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January 7, 2011

FILED/ACCEPTED
JAN - 7 2011
Federal Communications Commission
Office of the Secretary

By Hand Delivery
Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: Notice of *Ex Parte* Presentation in LightSquared Subsidiary LLC Application for Modification of Authority for Ancillary Terrestrial Component, File No. SAT-MOD-20101118-00239

Dear Ms. Dortch:

On January 6, 2011, representatives of the United States GPS Industry Council and several member companies met with officials from the Commission's Office of Engineering and Technology, International Bureau, Wireless Telecommunications Bureau, Enforcement Bureau, Public Safety and Homeland Security Bureau, and Media Bureau to discuss the prospect of harmful interference to the installed user base of L-band space services from the above-referenced proposal to allow co-primary terrestrial services to operate in the L-band spectrum allocated to mobile-satellite services. The application proceeding has been designated to have permit-but-disclose status for purposes of the Commission's *ex parte* rules.

The participants (listed on Appendix 1 to this letter) discussed in detail the material contained in the presentation that is included as Appendix 2 to this letter.

By this letter, and in accordance with Section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, two copies of this letter and its Appendices are provided for inclusion in the Commission's files.

Please direct any questions to me.

Respectfully submitted,

Stephen D. Baruch
Counsel for the United States GPS Industry Council

Enclosures

cc: (w/Enclosures): List of Persons in Appendix 1 (by e-mail)

APPENDIX 1

LIST OF PARTICIPANTS IN JANUARY 6, 2011 MEETING

FCC PARTICIPANTS:	U.S. GPS Industry Council Participants
Office of Engineering and Technology: Julius Knapp, Chief Walter Johnston Michael Ha Mark Settle Brett Greenwalt Geraldine Matise Alan Stillwell Ronald Repasi **International Bureau** Mindel De La Torre, Chief Robert Nelson Sankar Persaud Gardner Foster **Public Safety and Homeland Security Bureau:** Brian Butler Gene Fullano Pat Amodio Bill Lane **Wireless Telecommunications Bureau:** Tom Peters Paul Murray **Enforcement Bureau:** Emil Cherian Jim Higgins Priya Shrinivasan **Media Bureau:** John Gabrysch	**U.S. GPS Industry Council:** F. Michael Swiek, Executive Director A.J. von Dierendonck (via teleconference) **Garmin International (via teleconference):** Andrew Etkind Scott Burgett Doug Kealey Brian Poindexter Van Ruggles Anne Swanson Michael C. Simmons **NovAtel Inc. (via teleconference):** Neil Gerein **Trimble Navigation, Ltd. (via teleconference):** Ann Ciganer Bruce Peetz **Lerman Senter PLLC** Raul R. Rodriguez (via teleconference) Stephen D. Baruch

APPENDIX 2

Interference To The Installed User Base Of L-Band Space Services From The Proposal To Allow Co-Primary Terrestrial Services in the MSS L-Band

Presentation to:

The FCC Office of Engineering and Technology

By

The United States Global Positioning System (GPS) Industry Council

On

January 6, 2011

Overview

- Rationale for allocation of the L-band to space services
  - Introducing *Ancillary* Terrestrial Component (ATC) in the L-band
- Coordination process and operating conditions proposed for the first ATC license in 2002
  - Protection criteria for GPS based on out-of-band emission (OOBE) limits
- Proposing a reallocation of L-band from MSS to a primary terrestrial service
  - Introduces a different interference problem for the installed GNSS user base
  - Needs additional mitigation measures to be taken—beyond OOBE
- Possible mitigation techniques
- Overview of the installed GPS user base; maximum allowed power at a GNSS receiver
  - Three decades of user-driven GPS innovation have resulted in a pervasive public and private sector dependency on GPS position, navigation, and timing (PNT) information.
- Different regulatory treatment for contemplating a change in spectrum use
  - FCC NPRM/NOI on broadband;
  - FCC File Number SAT-MOD-20101118-00239
- Recommendations

Rationale For Allocation Of The L-band To Space Services

- Distinctive physical properties of the L-band include a low loss characteristic through the atmosphere that makes it uniquely suited to space to ground communications
- These physical properties are uniquely suited to the intended functions of:
  - Mobile-satellite services (MSS) in 1525-1559 MHz
  - Radionavigation Satellite Services (RNSS) in 1559-1610 MHz
- MSS and RNSS operate in adjacent bands where the spectrum has been allocated to space services for several decades:
  - Without any terrestrial transmissions
- As long as these adjacent bands remain allocated to truly satellite service operations as the primary service:
  - Their spectrum use (noise floor management) and power levels could be moderated to avoid interference between satellite services
  - Allowing operational "harmony" between a space-based communication service (MSS) and a broadcast, receive-only service (RNSS)

Introducing Ancillary Terrestrial Component (ATC) In The L-band

- Terrestrial and satellite operations have different physical and geometric characteristics
  - Makes it very difficult for the two to co-exist without the terrestrial transmissions interfering with the satellite transmissions.
- When MSS operators added ATC to complement and augment their space-service in 2002, this augmentation created the potential for significant new interference to adjacent space services operating in the L-band for:
  - MSS operations;
  - RNSS operations especially for adjacent GPS operations using the L1 (1559-1610 MHz)
    - The GPS L1 is bracketed by MSS operations (1525-1559 MHz and 1626.50 -1660.50 MHz)
    - This bracketing raises the GPS noise floor resulting from MSS operations on both sides of GPs L1
- According to FCC rules, ATC is a secondary allocation in the L-band allocated to MSS on a primary basis and is required to operate:
  - To not cause interference;
  - To accept interference
- As adopted, FCC MSS/ATC rules took great care to ensure that ATC providers remain bona fide satellite service providers by requiring:
  - MSS/ATC operators to maintain a ground spare satellite;
  - By definition that an MSS/ATC licensee offer an integrated service that requires including MSS in the offering to the customer

The First ATC License In 2002 Coordination Process And Operating Conditions As Proposed

- Mobile Satellite Ventures (MSV), the operator of MSS/ATC in the L-band, began coordination of its ATC license with the Interdepartment Radio Advisory Committee (IRAC) and the National Telecommunications Information Administration (NTIA):
  - MSV originally proposed a single protection limit (-70 dBW/MHz) for GPS operations in the adjacent L1 band:
  - NTIA and the IRAC members encouraged MSV to confer with members of the GPS industry on protection of GPS;
  - MSV was the single operator of both the proposed MSS/ATC operations in the L-band;
  - ATC operations were to be deployed as a gap-filler to augment and extend MSS coverage in areas such as urban canyons;
  - MSV planned for operation of dual-mode handsets exclusively
  - As a practical matter, in making this commitment to exclusive dual-mode handset use, MSV had a particular interest not to overwhelm the satellite channels when close to an ATC base station.
  - None of these considerations speculated on the operation of a primary mobile terrestrial broadband communication service.

Protection Criteria for GPS Out-of-Band Emission (OOBE) Limits

- In recognition of the increased potential for interference to adjacent space services, when ATC was introduced in the MSS bands, MSV and the U.S. GPS Industry Council negotiated an agreement on out-of-band emission (OOBE) limits to protect GPS operations in the L1 band:
  - Mobile terrestrial stations must limit their equivalent isotropically radiated power (EIRP) to
  - - 95 dBW/MHz for wideband emissions; while narrowband emissions are subject to a limit of -105 dBW/kHz
  - Fixed or mobile base stations must adhere to a wideband EIRP density emission limit of -100 dBW/MHz; and a narrowband emission limit of – 110 dBW/kHz
- Subsequently, MSV's corporate successor, SkyTerra, approached the Council concerning its proposal to introduce ATC femtocells for indoor operations and the original joint agreement was modified for greater OOBE protection for indoor GPS use:
  - Femtocells operating indoors were agreed to limit EIRP density in the GPS band of – 111.7dBW/MHz for one operating; and – 144.7 dBW/MHz when two femtocells are in the same room.

In each case, the underlying premise of these agreements is that the L-band operator of MSS/ATC (first MSV, then SkyTerra) agreed to protect GPS transmissions in the adjacent RNSS L-band.

Proposing A Reallocation Of L-band From MSS To A Primary Terrestrial Service

- Application request for modification of its authority for Ancillary Terrestrial Component (FCC File No. SAT-MOD-20101118-00239) seeks to effectively reinterpret its ATC rules to:
  - Operate a co-primary terrestrial wireless service in urban areas:
    - By deploying a densely populated network of strong signal transmitters whose emissions would effectively blanket entire urban areas;
  - While conducting its MSS operations outside of areas where its proposed terrestrial service would operate;
  - Thus, this application proposes to provide a primarily terrestrial wireless service with ancillary MSS, which is the opposite of the original premise of the service embodied in the current rules and its L-band license;
  - Instead of offering an integrated MSS/ATC handset exclusively as required in its existing ATC license, it proposes an integrated MSS/ATC service for which its retailers could choose to offer terrestrial handsets only to end-users
- The Applicant "estimates that the capacity of its fully deployed terrestrial network across all base stations will be tens of thousands of times the capacity of either of the Sky Terra satellites":
  - Consequently, the physics and dynamics of this newly proposed terrestrial service would radically change and degrade the environment in which the adjacent GPS L1 signal operates; the ultimate effect would be a loss of GPS service.
- In comments filed in FCC ET Docket 10-142 (page 12, para. 1), LightSquared specifically requests the "Commission could, however, make it substantially easier to implement ATC domestically in the future by expanding the definition of MSS in its rules to include ATC and thus rendering ATC a primary service."

Introduces A Different Interference Problem For The Installed GNSS User Base In The RNSS L-band

- Broadcast satellite signals are very low power at the Earth's surface.
- Reallocation of the MSS L-band from a primary space-based service to a primary terrestrial service introduces a fundamental, difficult, interference problem at the GPS receiver because its ability to filter strong signals transmitting in nearby bands, while trying to listen to weak signals, is limited.
- Depending on the interference source, the effect on GPS receivers' performance can result in desensitization, which prevents the receiver from functioning properly, and thus constitutes harmful interference.

Additional Mitigation Measures Need To Be Taken Beyond OOBE

- When ATC was first authorized, the OOBE limits were negotiated to protect GPS
- These limits were established with the understanding that the business and operations plan for ATC was strictly as an infill service for where the MSS satellite signal did not reach.
  - With this understanding, GPS got an additional measure of protection because areas not served by MSS satellite signals were highly limited in scope, and GPS protection would be partly achieved by the interest of MSS operators in protecting the integrity of their own satellite signals
  - With the reallocation of the MSS L-band from a space-based service, to a primary terrestrial broadcast, this protection and the incentive for it, disappears
- Thus, additional mitigation measures will need to be taken beyond the established OOBE limits in the existing ATC authorizations.

Possible Mitigation Techniques

- Possible techniques to mitigate harmful interference to RNSS from the introduction of widely-deployed terrestrial transmitter on a primary basis:

  1. Introduce new terrestrial broadband transmitters as far from mobile satellite applications as possible, especially from the RNSS L-1 band at 1559-1610 MHz:
     - Migrate the satellite services closer together and allocate terrestrial services at the edge of the satellite grouping as the bands get cleared.
     - The objective of this approach is to keep the two types of distinctly different (space-based versus terrestrial) services separate and have an acceptable amount of margin around the edge of all satellite services to protect their fundamental operations and utility to long-established installed user base of the adjacent L-band RNSS services and devices
  2. Establish a power limit for the newly-proposed terrestrial transmitters based on their frequency proximity to the satellite bands (in particular to the broadcast RNSS bands allocated to GPS/GNSS operations):
     - Terrestrial transmitters close in frequency to the GPS band would have to be limited to less than the current limit of 31.9 dBW in proportion to their proximity to the GPS band
  3. Establish a power limit for the newly-proposed terrestrial transmitters in the MSS band based on the density of installations.
     - While this approach does not eliminate the potential effect of new terrestrial transmitters overcoming GPS receiver selectivity, it does reduce the probability of this occurring.

The Installed GNSS User Base

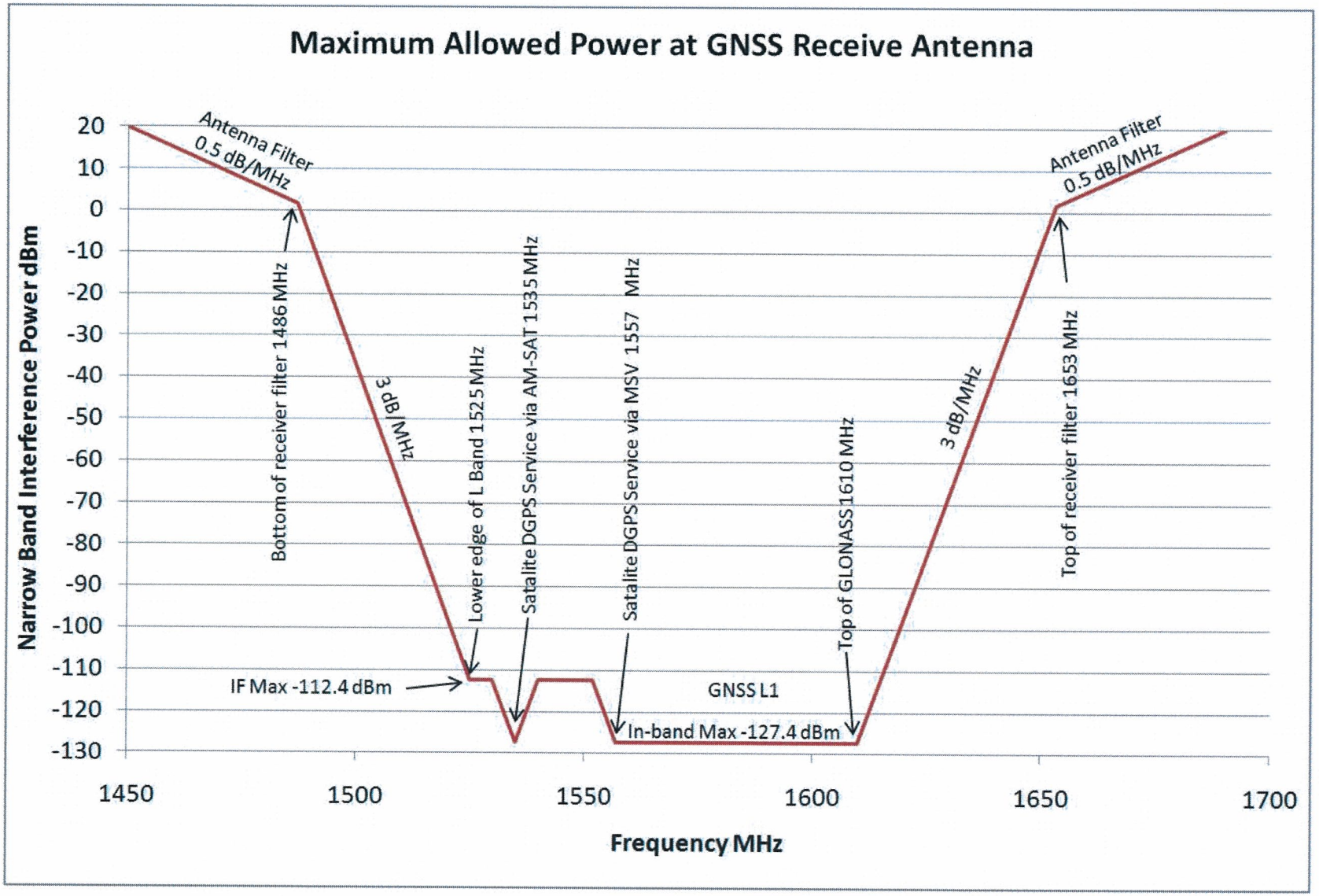
- For purposes of this technical discussion, we developed an overview of today's existing installed GPS user base who will be potentially adversely affected by the proposed reallocation of the MSS L-band to primary terrestrial wireless use. This technical input was developed based on analysis and test data for installed GNSS receivers;

- This overview represents a composite of receivers that serve a wide variety of markets: E911; police, fire, paramedic response; consumer applications; precision construction; structural deformation monitoring; machine control; survey; mapping; geographic information systems (GIS), including MSS-delivered correction services.

- Receiver sensitivity to signals across the L-band is shown with respect to the receiver antenna. Proposed co-primary terrestrial wireless service signals transmitting above the level shown on the graph, may, depending on the receiver type, jam the receiver. This graph can be used to establish a sphere of jamming from a terrestrial transmitter of a specific frequency and power .

- This overview, produced on short notice, serves to illustrate the extent of the problem. A thorough technical study of the effect on GPS receivers in the public and private sector from the newly proposed terrestrial L-band transmissions is required for definitive decision-making.

Maximum Allowed Power At A GNSS Receiver (Mask)



Technical Discussions With LightSquared

To date, the Council has had two technical discussions with LightSquared, including:

- To facilitate an understanding of the different technical problem at the GPS receiver created by the proposed terrestrial wireless service, the Council developed a technical overview of the existing installed user base of GPS that shows the:
  - Potentially adverse effect at the composite GNSS receiver:
  - Additional technical mitigation that would be needed to ensure that this existing installed user base continues to receive the GPS signals.
- LightSquared provided technical input on the proposed operating conditions (our discussions have not been conducted under a non-disclosure agreement)

Three Decades Of Expanding GPS Use

- A brief review of the evolution of GPS and its growing ubiquity can aid the understanding of practical and effective technical solutions to ensure that mobile terrestrial services are able to serve the many customers, who in all likelihood, already depend on GPS:

1978 - First GPS satellite launched

1981 - First civilian GPS product introduced for survey use by a Federal Agency

1984 - GPS products introduced for timing infrastructure and commercial survey

1989 - Mobile GPS handheld introduced for consumer use

1990's (early) - Dual-frequency GPS products introduced for scientific and commercial use in dynamic, high precision applications requiring a centimeter or better accuracy in real-time

1995 - GPS system declared Full Operational Capability (FOC)

1996 - Presidential Decision Directive (PDD) announced: "GPS provides substantial military advantage and is now being integrated into virtually every facet of our military operations [and] GPS is also rapidly becoming an integral component of the emerging Global Information Infrastructure, with applications ranging from mapping and surveying to international air traffic management and global change research."

Late 1990s - Commercial high precision GPS networks in urban and rural areas:

- Provide to multiple, diverse range of end-users the capability to leverage the utility of positioning, navigation, and timing (PNT) information to increase operational productivity.

Three Decades Of Expanding GPS Use *(continued)*

- 2000 – The United States recognized the increasing importance of GPS to civil and commercial users by ending the deliberate degradation of accuracy for non-military signals, known as Selective Availability
  - Since this time, commercial and civil GPS applications have continued to multiply and their importance in critical infrastructures has increased significantly.
- 2004 – President's Positioning, Navigation, Timing Policy declared that "services dependent on Global Positioning System information are now an engine for economic growth enhancing economic development and improving safety-of-life, and the system is a key component of multiple sectors of U.S. critical infrastructure,"
  - "Over the past decade, the Global Positioning System has grown into a global utility whose multi-use services are integral to U.S. national security, economic growth, transportation safety, and homeland security and are an essential element of the worldwide economic infrastructure."
- 2006 – GPS-enabled cellphones were introduced, including for E911 use
- 2008 – GPS-enabled mobile social networking applications introduced (*e.g.*, Foursquare; Facebook, etc.)

Increasing small, medium, and large companies, having operations that depend on the availability of the GPS signals, are driving complete "site integration" of the PNT information available from these space-based RNSS signals.

FCC ET Docket 10-142 Proposed The Standard Regulatory Approach When Contemplating A Change In Spectrum Use (2GHz)

The FCC's proceeding on MSS Broadband has two distinct parts:

1. The first part is a Notice of Proposed Rule-making (NPRM):
   - Proposes to allow use of secondary market leasing rules that already apply to terrestrial mobile systems in the context of MSS/ATC in the L-band, Big LEO, and 2 GHz MSS spectrum;
   - Other provisions are as proposed, but at its core this NPRM proposes a "relaxation" of the MSS/ATC rules to promote use of this spectrum for broadband applications;
   - Nevertheless, the NPRM is clear that the existing MSS/ATC rules will continue to govern the service, specifically noting the continued application of the OOBE in the authorizations of each of the licensed MSS/ATC systems.
2. The second part is a Notice of Inquiry (NOI):
   - The FCC invites comments on a potential later NPRM to consider allowing co-primary terrestrial use of **only** the 2 GHz MSS spectrum;
   - The significance of this NOI is that the FCC considers it premature to have an NPRM on the subject of the reallocation of the 2 GHz MSS spectrum to terrestrial use.

The issues raised by the FCC in this NOI are precisely the types of issues that need to be addressed when contemplating a change in use of spectrum, particularly when adding a co-allocation of a terrestrial use to space-based spectrum use.

FCC File No. SAT-MOD-20101118-000239 But, The Standard Regulatory Approach Is Not Proposed For The Same Change In Spectrum Use In The L-Band (As 2GHz)

- However, this is not how the FCC is proceeding in contemplating the proposed waiver of the MSS/ATC L-band applicant's existing ATC authorization to effectively allow co-primary terrestrial use of the L-band allocated to primary MSS use:
  - What the FCC considered too premature for the MSS Broadband NPRM (reallocation) (ET Docket 10-142), is now being proposed in the L2 waiver (FCC File No. SAT-MOD-20101118-000239) without first seeking public comments first in an NOI followed by an NPRM.
- Thus, the FCC is now proposing an effective co-primary allocation to terrestrial use in spectrum allocated to a primary space service (MSS) which is not only without precedent, but also not following the FCC's regulatory approach that the Commission has set out in its own companion proceeding (ET Docket 10-142).

Two Critical Questions

- If LightSquared already has authority to provide terrestrial service under its MSS/ATC license, why is the waiver needed?

- If a waiver is needed to provide the service they are proposing, why is the Commission not treating it for what it really is – a reallocation of spectrum – and using the same process as under the NOI in the MSS Broadband proceedings (ET Docket 10-142)?

Recommendations

To avoid creating a setback for the Nation's broadband agenda and potential harm to the national GPS utility, ensure that:

1. Equivalent regulatory treatment is undertaken for contemplation of a co-primary terrestrial service allocation in the L-band allocated to MSS use as the FCC is proposing for the co-primary terrestrial service allocation in the 2GHz band allocated to MSS:
   - Consider the application for modification of the MSS L-band ATC license (FCC File No. SAT-MOD-20101118-00239) under the FCC NPRM/NOI on broadband (FCC ET Docket 10-142) to allow adequate development of the public record and robust public comment, especially to fully understand the potential for harmful interference to adjacent MSS and RNSS services in the L-band;
2. A comprehensive technical analysis of the potential for harmful interference is undertaken by the appropriate representatives of the United States Government (USG) having technical expertise, including specialized technical expertise, relevant to the broad range of public and private sector operating scenarios among the installed user base of the GPS signals in the RNSS L-band today; such as: FCC OET; NTIA; IRAC members;
3. **All mitigation measures are identified and enabled to protect GPS use in the L-band prior to authorizing a terrestrial service in the L-band.**