IB Docket 11-109

United States
GPS Industry Council

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OCT - 5 2011

Federal Communications Commission
Office of the Secretary

August 18, 2011

By Electronic Posting

Mr. Julius Knapp
Chief
Office of Engineering and Technology
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: Request for Additional Information in IB Docket No. 11-109 and File No. SAT-MOD-20101118-00239

Dear Mr. Knapp:

I am writing to inform you that the August 10, 2011 request you made for additional information pertaining to the above-referenced proceedings was jointly provided to all participants (members and advisors) in the Technical Working Group ("TWG") by the U.S. GPS Industry Council ("USGIC") and LightSquared Subsidiary LLC ("LightSquared"). *See* Letter dated August 10, 2011, from J. Knapp, Chief, OET, FCC to C. Trimble and J. Carlisle, Co-Chairs of the Working Group Assessing the Potential for Harmful Interference from LightSquared Terrestrial Mobile Broadband Operations in the 1525-1559 MHz and 1626.5-1660 MHz Bands to Global Positioning System ("GPS") Receivers and GPS-Dependent Devices ("August 10 Letter"). The details follow.

By a joint email message to all TWG participants that was sent on August 12, the USGIC and LightSquared: (i) provided a copy of your August 10 letter; (ii) apprised entities that provided GPS or GPS-assisted receivers or devices to the TWG study effort that the Commission is requesting additional information from them by specified dates; (iii) suggested that further responses on the GPS elements of your request should flow directly from the responding entities to the Commission; and (iv) encouraged anyone with questions on the information request to direct those questions to the contact persons identified in the August 10 Letter. A copy of the August 12 joint email message (with addressees omitted) is included in the Attachment to this letter.

By a follow-up joint email on August 16, 2011, the USGIC and LightSquared informed all TWG participants that LightSquared had, on August 15, 2011, filed the device code key you sought under the cover of a request for confidential treatment. The email specifically reminded recipients that your August 10 Letter asked for information

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on any external antennas that were used with devices during the testing process (manufacturer and model number), and that participants in the TWG who provided receivers and devices to the test process should include this information on any external antennas with any other device information they provide to the FCC pursuant to your request.

The June 30 Final Report contains the full list of participants in the TWG studies and the identities of GPS receivers and GPS-assisted devices that were included in the testing program. Should you have any need for additional information on particular tested devices, please do not hesitate to contact the provider or providers directly. The USGIC will be glad to answer any other questions you may have and facilitate the gathering of any other information you may require.

Copies of this letter are provided for the record of the above-referenced proceedings.

Respectfully yours,

F. Michael Swiek
Executive Director

Encl.
cc (w/encl.): Ron Repasi, Deputy Chief, OET (by email)

ATTACHMENT

Sent: Friday, August 12, 2011 3:45 PM

TO: Participants in the GPS Working Group

FROM: Jeff Carlisle and Charlie Trimble

RE: Information Request from the FCC

As you may be aware, the FCC's Office of Engineering and Technology (OET) has recently issued a request for additional information with due dates as it continues to review the final report of the GPS Working Group. A copy of the letter is attached to this email for your reference.

If you or your organization provided GPS or GPS-assisted receivers or devices to this study effort, the FCC is seeking additional information from you. Any response should be made directly to the FCC.

LightSquared will be providing the requested information under the "Device Code Key" section. Consistent with the agreement among the TWG members, this information will be identified as confidential and provided to the FCC under a request for confidential treatment.

As you review OET's letter for the details of the FCC's information request, please direct any questions to the contact information provided by the FCC in the attached letter.

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Federal Communications Commission
Washington, D.C. 20554

August 10, 2011

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Mr. Jeffrey Carlisle, Executive Vice President
for Regulatory Affairs and Public Policy
LightSquared Subsidiary LLC
10802 Parkridge Boulevard
Reston, Virginia 20191

Mr. Charles R. Trimble, Chairman
U.S. GPS Industry Council
c/o Raul R. Rodriguez, Esq.
Lerman Senter PLLC
2000 K Street, N.W., Suite 600
Washington, DC 20006

Re: Request for additional information

Gentlemen,

The Commission's staff has been reviewing the June 30, 2011, Final Report of the Working Group that was formed to study the GPS overload/desensitization issue described in our Order and Authorization of SAT-MOD-20101118-00239.[1]

To better evaluate receiver performance, we seek some additional information, as described below. Certain information may be kept confidential pursuant to Section 0.459 of our rules upon your appropriate request for such treatment. We note that the Commission may disclose such confidential information to other federal agencies under the procedures set forth in Section 0.442 of our rules. We seek the following additional information:

Device Code Key. As discussed in Section 2.6 of the Working Group Report, the results of the testing were made anonymous via a mechanism that assigned numbers randomly to GPS receivers in each class. In order to help determine the characteristics of those receivers most- and least-affected by interference, we wish to identify the receivers associated with each measurement and therefore request the "device code key," which provides that cross-reference. If an external antenna was used, please also provide the manufacturer and model number of the antenna.

Production/sales information. It is unclear to what extent the GPS receivers and devices tested are current production models, into what market segments those receivers and devices are most commonly sold, what fraction of a given market segment those devices represent, and their design lifetimes and typical owner-use lifetimes. This information is important in assessing the likely impact, if any, of interference on various use cases over time. We therefore request production and U.S. sales information for each of the devices tested, including (1) the dates of

[1] DA 11-133, "In the Matter of LightSquared Subsidiary LLC, Request for Modification of its Authority for an Ancillary Terrestrial Component," Adopted and Released January 26, 2011.

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production, (2) the market segment(s) to which the device is targeted or sold, (3) total annual sales volume and annual sales volume by market segment or estimates thereof, (4) the date on which full support of the device by the manufacturer ceased (or will cease), (5) estimated time period after which the device owner would likely replace or discontinue use of the device.

Technical performance data. It is unclear which technical specifications may be limiting the interference susceptibility of the GPS receivers and devices of various classes. The frequency response of the first stage of the device often limits its ability to reject energy from emissions outside the band of interest. We therefore request data showing the frequency response of the RF front-end (including the antenna system, if commonly integrated or associated with the receiver or device) to input signals over a frequency range of at least 1,100 to 2,000 MHz, low noise amplifier gain and the low noise amplifier 1 dB gain compression point. This information should be provided for each receiver or device tested.

Base Station deployment plan. LightSquared's current plan for base station deployment envisions use only of the lower 10 MHz segment of the downlink band. Because that amount of spectrum is more limited than initially submitted to the Working Group for study, we request an updated plan for base station deployment.

The Commission's staff will continue to work with LightSquared and the GPS community to fully study the potential for overload interference to GPS devices and to identify any measures necessary to prevent harmful interference to GPS. A full understanding of the technical performance of receivers and devices as well as of the user segment is important to this effort and we appreciate the cooperation of LightSquared and the GPS industry in supporting our review of the compatibility of the two services.

To further assess the interference susceptibility of the various categories of GPS receivers and devices, we ask that you provide the device code key on or before August 15, 2011. We recognize that the remaining information may take more time to assemble. We therefore request that you submit the production/sales information, technical performance data, and base station deployment plan on or before August 22, 2011. Should you have any questions concerning this request, please do not hesitate to contact me or Ron Repasi, Deputy Chief of OET.

Sincerely,

Julius P. Knapp
Chief
Office of Engineering and Technology

cc: Henry Goldberg, Esq.
Counsel for LightSquared Subsidiary, LLC
Goldberg, Godles, Wiener & Wright
1229 19th Street, N.W.
Washington, DC 20036

IB Docket
11-109

Nicholas B. Vedder, M.D.
7580 SE 71st Street
Mercer Island, Washington 98040

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Federal Communications Commission
Office of the Secretary

October 1, 2011

Federal Communications Commission
Washington, D.C.

Re: FCC File #SAT-MOD-20101118-00239

To Whom It May Concern:

I was appalled to learn that the FCC recently granted a license to LightSquared that will potentially seriously disrupt the normal, safe operation of GPS systems. As an owner and skipper of a 52 ft. sailboat in the Pacific Northwest, I rely on the constant availability of accurate GPS positioning for the safety of my family, my crew, and myself. It is inconceivable to me that the FCC would even consider jeopardizing this critical navigation system through such an action.

The FCC must make clear, and the NTIA must ensure, that LightSquared's license modification is contingent on the outcome of the mandated study unequivocally demonstrating that there is no interference to GPS. The study must be comprehensive, objective, and based on correct assumptions about existing GPS uses rather than theoretical possibilities. Given the substantial pre-existing investment in GPS systems and infrastructure, and the critical nature of GPS applications, the results of studies must conclusively demonstrate that there is no risk of interference. If there is conflicting evidence, doubts must be resolved against the LightSquared terrestrial system. The views of LightSquared, as an interested party, are entitled to no special weight in this process.

The FCC should make clear that LightSquared and its investors are proceeding at their own risk in advance of the FCC's assessment of the working group's analysis. While this is the FCC's established policy, the Commission's International Bureau failed to make this explicit in its order.

Resolution of interference has to be the obligation of LightSquared, not the extensive GPS user community of millions of citizens. LightSquared must bear the costs of preventing interference emanating from their devices, and if there is no way to prevent interference, it should not be permitted to operate. GPS users or providers should not have to bear any of the consequences of LightSquared's actions.

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This is a matter of critical national interest. You must take immediate action to undo and reverse the reckless approach that you have taken in this matter.

Sincerely,

Nicholas B. Vedder

Nicholas B. Vedder, M.D.

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OCT - 5 2011

Federal Communications Commission
Office of the Secretary

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

September 28, 2011

Re: Notice of Ex Parte Presentation in LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, IB Docket No. 11-109
IBFS File No. SATMOD2010111800239

Dear Ms. Dortch:

On September 28, 2011, at the request of Michael Ha, Hemisphere GPS attended a teleconference with the following personnel from the FCC:

Michael Ha, Office of Engineering and Technology (OET)
Ron Repasi, OET
Chip Fleming, International Bureau (IB)
Sankar Persaud, IB

From Hemisphere GPS the following personnel attended the call:

Bradley P. Badke PhD, Senior Principal Systems Engineer

Hemisphere GPS designs and manufactures innovative, cost-effective GNSS (GPS, Glonass, Galileo, etc) and complimentary products for positioning, guidance, machine control and agriculture applications. In the last 20 years, we have established numerous patents and other intellectual property. Hemisphere GPS is a global company with sales in more than 35 countries.

The purpose of this teleconference was to discuss the performance of two Hemisphere GNSS receivers in the presence of LightSquared interference at the Pax River Naval Air Station indoor anechoic chamber (also known as the NAVAIR FARM). In particular we discussed the performance of a wideband multi-frequency GPS/Glonass/OmniStar receiver (code name H09956) and a wide bandwidth GPS L1 only (single frequency) receiver (code name H13565). The H13565 was less degraded by the LightSquared signals than the H09956 receiver but it was not immune to LightSquared interference. The reason the H13565 performed better than the H09956 is that it is not as wide-band as the H09956. The testing at NAVAIR covered several signal configurations. They are listed below in order from most degradation to least degradation.

1. 10L+10H (most degradation of L1 GPS)
2. 10H
3. 5L+5H
4. 5H
5. 10L
6. 5L
7. HS (handset) (least degradation of L1 GPS)

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Further, we discussed the fact that Glonass was not tested nor were any of the new wider band GPS, Galileo and Compass signals that would possibly be more degraded than GPS L1.

Hemisphere also discussed the fact that it is important that the FCC not allow a creeping specification for the LightSquared signal. GNSS manufacturers need to have a solid specification before designing any new GNSS receivers for the LightSquared interference environment.

Hemisphere also discussed the fact that many of the precision receivers in question have wideband antennas and an initial wideband filtering stage prior to the first LNA to accommodate what are known as the L-Band signals (OmniStar, for example). This wideband signal then goes through a diplexer or power divider and passes through further filtering at both RF and IF frequencies to select the desired signal of interest (GPS L1, GPS L2, GPS L5, OmniStar, Glonass L1, Glonass L2, Galileo, etc.). This refutes the statement seen in the popular press that GPS manufacturers do not use filtering in their receivers.

Hemisphere's unofficial participation in the Live Air testing in Las Vegas, Nevada was also discussed. Hemisphere tested several more receivers for one night only at the location known as the "rural sight". The "rural sight" was the cell tower located closest to Boulder City, Nevada. The night of Hemisphere's participation in this test, unfortunately, was one of the nights that the LightSquared signal was 3dB low. The Las Vegas, Nevada tests only tested the 5H+5L configuration. The performance of the Hemisphere receivers was about as expected, including the performance of two medium bandwidth GSP L1 only receivers that were designed for a high interference marine environment. These receivers, while not completely immune to the LightSquared interference, were much more jam resistant than wideband multi-frequency GNSS receivers. These receivers had degraded C/N0 while close (<200 meters) to the tower but were never completely jammed so that they would not track GPS L1 signals. The wider band muti-frequency GNSS/OmniStar receivers were completely jammed at various ranges from the LightSquared cell tower.

Sincerely,

Bradley P. Badke PhD
Senior Principal Systems Engineer
Scottsdale, AZ
8444 N. 90th Street, Suite 130
Scottsdale, AZ, USA 85258
Phone: (480) 348-6323

Other Hemisphere GPS Office Locations:

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Calgary, Alberta, Canada T2G 3C4
Phone: (403) 259-3311

Hiawatha, KS (Ground Agriculture Group)
2207 Iowa Street
Hiawatha, KS, USA 66434
Phone: (785) 742-2976

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OCT - 5 2011
Federal Communications Commission
Office of the Secretary

September 28, 2011

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

Re: Notice of *Ex Parte* Presentation in LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component, IB Docket No. 11-109; IBFS File No. SAT-MOD-20101118-00239

Dear Ms. Dortch:

On September 26, 2011, at the request of Michael Ha, I attended a teleconference with the following personnel from the Federal Communications Commission ("FCC"):

Michael Ha (OET)
Walter Johnston (OET)
Ron Repasi (OET)
Brian Butler (OET)
Brett Greenwalt (OET)
Chip Fleming (IB)
Sankar Persaud (IB)

During the teleconference, I provided certain technical information in response to questions from the FCC staff regarding the performance of global positioning satellite ("GPS") chipsets manufactured by CSR Technology, Inc. ("CSR") and the specific GPS chipset markets that CSR serves.

Sincerely,

/s/ Greg Turetzky

Greg Turetzky
Senior Director, Strategic Marketing

cc: Michael Ha
Walter Johnston
Ron Repasi
Sankar Persaud
Brian Butler
Brett Greenwalt
Chip Fleming

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

Re: IBFS File No. SATMOD2010111800239

Dear Ms. Dortch:

On September 2nd, 2011, at the request of Michael Ha, I met with Bob Weller, Ron Repasi, Chip Fleming, and Michael Ha of the FCC by phone to provide information about GPS simulation and test methodology utilized during the test effort leading up to the FCC LightSquared Technical Working Group (TWG) final report[1]. Brock Butler and John Pottle, also from Spirent, joined the meeting with me.

Spirent is the leading supplier of test and measurement equipment to the GPS and mobile device location technology industry. Spirent offers GPS simulators, GPS record and playback devices, and A-GPS automated test systems, many of which were used during the FCC LightSquared TWG test campaign to provide an accurate and repeatable test environment for assessing the impact of LightSquared L-Band interference. In the High Precision and Cellular working groups, Spirent was contracted by LightSquared to provide customized test automation of the working group test plans. I also served as an advisor to the Cellular working group.

The purpose of this meeting was to provide the FCC with specifics of the GPS simulation and test methodology used during the Cellular, High Precision, and General Navigation working group testing, with the intention of making the results more meaningful.

Three types of Spirent GPS simulators were used during the FCC LightSquared TWG test campaign:

- GSS6700, GSS6560, GSS5060[2] – These three instruments are functionally equivalent for the purposes of this testing. All offer GPS L1 C/A-code 12-channel simulation. Spirent SimGEN software is used to create test scenarios which can be standards-based or generated in real time to mimic real world characteristics.
- GSS7790 – This is a high-end GPS simulator capable of simulating GPS signals at L1 and L2, and it used for testing high precision and military grade receivers. The GSS7790 has combined output and multi-output modes. In single output mode, it shares many characteristics with Spirent's current high-end offering for GNSS simulation, the GSS8000[3].
- GSS6400[4] – This instrument uses a GPS antenna to sample RF signals in the live environment, storing them to a hard drive, and allowing them to be replayed in a laboratory environment. This instrument uses a 2MHz bandwidth to capture signals. All RF signals in this band will be captured and replayed.

These simulators were used in both radiated and conducted environments:

[1] Federal Communications Commission, LightSquared Technical Working Group final report, Washington, D.C., June 30, 2011
[2] GSS6700 Information on Spirent Web Site: http://www.spirent.com/Solutions-Directory/GSS6700
[3] GSS8000 Information on Spirent Web Site: http://www.spirent.com/Solutions-Directory/GSS8000
[4] GSS6400 Information on Spirent Web Site: http://www.spirent.com/Solutions-Directory/GSS6400

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- Radiated – The Cellular, General Navigation, and High Precision working groups utilized anechoic chambers to provide a controlled RF environment for GPS, interference, and augmentation signals to be transmitted over-the-air.
- Conducted – The Cellular working group also tested some devices with RF signals fed directly into devices through coaxial cable and RF connectors, bypassing the GPS antenna and associated circuitry.

Cellular working group overview: Spirent helped the Cellular working group create a test plan and perform tests that were based on industry standards, while also adapting them as needed to provide meaningful results in a realistic timeframe. Spirent's GSS6700, GSS6560, and GSS5060—all equivalent GPS Simulators—were used for the testing. These instruments were part of Spirent's LTS[5] and PLTS[6] automated test systems for UMTS and CDMA A-GPS, respectively. The UMTS device tests were based off of the 3GPP 34.171 A-GPS tests and the CDMA device tests were based off of TIA-916 A-GPS tests. UMTS devices were predominantly tested radiated because most were missing RF connectors. CDMA devices were predominantly tested conducted because all were provided with appropriate RF connectors and cables. To make sure the results were analogous, the UMTS device testing included a procedure for calibrating the GPS antenna loss. This calibration factor was derived by presenting devices with a range of known signals and evaluating the measured GPS C/No. Each device had a unique calibration factor that was accounted for in the test automation software. This allows the results from conducted and radiated testing to be comparable.

Why are satellite signal power levels so much lower in cellular working group when compared to other working groups? Cellular devices are made to work in difficult environments like urban canyons and indoors and they benefit from assistance data sent over the cellular network. The industry-standard sensitivity test specifications account for this and set the requirement for devices to work well in an environment where the satellite signal levels are 10 to 20 dB below nominal levels. A 0 dBi antenna is assumed when determining the level to be applied to the device. This may not be an easy scenario for autonomous GPS devices to operate in. As a result, the General Navigation and High Precision working groups used power levels quite a bit higher than this.

Were tests based on FCC E911 requirements? Yes, industry standards A-GPS tests for cellular devices are based on E911 requirements and are reflected in the LightSquared test plan and results.

High Precision working group overview: Spirent helped the High Precision working group by automating test execution for the multi-day test plan in which 57 devices had to be tested simultaneously. Spirent created the GPS scenario with L1 C/A code, L1 Pseudo Y code, and L2 Pseudo Y code using the GSS7790 simulator. Precautions were taken to ensure that devices did not interfere with each other. The simulation had the following characteristics

- L1 had C/A + Pseudo Y code simulated and L2 just Pseudo Y code (the AS flag in the Nav Data was set to show this)
- A typical choke ring antenna pattern was used; 0dB's loss at the zenith rising to 10dB's at 0 degrees elevation
- The elevation mask was set to 5 degrees
- Signal strength set so that the receivers reported similar levels as in real life

[5] Spirent's Location Technology System (LTS) for UMTS A-GPS: http://www.spirent.com/Solutions-Directory/8100_Location_Technology

[6] Spirent's Position Location Test System (PLTS) for CDMA A-GPS: http://www.spirent.com/Solutions-Directory/C2K-ATS/C2K_LBS

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- The number of channels being simulated varied with time as SV's rose and set in the constellation; typically 8 or 9 SV's in view. Log files were provided for a complete set of signal data.

How were 24 satellites simulated with a 12-channel simulator? A full GPS satellite constellation is setup in Spirent's SimGEN software, but only 8-9 satellites are ever visible at one time in the test set up used here. The scenario was setup to simulate latitude and longitude at NavAir facility, which is as representative a United States GPS environment as any other for the purposes of this testing.

Explanation of simulated antenna pattern: A choke ring antenna pattern was used in the simulation to vary attenuation between 0 and 10 dB, with more attenuation as satellites go closer to the horizon. This antenna pattern is simulated in the software and used to make the GPS scenario more realistic. The software was set up such that signals from satellites that are less than 5 degrees above the horizon are not transmitted. The antenna pattern of actual devices will vary from device-to-device, but this model is representative.

Why does the SV signal level vary from working group to working group? The Satellite Vehicle satellite strength differs between High Precision, General Navigation, and Cellular working group test plans. In Spirent's view this is a result of there being no accepted industry standards for GPS performance generally (cellular being a notable exception), and the variation form working group to working group illustrates this fact. Without a clear reference, different groups of industry experts will define different GPS test scenarios based on their particular application. This would appear to be what happened here.

General Navigation working group overview: Spirent did not participate in the General Navigation working group, but Spirent GSS6700 and GSS6400 GPS simulators were used for the testing. This working group defined both Static and Dynamic tests. The Static tests were executed with the GSS6700 and a basic simulated GPS scenario. The Dynamic tests were executed with the GSS6400 and a record and playback GPS scenario. The main advantage of a record and playback approach is the ability to capture and replay exact field conditions. Unlike field testing, a recorded data set can be repeatedly and precisely replayed in a laboratory. This is a test approach employed by many GPS chipset manufacturers because it is overly challenging to exactly replicate challenging and chaotic field conditions synthetically. The General Navigation working group captured several field scenarios that appear to be representative of common use cases, and all sample devices were tested against these scenarios with varying levels of a simulated LightSquared interferer. All tests were performed radiated.

Are the record and playback scenarios used representative? The record and playback approach is widely used in the industry, but the specific scenarios used are effectively proprietary to each manufacturer rather than being set in a standard. The recordings and resulting data sets used here appear to be carefully selected and executed.

Respectfully Submitted,

Ronald Borsato
Solutions Architect
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