

Dear Chairman Pai and Commissioners Clyburn, O'Rielly, Carr and Rosenworcel:

The Resilient Navigation and Timing Foundation (www.RNTFnd.org) is a nonprofit, public benefit corporation that helps protect critical infrastructure by promoting resilient navigation and timing worldwide. We share your goal of protecting the nation's critical positioning, navigation, and timing (PNT) services delivered by GPS, while also maximizing the efficient use of spectrum. This requires protecting, toughening, and augmenting our nation's PNT services.

As a result, the Resilient Navigation and Timing Foundation opposes any efforts that will result in harmful interference to PNT services delivered by GPS that are relied on by hundreds of millions of American citizens and businesses every day. To that end, in your deliberations in the above-referenced dockets, please carefully consider the following attachments:

- Feb. 27, 2018 op-ed from *The Hill* titled "FCC Must Act to Avoid a Grave Threat to GPS" by Bradford W. Parkinson, James Geringer and Thad Allen. The authors, while writing as private citizens, are also members of the President's National Space-based Positioning, Navigation and Timing Advisory Board. They are notable experts in their own right, are not paid advisors to any individual company who has filed in the above referenced dockets, and have no other interest in the issue other than their concern for the nation. Their membership on the advisory board also gives them access to the most recent testing information and exposure to the views of other experts from across the world.
- Jan. 16, 2018, article in *GPS World* titled "A Grave Threat to GPS and GNSS" by Bradford W. Parkinson.

- Mar. 6, 2018 op-ed from *Bloomberg BNA* titled "Haste and Consequence in Regulation: The Cautionary Tale of Ligado Networks" by Larry Spiwak.

Sincerely,

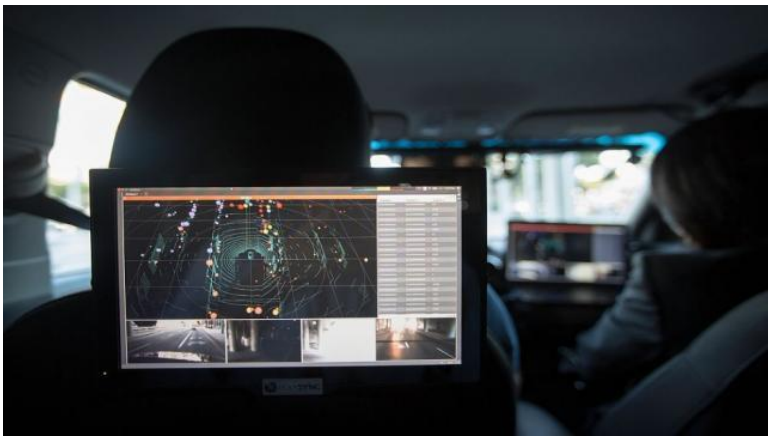
Dana A. Goward
President

cc: Rachael Bender
Louis Peraertz
Erin McGrath
Will Adams
Umair Javed

FCC must act to avoid a grave threat to GPS

BY BRADFORD W. PARKINSON, JAMES GERINGER AND THAD ALLEN, OPINION CONTRIBUTORS — 02/27/18 09:00 AM EST

THE VIEWS EXPRESSED BY CONTRIBUTORS ARE THEIR OWN AND NOT THE VIEW OF THE HILL



If you like your GPS, you should be worried.

A proposal before the Federal Communications Commission would allow transmissions that will block or degrade GPS service for millions of Americans.

Over the past 20 years, GPS has become a silent utility upon which most of our infrastructure — as well as daily life — now depends. The benefits of GPS run deep throughout our society and economy. Its thousands of uses have greatly improved our lives in areas as varied as:

- Emergency response, safer air travel and delivery services;
- Precision surveying, construction and agriculture using less materials, chemicals and energy;
- Synchronizing wireless networks to enable the continuing cell phone and information technology revolution.

In these and many other ways, GPS has become an economic engine for America. A recent study concluded that a small portion of these applications exceed $65 billion a year in benefits to the U.S. economy. Over half of those benefits come from high-precision receivers that routinely measure position to accuracies of better than an inch. While many users could be impacted, high-precision receivers are most at risk from the proposal before the FCC.

A U.S. satellite communications company called Ligado Networks is seeking FCC approval to transmit at frequencies near those used by GPS to become a national communications provider like Verizon or AT&T. Ligado would deploy as many as 40,000 towers across the United States and transmit a signal over a billion times more powerful than the GPS signal. If the FCC approves the Ligado application, the value of the company's spectrum alone could increase by $10B or more.

The cost to America, though, could be staggering.

Multiple recent government studies have shown that such transmissions would severely impact many GPS users up to several miles from each tower. Much like driving past a powerful radio station's antenna in your car and getting static on the radio, Ligado's high-power signals would bleed over and disrupt GPS receivers, sometimes within miles of their antennas. Although Ligado has offered modifications to its proposal over the years, in response to potential impact on GPS users, close examination has shown little to no improvement to the disruption its system would cause.

Recent legal action by early investors in Ligado's predecessor company claims that the impact of these transmissions on GPS should have been disclosed as early as 2001. The suit says tests showed the transmissions "…would effectively cripple receivers used by GPS and would be fatal to the millions of GPS devices

already in use, many of which are critical to the national infrastructure and already widely used for aviation, safety, defense, and research purposes across the country."

Approval of Ligado's application by the FCC could degrade or prevent current GPS receiver use for aircraft navigation, guidance of drones, precision agriculture, timing in cell phone and information networks, and hosts of other applications — even far away (miles in some cases) from of any of their 40,000 towers. This would also place today's first-responder helicopter and ground operations at risk, and could effectively cripple development of budding drone aircraft, autonomous vehicle and intelligent transportation systems.

That's why the administration's National Advisory Board for GPS, along with many others in the GPS community, strongly argued against the Ligado proposal and similar earlier proposals for the past eight years.

The administration must take a strong stand against the current Ligado proposal. And the FCC must ensure that any proposal it considers in the future minimizes the impact on our ubiquitous and essential GPS services.

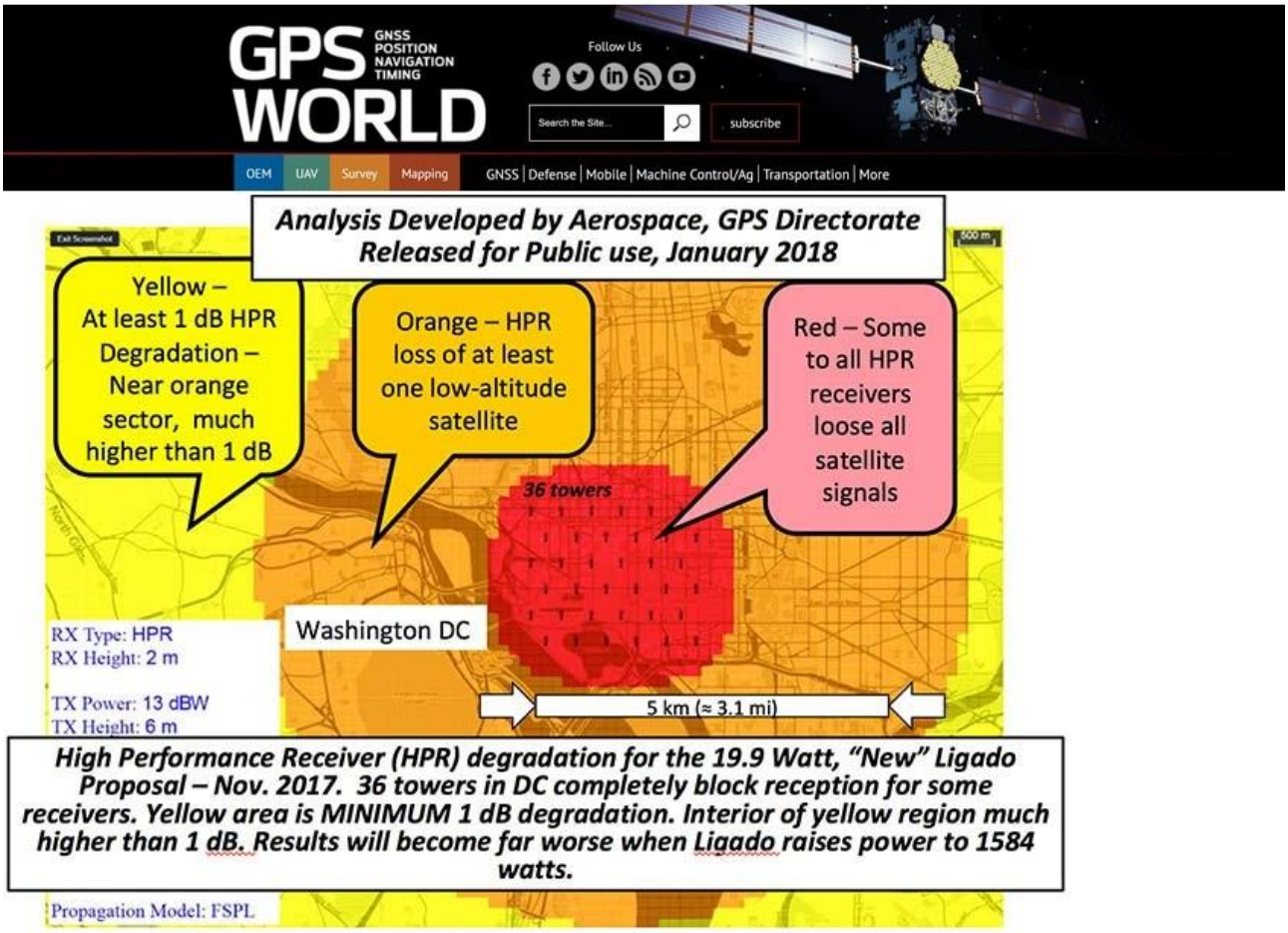
America has four major telecommunications providers and dozens of smaller ones.

We have only one GPS. We endanger it at our own peril.

Bradford W. Parkinson was the original chief architect for GPS. He is a co-director at the Stanford Center for Position, Navigation and Time, Stanford University.

James Geringer served as Wyoming's governor from 1995-2003. He is a senior director with Esri, the leading developer of mapping and spatial analytics software.

Thad Allen, a retired U.S. Coast Guard admiral, was commandant of the Coast Guard and served as the principal federal official for responses to Hurricane Katrina and the Deepwater Horizon oil spill.



A grave threat to GPS and GNSS

January 16, 2018
By Bradford Parkinson

By Bradford Parkinson

Vice-chair, U.S. PNT Advisory Board

In the coming months, the U.S. Federal Communications Commission (FCC) may allow high-powered, ground-based, communication transmitters to broadcast at a frequency near GPS L1. U.S. Department of Transportation (DOT) tests have shown that such transmitters effectively become jammers for many existing GPS receivers.

I believe that this possibility is the greatest current threat to the position, navigation and timing (PNT) community.

L1 is the primary band for GPS as well as for similar GNSS. For example, the international signal called L1C is to be centered at L1, albeit with wider spreading than the current L1 civil signal, C/A.

Why is this of critical importance? An economics study that only considered a small subset of benefits concluded that the U.S. alone realized $65 billion per year in direct economic value. A more complete recent study for the UK, extrapolated to the U.S., estimated the total impact of the loss of GPS to be over $3 billion per day for a five-day outage — a far greater rate. Virtually all GPS applications rely on the signals at L1. Thus, any threat to GPS is not simply an inconvenience, it would have great potential to do economic harm.

The PNT Advisory Board (PNTAB)has been trying to protect PNT, particularly GPS, and at the same time accommodate Ligado, a company that has requested repurposing of nearby spectrum. At our November meeting, we reviewed the Ligado proposal and framed a response that will be made public in due time. Meanwhile, these observations and conclusions are my own.

History

In 2011, LightSquared proposed that existing restrictions on its existing frequency authorization in the Mobile Satellite Service (MSS) band (a faint signal, satellite-to-ground) be waived so that the band is effectively repurposed to allow for high-power terrestrial transmissions.

The company has two space-to-ground authorizations in the 1525–1559 MHz band (1526–1536 MHz and 1545–1555 MHz) very close to the GPS primary frequency (L1 at 1575MHz). Initially it requested repurposing to ground transmission of 42 dBW (15.8 kW).

Faced with tests and analysis that showed this would be very destructive to GPS, it proposed to abandon the closer band and reduce power in the further band to 32 dBW, or 1580 Watts.

Ligado filings suggest a spacing of approximately ¼ mile between transmitters. A GPS receiver would find even these weaker signals 5 billion times the power of GPS at the maximum range of ¼ mile.

Most PNT users would be much closer.

International criterion

To ensure ranging accuracy, the international standard for interference to GPS is a 1-dB increase in noise levels. In conventional terms, this max allowable 1 dB is a 25.8% increase in background noise. The power of the weak GPS signal is only about 1% of the background radio noise. Sophisticated signal processing algorithms allow the signal to be reconstructed.

The result: the international 1-dB standard is equivalent to a **25% reduction in GPS** radiated power.

Two additional points

The 1 dB is not simply to protect signal lock, it is to protect ranging accuracy. Most GPS receivers will stay locked for higher levels of interference but lose high precision. This is particularly a problem for high-precision receivers, which need relative timing to sub-nanosecond accuracies.

These measurements are equivalent to the time it takes light to travel ¼ inch. Protecting such accuracies is of paramount importance to PNT users and applications.

Allowing such maximum degradation from a single source is not the whole picture. There are many other potential sources of interference and attenuations of the GPS signal. For example, foliage may reduce the GPS signal.

A receiver must cope with all of these difficulties. Allowing a single cause, such as the Ligado repurposing, the 25.8% equivalent reduction might be considered quite generous, but it is the accepted International Standard.

Ligado has specifically rejected this criterion, largely because testing has shown that the Ligado repurposing would then be unacceptable for many PNT user classes.

To support its rejection of the International Standard, Ligado has repeatedly alleged that five of the major manufacturers are in complete agreement regarding its repurposing. This is a substantial distortion. The record was set straight by Brian Ramsay of MITRE at the November PNTAB meeting: "Four of the five parties that reached agreements with Ligado (except for Topcon Positioning) support the 1-dB Interference Protection Criterion (IPC) in comments filed in response to this Public Notice."

Further support was highlighted by Captain Robyn Anderson: "In June 2017, the Air Force produced a white paper on the 1-dB IPC that explained the relationship between harmful interference (levels that affect GPS receiver performance) and the 1-dB IPC (keeps interference below a level that would cause harmful interference)."

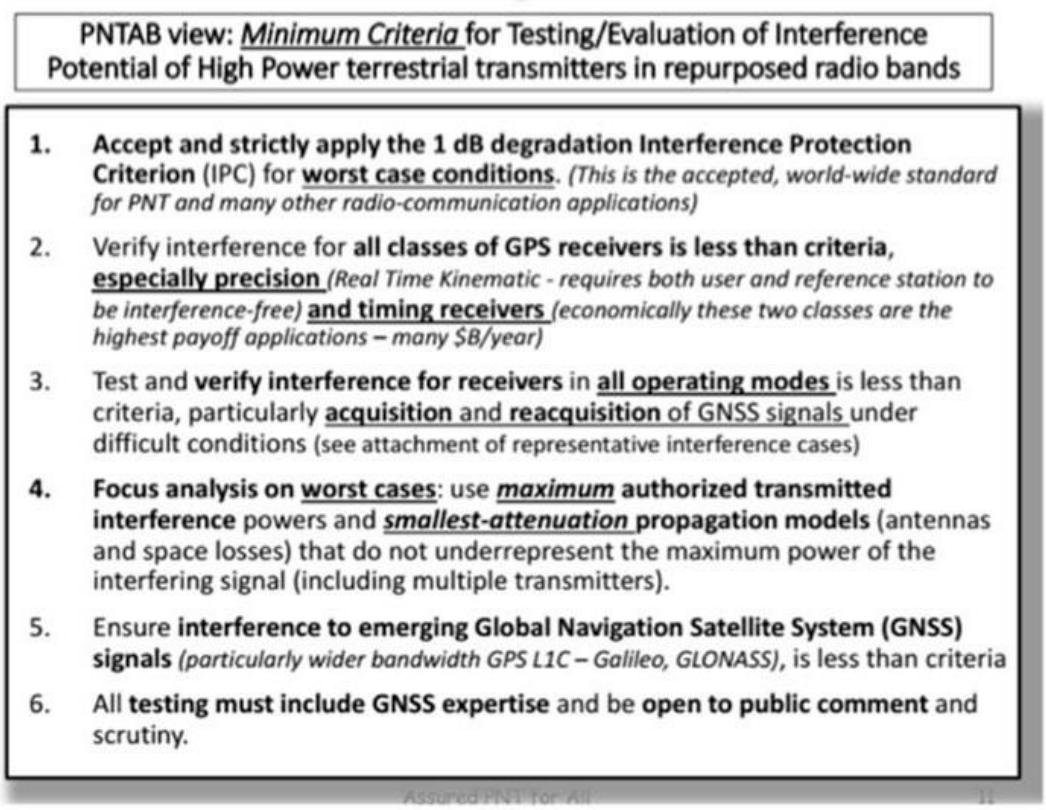
Lightsquared's motivation in 2011 was clear: a $10 billion windfall profit (estimated increased value of the spectrum on open-market auction). The FCC did not confirm Lightsquared's modified request, and in 2012 the company went into bankruptcy.

Reorganizing as Ligado and emerging in December 2015, it continued to pursue repurposing of its spectrum, sponsoring tests by Roberson and Associates, and tests at National Institute of Standards and Technology (NIST)/National Advanced Spectrum and Communications Test Network (NASCTN) to establish test procedures.

Both groups of tests were carefully reviewed by our PNTAB who found serious flaws. In general, Ligado rejected the 1-dB criterion and did not accept the need to protect all classes of users, particularly high-precision receivers. In addition, it did not consider the new GPS L1 signals (L1C and L1M), nor did it check the impacts on the international GNSS. The PNTAB assembled a 14-point summary of deficiencies and requested updates and corrections for the flaws.

NASCTN'S response did not really address the points, or claimed that there were no funds to correct the problems. The PNTAB then developed a **Six-Point Criteria** for acceptable interference testing, summarized as:

- Accept and strictly apply the 1-dB criterion
- Verify interference for all classes of receivers
- Test and verify for all operating modes
- Focus analysis on worst cases.
- Include the new GNSS signals.
- Include GNSS expertise and openly publish results



We believe it is a very reasonable set that aims to protect PNT users and our economic benefits. In its sponsored tests, and in representations to the FCC, Ligado has consistently overlooked a basic facet of radio ranging: it is ranging accuracy, not simply locking onto a signal, that is the fundamental objective for PNT.

Both Ligado test sets clearly failed on all six points.

DOT ABC tests

While the Ligado-sponsored tests were neither independent nor adequate, the Department of Transportation, led by Karen VanDyke, sponsored a very complete set of independent tests; these are the most credible estimates of harmful interference. The ABC results have been made public. The PNTAB's six points were published after DOT testing had begun, but DOT expanded and modified their effort to satisfy the criteria. The DOT conclusions, based on modeling real-world antennas and propagation patterns, are shown in **Table 1**.

Standoff Distance	General Location/ Navigation	High-Performance Receivers	Timing Receivers	Cell Phones
10 Meters	0.8 milliwatts (P2 is 197,900 times too large)	64 microwatts (P2 is 24,687,500 times too large)	8.7 milliwatts (P2 is 181,609 times too large)	12.3 Watts (P2 is 128 times too large)
100 Meters	79.4 milliwatts (P2 is 19,899 times too large)	6.5 milliwatts (P2 is 243,077 times too large)	0.9 Watts (P2 is 1756 times too large)	1.2 kilowatts (P2 is 1.25 times too large)

TABLE 1. DOT ABC test results. Maximum tolerable effective radiated power (EIRP) for classes of the most susceptible GPS receivers for modified Ligado proposal (P2) of 1.58 kilowatts. In red are the factors that Ligado P2 exceeds the maximum tolerable radiated power.

At 100 meters, all classes of receivers tested had results that would exceed the 1-dB threshold, even for the reduced power level (P2, 1580 Watts) that has been the most recent filing. The shaded square is particularly troublesome. It shows that, for the most susceptible high-precision receivers, the Ligado proposed power exceeds the 1-dB threshold by over 200,000. This result is particularly damning for the proposed repurposing, because it is this class that produced the highest payoff in the recent Department of Commerce Study — over $30 billion per year.

PNT operations at risk

These are examples of unintended and potentially hazardous consequences of repurposing.

UAVs. Unmanned aerial vehicles (drones) will fly very close to the dense array of transmitters that Ligado would deploy. They usually require GPS for flight control. Even more important, if we are to monitor them and keep them from collisions, GPS offers the only viable techniques with 3D accuracy and almost 100% availability.

Precision survey. This is routinely used in urban areas for building construction and is a major source of productivity gains. These survey receivers are all high precision and routinely make measurements to better than ¼ inch.

Helicopters. These are found in urban area at all altitudes. They are used for law enforcement, rescue and passenger transportation. GPS is mainly used for general navigation.

Public safety vehicles. Fire, police and ambulances use GPS for both navigation and dispatch tracking. In a city, they would drive in and out of susceptible high-interference zones.

The PNTAB believes the DOT results are representative, accurate and credible. The National Coordinating Office for PNT also sponsored an evaluation of all testing to date. A summary report is now in coordination, as a combined Department of Defense (DOD) and DOT effort.

The DoD, which uses GPS in the national airspace for routine flight, testing, training, guiding rocket launches, and for humanitarian rescue missions, has opposed repurposing. The Air Force reported, “Results from the DOD ABC Assessment support the conclusions drawn from Department of Transportation’s ABC Assessment.”

November PNTAB meeting

At our November meeting, the board invited Ligado to make a presentation on its repurposing proposal. The invitation said: "Specifically describe your implementation plan, with a corresponding test plan addressing the issues we have openly raised. We request you specifically focus on those regarding the potential for interfering with any GPS/GNSS services that operate in the protected space-to-Earth L-band (1559–1610 MHz). Included should be all modes of operation and the use of all current and future GNSS signals."

Valerie Green, executive vice president and chief legal officer of Ligado Networks, represented Ligado. In the run-up to the meeting, the Six-Point Criteria had been sent to Ligado. Green did not address the six points at all.

She did offer to reduce initial power to "the safe power level in the 1526–1536 MHz channel ranges from 9 to 13 dBW EIRP nationwide, not just near airports."

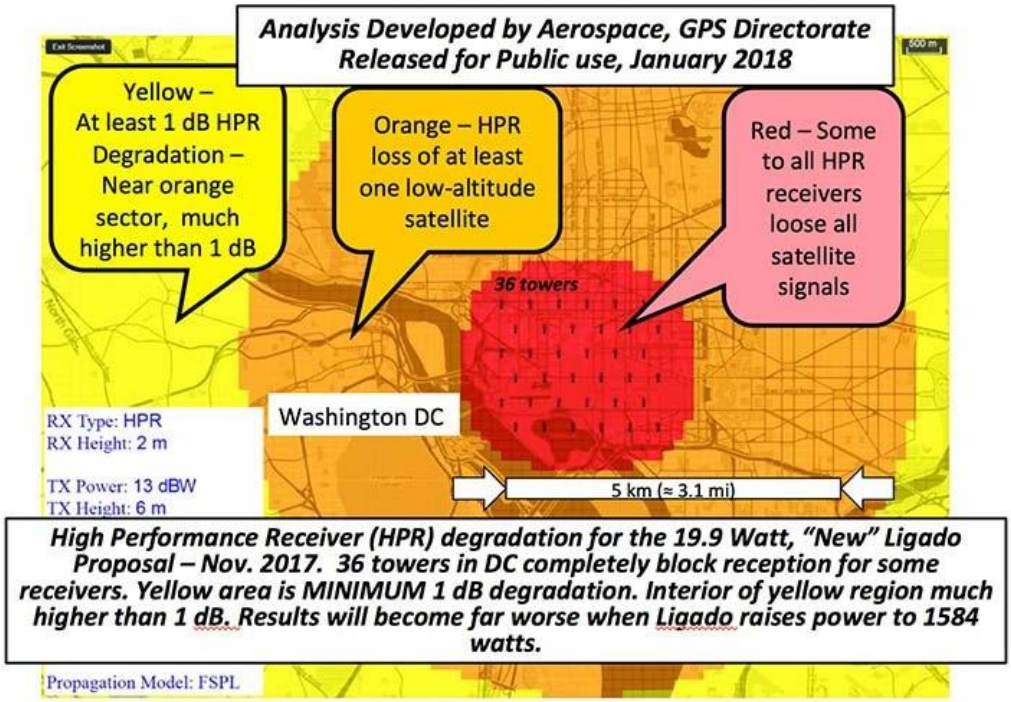


FIGURE 1. Potential impacts on high-performance receivers. Red: loss of lock of all satellites. Yellow: loss of lock of low-elevation satellites. Green: 1-dB degradation.

The 13 dBW corresponds to initial power levels of 19.95 W. However, Ligado has made clear in its FCC filings that it ultimately still wants a full 32 dBW base-station transmit power level, consistent with typical 4G/LTE networks.

The initial reduced power sounds like a major move in the right direction, but further questioning revealed two major issues:

Tower Spacing. Green was very evasive on the spacing of transmitter towers. Clearly, at the reduced power level, greater density would be needed to carry the original data bandwidth. At about 1/100th the power, density would have to increase by a factor of 100, and the spacing would have to decrease

to 1/10th for the same data output rate.

Green referred us to an earlier filing which specified 0.25 mile, but did not clearly state that this was the plan; she claimed the details were proprietary. If this fundamental parameter, spacing, is not specified, it is hard to see the basis for the FCC evaluation of any new proposal. If the transmitter spacing is reduced to less than 1/10th of a mile, the sources of potential harm would be multiplied in a very worrisome way.

Future power constraint. A public presentation does not ensure that Ligado will actually file and agree to abide by those power constraints indefinitely. Board members pressed Green on the permanence of the power constraint.

She suggested it would be tied to the RTCA Minimum Operational Performance Standard. Revising the MOPS takes many years, if not decades, both to formulate and to implement. Retrofitting the commercial aircraft fleet is very expensive and time-consuming.

Further, her statement focuses only on commercial aircraft, ignoring the high-precision classes as well as future signals.

A modified summary chart (**Table 2**) for the lower power, based on the DOT ABC test results, shows that even at the lower power, the threshold for high-precision receivers is exceeded by a factor of over 3,000 at 100 meters. In fact, only cell phones, which are relatively inaccurate, could operate at 100 meters without exceeding the threshold.

Standoff Distance	General Location/ Navigation	High-Performance Receivers	Timing Receivers	Cell Phones
10 Meters	Too powerful by factor of 24938	Too powerful by factor of 311719	Too powerful by factor of 2293	Too powerful by factor of 2
100 Meters	Too powerful by factor of 251	Too powerful by factor of 3069	Too powerful by factor of 22	Cell phone at 100 meters is OK - 0.02

TABLE 2. Results of DOT ABC test with Ligado transmitters constrained to 19.95 Watts (13 dBW). This illustrates that the International Interference Limit is exceeded many times over at 100 meters for certain high- precision receivers, highlighted in red.

With these expectations and uncertainties, the PNTAB did not find the new revision acceptable to the PNT community.

Three fundamental issues

Ligado has steadfastly not accepted the realities of non-interference.

1 dB. Acceptance of the 1-dB (25.8% noise increase) International Interference standard is fundamental to protecting GPS applications throughout the country.

All current and future uses. Users of great concern are emergency services, helicopter and general aviation, UAVs, and precision survey and machine control. For example, many of the underground utilities in the U.S. have been mapped with precision, GPS-based, geographic information receivers. This application requires sub-meter accuracy and operates in both rural and urban environments.

Ligado has tended to simply focus on certified aviation, claiming that protecting that class of user is enough. The PNT community rejects that view. All current and future PNT users must be protected.

Worst–case interference. The recent round of testing was largely in a laboratory. Extrapolating to the real world must examine the situations with greatest interference. For example:

Number of simultaneous interfering transmitters. A single transmitter situation is not typical; three or more are apt to be in range. The additive power must be considered.

Propagation models. Propagation models for communications differ from those for evaluating potential interference to a navigation signal. For assured communication, a typical model assumes transmitted signal fall-off a little faster than 1/(distance squared). Ligado would naturally prefer to use this model, which is far from worst-case for interference. The early round of tests in Las Vegas verified the communications model would vastly underestimate interference levels, by factors of 10 or more. A more realistic model must be used.

Degradation Radius. This is the size of the circle within which the International Standard is violated for receivers in a specified class. If the spacing of transmitters is 400 meters, and the degradation radius is 200 meters, virtually all receivers are in the degradation zone. Ligado suggested an appropriate degradation radius is 250 feet for aviation (approximately 100 meters). Thus, they claim the PNT community should tolerate violation of the standard when closer than 100 meters to their transmitters. At 400 meters spacing, 25% of the area would be in violation.

But the ABC test results reveal a much graver situation. They show that, for the current Ligado proposal (1580 watts), the degradation radius is over 14 kilometers for high-precision receivers. See **Figure 2**.

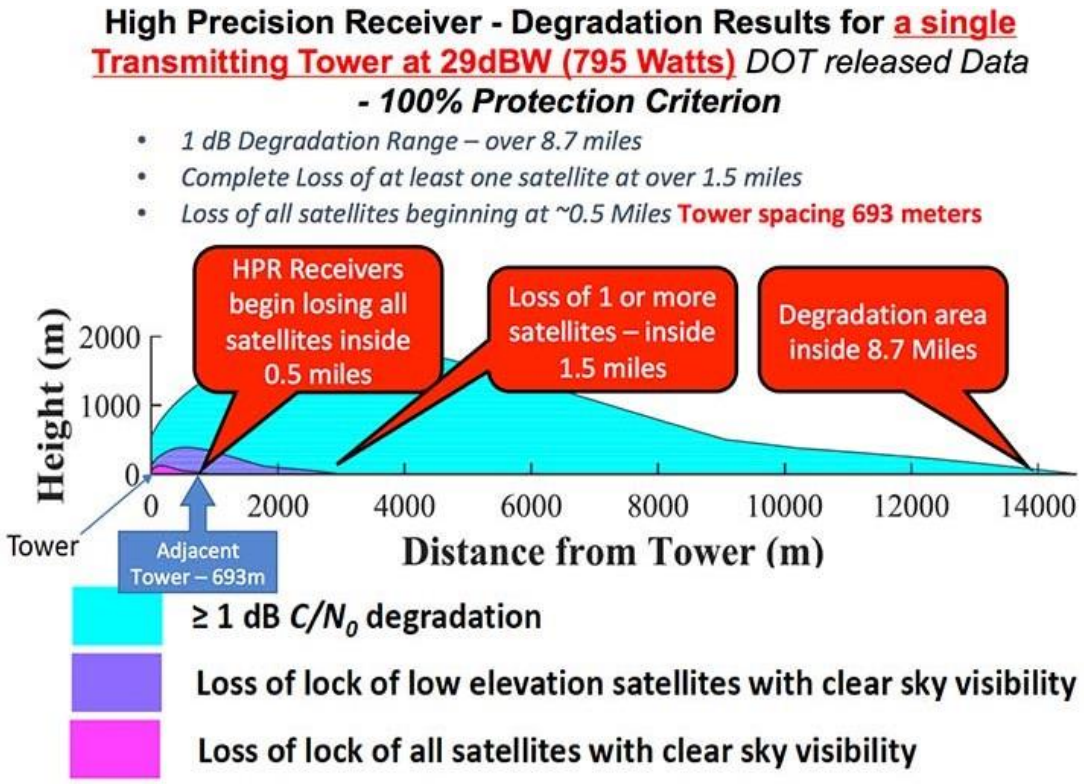


FIGURE 2. Macro urban transmitter, high-precision receiver, 1530 MHz.

Conclusions

The 1-dB criterion is the correct, accepted and somewhat generous allocation of interference that can be accepted by the PNT community. We would hope that the FCC would continue to insist on this standard.

PNT users must, yet again, defend the spectrum vigorously. Most of us are scientific and technical people. We are not used to discussions that deliberately avoid the technical issue or deny scientific evidence. We reject arguments that violate the fundamental laws of physics.

The currently filed proposal, 1580 Watts at spacing of ¼ mile, is unacceptable. It will do grave harm to many important PNT applications

We must be very leery of the new proposal by Ligado of 9–13 dBW. It still would violate the 1-dB criterion at 100 meters for many PNT users.

Moreover, the company history has been to bait and switch; it has an authorization for MSS Ancillary Terrestrial Component (MSS ATC) stations to fill the gaps in satellite coverage with ground transmitters. These must operate in conjunction with the space-to-ground link that made them effectively self-limiting. However, in 2011, it almost succeeded in switching this to a ground-only system, which would have achieved a huge financial windfall.

Open-air verification

If the FCC continues to consider this proposal, there is one step that it should take before granting it. It should require Ligado to deploy an array of transmitters in its advocated configuration, and run real-world, open-sky testing to assess the harm that may result, particularly to high-precision accuracy.

Such testing was done when the issue was first raised in 2011 and conclusively demonstrated unacceptable interference. Nothing has really changed from the baseline that was tested and found unacceptable then.

The company should carry the full financial burden of such a verification, under PNT supervision. The government, having already spent millions of dollars to defend the spectrum, should not bear the cost of such retesting.

Without this confirmation, it is hard to conceive of putting GPS and PNT at significant risk to satisfy investors who want to flip a company, after gaining “rezoning” permission for their spectrum.

From 20,000 feet altitude

If we examine the situation without the technical details, we have this: Fundamentally Ligado wants to provide service using its allocated frequency band for an unlimited number of Internet-of-Things installations.

It is not proposing a small, fixed number of transmitting towers located in isolated regions, but rather an accelerating deployment of private networks, many of which will be close to commercial and essential infrastructure where GPS use is critical.

It seems unrealistic that Ligado can or will reliably guarantee that these widespread installations will be continually adjusted and monitored to avoid GPS interference.

I believe the concept of allowing the installation of transmitting towers that, by design, will interfere with normal GPS use at some distance away opens the door to tacit approval of short-range (or not-so-short-range) GPS jammers.

While I can commend the entrepreneurial spirit, the Ligado proposal seems very reckless indeed. The incremental value of an additional broadband transmitting system when there are at least five already in existence seems trivial compared to the potential damage done to the modern utility named GPS.

I sincerely hope the FCC can find a spectrum swap or deny outright the current Ligado application.

Haste and Consequence in Regulation: The Cautionary Tale of Ligado Networks

March 6, 2018
By Lawrence J. Spiwak

Lawrence J. Spiwak is President of the Phoenix Center for Advanced Legal & Economic Public Policy Studies (http://www.phoenix-center.org), a non-profit 501(c)(3) research organization that studies broad public-policy issues related to governance, social and economic conditions, with a particular emphasis on the law and economics of the digital age.

When it comes to being satisfied with the number of broadband providers, policymakers often act like guitar players: they always want just one more.

To its credit, over the last four decades, the Federal Communications Commission—often with legislative help from Congress—has developed and implemented an assortment of pro-entry policies. These pro-entry policies have transformed the industry from the old Bell monopoly to the vibrant market American consumers enjoy today.

Still, the Obama Administration's FCC was impatient with the pace of progress. To speed things up, Obama's two FCC Chairmen (Julius Genachowski and Tom Wheeler) routinely cut regulatory corners, casting a cloud over the agency's competency and leaving a mess for the current FCC to clean up.

The Rush to Deploy

By way of example, take the ongoing saga of Ligado Networks.

Ligado Networks began its journey as LightSquared Networks, a company formed by the 2010 merger of SkyTerra and Harbinger Capital. The deal would shift control of a significant number of Mobile Satellite Service ("MSS") licenses to a venture capital firm run by Phil Falcone, so LightSquared needed to convince the FCC that it was a good idea.

Grasping the Obama Administration's lust for "more" firms, the company lobbied to convert its 40 MHz of satellite spectrum to terrestrial use and promised to build a state-of-the art wholesale mobile network capable of providing overage in the United States to at least 100 million people. The agency bit—enthusiastically but blindly.

Inexplicably, though, no one in the FCC leadership paused long enough to assess whether converting this satellite spectrum to terrestrial use would cause interference to others operating in adjoining bands.

It did.

Shortly after the FCC approved the LightSquared deal, the Federal Aviation Administration (FAA) and the National Telecommunications and Information Administration (NTIA) informed the FCC that LightSquared's network would interfere with high-precision GPS receivers, thereby threatening the safety and efficiency of air travel, stranding billions of dollars in FAA and GPS investments, and requiring a retrofit of all airplanes. Their potentially disastrous oversight exposed, the Commission was forced to delay approval of LightSquared's request, a delay that eventually drove LightSquared into bankruptcy.

The Second Round

Down but still hoping to arbitrage its 40 MHz of MSS spectrum into terrestrial wireless broadband, LightSquared—now rebranded as Ligado Networks—emerged from bankruptcy in December 2015 with a new plan. Among other changes, Ligado proposed to abandon terrestrial operations in one slice of its spectrum holdings, and entered into settlements with several large GPS manufacturers to mitigate their concerns following contentious litigation.

Ligado now argues that the FCC should grant their revised application to convert their spectrum and allow then to begin operations. The cautionary tale that has already unfolded, however, suggests that the current FCC should exercise a bit more diligence in reviewing Ligado's revised application.

Indeed, the fact that Ligado may have reached deals with several GPS providers does not mean that all of the interference concerns are resolved.

Ongoing GPS Issues?

Just last week, Brad Parkinson, considered the "godfather of GPS," wrote that Ligado's modified proposal remains a "grave threat to GPS." Parkinson stated that "approval of Ligado's application by the FCC could degrade or prevent current GPS receiver use for aircraft navigation, guidance of drones, precision agriculture, timing in cell phone and information networks, and hosts of other applications."

A number of users who rely heavily on interference-free GPS services, including several major airlines, general aviation enthusiasts, major aerospace and defense manufacturers, and the US Department of Transportation, also continue to express concern about interference. And Iridium Communications, the world's largest commercial satellite system, has said repeatedly that Ligado's proposed service would pollute its spectrum.

Adding to Ligado's credibility problem is a recent story in the *Wall Street Journal* reporting that Phil Falcone is now suing Apollo Global Management for allegedly concealing fatal interference issues in LightSquared's plans, flaws the company has denied existed all along. According to the *Journal* article, Falcone claims that a newly unearthed patent application from 2001 reveals that the planned terrestrial network could "overload" GPS receivers, which "would effectively cripple receivers used by GPS and would be fatal to the millions of GPS devices already in use, many of which are critical to the national infrastructure."

The Road Ahead

Hopefully, Ligado can be forthright and diligent about resolving such interference concerns. If they are successful, then good for them and good for us. The company has assumed significant financial risk in its speculative endeavors, and if it can assuage interference concerns, then it deserves to be rewarded as handsomely as the market will bear.

But for now it appears the evidence is against Ligado. And the recent lawsuit by its founders certainly provides no aid to the company's reputation.