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February 7, 2011

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FEB - 7 2011

Federal Communications Commission
Office of the Secretary

VIA HAND DELIVERY

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

Re: Notification of *Ex Parte* Presentation in LightSquared Subsidiary LLC Application for Modification of Authority for Ancillary Terrestrial Component, File No. SAT-MOD-20101118-00239

Dear Ms. Dortch:

On February 4, 2011, on behalf of Garmin International, Inc. ("Garmin"), I met with Paul de Sa, Chief of the Office of Strategic Planning and Policy Analysis, to discuss the results of empirical experimentation conducted by Garmin to assess the impact on GPS receivers operating in the 1559-1610 MHz band of fixed, high-power terrestrial broadband transmitters of the new, non-ancillary type LightSquared Subsidiary LLC ("LightSquared") first proposed in its above-referenced November 2010 application. The LightSquared application proceeding has been designated to have permit-but-disclosure status for purposes of the Commission's *ex parte* rules. I provided Dr. de Sa with a copy of the *ex parte* report filed by the GPS Industry Council on January 20, 2011 in connection with the application as well as the attached press reports.

By this letter, and in accordance with Section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, two copies of this letter and its Appendices are provided for inclusion in the Commission's files.

Please let me know if you have any questions.

Very truly yours,

M. Anne Swanson
Counsel for Garmin International, Inc.

Attachments
cc w/attach. (by email): Dr. Paul de Sa



WASHINGTON, DC

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FEB - 7 2011

Federal Communications Commission
Office of the Secretary

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January 20, 2011

By Hand Delivery

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

**Re: Notice of *Ex Parte* Presentation in LightSquared Subsidiary LLC
Application for Modification of Authority for Ancillary Terrestrial
Component, File No. SAT-MOD-20101118-00239**

Dear Ms. Dortch:

On January 19, 2011, representatives of the United States GPS Industry Council and several member companies held a teleconference with officials from the Commission's Office of Engineering and Technology, International Bureau, Public Safety and Homeland Security Bureau, and Wireless Telecommunications Bureau to discuss the results of empirical experimentation conducted by Garmin International ("Garmin") to assess the impact on GPS receivers operating in the 1559-1610 MHz band of fixed, high-power terrestrial broadband transmitters of the new, non-ancillary type LightSquared Subsidiary LLC ("LightSquared") first proposed in its above-referenced November 2010 application. The LightSquared application proceeding has been designated to have permit-but-disclose status for purposes of the Commission's *ex parte* rules.

The participants (listed on Appendix 1 to this letter) discussed in detail the methodology, parameters, and findings presented in the Garmin report, entitled *Experimental Evidence of Wide Area GPS Jamming That Will Result from LightSquared's Proposal to Convert Portions of L Band 1 to High Power Terrestrial Broadband*, that is included as Appendix 2 to this letter.

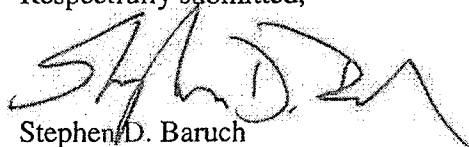
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Marlene H. Dortch
January 20, 2011
Page 2

By this letter, and in accordance with Section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, two copies this letter and its Appendices are provided for inclusion in the Commission's files.

Please direct any questions to me.

Respectfully submitted,



Stephen D. Baruch
Counsel for the United States GPS Industry Council

Enclosures

cc: (w/Enclosures): List of Persons in Appendix 1 (by e-mail)

APPENDIX 1

LIST OF PARTICIPANTS IN JANUARY 19, 2011 TELECONFERENCE

<u>FCC PARTICIPANTS:</u>	<u>U.S. GPS Industry Council Participants</u>
<p>Office of Engineering and Technology:</p> <p>Julius Knapp, Chief Ronald Repasi Michael Ha Mark Settle Robert Weller</p> <p>International Bureau</p> <p>Robert Nelson Sankar Persaud</p> <p>Public Safety and Homeland Security Bureau:</p> <p>Pat Amodio</p> <p>Wireless Telecommunications Bureau:</p> <p>Paul Murray Tom Peters</p>	<p>U.S. GPS Industry Council:</p> <p>F. Michael Swiek, Executive Director A.J. von Dierendonck Stephen D. Baruch (Lerman Senter PLLC)</p> <p>Garmin International:</p> <p>Andrew Etkind Scott Burgett Bronson Hokuf Doug Kealy Brian Poindexter Van Ruggles Micheal C. Simmons M. Anne Swanson (Dow Lohnes PLLC)</p> <p>Trimble Navigation, Ltd.:</p> <p>Ann Ciganer Bruce Peetz Russell Fox (Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.)</p>

APPENDIX 2

Experimental Evidence of Wide Area GPS Jamming That Will Result from LightSquared's Proposal to Convert Portions of L Band 1 to High Power Terrestrial Broadband

January 16, 2011

Scott Burgett, Bronson Hokuf
Garmin International, Olathe, Kansas

Executive Summary

On November 18, 2010 LightSquared Subsidiary LLC filed an application requesting modification of its authority for Ancillary Terrestrial Component (FCC File No. SAT-MOD-20101118-00239) of L Band 1 MSS (Mobile Satellite Service). This application proposes to fundamentally change the usage of the L Band 1 spectrum (1525 MHz– 1559 MHz) from MSS (very low power, space to earth signals) to fixed, high power, terrestrial broadband service. The L Band 1 is adjacent to the GPS band (1559 MHz – 1610 MHz) where the GPS and other satellite based radio navigation systems operate.

If this modification is approved, widespread, severe GPS jamming will occur. In careful, experimental testing at Garmin using the technical details (power, frequency, modulation bandwidth) of the proposed LightSquared system, two common state-of-the-art Garmin GPS receivers experienced significant jamming within a radius of several miles from a simulated LightSquared transmitter.

The nüvi 265W, a very common portable consumer automotive navigation device, began to be jammed at a power level that represents a distance of 3.6 miles (5.8 kilometers) from the transmitter. **The nüvi 265W lost a fix at a distance of 0.66 miles (1.1 kilometers) from the transmitter.**

A GNS 430W, a common FAA certified General Aviation receiver that supports the FAA's NextGen RNAV and RNP operations, began to be jammed at a distance of 13.8 miles (22.1 kilometers) from the LightSquared transmitter. Total loss of fix occurred at a distance of 5.6 miles (9.0 kilometers) from the LightSquared transmitter. **This GPS receiver is certified for LPV (Localizer Performance with Vertical guidance) approach operations to 200 feet decision height, yet will be completely jammed by LightSquared transmitters over 5.6 miles (9.0 kilometers) away. Further, due to the special FAA requirements that this receiver is designed to meet, it takes on the order of 90 seconds to regain a fix once lost.**

Background

As discussed in the Executive Summary, LightSquared wants to fundamentally change the nature of L band 1 (1525 MHz – 1559 MHz) from a mobile, space to earth band containing very weak signals to a very noisy terrestrial broadband band full of extremely powerful signals. This will have a severe impact on the adjacent GPS band (1559 MHz – 1610 MHz) where GPS and other satellite navigation and

augmentation systems operate (Glonass, Galileo, WAAS, etc).

LightSquared's published plans (ref LightSquared Letter to Marlene Dortch, November 18, 2010) entail the installation of up to 40,000 high power transmitters. These transmitters are authorized for up to 42 dBW (over 15,000 watts). **The operation of so many high powered transmitters so close in frequency to the GPS operating frequency (1575.42 MHz) will create a disastrous interference problem for GPS receiver operation to the point where GPS receivers will cease to operate (complete loss of fix) when in the vicinity of these transmitters.**

Garmin products represent over 90% of the installed navigation equipment in the General Aviation segment in the United States. Garmin also represents over 50% of the portable consumer automotive and handheld GPS devices sold in the United States. When faced with this potentially catastrophic interference threat, Garmin set out to quantify the jamming threat by carefully simulating the jamming scenario in the lab using high fidelity simulation equipment. Garmin tested two of our most popular devices. From the consumer automotive segment, testing was performed using a nüvi 265W, which is a popular member of a best-selling family of consumer automotive navigation devices. From the aviation segment, testing was performed using a GNS 430W, a receiver designed to meet the FAA TSO-C146a minimum performance specifications and which presently supports FAA's NextGen RNAV and RNP operations and is expected to be approved as a position source for FAA's NextGen ADS-B Out mandate.

Due to the accelerated schedule with which the FCC is processing LightSquared's request for waiver, only these two devices were tested in the interest of time. These devices are very representative of the installed user base of Garmin products in the United States.

Experimental Setup

The goal of these experiments was to use Garmin's engineering test lab to faithfully replicate the real-world scenario of LightSquared's proposed transmissions in the MSS band adjacent to GPS signals in the RNSS band. In general, care was taken to err in LightSquared's favor whenever assumptions were made about its transmissions. For example, Order and Authorization (SAT-MOD-20090429-00047, et. al.) released March 26, 2010 authorizes transmissions of 42 dBW EIRP (15.85 kW) with power allowed all the way to the band edge of 1559 MHz (paragraph 46); however, this test setup was based on LightSquared's verbal guidance (conference call between LightSquared and the USGPSIC (US GPS Industry Council), December 17th, 2010) that they would not transmit in excess of 32 dBW EIRP at 1555 MHz. Furthermore, the simulated GPS scenario used was comprised of strong signals and a stationary DUT (device under test) (no dynamics, fading, etc.).

LightSquared Transmitter Setup

Table 1 shows the constraints that were used to replicate LightSquared's transmissions in the MSS band. These were based on information that LightSquared provided to the USGPSIC on December 17, 2010. Once again, it is important to note that the upper band edge used for this experiment is only 1555 MHz, not 1559 MHz, which is the upper band edge of L Band 1 and would represent the worst case interference scenario.

TX Power (P_{TX})	62 dBm
Center Frequency	1552.5 MHz
Modulation	QPSK
Bandwidth	5 MHz
Transmit Antenna Gain (G_{AT})	0 dBi

Table 1: LightSquared Transmitter Specifications

In order to calculate the power incident upon one of the millions of deployed GPS navigation devices in the field at a given distance from the transmit tower, standard link budget and path loss equations for free space propagation were used. The power incident on the DUT (P_{DUT}) is equal to the transmit power (P_{TX}) plus the transmit antenna gain (G_{AT}) plus the path loss (G_{PL} , a negative quantity).

$$P_{DUT} = P_{TX} + G_{AT} + G_{PL}$$

Likewise, the free space path loss with respect to distance d and wavelength λ (in meters) is given by:

$$G_{PL} = -20 \text{Log} \left(\frac{4\pi d}{\lambda} \right)$$

The resultant P_{DUT} is shown with respect to distance in Figure 1.

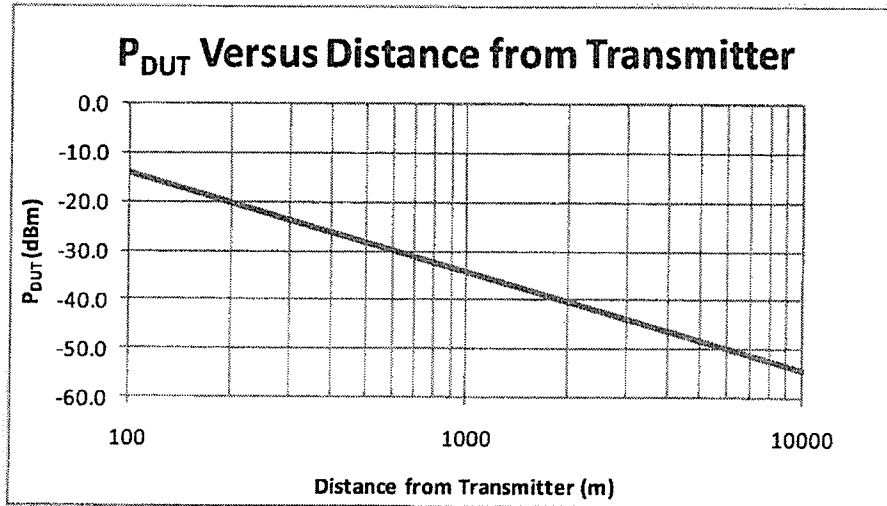


Figure 1: P_{DUT} Versus Distance from Transmitter

Experimental Setup in the Anechoic Chamber

As stated earlier, the goal of these tests was to emulate LightSquared’s transmitter in a controlled laboratory environment. Consequently, the test setup was designed to allow the DUT to experience the same power levels seen in Figure 1 while simultaneously receiving ideal simulated GPS signals. An RF shielded room / anechoic chamber was used to create a test environment free from reflections and outside interference. In addition, calibrated antennas and state of the art test equipment were used to create the best possible test with the information available to date.

LightSquared Transmitter Simulation Setup

LightSquared’s signal was simulated according to the parameters described above in Table 1 using a Rhode and Schwartz SMIQ-03S signal generator with digital modulation. This signal was then amplified with an Amplifier Research linear 5W amplifier (Model #5S1G4) to achieve the signal strengths needed to run the test. The output of the amplifier was padded by 10 dB and then run through a notch filter centered at 1575.42 MHz to reject any in-band spurious emissions from the RF signal generator. A detailed list of test equipment is available upon request. An Agilent N9020A spectrum analyzer was used to measure the output power (P_{TX}) of the LightSquared Transmitter Simulator as illustrated in Figure 2.

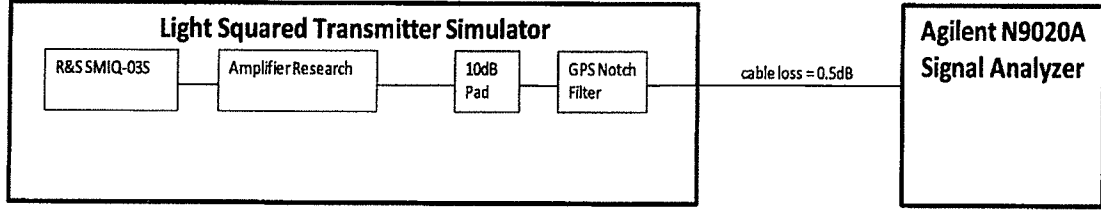


Figure 2: Transmitter Simulator Setup

Next, the output of the transmitter simulator was connected to a vertically polarized transmitting antenna located inside an RF anechoic chamber at exactly 3 meters from the DUT, as illustrated in Figure 3.

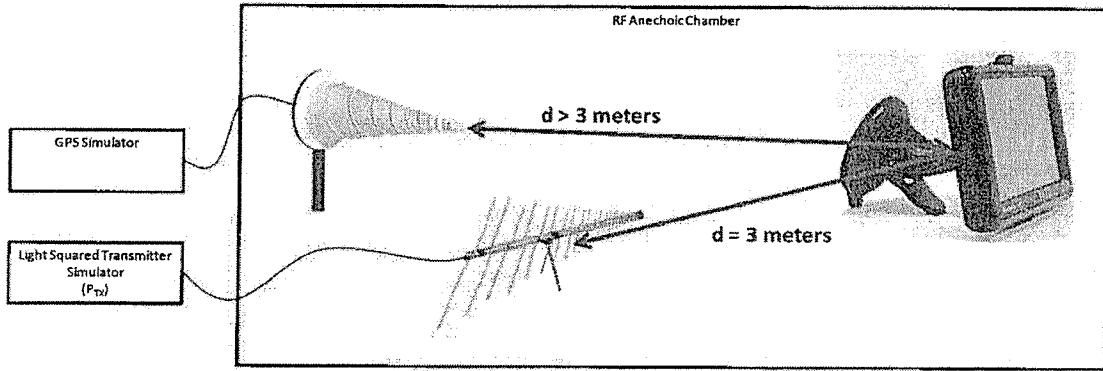


Figure 3: RF Anechoic Chamber Test Setup

Hence, the power incident upon the DUT (P_{DUT}) was controlled according to the following equation.

$$P_{DUT} = P_{TX} + G_{CABLE} + G_{AT} + G_{PL}(3m)$$

The free space path loss at 3 meters follows the path loss equation stated earlier such that $G_{PL}(3m) = -45.8dB$. Furthermore the Cable Loss (G_{CABLE}) was measured with a Network Analyzer as $G_{CABLE} = -2.56dB$ at 1552.5 MHz. Finally, the vertically polarized test antenna had a gain of $G_{AT} = 6.8dBi$ at 1550 MHz. These numbers were used to calculate the power incident upon the DUT and then a simulated path loss ($G_{PL-Simulated}$) was derived based on a LightSquared's stated transmit power of 62dBm (32dBW) and assumed antenna gain of 0dBi. This simulated path loss was then used to calculate the simulated distance from the LightSquared transmitter by the following equation.

$$d = \frac{\lambda}{4\pi} 10^{-\left(\frac{G_{PL-Simulated}}{20}\right)}$$

The test results shown henceforth throughout this document are based upon this setup. The actual jamming levels were measured during the experiment and then used to calculate the apparent distance from LightSquared's transmitter.

GPS simulation setup

The GPS signals were simulated by a Spirent GSS 6560 GPS Simulator. A stationary scenario at location N39.0000 and W95.0000 was used. The GPS constellation simulated contained 31 GPS satellites, which is the number of GPS satellites currently active. The time was set to the current wall clock time and was allowed to run freely over the duration of the test to facilitate the acquisition of GPS signals by the devices under test.

An external LNA (Mini-Circuits PN ZHL-1217HLN) was used in series with a right-hand circularly polarized (RHCP) conical antenna in an RF anechoic chamber. The output signal of the Spirent was adjusted so that each DUT reported a signal strength of approximately 40 dB-Hz C/N_0 .

This scenario is considered to be rather benign in that there is no acceleration or signal obscuration being simulated. A reported signal strength of 40 dB-Hz is considered to be a strong signal.

Units Tested

Due to the accelerated nature with which the FCC is considering LightSquared's request for modification of its ATC authorization, there was not an abundance of time with which to test. In the interest of time, Garmin selected two common units, a nüvi 265W and a GNS 430W-- one from the Consumer Automotive business segment and one from the Certified Aviation segment.

The nüvi 265W is representative of Garmin's family of PNDs (Portable Navigation Devices). Tens of millions of devices similar to the nüvi 265W have been sold in the past few years in North America. It is also representative of the technology used by other manufactures of PND's, SmartPhones, and other portable GPS units. It is designed using a state of the art antenna, preselect filter, LNA, post-LNA filter and GPS demodulator. It is a high sensitivity, multi-channel design.

The GNS 430W is one of a number of FAA-certified navigation devices produced by Garmin that utilize a common GPS/SBAS receiver designed to meet the FAA TSO-C146a and TSO-C145a minimum performance specifications documented in RTCA DO-229C. As of December 31, 2010, Garmin has produced and shipped 57,812 FAA-certified products that utilize this GPS/SBAS receiver design. These products are installed in an estimated 43,321 aircraft worldwide. Garmin estimates that 70% of these products and aircraft are in the United States.

Test Results

Nüvi 265W Jamming

Table 2 describes the effect of jamming on the nüvi 265W. "Jamming is Detected" refers to the point at which the receiver experiences 1 dB of de-sensitization. "Loss of Fix in the Urban Canyon" refers to the point at which the receiver experiences 10 dB of de-sensitization. In Garmin's judgment, this much loss of signal in a challenging urban canyon environment would typically result in a loss of GPS service. "Loss of Fix in the Open Sky" refers to the point at which the GPS receiver lost its fix completely.

Effect	Distance
Jamming is detected	3.57 miles (5756 meters)
Loss of Service in the Urban Canyon	1.79 miles (2884 meters)
Loss of Fix in the Open Sky	0.66 miles (1059 meters)

Table 2: nüvi 265W Results

GNS 430W Jamming

Table 3 describes the effect of jamming on the GNS 430W. "Jamming is Detected" refers to the point at which the receiver experiences 1 dB of de-sensitization. "10 dB Loss of Sensitivity" refers to the point at which the receiver experiences 10 dB of de-sensitization. "Loss of Fix in the Open Sky" refers to the point at which the GPS receiver lost its fix completely.

Effect	Distance
Jamming is detected	13.76 miles (22137 meters)
10 dB Loss of Sensitivity	9.85 miles (15853 meters)
Loss of Fix in Open Sky	5.60 miles (9018 meters)

Table 3: GNS 430W Results

Conclusion

As shown by the Garmin testing described in this document, the proposed LightSquared plan to add 40,000 high-powered transmitters in the band adjacent to GPS will result in widespread, severe GPS jamming. This will deny GPS service over vast areas of the United States.



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Data Shows Disastrous GPS Jamming from FCC-Approved Broadcaster

February 1, 2011

Representatives of the GPS industry presented to members of the Federal Communications Commission clear, strong laboratory evidence of interference with the GPS signal by a proposed new broadcaster on January 19 of this year. The teleconference and subsequent written results of the testing apparently did not dissuade FCC International Bureau Chief Mindel De La Torre from authorizing Lightsquared to proceed with ancillary terrestrial component operations, installing up to 40,000 high-power transmitters close to the GPS frequency, across the United States.

The document describing the testing states that the Lightsquared initiative "will have a severe impact on the GPS band" and "will create a disastrous interference problem for GPS receiver operation to the point where GPS receivers will cease to operate (complete loss of fix) when in the vicinity of these transmitters."

On January 26, the FCC waived its own rules and granted permission for the potential interferer to broadcast in the L Band 1 (1625 MHz—1559 MHz) from powerful land-based transmitters. This band lies adjacent to the GPS band (1559—1610 MHz) where GPS and other satellite-based radio navigation systems operate.

The company, Lightsquared, has stated that it will work with the GPS industry to see which GPS equipment needs "filtering so that they don't look into our band." The FCC wants to start the testing process on February 25 and have it completed by June 15, 2011. "It's a fast process," noted Lightsquared executive vice president for regulatory affairs and public policy Jeff Carlisle.

Prior to the decision, representatives of the U.S. GPS Industry Council and two prominent GPS manufacturers, Garmin and Trimble, presented a report, "Experimental Evidence of Wide Area GPS Jamming That Will Result from LightSquared's Proposal to Convert Portions of L Band 1 to High Power Terrestrial Broadband," to five members of the FCC's Office of Engineering and Technology, including its chief, two members of the FCC International Bureau, one from the Public Safety and Homeland Security Bureau, and two from the Wireless Telecommunications Bureau.

Click on the following link for a full PDF of the [Experimental Evidence of Wide Area GPS Jamming](#).

The document conveys results of testing on a common portable consumer automotive navigation device and on a common general aviation receiver. The consumer GPS device began to be jammed at a power level representing a distance of 3.6 miles (5.8 kilometers) from the simulated LightSquared transmitter. The consumer device lost a fix at 0.66 miles (1.1 kilometers) from the transmitter.

Effect	Distance
Jamming is detected	3.57 miles (5756 meters)
Loss of Service in the Urban Canyon	1.79 miles (2884 meters)
Loss of Fix in the Open Sky	0.66 miles (1059 meters)

Table 2: nūvi 265W Results

The Federal Aviation Administration (FAA)-certified aviation receiver began to be jammed at a distance of 13.8 miles (22.1 kilometers) and experienced total loss of fix at 5.6 miles (9.0 kilometers) from the transmitter.

Effect	Distance
Jamming is detected	13.76 miles (22137 meters)
10 dB Loss of Sensitivity	9.85 miles (15853 meters)
Loss of Fix in Open Sky	5.60 miles (9018 meters)

Table 3: GNS 430W Results

During the laboratory testing, GPS signals were simulated by a Spirent GSS 6560 GPS simulator, representing a constellation of 31 GPS satellites, the current configuration. LightSquared's signal was simulated using a Rhode and Schwartz SMIQ-035 signal generator with digital modulation, amplified to achieve the relevant signal strengths. Full technical specifications and parameters are described in the Experimental Evidence document linked above.

The industry report concludes: "As shown by the Garmin testing described in this document, the proposed LightSquared plan to add 40,000 high-powered transmitters in the band adjacent to GPS will result in widespread, severe GPS jamming. This will deny GPS service over vast areas of the United States."

In its subsequent decision document on January 26, the FCC not only authorized LightSquared to proceed, it turned up its nose at assertions that the entire process had been conducted in near-stealth mode as well as on an accelerated track. Lightsquared filed its petition to the FCC just prior to the U.S. Thanksgiving holiday and much of the process transpired during the run-up to winter holidays. "We conclude that the pleading cycle for LightSquared's request — in which the Comment Public Notice was issued on November 19, 2010, with comments due on December 2, 2010, and reply comments due on December 9, 2010 — is sufficient for the decisions we make herein."

In a passage far down the FCC decision document that specifically addresses GPS, the Commission states:

"GPS AND OTHER INTERFERENCE CONCERNS

A. GPS-Related Interference Concerns

39. Several commenters raise concerns about potential interference to GPS receivers and other devices that may result from operation of LightSquared's base stations, while LightSquared asserts that it continues to meet its obligations with regard to addressing interference concerns. NTIA also expresses concern that LightSquared's services could adversely impact GPS and other GNSS receivers, and asks that the Commission address these interference issues before interference occurs. We emphasize that any potential interference to GPS is a significant concern, and note that the Spectrum Task Force at the Commission recently established an internal technical working group dedicated to examining this issue. 40 The U.S. GPS Industry Council

proposes that NTIA, working with industry and government technical experts, examine the potential for interference within a reasonable time frame, not to exceed 90 days. In its letter, NTIA states that, if the Commission grants LightSquared's request, the Commission should establish a process that will ensure the interference issues are resolved prior to LightSquared's offering service that could cause interference, and that will motivate all parties to move expeditiously and in good faith to resolve the issues. NTIA further states that it stands ready to work with the Commission, LightSquared, and affected parties and concerned Federal agencies to address these interference concerns. More recently, LightSquared states that it takes the concerns raised by the GPS community about possible overload of GPS devices by LightSquared's base stations very seriously, and that it is appropriate for interested parties to devote resources to a solution as soon as possible.

LightSquared professes confidence that the issues can be resolved without delaying deployment of its network. At the same time, in order to address the concerns raised, LightSquared states that it would accept, as a condition of the grant of its request, the creation of a process to address interference concerns regarding GPS and, further, that this process must be completed to the Commission's satisfaction before LightSquared commences offering commercial service, pursuant to the approval of its request, on its L-Band MSS frequencies. Further, LightSquared commits to working diligently and cooperatively with the Commission, NTIA and the Federal agencies, and the GPS community to help resolve the interference issues through a rigorous process that can address these issues in a comprehensive manner.







41. We agree on the need to address the potential interference concerns regarding GPS as LightSquared moves forward with plans to deploy and commence commercial operations on its network. Further, we believe that establishing a working group that brings LightSquared and the GPS community together to address these interference issues expeditiously would serve the public interest. We envision a working group in which cooperative and candid discussions can ensue, and where information, including proprietary information, can be shared among the participants with appropriate measures in place to protect the confidentiality of that information. Commission staff will work with NTIA, LightSquared, and the GPS community, including appropriate Federal agencies, to establish a working group to fully study the potential for overload interference to GPS devices and to identify any measures necessary to prevent harmful interference to GPS. As a condition of granting this waiver, the process described below addressing the interference concerns regarding GPS must be completed to the Commission's satisfaction before LightSquared commences offering commercial service pursuant to this waiver on its L-band MSS frequencies.

42. As an additional condition of granting this waiver, we require LightSquared to help organize and fully participate in the working group described above. The working group shall focus on analyzing a variety of types of GPS devices for their susceptibility to overload interference from LightSquared's terrestrial network of base stations, identifying near-term technical and operational measures that can be implemented to reduce the risk of overload interference to GPS devices, and providing recommendations on steps that can be taken going forward to permit broadband wireless services to be provided in the L-Band MSS frequencies and coexist with GPS devices. Because the GPS interference concerns stem from LightSquared's transmissions in its authorized spectrum rather than transmissions in the GPS band, the Commission expects full participation by the GPS industry in the working group and expects the GPS industry to work expeditiously and in good faith with LightSquared to ameliorate the interference concerns.

43. Further, we require that LightSquared submit an initial report to the FCC and NTIA by February 25, 2011, that includes a work plan outlining key milestones for the overall analyses. In addition, LightSquared must submit progress reports on the 15th day of each succeeding month or first business day thereafter. The first of these reports must at a minimum include base station transmitter characteristics, categories of GPS devices and their representative performance characteristics, and test plans and procedures. LightSquared is further required to submit a final report no later than June 15, 2011, that includes the working group's analyses of the potential for overload interference to GPS devices from LightSquared's terrestrial network of base stations, technical and operational steps to avoid such interference, and specific recommendations going forward to mitigate potential interference to GPS devices. The Bureau reserves the right to adjust the reporting dates and requirements in consultation with NTIA. The process will be complete once the Commission, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete.

[The full PDF of the FCC decision is available here.](#)

For further background on this story, see [GPS Community Urged to Contact Congress Regarding FCC Proposal](#).

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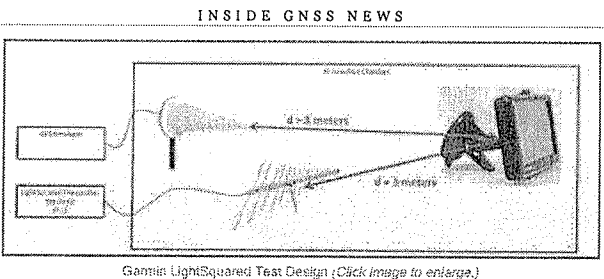
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Gainix LightSquared Test Design (Click image to enlarge.)

GNSS Community Feels New Telecom Interference Threat from LightSquared

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In his State of the Union address on January 25, President Obama held up the Global Positioning System as a prime example of government providing "cutting-edge scientists and inventors with the support that they need" to create world-leading, job-creating innovation.

The following day, the Federal Communications Commission (FCC) unanimously approved a conditional waiver allowing LightSquared Subsidiary LLC to build tens of thousands of terrestrial transmitters for wireless communications in frequencies on either side of the GPS L1 band. Reportedly, the transmitters are authorized to operate at 42 dBW (15 kilowatts) of power.

In a response similar to that of the ultrawideband controversy nearly 10 years ago, the GNSS community has expressed dire concern that, if implemented, the Lightsquared initiative could cause serious problems for millions of users in the United States.

Letters to the FCC calling for a more substantive technical evaluation before allowing LightSquared to proceed came from the U.S. GPS Industry Council (USGIC) and the National Telecommunication & Information Administration (NTIA), a U.S. Department of Commerce agency that serves as the President's principal adviser on telecommunications and information policy.

The Air Force has asked the Aerospace Corporation, a federally funded research and development organization that works closely with the GPS Directorate, to assess whether the LightSquared plan would create problems for GPS receivers.

A December 23 USGIC issue paper characterized the LightSquared proposal as "a radical change in the spectrum environment for GPS" that "has the strong potential to cause interference. . . ."

In a January 16 report, GARMIN International described a recent test evaluating the effects of proposed LightSquared broadcasts on two of its most popular receivers: a GNS 430W FAA-certified general aviation receiver and a nüvi 265W portable navigation device. Both lost open-sky positioning capability at a distance 5.6 to 0.66 miles, respectively.

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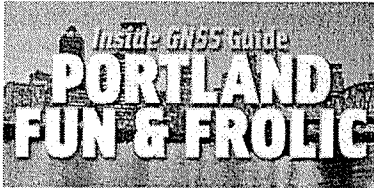
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The company's conclusion: "If this [FCC-LightSquared] modification is approved, widespread, severe GPS jamming will occur."

Technically, the FCC action grants LightSquared a waiver to its ancillary terrestrial component (ATC) "integrated service" rule, which requires mobile satellite services (MSS) that have a ground transmission infrastructure to provide only combined satellite/terrestrial user equipment.

According to the FCC order, "Although LightSquared does not, itself, intend to offer ATC-only subscriptions to its wholesale customers, it contemplates that its customers may well offer ATC-only subscriptions to consumers."

In effect, LightSquared's application "proposes to fundamentally change the usage of the L Band 1 spectrum (1525 MHz-1559 Mhz) from MSS (very low power, space to earth signals) to fixed, high power terrestrial broadband service," Garmin argued.

LightSquared is working to gain access to 20 megahertz or more of L-band spectrum allocation, including a \$ 337.5 million purchase from Inmarsat. With that resource, it would offer the first-ever wholesale nationwide 4G-LTE wireless broadband network integrated with satellite coverage for its customers to offer terrestrial-only, satellite-only, or integrated satellite-terrestrial services to end users.

The FCC ruling does acknowledge "the need to address the potential interference concerns regarding GPS," and requires "As a condition of granting this waiver, the [interference review] process . . . must be completed to the Commission's satisfaction before LightSquared commences offering commercial service pursuant to this waiver on its L-band MSS frequencies."

However, the ruling also requires LightSquared to begin implementing its system and assuring the availability of user equipment within a matter of months. Moreover, concern exists among that the solution to any interference problem could be placed on the backs of GNSS receiver manufacturers who would need to incorporate expensive design changes in user equipment.

LightSquared told the FCC that it is investing more than \$50 million to underwrite the costs of developing a Qualcomm dual-mode chipset, related components, and an associated satellite ground station infrastructure.

In a January 21 filing with the FCC, Qualcomm, a large-scale manufacturer of integrated GPS and wireless communications chips, described how it has protected its assisted-GPS (AGPS) solution against self-interference from the phone's cellular uplink transmitter at 1710 MHz, 135 megahertz away from the GPS L1 band. The company admitted that it didn't know if the receiver filter it used to prevent the uplink interference would also serve for an L-band downlink.

"Qualcomm is now in the process of evaluating the extent of interference from LightSquared L Band LTE base stations (i.e., downlink) into the GPS receivers of cell phones using Qualcomm's AGPS solution, particularly legacy phones already in the market today, given the close proximity of the L and GPS L1 bands," wrote Dean R. Brenner, Qualcomm's vice-president for government affairs.

Moving Quickly

Backed by billions of dollars from principal investor Harbinger Capital Partners, LightSquared — which was only formed last July — is on the fast track to implementing its MSS system.

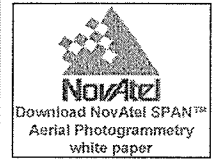
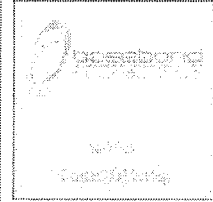
The company has assembled a cast of luminaries from the wireless telecom community, including Chairman and CEO Sanjiv Ahuja, former CEO of UK wireless giant, Orange; Chief Marketing Officer, Frank Boulben, former global director of commercial strategy for the Vodafone Group; and Chief Network Officer Douglas Smith, who left a position as senior vice-president, engineering and operations, for Clearwire, a nationwide mobile broadband WiMAX network with majority ownership by Sprint.

In September 2010, LightSquared disclosed an eight-year, \$7-billion agreement for Nokia Siemens Networks to deploy, install, operate and maintain the LightSquared nationwide network.

The company's effort is aided by Goldberg Godles Wiener & Wright, a Washington, D.C.-based telecommunications law firm whose senior policy advisor is Thomas Tycz, who joined the firm in 2005 from his position as head of the FCC International Bureau's Satellite Division.

Tycz's experience at the FCC presumably would have aided LightSquared in moving its waiver request — which coincided with the busy Thanksgiving/Christmas holiday season — quickly through the agency's procedural channels.

Ironically, given Obama's State of the Union shout-out for GPS, the LightSquared situation is driven in part by the president's own initiative, Unleashing the Wireless Broadband Revolution, issued in June 2010. In it, Obama committed to make available 500 megahertz of Federal and nonfederal spectrum over the next 10 years.



The Garmin Tests

The rapid emergence and evolution of the LightSquared initiative clearly caught the GNSS community off guard, and the accelerated FCC process has allowed little time for a technical evaluation of its side effects before the fact.

Consequently, the Garmin testing effort provides a key data point — especially considering that Garmin claims to have provided more than 90 percent of the current general aviation GPS receivers and 50 percent of the automotive and handheld equipment now operating in the United States.

Using a Spirent GSS6560 GPS simulator, a Rohde & Schwartz SMIQ-03S signal generator, and an Agilent N9020A spectrum analyzer to measure output power of the simulated LightSquared transmitter, Garmin engineers set up a test scenario with the receivers in an RF shielded, anechoic chamber to measure the likely real-world effects of the LightSquared terrestrial network.

In their report, the Garmin engineers said they took care “to err in LightSquared’s favor whenever assumptions were made about its transmissions.” For example, although an FCC order allows a transmitter antenna to emit 42 dBW EIRP (effective isotropic radiated power) up to the 1559 MHz band bordering GPS L1, the test setup used a LightSquared “verbal guidance” that they would not transmit in excess of 32 dBW EIRP at 1555 megahertz.

The simulated scenario also assumed GPS satellite signals (40 db-Hz carrier/noise ratio) and a stationary receiver, which would eliminate dynamic effects, fading, and so forth.

Under these conditions, the nüvi receiver detected simulated LightSquared jamming at 3.57 miles and would have lost service in an urban canyon environment if the transmitter was 1.79 miles away or closer, according to Garmin.

For the aviation receiver, effects were even more marked: it detected the jamming at 13.76 miles and experienced a 10-decibel loss of sensitivity at 9.85 miles.

FCC Conditions

With its conditional waiver for LightSquared, the FCC is ostensibly taking its responsibility seriously to ensure non-interference with existing services.

Agency staff will be directed to “work with NTIA, LightSquared, and the GPS community, including appropriate Federal agencies, to establish a working group to fully study the potential for overload interference to GPS devices and to identify any measures necessary to prevent harmful interference to GPS.”

In fact, the Institute of Navigation, which has long hosted the leading GNSS conferences, wrote to the agency on January 26, offering to help identify “technical experts who might best assist the FCC in evaluating risks and impacts of LightSquared’s proposal.”

However, the phrasing in the conditions set by the FCC seems to suggest an assumption that LightSquared will be accommodated, directing that the working group provide “recommendations on steps that can be taken going forward to permit broadband wireless services to be provided in the L-Band MSS frequencies and coexist with GPS devices.”

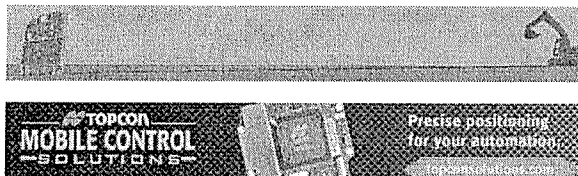
Moreover, the burden of proof appears to rest on the GPS community.

“Because the GPS interference concerns stem from LightSquared’s transmissions in its authorized spectrum rather than transmissions in the GPS band,” the FCC order reads, “the Commission expects full participation by the GPS industry in the working group and expects the GPS industry to work expeditiously and in good faith with LightSquared to ameliorate the interference concerns.”

In addition, LightSquared is charged with preparing the information for the agency; no other organization or group

And the compressed timeline for dealing with the issue continues: An initial report and workplan by February 25 and a final report by June 15, 2011, “that includes the working group’s analyses of the potential for overload interference to GPS devices from LightSquared’s terrestrial network of base stations, technical and operational steps to avoid such interference, and specific recommendations going forward to mitigate potential interference to GPS devices.”

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