



SPACE-BASED POSITIONING
NAVIGATION & TIMING

NATIONAL COORDINATION OFFICE

*U.S. Space-Based Positioning,
Navigation and Timing (PNT)
Status and Policy Update:
Strategic Plan for Potential
Interference (SPPI)*

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Background



- **A U.S. telcom company, Lightsquared, applied to Federal Communications Commission (FCC) for terrestrial communication in spectrum band adjacent to GPS, and FCC granted conditional waiver. 2010 - 2011**
- **Testing demonstrated harmful interference to GPS, National Executive Committee for Space-Based Position, Navigation & Timing (EXCOM) letter to National Telecommunications and Information Administrations (NTIA) for FCC, Lightsquared filed for bankruptcy. 2011 - 2012**
- **Lightsquared emerged from bankruptcy, became Ligado Networks, modified the application to FCC for terrestrial comm. 2015 - 2016**
- **Department of Transportation (DOT) Adjacent Band Compatibility (ABC) study, tested many GPS receivers, determined maximum tolerable adjacent band power limits for GPS receivers. 2018**
- **EXCOM letter to NTIA for FCC: proposals to operate services in bands adjacent to GPS should not be approved unless, at a minimum, they do not exceed the tolerable power limits in the DOT ABC study. 2018**



Background (cont'd)



On April 20, 2020, the Federal Communications Commission (FCC) announced their approval of Ligado's application to deploy "a low-power terrestrial nationwide network in the L-Band that will primarily support 5G and Internet of Things services" with the following conditions:

- **“...shall provide no less than six months advance notice regarding the activation of any base station transmitting in the 1526-1536 MHz” (advance notice provided and transmission will start on or after September)**
- **“Advance notice must include a coverage map showing, by county, the locations where Ligado’s and its customers’ terrestrial network will provide coverage based upon the base stations”**
- **Ligado must provide “base station information at least 30 days before commencing transmission at a base station site”:**
 - **location of the proposed base station antenna site (latitude and longitude);**
 - **base station antenna radiation center height above ground level;**
 - **base station antenna tilt for both mechanical and electrical tilt; and**
 - **base station antenna specification, including polarization and pattern**



Strategic Plan for Potential Interference Working Group (SPPIWG)



- In 2020, out of concerns about the potential impact to GPS users across America should Ligado transmissions commence at the FCC approved power level of approximately 10 watts, the EXCOM directed development of a mitigation plan for potential interference from a Ligado deployment
- National Coordination Office for Space-Based Position, Navigation & Timing (NCO) established a Strategic Plan for Potential Interference Working Group (SPPIWG), with membership across the EXCOM
- The SPPIWG has met numerous times since 2020 to develop and refine the plan, and begin to put the plan into action
- NCO SPPIWG plan (the SPPI) includes the following major elements:
 - Outreach and Communications
 - Spectrum Monitoring
 - Impact Monitoring



Outreach and Communications

External communication plan for Federal and non-Federal GPS users includes several potential areas.

- Create awareness of the issue and reporting processes
- Identify what capabilities are available for users to determine whether their applications will be affected
 - Most GPS-enabled devices don't alert users to interference
- Ensure any interference reports are provided to the government (e.g., USCG Navigation Center) and actions are taken in response
- Determine potential options to remedy the issue
 - Government Best Practices document to guide users on how to identify interference

Outreach Mechanisms

- www.gps.gov
- Civil GPS Service Interface Committee
- Webinars, Workshops, and Conferences
- Federal Register Notice
- USG Constituent Portals (ex. FAA Safety Team)
- CISA Regional Outreach and through Sector Risk Management Agencies



Spectrum Monitoring



- The goal of the spectrum monitoring element is to provide a monitoring system capable of clearly characterizing emissions and attributing Ligado transmissions to GPS equipment performance degradations
- Spectrum monitoring consists of four main tasks:
 - 1) Develop GPS equipment interference effects metrics and equipment identification
 - 2) Validation of effects metrics with laboratory testing
 - 3) Develop field monitoring and measurement recording capability and integration into a deployable test vehicle(s)
 - 4) Pre and post Ligado field deployments and associated data characterizations



DOT - Spectrum Monitoring Capability



- **Establish spectrum monitoring capability**
 - Three variants: lab, mobile, and eventually fixed/leave-behind
 - Equipage: spectrum analyzer, directional horn antennae, L-band recording, protected + unprotected RF circuit for suite of GPS user equipment (attribute Ligado signal interference to receiver performance impact)
- **Matured set of harmful interference metrics**
 - DOT stands by ITU 1 dB Interference Protection Criteria
 - Technical team has leveraged the GPS ABC study data set to develop metrics focused on CNR degradation, loss of lock, increase in acquisition time, ranging error, and positioning error
 - Interagency feedback and support through the NCO SPPIWG and coordination with NTIA for use in monitoring
- **Stakeholder engagement efforts**
 - Interagency coordination (DOC, DOE, NASA, FAA, and DHS) on GPS user equipment to include in monitoring capability, as well as terrestrial and space networks for suitability of broad geographic monitoring
 - Vendor outreach on planned or existing protective measures in GPS user equipment



Recent Items of Interest



- **Ligado submitted application to Canada for terrestrial comm in Canada, band adjacent to GPS, at 776 watts (77 times the power of Ligado transmissions in U.S.)**
- **FY21 NDAA chartered National Academy of Sciences, Engineering, and Medicine (NASEM) technical review of FCC order and NASEM released the study report 9 Sep 2022**
- **DoD, NTIA, and the EXCOM released coordinated statements about the NASEM study on 9 Sep 2022.**
- **Ligado's September 12 filing notified the FCC it does not intend to move forward with its trial deployment in northern Virginia to allow for resolution of spectrum issues with NTIA**



Summary



- **NCO will continue to lead the SPPIWG in response to potential interference from Ligado**
- **SPPIWG will continue efforts within the main elements:**
 - Outreach and Communications
 - Spectrum Monitoring
 - Impact Monitoring