

FCC:

I have serious concerns about LightSquared's proposal for a nationwide 4G LTE system. I'm afraid that neither LightSquared nor the FCC fully understand the impact of LightSquared's proposed system on GPS receivers, America's small businesses, America's infrastructure, America's agriculture, and America's economy.

As a Professional Land Surveyor and college instructor, my specialties are land development, heavy infrastructure construction, and the role of high-precision GPS receivers in those fields. Hundreds of thousands of high-precision GPS receivers in the U.S. are used across many market segments including civil/environmental engineering, land development, construction, land surveying, Geographic Information Systems (GIS), agriculture, forestry, road/rail/airport, hydrography, environmental, water/gas/electric/oil/telecom utilities, mining, bridge/dam monitoring, emergency management, defense & intelligence, disaster preparedness, higher education, research, and all levels of Fed/State/Local government.

I rely on \$50,000 worth of high-precision GPS technology in my small land surveying business to efficiently complete my projects. While that may not sound like a lot compared to the FCC budget, it is a significant expense to my company. Allowing the LightSquared plan using the L-band frequency to move forward would render my high-precision GPS equipment obsolete. With no hope of affording replacement equipment (even assuming the technology did exist at this time), my firm would collapse.

Nationally, high-precision GPS users rely on a complex infrastructure of 7,000+ high-precision, fixed-mount GPS base stations deployed nationwide. The infrastructure began with a few receivers in the early 1990s and has been built upon over the past 18 years by the GPS user community volunteering time, money, equipment, and expertise. It would be impossible to replace all of these receivers since the ownership is so disparate. Many are publicly owned and the rest are commercially owned by businesses and used by people in all the market segments I listed above. To illustrate, one such network consisting of more than 875 high-precision GPS receivers

is located in the western United States managed by UNAVCO, a university-governed consortium which is sponsored by the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), U.S. Geological Survey (USGS), and National Oceanographic and Atmospheric Administration (NOAA).

UNAVCO uses this massive network of high-precision GPS receivers to, among other things, monitor the earth's crustal plate movement (think earthquake monitoring). The California Spatial Reference Center (CSRC) and the Scripps Orbit and Permanent Array Center (SOPAC) are involved in continuous monitoring of tectonic plate movement and ultimately earthquake prediction and early warning, including automated shut-down of critical utilities and infrastructure such as natural gas lines and major bridges.

Another type of high-precision GPS network is called an RTK network. It delivers real-time, high-precision corrections to engineers, land surveyors, Geographic Information Systems (GIS) specialists, construction specialists, and others.

Recommendations

I'm grateful for this 30-day public comment period as I think it will give the FCC and LightSquared a new perspective on the impact that disrupting high-precision GPS receivers would have on the GPS user community and America's economy.

Although I'm in favor of a nationwide 4G LTE system, I'm opposed to LightSquared's proposed plan. Please consider the following statements and explanations:

1. Lightsquared falsely contends the GPS user community knew this was coming and chose to do nothing. Contrary to what LightSquared asserts, the GPS user community did not know anything about this potential interference

until November 2010. LightSquared and the FCC incorrectly assumed that communicating/negotiating with the U.S. GPS Industry Council (USGIC) was the equivalent of communicating/negotiating with the GPS user community. That is a false assumption. The USGIC does not communicate directly with the GPS user community and never has. That's not its role.

Furthermore, there is a clear precedent already set that demonstrates how to handle a case very similar to the current LightSquared situation. In 2008, the U.S. Air Force proposed to discontinue supporting the semicodeless technique that is used by virtually every civilian L1/L2 high-precision GPS receiver in existence. It was the first time in history that an action would render several hundred thousand high-precision GPS receivers obsolete, a scale which is very similar to the impact of the LightSquared system.

There was no industry coalition formed to engage the Air Force. There was no industry outcry. A public/private technical working group was not formed to test the effects on receivers if semicodeless was not supported. Why is that?

The answer is very simple. The U.S. Air Force, to its credit, did a fantastic job of communicating directly with the GPS user community along with the Department of Commerce. It issued public statements describing the impact the action would have on high-precision GPS receivers.

The U.S. Air Force did its homework. At the end of the day, it set a sunset date of December 31, 2020, to discontinue supporting the semicodeless technique. It correctly determined that 12 years is about the amount of time that would allow a smooth transition with a manageable financial impact to the high-precision GPS user community.

Imagine if the U.S. Air Force had set a period of one year to transition away from using the semicodeless technique. That action would have destroyed the high-precision GPS user community resulting in billions of

dollars in losses and widespread small business closure. Fortunately, they did their homework, understood the impact, and made the correct decision.

LightSquared, on the other hand, either didn't do its homework or intentionally kept quiet in order to fly under the radar and push its initiative through before the GPS user community (and others) knew what was happening. In either case, the GPS user community shouldn't be held accountable in paying for the FCC's and LightSquared's lack of communication/notification.

2. The FCC needs to consider future GPS signals as well as satellite signals from other satellite navigation systems. The FCC needs to investigate the effect of the LightSquared system on the future GPS L1C signal as well as GLONASS L1 (Russia), Galileo L1 (Europe), and Compass L1 (Chinese) to understand the effect on receivers of today and of the future. GPS L1C, Galileo L1, and Compass L1 all use wider bandwidth than today's GPS L1, which makes them even more susceptible to interference from LightSquared's system.

L1 and L5 are the GPS, GLONASS, Galileo, and Compass signals of the future. Those signals will drive hundreds of billions of dollars in revenue because they will bring high-precision accuracy to our everyday lives, which is something only available on very expensive GPS receivers today.

Again, precedence has been set. Look at what happened to GPS navigation after Selective Availability (SA) was turned off in May 2000. Overnight, recreational grade GPS accuracy improved from 100 meters to 10 meters, and subsequently the multi-billion dollar market for GPS automobile navigation devices was launched. Companies like TomTom grew from zero revenue to multi-billion dollar corporations. Now many cellular phones include this technology.

The same is expected to happen again when mainstream GPS accuracy improves from 10 meters to well under a meter using the L1 and L5 signals, but that

will only occur if the GPS L1, GLONASS L1, Galileo L1, and Compass L1 signals are protected. Some say that L2 can be used instead of L1 in the future. While that's true for GPS, L1 and L5 have become the international standard while L2 is not supported by the international community.

3. LightSquared mobile devices are potentially portable GPS jammers. The FCC needs to seriously investigate the interference impact of LightSquared mobile handsets (1626.5-1660.5 Mhz) on GPS receivers. It is already known that Inmarsat (1626.5-1660.5 MHz) devices and Iridium (1616-1626.5 MHz) devices interfere with each other, but Iridium devices are only used in remote areas so it's not a widespread problem. It is also known that these devices interfere with the GLONASS L1 signal (1597-1605 MHz). We don't know the extent of the effect that LightSquared mobile devices will have on GLONASS L1, GPS L1, Galileo L1, or Compass L1 signals. The problem is that no LightSquared mobile phones are available to test. Yes, lab simulations can be performed, but LightSquared devices will be made in Asia, among other places, where the designers won't care one bit about GPS interference. There is not an acceptable design margin, if any, to allow for sloppy LightSquared device designs.

The consequence of LightSquared mobile devices interfering with GPS L1, GLONASS L1, Galileo L1, and Compass L1 is hard to imagine and might be worse than interference from the 40,000 LightSquared towers. Although the LightSquared mobile devices are much lower power (2-3 watts vs. 1,500 watts), LightSquared has announced they intend to deploy more than 250 million mobile devices, which could behave like portable GPS jammers.

Please pay attention this important technical issue that many have chosen to ignore.

4. LightSquared needs to permanently abandon using the upper frequency spectrum (1545-1555 MHz) for terrestrial broadcasting. The idea of LightSquared using its licensed upper frequency spectrum (1545-1555 MHz) for terrestrial purpose needs to be permanently abandoned. It's clear from the test results that this causes widespread GPS interference no matter

which class of GPS is used.

The GPS user community should bear no cost as a result of any interference from LightSquared's system. The GPS user community was blindsided in November 2010. While you can debate whether about the communication between the FCC, MSV/Skyterra/LightSquared, and the U.S. GPS Industry Council, no case can be made that the GPS user community knew of MSV/Skyterra/LightSquared's intentions earlier than late last year. Can the FCC and LightSquared expect the GPS user community to bear the cost of interference caused by LightSquared's system?

Furthermore, far too little testing has been completed in order to fully understand the impact of LightSquared's system on GPS receivers. Yes, we have a rough idea of the scale of interference from the test reports submitted in June 2011, but the devil is in the details.

Even if LightSquared only uses the licensed lower spectrum (1526-1536 MHz), as it has proposed as an alternative, the number of high-precision receivers affected would be at least 200,000 at an estimated replacement cost of \$10,000 per unit which equates to a total equipment replacement cost of \$2 billion dollars. That does not include the cost of removal/installation, lost productivity, required software upgrades, and training. Does the FCC expect the GPS user community to bear that cost?

For the above reasons, I recommend that the FCC deny LightSquared's request to proceed and encouraged them to use spectrum outside of the MSS band. The resources expended by federal/state/local governments, private companies, and corporations to vet LightSquared's proposal to use the MSS band has run into the tens of millions of dollars, if not more than a one hundred million dollars. I'm afraid the cost of further vetting will double or triple the expenditure as well as result in tremendous opportunity cost as significant resources are expended by public and commercial entities to continue this debate.

Thank you for your attention. Sincerely,

Robert McMillan, PLS