GPS and Light Squared

Background:

Lightsquared is a 4G Broadband telecommunications company that purchased another company that held an FCC license directly adjacent to the frequency used by the GPS L1 band. The former company was to use this frequency band for spaced based communication. For that purpose, there would be no adverse impact on GPS. Lightsquared was able to secure a modification through the FCC from the spaced based use to terrestrial transmissions. Terrestrial transmissions are significantly stronger and may either creep into the L1 band or create enough noise to disrupt GPS receivers. There is another side to this though. Certain GPS receivers also "see" into the frequency band now allocated to Lightsquared. If the problems that are being realized by the preliminary test result (to follow)prove to be true, there could be significant impacts to the public health and safety, shipping commerce, aircraft navigation as well as to the geospatial community at large. Imagine oil tankers not being in a shipping channel, or an aircraft full of people trying to land in the fog without the aid of GPS?

The following are excerpts from GPS World magazine articles as well as information that was disseminated at a Civilian GPS User Seminar held on 4/27/11 in Groton.

These first excerpts are from a 2/1/11 GPS World article:

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 (1525 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.

There are official tests being done right now that are supposed to be completed by 6/15/11. Discussions at the aforementioned 4/27 meeting indicated that there are definitely issues, but

without complete analysis, nobody was able to fully discuss them. The following tests were done by GPS manufacturers and are excerpted from the 2/1 GPS World Article:

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: nüvi 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-03S signal generator with digital modulation, amplified to achieve the relevant signal strengths.

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."

Here are some more reasons to be concerned (From GPS World Article dated 3/2/11):

1. Consumer GPS receivers and professional-grade GPS receivers designed for higher performance (mapping, surveying, etc.) aren't necessarily designed the same way. High-performance GPS receivers use a wider bandwidth radio design.

For example, the GPS L1 frequency is 1575.42 MHz Many high-performance GPS receivers use a wide bandwidth radio that scans +/- 20 MHz from 1575.42 MHz That equates to a range of 1555 MHz to 1595 MHz Lightsquared's frequency spectrum is 1525 MHz to 1559 MHz Clearly, there's overlap, which is

another word for interference. On top of that, Lightsquared plans on a broadcast strength of 1,500 watts from a tower located down the street. The GPS broadcast signal strength is about 30 watts from a satellite located some 19,000 kilometers away in outer space. Who's going to win that battle?

2. Neither the policymakers nor Lightsquared know about or understand the user community of high-performance GPS receivers comprised of hundreds of thousands of high-end GPS receivers. They think the GPS user community is comprised of auto navigation and mobile-phone users. They don't understand that we are the infrastructure people. We use GPS in a way that they don't understand, but is so critical to our infrastructure. It's not their fault, but you can't assume they know, so it's up to us to inform them. You have to speak up.

3. Furthermore, it's relatively easy to acquire and operate an inexpensive consumer GPS receiver. Can you picture Lightsquared attempting to test a sub-meter GPS L1 receiver or a RTK setup? GPS, GLONASS, SBAS, DGPS, real-time, post-processing, and the myriad of receivers on the market need to be tested. Although it's likely not possible to test all equipment on the market, it's not prudent to leave anything to chance. If, one year from now, you wake up and find out your $10,000 RTK receiver doesn't work like it used to, it will be too late to do much about it. It takes very little time to voice your concern now to your elected officials so the appropriate attention is given to high-precision users.

We as Professional Land Surveyors need to stay vigilant on this issue. Be prepared to contact your local U.S. Senator or Congressman.