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LightSquared and Its Impact on the GPS Industry

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Garmin Overview

Global Supplier of Navigation, Communication and Information Products

- Consolidated 2011 revenue of almost $2.8B
- Cash of over $2.6B with no debt
- Nearly 16 million units sold worldwide in 2011
- Over 100 million GPS enabled units sold worldwide since inception
- Global leader in each market we serve

Markets We Serve

Automotive / Mobile

- Personal Navigation Devices
- On and off board applications for mobile phones
- Automotive OEM solutions

Outdoor

- FRS, GMRS, PMR communication devices
- Wireless tracking
- Geocaching
- Touch screen golf GPS
- Handheld devices for hunting and hiking

Fitness

- Wearable GPS based fitness devices
- Speed and distance watches
- Heart rate monitoring
- GPS based cycle computers

Marine

- Broad product line from handhelds to chartplotters
- Core technology includes radar, sounders, autopilots, networks
- Solutions for aftermarket and OEM

Aviation

- General aviation products targeting small to mid size aircraft
- Core technology includes communication, radar, flight control, mapping and navigation
- Revolutionary glass cockpits

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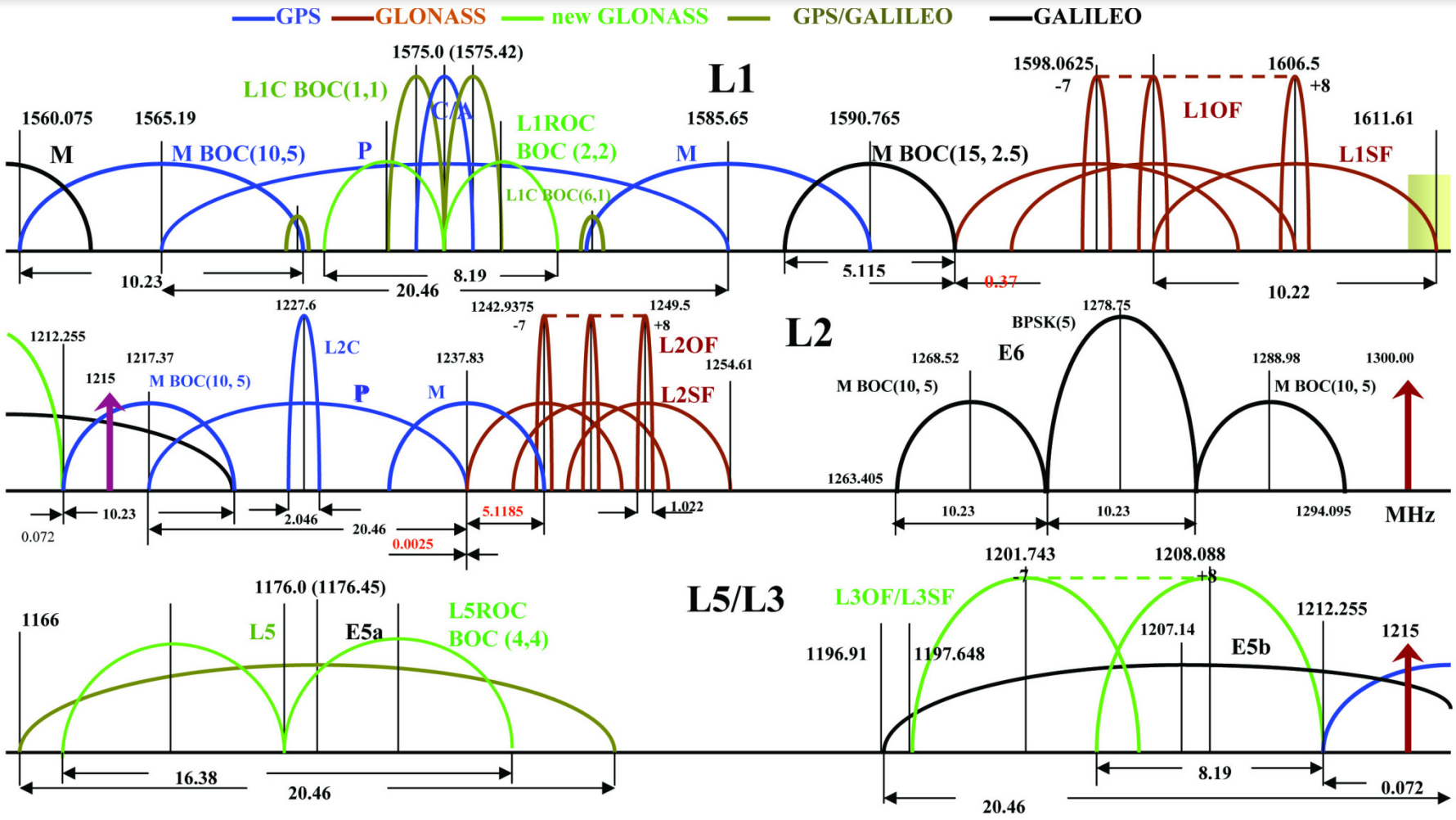
GPS System Overview

The Global Positioning System (GPS) enables determination of precise location using very low power radio signals from distant satellites.

- Satellites are located in Medium Earth Orbit, more than 12,000 miles above the earth.
- Satellites are solar powered, which necessitates low-powered radio transmissions (~50 Watts).
- Receivers must be extremely sensitive in order to receive the low-power GPS signals.
- GPS signal power on the ground is less than a millionth of a billionth of a Watt (1e-15 Watts).

GPS System Overview



The GPS system operates alongside other Global Navigation Satellite Systems (GNSS) in the Radio Navigation Satellite Service (RNSS) band.

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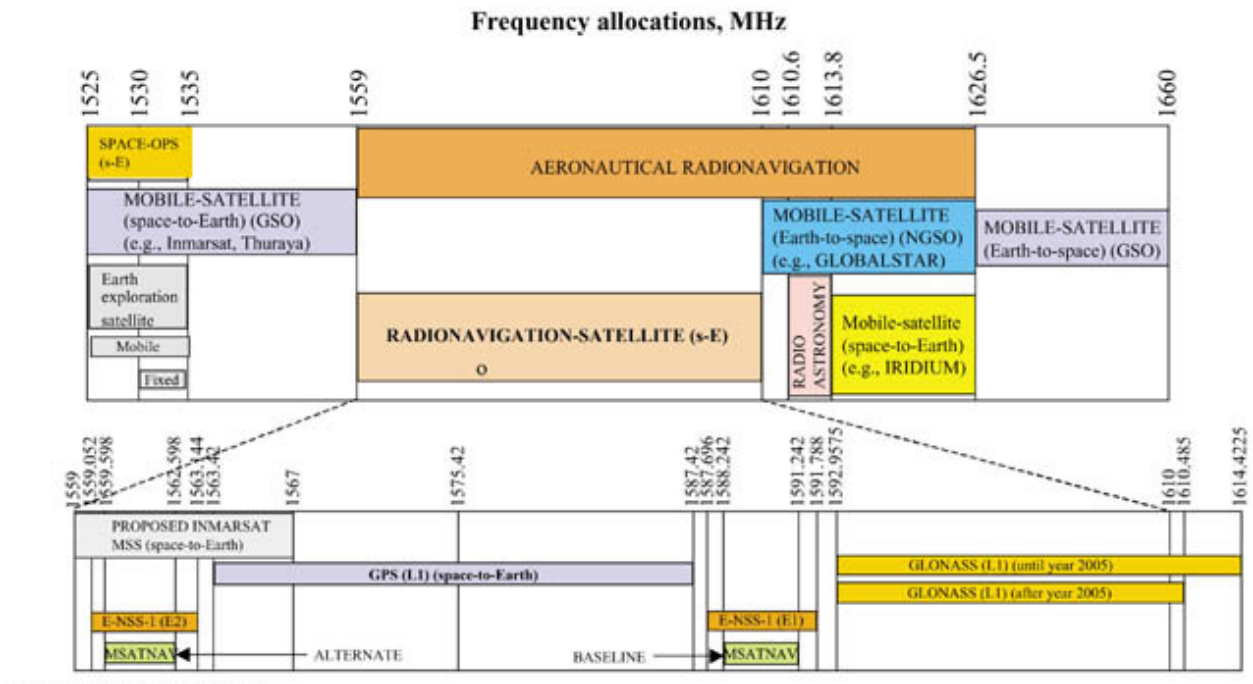
GPS System Overview

GNSS systems operate in the Radio Navigation Satellite Services (RNSS) band. This is not an accident. These frequencies were chosen intentionally because of their excellent propagation characteristics through the earth's atmosphere. Mobile satellite services bookend the GPS spectrum.



The MSS band is a quiet, low-power spectrum neighborhood ideally suited for space-to-earth and earth-to-space transmissions. Any changes to spectrum allocation must be the result of careful study, testing, and consideration of incumbent uses.

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The LightSquared Process

The LightSquared Process

Since LightSquared's first request for a fundamental repurposing of the MSS-band in November 2010, Garmin has been an active participant in the process of testing and evaluating the impact to GPS devices.

- Upon learning of LSQ's 11/18/10 request for a waiver of the integrated service rule, Garmin immediately commenced testing of GPS devices with respect to the LightSquared terrestrial signal.
- LightSquared's request would have permitted it to offer terrestrial service without regard to whether that service would interfere with LightSquared's own or other satellite services operating on the same or adjacent spectrum.
- In a letter to NTIA on 12/28/10, the Department of Defense raised objections that granting LightSquared's requested authorization would severely disrupt operations of both government and non-government GPS devices.
- Garmin's test results, showing the catastrophic implications of high-powered terrestrial signals in the MSS band, were filed with the FCC on 1/20/11.

The LightSquared Process

- On 1/26/11, the FCC granted LightSquared's requested waiver with conditions requiring LightSquared to work with the federal government and the GPS industry to test the interference through a technical working group ("TWG") process and stating that LightSquared could not commence operation until it had demonstrated mitigation of the interference.
- Garmin was a key participant in the TWG process and chaired the General Location/Navigation subteam.
- Garmin participated in the RTCA's testing and analysis of the impact on aviation.
- Garmin participated in subsequent NTIA-sponsored testing at White Sands Missile Range (WSMR) in fall 2011, contributing both test devices and manpower.
- On 2/14/12, NTIA submitted a letter to the FCC concluding that LightSquared's proposed operations could not coexist with GPS without causing interference and transmitting, as support, studies from the National Executive Committee for Space-Based Positioning, Navigation and Timing and the FAA.
- On February 2/15/12, the FCC issued a public notice seeking public comment on rescinding LightSquared's conditional waiver and suspending indefinitely its authority to offer ancillary terrestrial services.

Brief Overview of Recent Test Reports

The report of the most recent testing conducted by the National Executive Committee for Space-Based Positioning, Navigation & Timing (PNT) was publically released on 2/14/2012.

This report provides the results of testing conducted last fall at White Sands Missile Range and at the Space and Naval Warfare Systems Command. The tests evaluated the performance of GPS devices in the presence of LightSquared's modified transmissions in its lower 10 MHz band. Among the key findings were the following:

1. 75% of the units tested would suffer harmful interference from the LightSquared signal
2. The report concludes that there are no proven mitigation options at this time, and, if any were to materialize, they would take years to implement.
3. LightSquared handset transmissions have the potential to cause interference to GLN devices.

http://www.gps.gov/news/2012/02/lightsquared/NPEF-report.pdf

Brief Overview of Recent Test Reports

FAA Report on LightSquared Interference to Certified Aviation Devices dated 1/27/2012.

Since the summer of 2011, the FAA has worked with LightSquared (at a cost to taxpayers of more than two million dollars) to understand the effects of 40,000 LightSquared transmitters on certified aviation GPS receivers. The FAA's report draws two critical conclusions:

1. The LightSquared network is not compatible with FAA requirements for GPS receivers used in low altitude aviation operations. (Perhaps most concerning is interference to terrain awareness and warning systems (TAWS) which help keep planes and helicopters from flying into the ground.)
2. Due to the wide variety of environments where certified aviation GPS receivers must operate, the FAA determined that there is no readily-available mitigation option for the LightSquared interference.

http://www.gps.gov/news/2012/02/lightsquared/FAA-report.pdf

FCC Request for Public Comment

Two proposals from the FCC on which its 2/15/2012 public notice requested comments:

1. Vacatur of the *Conditional Waiver Order* due to LightSquared's inability to address satisfactorily the legitimate interference concerns surrounding its planned terrestrial operations, and the conclusion that the interference resolution process has no realistic prospect of being successfully completed by LightSquared in a reasonable period of time.

2. Modification of LightSquared's satellite license, pursuant to Section 316 of the Communications Act, to suspend indefinitely LightSquared's underlying ATC authorization, first granted in 2004, to an extent consistent with the *NTIA Letter.*

Comments and reply comments were complete on 3/30/2012. The FCC has not acted on these proposals to date.

Lessons Learned

- **The demand for spectrum for terrestrial wireless broadband is huge and not going away**
- **GPS has been an enormous global success story, revolutionizing many different industries – yet the GPS system has a relatively low profile**
- **Spectrum re-allocation activities require careful consideration and require a lot of time for comment and analysis**
- **Vigilance by the GPS Industry is necessary to protect the spectrum and ensure that services in adjacent bands are compatible with the full potential of the system.**

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