



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Overview of GPS Adjacent Band Compatibility Assessment Plan

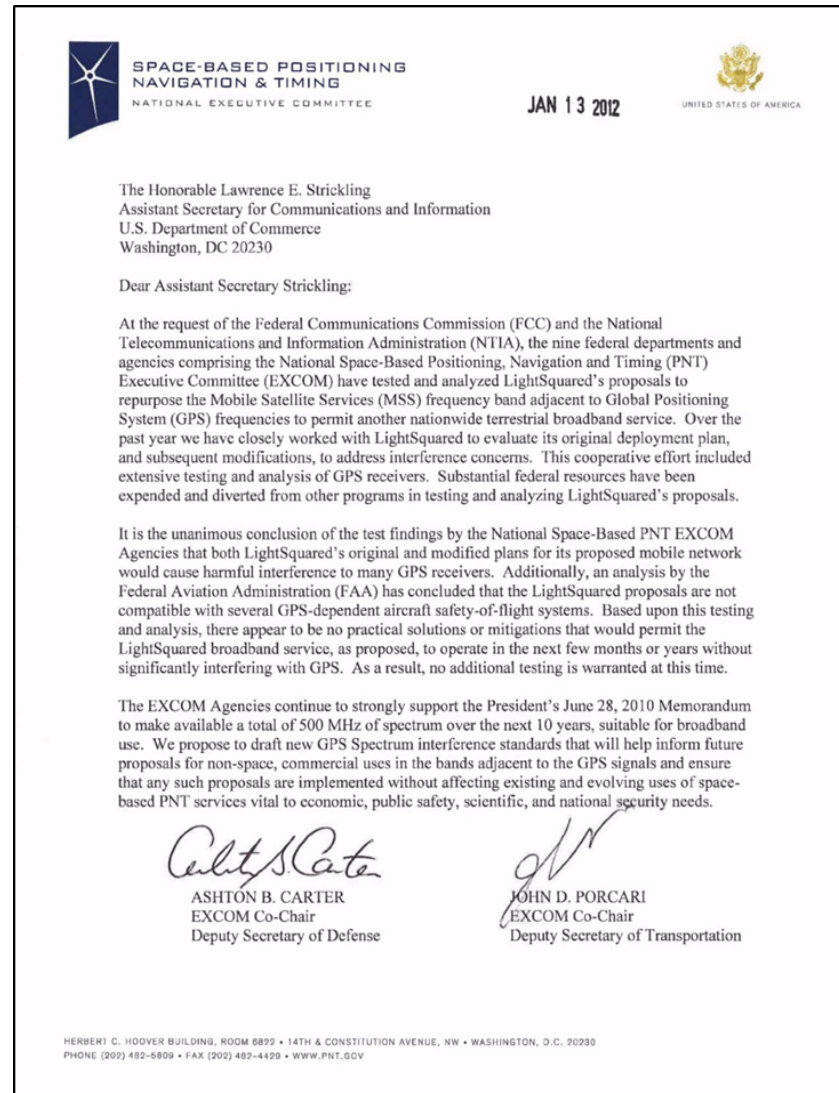
**International Committee on GNSS (ICG)-9
Prague, Czech Republic**

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January 2012 Space-Based PNT EXCOM

January 13, 2012 National Space-Based Positioning, Navigation, and Timing (PNT) Executive Committee (EXCOM) co-chair letter to National Telecommunications and Information Administration (NTIA) proposed to draft new Global Positioning System (GPS) spectrum interference standards:

- Inform future proposals for non-space, commercial uses in the bands adjacent to the GPS signals.
- Ensure such proposals are implemented without affecting existing and evolving uses of space-based PNT that are vital to economic, public safety, scientific, and national security needs.



DOT GPS Adjacent Band Compatibility Assessment

- DOT Deputy Secretary Tasking:
 - Collaborate to develop a spectrum protection plan which provides a framework to define the processes and assumptions for development of GPS spectrum protection criteria on behalf of GPS civil users.
- GPS Adjacent Band Compatibility Assessment will identify the processes for:
 - Deriving adjacent-band power limits, as a function of offset frequency, necessary to ensure continued operation of all applications of GPS services.
 - Determining similar levels for future GPS receivers utilizing modernized GPS and interoperable Global Navigation Satellite System (GNSS) signals.



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Elements of the DOT Assessment Plan

- Develop assumptions on the type of application planned for deployment in the adjacent-band
 - Validate assumptions with NTIA and FCC
- Determine GPS receiver interference tolerance masks and use cases
 - Current GPS Receivers (Set 1 limits)
 - Modernized GPS/GNSS Receivers (Set 2 limits)
- Determine interaction scenario(s)
- Specify the adjacent-band application transmitter power limits



Approach to DOT GPS Adjacent Band Compatibility Assessment

- Develop an implementation plan, that incorporates aspects from the DOT Assessment plan, with a near term focus of current GPS/GNSS receivers
- FAA conducting effort for certified avionics in conjunction with RTCA SC-159
- Non Certified Aviation (everything else) effort being led by DOT/Volpe Center
- Open and transparent approach
- Identify forums and provide public outreach to make sure the plan, on going work, and assumptions are vetted and an opportunity to gain feedback
 - First workshop held Sept. 18th; Second to be held Dec. 4th
- Goal is to protect existing and evolving uses of space-based PNT



GPS Adjacent Band Compatibility Assessment Implementation Plan Outline

1. Document GPS use cases and list of current (representative) GPS receivers
2. Develop representative receiver masks for each application.
 - A. Collect receiver specifications and available test data
 - B. Develop a generic receiver model. Validate model against collected data and use it to Perform sensitivity analysis on receiver specs.
 - C. Develop a plan for testing of GPS receivers
3. Conduct GPS receiver testing to validate Manufacturer provided test results
4. GPS Interaction scenarios and antenna characteristics
5. Collect future and multi-channel GNSS receiver specifications



Near-Term Focus

- Frequency Bands Adjacent to GPS L1 (1500-1700 MHz)
- Leverage Receiver Categories from TWG
 - Aviation
 - Cellular
 - General Location/Navigation
 - High Precision
 - Timing
 - Networks
 - Space
- ❖ Develop a set of curves demonstrating the maximum aggregate power level as a function of frequency offset from GPS



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Document Use Cases

- Identify characteristics of use cases - for each application determine:
 - Most likely geographic and topographic characteristics
 - Range of heights for GPS receiver antenna
 - Typical GPS receiver antenna pattern(s)
 - Expected Range of antenna boresight inclinations from zenith
 - Mobility: Stationary vs. mobile (typical speeds)
- Solicit information on selection of representative receivers within each category
- Gather feedback on the use cases parameters



Develop Receiver Mask Data Collection

- Collect test data and specifications from GPS receiver manufacturers.
 - Define the type of test data needed as well as the most relevant receiver specs for the analysis (especially in absence of test data).
 - Involve the receiver manufacturers and industry stakeholders to update them on the current state of the analysis and obtain feedback
 - Collect data provided by GPS receiver and antenna manufacturers
 - Follow up and interact with manufacturers to obtain additional information as well as resources they are willing to contribute for future testing



Develop a Test Plan

- Review available information on previous receiver testing effort
- Expand on the previous testing approach to cover a wider frequency range and assess the level of assistance expected from manufacturers and stakeholders
- Outline the testing procedure and equipment needed.
 - Testing procedure and equipment needed for wired tests
 - Same for wireless tests (anechoic chambers test). Primarily for receivers for which the antenna input port is not accessible
- Identify and begin coordination with the testing facilities



Collect Future and Multi-Channel GNSS Receiver Specifications

- This effort is expected to be a combination of modeling and testing with more emphasis on the modeling and analysis in the absence of actual receivers to test.
- Obtain information from direct contact with receiver manufacturers and/or through workshops, as well as subject matter experts on the future of the receiver architecture, filtering, oscillators and antenna technology to guide the modeling-based assessment
- Extend the test plan and perform testing as these new receivers become available.



Next Steps

- Continue engagement with Industry
 - Public Workshop Information available on www.gps.gov
 - Next Workshop Dec. 4th in Los Angeles (Webex Capability)
- Effort being worked in conjunction with DOT Extended Pos/Nav Working Group, GPS Directorate, Aerospace Corporation, and Stansell Consulting

