



## Update: LightSquared Interference with GPS July 2011

Federal Communications Commission (FCC) actions earlier this year set in motion a series of events and developments, including:

- Growing, widespread and outspoken opposition to the plans of LightSquared to deploy 40,000 high-powered transmitters in spectrum adjacent to low-powered Global Positioning System (GPS) signals in satellite frequency bands reserved for decades for use by GPS, a valued national utility.
- Serious concerns about the disastrous effects LightSquared's plans could have on GPS have been continually raised by key U.S. government officials along with members of the GPS community. Now a very large number of organizations, companies and individuals have come together under the umbrella of Coalition to Save Our GPS, with more than 100,000 companies and millions of employees represented either independently or through their trade organizations.
- A five month technical study that found conclusively that LightSquared's plans would cause widespread harmful interference to hundreds of millions of GPS receivers.
- A vitally important FCC public comment period, which ends July 30, 2011, that provides the public with the opportunity to weigh in on the value of GPS in their everyday lives and the harm that LightSquared's plans would cause to their use of GPS.

Both the content and volume of the comments should play an important role in how the FCC decides to rule, and the Coalition has accordingly redoubled efforts to both add new members and help educate the public about the opportunity to voice their opinions to the FCC.

### **Background**

The January 2011 conditional waiver by the FCC's International Bureau (FCCIB) would allow the dramatic expansion of terrestrial use of the mobile satellite spectrum (MSS) immediately adjacent to the frequency band used by GPS receivers – utilizing extremely high-powered ground-based transmissions that subsequent tests have conclusively proven cause severe interference to hundreds of millions of GPS receivers.

The conditional waiver was granted to LightSquared, a company controlled by a New York-based hedge fund. If LightSquared is allowed to proceed with its plans, low-power satellite-based GPS signals would receive massive interference from land-based high-power transmissions from LightSquared's planned network of 40,000 stations.

The consequences of disruption to GPS signals are far reaching: LightSquared's facilities could create tens of thousands of "dead spots" – each miles in diameter – throughout the U.S. The Coalition and others have made it clear that the LightSquared system must not be deployed until all concerns about

interference have been addressed, conclusively guaranteeing that GPS is fully protected from all interference.

**LightSquared plans to transmit radio signals that would be one billion or more times more powerful than the signals that GPS receives – causing severe interference impacting hundreds of millions of GPS users. This includes receivers used by U.S. federal agencies, state and local governments, first responders, airlines, civil engineering, construction and surveying, agriculture, other industries, and everyday consumers in their cars and on hand-held devices.**

- Solar panels are the lone source of power for GPS satellites, and the satellites send signals using about the same power that it takes to power a refrigerator light bulb. That signal then travels 12,000 miles and is extremely faint by the time it is received on earth by a GPS receiver.
- LightSquared's planned ground transmissions are more than one billion times more powerful (in the live interference tests, power differentials up to *800 billion times* were observed), “drowning out” the faint GPS signals in the immediately adjacent frequency band.
- LightSquared’s planned use of these high-powered terrestrial networks in the frequency immediately adjacent to the GPS frequency is unproven, unprecedented and fundamentally incompatible with existing GPS uses.

**The FCC International Bureau’s process leading up to the waiver and subsequent testing was troublesome. The usual FCC process is to conduct extensive testing followed by approvals. For LightSquared, the process was to approve first, *then* test. The unusual fast-track procedure also did not allow Commissioners the opportunity to vote on the matter; instead, it was handled at the International Bureau level. The January 2011 waiver granted to LightSquared through these unorthodox procedures allows it to use its satellite spectrum for high-powered ground-based broadband transmissions if the company can demonstrate that harmful interference could be avoided.**

- Issues of interference should have been addressed before the waiver was granted.
- The waiver was granted in just two months. Even with such a short window, the U.S. GPS Industry Council, the National Telecommunications and Information Administration (NTIA) – along with some federal departments, state and local governments, public safety authorities, and GPS commercial users – all voiced strong objection to LightSquared's plans.
- The problem arose because LightSquared bought the spectrum right next door to GPS cheaply, hoping to change the rules and make the spectrum more valuable. The FCC's process has been driven by a private, speculative New York hedge fund, rather than sound spectrum planning.

### **The Technical Working Group Tests**

In granting LightSquared a conditional waiver, the FCC directed that LightSquared conduct tests to determine the extent of the interference. In five months, the Technical Working Group (TWG), which consisted of LightSquared and representatives from the GPS user and manufacturer communities tested more than 100 different GPS devices. The tests were conducted in laboratory, anechoic chamber and “live sky” test environments, with more than 100 engineers, technical experts and advisors participating in the study and preparation of the final report.

**The final TWG report clearly and conclusively demonstrated that the ground-based cellular network deployment proposed by LightSquared at the time the TWG was formed would cause devastating interference to millions of GPS users.**

- The nearly 1,000 page TWG report was based on extensive testing and analysis by sub-groups of different type of GPS users, including Aviation, Cellular, General Location/Navigation, High Precision GPS, Timing, Networks, and Space-based GPS. (The High Precision, Timing, and Network Subgroups joined together to issue a single report.)
- The Las Vegas “live sky” tests confirmed that LightSquared transmitters generated power levels in excess of one billion or more times greater than GPS signals, even though the tests were conducted at power levels drastically reduced from those allowed in LightSquared’s FCC license.

**Any claims of technical fixes for the interference problem are unproven and highly suspect. There is no Evidence that LightSquared can successfully use only some of its spectrum.**

The testing was based on LightSquared’s declared deployment plan of utilizing the two separate blocks of MSS spectrum. As the tests progressed, LightSquared could see that the results showed massive interference from LightSquared operations in the upper segment of the MSS band. On the eve of the June 15 TWG final report deadline, LightSquared asked for an extension and the FCC agreed. Then, on June 20, LightSquared abruptly issued a two-page news release in which it declared it had a “solution” to the problem – it would switch from its original plan to deploy throughout the MSS spectrum and would instead initially use the lower band for its launch, reserving the right to use the upper MSS band at some point in the near future. Then, when the TWG final report was filed on June 30, 2011, LightSquared submitted its own “Recommendation” document that also called for use of the lower band.

Without citing any data whatsoever, LightSquared made public statements that operations in the lower band only would solve interference to “99.5 percent of GPS receivers. . .and 100 percent of GPS enabled cell phones.” But the official test results show something entirely different: operations using the lower band would still cause severe interference to existing GPS users across a wide range of applications, including cell phones. In fact, well over 50 percent of all GPS receivers tested in the study were reported to still suffer harmful interference or loss of function with operations in the lower band only – the band that LightSquared claimed would not cause interference. That 50 percent-plus finding was determined in the limited testing conducted on LightSquared’s backup plan shortly before the TWG filing deadline. More detailed testing will likely reveal many more problems.

Four TWG sub-groups – General Location/Navigation, High Precision GPS, Networks, and Space based GPS – all concluded that significant harmful interference was still observed in testing of the lower band and that switching to it is not a viable mitigation strategy. Contrary to LightSquared’s contention, the Aviation sub-group did not conclude that the lower band is safe for aviation GPS users. Instead, the sub-group observed that in this lower channel mode there is not a sufficient in-flight safety margin to allow the critically important “initial acquisition” of the GPS satellites.. So, the sub-group stated that “compatibility could not be determined definitively without additional study.”

Cellular sub-group data show that LightSquared’s claim that 99.5 percent of GPS receivers and 100 percent of cell phones would be unaffected in the lower band is simply not supported by the facts. In addition, many GPS receivers used for safety of life and critical economic and government activities will be seriously affected.

Responding to this switch in plans, the Coalition stated, “Since LightSquared was completely wrong in formulating its initial deployment plans and claiming that they would not cause interference, why should the company’s reassuring technical claims about its ‘new’ deployment plan be given credibility? . . .The bottom line is that, just as LightSquared was wrong in 2010 and the first six months of 2011, it is wrong now.”

**There is no known technical fix for this problem, and the laws of physics suggest that there won't be any viable fix. This is not a problem with GPS receivers – it comes from allowing high powered terrestrial stations in satellite spectrum immediately adjacent to the band used by GPS.**

- GPS receivers already use state-of-the art filters. GPS receivers are designed to be highly sensitive in order to detect very distant and very low-power GPS satellite transmissions. GPS signals are so faint and LightSquared's ground station signals are so powerful that no existing GPS filter can overcome this physics problem.
- Even if filters become available at some point in the future, there is no possible way to "retrofit" the hundreds of millions of GPS receivers already in use. Furthermore, their use would also threaten to block GPS receivers’ use of the GPS spectrum, as well as LightSquared spectrum, reducing the effectiveness of GPS devices, particularly more sophisticated GPS devices that use the entire spectrum allotted to GPS.

#### **GPS Technology and Its Economic Impact**

**The Global Positioning System began operations more than 30 years ago and is now a critical and extremely reliable part of our national infrastructure. Millions use it routinely every day.**

**Significant interference with GPS would endanger the use of GPS in many critically important sectors, including Homeland Security; public safety; consumer applications such as cell phones and navigation devices; aviation; commercial surface transportation; agriculture; forestry; engineering and construction; surveying, mapping and land management; utilities; natural resources; disaster management; and scientific research.**

- The federal government has invested \$35 billion in the GPS satellite constellation alone and many more billions in critical systems that use GPS. Business and consumers have also spent billions on GPS-based technologies and devices.
- The U.S. is the world's leader in satellite navigation technology, and our GPS infrastructure is the envy of the world. Russia, China, and the European Union are all building competitive systems that could supersede a hobbled U.S. system.
- The U.S. government agencies and businesses that use or make GPS-based systems and devices employ millions of people.

**A recent economic study shows that more than 3.3 million U.S. jobs in agriculture and related industries rely heavily on GPS technology and the disruption posed by LightSquared’s plans threatens direct economic costs of up to \$96 billion to U.S. commercial GPS users and manufacturers.**

- The study by Dr. Nam D. Pham of the Washington, D.C.-based NDP Consulting Group warns of “serious economic repercussions for the U.S. economy” if LightSquared’s plans proceed and points out that the \$96 billion economic figure represents the equivalent of 0.7 percent of the U.S. economy.

- The \$96 billion figure is the total of up to \$87.2 billion in costs to commercial GPS users and up to \$8.8 billion in costs to commercial GPS manufacturers.
- The study states that the commercial adoption of GPS continues to grow at a high rate. It is expected to create \$122.4 billion in annual benefits and grow to directly affect more than 5.8 million jobs in the downstream commercial GPS-intensive industries.

The study makes clear that its analysis is confined to the economic benefits of GPS technology to commercial GPS users and GPS manufacturers, mainly high precision GPS users, and the economic costs of GPS signal degradation to only those sectors. The report therefore does not capture the considerable additional benefits and costs to consumer users of GPS, other non-commercial users, and military users.

Referring to LightSquared's plans, the economic report states, "The commercial stakes are high. The downstream industries that rely on professional and high precision GPS technology for their own business operations would face serious disruption to their operations should interference occur, and U.S. leadership and innovation would suffer."

### **The Way Forward**

**The GPS industry worked in a committed fashion with LightSquared, FCC, NTIA and other interested parties in the FCC's TWG process, culminating in the June 30, 2011 release of the TWG final report.**

1. The FCC should stop wasting time and effort attempting to allow incompatible use of the MSS band L-Band.
2. Given the critical nature of GPS interference, this matter should be dealt with at the commissioner level and not at the staff level as is currently the case.
3. The tests have shown conclusively that LightSquared's planned deployment is totally incompatible with GPS. LightSquared has other spectrum available to it, and it is time it switched to that other spectrum.
4. If LightSquared wishes to pursue other plans that were not fully tested as part of the TWG process, testing should be conducted by neutral, third parties with full industry participation at LightSquared's expense using the parameters at which LightSquared will actually operate. However, only if *those* tests conclusively demonstrate that there is no interference to GPS reception can LightSquared be permitted to proceed.

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