January 26, 2012

FILED ELECTRONICALLY

Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC  20554

Re:  Ex Parte Communication of the U.S. GPS Industry Council in
File No. SAT-MOD-20101118-00239 and IB Docket No. 11-109

Dear Ms. Dortch:

The U.S. GPS Industry Council (“USGIC”) herein responds to two ex parte communications by LightSquared Subsidiary LLC (“LightSquared”) in the above-referenced proceedings dated December 7, 2011 and December 12, 2011 (“LightSquared Letters”). The LightSquared Letters sought to provide the company's views on its “power on the ground” approach in addressing GPS receiver overload/desensitization issues. In the attached document, USGIC examines the technical analyses presented in the LightSquared Letters and sets out the defects and shortcomings of this new proposal. USGIC also points out that LightSquared's “power on the ground” proposal does not take into account interference to aviation receivers and thus its impact on safety-of-life aviation systems.

As is clear from the attached analysis, LightSquared’s “power on the ground” proposal must be rejected as it would not result in diminished interference to GPS receivers, including those in safety-of-life applications.

Please contact me if you have any questions regarding the foregoing.

Respectfully submitted,

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LightSquared’s Latest Filings Do Not Address Significant Problems with Its “Power-on-the-Ground” Proposal

In its December 7th and 12th filings, LightSquared provides “further details” regarding its “power-on-the-ground” proposal. These new details do not address deficiencies in the power-on-the-ground proposal pointed out in earlier filings, and in many cases show that the power-on-the-ground proposal has gotten even more unsuitable and unworkable as a methodology for preventing harmful interference to GPS receivers.

These issues remain unaddressed by LightSquared in any power-on-the-ground filing:

- Interference to aviation receivers aloft is not addressed, and is likely to be made worse if antenna downtilt is reduced as a means of reducing power-on-the-ground.
- In Attachment A of the November 9th USGIC response to LightSquared’s October 6 ex parte, the Industry Council thoroughly discredited LightSquared’s “option 2” power-on-the-ground proposal where base station transmit power was limited solely as a function of antenna height. This option should be formally removed from consideration by LightSquared.

These issues have gotten worse:

- LightSquared is proposing to predict on-the-ground signal strength using RF propagation models that are not suitable for an interference analysis. This virtually assures that the actual peak power-on-the-ground, and the GPS interference, will be far greater than the allowable limits even before the on-the-ground sampling begins. A model such as free space line of sight or the NTIA sanctioned ITM model should be used as a basis for initial system power configuration.
- An enormous reduction in the number of power samples to be collected on-the-ground is proposed in LightSquared’s December 7th filing. Whereas before, LightSquared would have checked between 75,000 and 125,000 sample data points for a group of 15-25 towers (see LightSquared’s September 7, 2011 ex parte), under its latest filing, for the same group of towers, it is proposing to check, at most, 5,000 sample points.
- The power monitoring protocol is insufficient in that there is no assurance that the area around a tower will be sampled in a statistically significant manner. In a prior proposal, LightSquared said that power sampling would be done at distances as close as practical to the base station starting at 50 meters. In this latest proposal there is no indication of where sampling will begin. (See Garmin’s October 28th filing, paragraph 2.c.)

“Attachment A” from LightSquared’s December 7th filing is included below with technical critiques interspersed in red. Although there are portions of “Attachment A” that are not

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1 See Garmin’s September 15, 2011 and October 28th filings as well as the USGIC’s November 9th filing.
specifically addressed, the lack of comment should not be construed as an endorsement of those sections.

ATTACHMENT A

Power-on-the-Ground Implementation and Measurement

RF Design

- Industry best practices, using commercial tools, will be used for predicting on-the-ground mean signal strengths as part of the basic system design. An objective of the RF design will be to ensure that the power on the ground limit is observed at all locations in the coverage area. The RF propagation prediction tools are “tuned” to market-specific characteristics which includes [sic] morphology types (dense urban, urban, suburban and rural) as well as a database of site-specific obstacles to wave propagation.

<USGIC Comment:> If LightSquared uses the RF propagation models it has cited in previous filings, it is certain that the actual power-on-the-ground will greatly exceed the models’ predictions. This is due to the fact that these models represent average power levels rather than peak power levels which are critical in an interference analysis.

- Best practices will be updated based on experience gained in the implementation and power optimization process.

- Perfecting the design process will result in efficient network designs and will minimize the number of post-deployment power adjustments necessary to comply with its power-on-the-ground obligations.

Power Optimization

- LightSquared will perform field test measurements to validate the power on the ground and make any necessary power adjustments within 48 hours of commencement of operation of new cell sites.

<USGIC Comment:> Network compliance must be verified prior to commencement of operation. This should be accomplished using a test mode that ensures the base stations are tested at maximum power and maximum loading.

- The measurement process will involve two phases.

  - Phase-1: In the first phase, which is effectively a screening phase, drive testing will be performed with a vehicle mounted, calibrated, power-measurement apparatus described below. The drive route will cover a cluster of base stations (generally 15-25 base stations per cluster). The object is to quickly identify regions where the signal powers on the ground
attain their highest values (*i.e.*, identify the hot spots in the cluster). At least 5000 power samples will be collected in the testing of each cluster.

<USGIC Comment:> This represents an enormous reduction in the number of data points that will be sampled on a per station basis compared to LightSquared’s prior filings. Now, instead of 5,000 samples per base station which LightSquared proposed in its September 7th filing, it proposes 5000 samples for as many as 25 base stations. This is a totally inadequate number of samples, and there is still no requirement to spatially sample the area around a base station in a statistically meaningful way. Changes like this raise questions about LightSquared’s commitment to meaningfully monitor power-on-the-ground and protect GPS from harmful interference.

This change also contradicts LightSquared’s statements about measuring power-on-the-ground in its September 27th filing, where it reiterated the fact that it intended 5000 data points to be collected around each base station. (See Garmin’s October 28th ex parte, paragraph 2.b.)

- A calibrated antenna, whose gain is known in azimuth and elevation to both vertical and horizontal linearly-polarized signals. The passband of the antenna will be sufficient to cover the lower 10 MHz ATC channel, *i.e.*, $1526 \text{ – } 1536 \text{ MHz}$.

- A calibrated power measurement instrument such as a commercial Scanner (used in cellular channel monitoring) or a spectrum analyzer will be used. The instrument will be capable of measuring the instantaneous received power and outputting it with some time-averaging, e.g. through video filtering in the spectrum analyzer, at the rate of at least 1 sample/second. The passband (IF bandwidth) of the power measurement apparatus will be set at 10 MHz to correspond to the bandwidth of the LightSquared base station signal. The combination of the scanner/spectrum analyzer video bandwidth and any additional averaging performed by the apparatus shall be set so that the reported power corresponds to an approximately 1 second averaging of the instantaneous received power.

- Means for recording the true position of the vehicle, comprising reference GPS receivers with inertial navigation assistance.

<USGIC Comment:> It would be helpful to have supplemental inertial navigation assistance as it is likely that an unassisted GPS receiver will be jammed by LightSquared’s transmissions during the data collection drive.

- Equipment for recording the collected data and archiving.
• As the receive antenna is mounted on a vehicle, the measurements will necessarily be performed at approximately 7 – 8 feet above ground. The relatively large ground plane provided by the roof of the vehicle (typically a van) will tend to over-predict the received power relative to a hand held cellphone or a General Navigation device mounted inside a car – these results will therefore tend to err on the conservative side.

<USGIC Comment:> We disagree with the assertion that a measurement antenna mounted on a rooftop ground plane will over-predict interference to GLN and cellular devices inside the car. In many cases, the GLN and cellular devices placed in the windshield of the car will be in the direct line of sight of the LightSquared tower. LightSquared’s comment also fails to recognize that many automotive GPS antennas are mounted on the roof of the vehicle.

• The base stations will be configured to simulate full traffic loading.

• Phase-2: In the second phase, static power measurements will be performed in all hot spots identified in the first phase. The object is to ensure that the “local mean”, contrasted with spatially-narrow power peaks produced by multipath, has been properly identified. It is noteworthy that the multipath peaks in dense urban environments typically have a correlation distance of 0.18 wavelength, which at 1531 MHz is 1.3 inches [Clarke, BSTJ, July – August 1968, p. 957].

<USGIC Comment:> It appears that the Phase 2 measurement regime is designed to allow LightSquared to minimize the effects of persistent multipath. (Persistent multipath is the result of ongoing additive interference due to the combination of the LightSquared signals that are received directly from the tower and those reflected off of fixed objects such as buildings.) Actually, persistent multipath is part of the environment in which GPS receivers must perform every day. Therefore, the power-on-the-ground due to LightSquared’s signals must also be reduced even in situations of persistent multipath. For example, a surveyor using a GPS survey system cannot be expected to find the minimum interference point in a 10 meter by 10 meter area in order to get a good survey measurement. The GPS system must work in-situ with no allowance for movement to find a non-jammed location.

• A minimum of 10 measurement samples will be taken, distributed approximately uniformly over a 10 meter by 10 meter area, approximately centered on the hot spot (to the extent possible). Each power measurement will be performed with the receiver completely stationary and with the reported dB value of the power averaged over 2 minutes. The object of this time averaging is to remove the small fluctuations caused by movements in the environment. The mean powers (in dB) from the above mentioned 10 locations will be also be averaged.
The phase 1 testing is done by car or van, and necessarily will be limited to taking measurements primarily on roads. However, phase 2 measurements require a 2 minute dwell time for each data point. It is completely unrealistic to expect that phase 2 measurements can be taken from the middle of a busy road. Therefore, the phase 2 measurements will necessarily need to be taken off the road, typically closer to buildings and other obstructions that will reduce the power of the LightSquared signal. This proposed procedure will be ineffective at measuring the peak power and will be highly inaccurate.

- The space-time, dB-averaged, power value will be used as the basis of determining if the compatibility requirement has been met. If not met, appropriate RF parameters of the relevant cell sites will be adjusted to ensure compatibility. LightSquared will reduce EIRP from individual sites as much as necessary in order to meet the power on the ground obligations.

<USGIC Comment:> Due to the great complexity of adjusting RF parameters for 15-25 towers in a group of cell sites, it will be necessary to re-test the entire area completely after each such “adjustment”. The number of iterations and re-tests that would be required to obtain satisfactory results would appear to make such a proposal infeasible.

- In no event will a cell site EIRP ever exceed 32 dBW.

<USGIC Comment:> The FCC must formally modify LightSquared’s authorization to reflect this. As has been repeatedly pointed out, there is nothing obligating LightSquared to operate at this power level, as the FCC has authorized 42 dBW maximum EIRP. As its latest filing evidences, LightSquared makes significant changes to its operating plans from filing to filing. There is nothing to prevent LightSquared from filing a new plan in the future using 42dBW EIRP authorized power.

The earlier comment about base station loading for Phase 1 applies here to Phase 2 as well. The base stations must be configured to use a test mode that simulates maximum power and loading. Testing at anything less than maximum power and loading will produce an inaccurate measurement of peak power-on-the-ground.

The following apply generally to both phases.

- The power shall be measured with a reference antenna meeting the following requirements:
  - Tuning: Passband of at least 1525-1610 MHz
  - Polarization: Right Hand Circular (or a vertically polarized antenna with appropriate adjustments made to recorded data)
- Pattern:
  - Azimuthal Gain: omnidirectional (approximate)
  - Elevational Gain: unspecified but calibrated (known gain versus elevation angle profile)

<USGIC Comment:> LightSquared’s description of its reference antenna is very generic and lacks the detail necessary to allow thorough analysis and cogent discussion of the proposal. A more complete review and specification of antenna parameters is necessary before such a proposal can even be evaluated as a possible solution.

- The power shall be reported with respect to a 0 dBi antenna, corresponding to the elevation angle of the nearest base station antenna. The elevation angle will be determined from the recorded true position of the power measurement.

<USGIC Comment:> As noted at the beginning of this document, LightSquared’s latest proposal fails to address any of the serious concerns related to the effect of its power-on-the-ground proposal on critical, safety-of-life aviation systems and services.