Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street, SW  
Washington, DC 20554

Re:  *Ex parte* presentation in IB Docket No. 12-340; IBFS File Nos. SAT-MOD-20101118-00239; SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SES-MOD-20121001-00872

Dear Ms. Dortch:

Aviation Spectrum Resources, Inc. (ASRI), Airlines for America (A4A), the Bristow Group Inc. (Bristow), the Cargo Airline Association (CAA), Federal Express (FedEx), Helicopter Association International (HAI), the International Air Transport Association (IATA), the National Air Transportation Association (NATA), Rockwell Collins Information Management Services (Rockwell-Collins IMS), and United Parcel Service (UPS) (collectively, the Joint Aviation Parties), hereby respond to the revised GPS receiver test plan prepared by Roberson and Associates, a consultant to LightSquared, filed on 30 September 2015 in the above-referenced proceeding.¹

ASRI is the communications company of the U.S. air transport industry, and is owned by U.S. airlines and other airspace users. As licensee for U.S. aeronautical enroute frequencies used for airline operational communications, ASRI sponsors the Aeronautical Frequency Committee (AFC) ² to enable the gathering of expertise and opinions from across the U.S. aviation sector, promoting the safe and efficient operation of civilian aviation radio communications and navigation systems operating within the U.S. By coordinating with the AFC membership, ASRI supports the safe operation of U.S. aviation in an international environment through participation with the International Civil Aviation Organization (ICAO), IATA, and International Telecommunication Union Radiocommunications Sector (ITU-R).

A4A is the industry trade organization for the leading U.S. airlines. Annually, commercial aviation helps drive nearly $1.5 trillion in U.S. economic activity and more than 11 million U.S. jobs. A4A vigorously advocates on behalf of the American airline industry as a model of safety, customer service and environmental responsibility and as the indispensable network that drives our nation’s economy and global competitiveness.

¹ *See* Attachment to Letter from Gerald J. Waldron, Covington & Burling, LLP, Counsel to LightSquared, to Marlene H. Dortch, Secretary, federal Communications Commission, filed in IB Docket No. 12-340, et al., dated September 30, 2015 (“LightSquared Plan”)

² Membership includes all major U.S. airlines, cargo carriers, and helicopter operators; A4A, Aircraft Owners and Pilots Association (AOPA), Helicopter Safety and Advisory Conference (HSAC), National Business Aviation Association (NBAA), NATA, and HAI.
Bristow is the leading provider of helicopter services to the worldwide offshore energy industry based on the number of aircraft operated and one of two helicopter service providers to the offshore energy industry with global operations. Bristow has major transportation operations in the North Sea, Nigeria, the U.S. Gulf of Mexico, and in most of the other major offshore oil and gas producing regions of the world, including Australia, Brazil, Canada, Russia, and Trinidad.

The CAA is the nationwide trade organization representing the interests of the nation’s all-cargo air carriers before Congress and federal and state regulatory bodies. Specializing in the transportation of cargo, CAA members are the primary drivers of a worldwide economy that demands the efficient time-definite transportation of a wide range of commodities.

FedEx delivers packages and freight to more than 375 destinations in 220 countries and territories each day. A subsidiary of FedEx Corporation, it operates the world's largest airline in terms of freight tons flown, providing a truly global time-sensitive express service.

HAI is a not-for-profit, professional trade association that represents the interests of the helicopter community. HAI has over 4,000 members, including 1,727 companies in 74 nations. Since 1948, HAI has provided its members with services that directly benefit their operations by offering programs to enhance safety, encourage professionalism, and promote the unique benefits of vertical flight. HAI’s first priority is — and always will be — safety.

IATA represents the interests of some 260 airlines in over 117 countries, over 90 of which fly into and out of the United States. The safety and security of our member airlines is IATA’s highest priority. As such, IATA has a significant interest in the protection of aviation GPS receivers.

NATA is the public policy group representing the interests of aviation businesses before Congress, federal agencies and state and local governments.

Rockwell-Collins IMS is a global aviation industry leader, with its ARINC air-to-ground network, which is depended on by airlines around the world to seamlessly deliver a true global link of voice and data communications.

UPS operates one of the world's largest, safest, and most on-time airlines. UPS Airlines integrates small packages and heavy freight in its daily network of more than 500 aircraft and nearly 1,800 flight legs that reach more than 700 destinations in over 220 countries and territories worldwide. At any given time, the economic value of the goods and services moving in the UPS supply chain equates to 6% of the U.S. gross domestic product and 2% of global GDP. UPS Airlines plays an integral role in that supply chain and it is essential that the national aviation network operates efficiently and effectively to ensure American competitiveness.
Introduction

LightSquared presents the LightSquared Plan as the preferred method for the Federal Communications Commission (the Commission) and the National Telecommunications and Information Administration (NTIA) to derive GPS receiver interference tolerance masks, centered on the L1 GPS frequency band 1559-1610 MHz. LightSquared claims that its revised test plan addresses the previous concerns raised by industry stakeholders, as well as refinements to its testing protocol.

The Joint Aviation Parties have reviewed the LightSquared Plan, and they have concluded that it makes numerous assertions and statements that would fatally undermine the credibility of any results produced by the LightSquared Plan. This is especially clear when the LightSquared Plan is compared to the DOT Test Plan being developed with industry-wide and federal agency support using objective and well-established metrics. The following comments explain the serious deficiencies of the LightSquared Plan with respect to the performance of certified aviation GPS receivers, noting significant shortcomings in LightSquared’s use of Key Performance Indicators (KPIs), in its attempt to define harmful interference, and in the testing methodology. Although described from an aviation GPS perspective, the deficiencies with the LightSquared Plan concerning the testing of interference effects suffered by certified aviation GPS receivers are common with LightSquared’s proposed testing of other categories of GPS receivers.

Aviation industry use of GPS systems

A GPS service free from interference remains essential to the aviation industry, ensuring the safe and efficient operation of aircraft for both the flying public, and the nation’s economy. Aviation GPS receivers are used by commercially operated aircraft globally to support navigation, position, traffic, weather, terrain awareness, system timing, and other functions. For example, GPS is integrated into the Terrain Awareness and Warning System (TAWS), a key safety system that provides information to pilots to ensure avoidance of collisions with terrain and man-made structures.

GPS is well recognized internationally as the primary satellite constellation for aircraft navigation. Continuing reliability and robustness of GPS service for aviation constitute both a commitment and obligation of the US Government to ICAO, the United Nations specialized agency for aviation, and to the global aviation community as the whole.

In accordance with international standards and recommended practices established under ICAO and national regulations established by the US Federal Aviation Administration (FAA), aviation requires detailed certification procedures to ensure installed equipment is designed and tested to a suitable standard to maintain the safety of the flying public. Therefore, the Joint Aviation

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Parties are concerned that the inherent flaws in the LightSquared Plan will produce a false representation of GPS receiver performance. The LightSquared Plan would cast aside internationally used standards relied upon by equipment designers, developers, manufacturers, and ultimately aviation companies and the flying public. The deployment of a commercial mobile wireless system in spectrum near the L1 GPS frequency band based on results stemming from the LightSquared Plan would further complicate operation of critical air safety systems and endanger the flying public and aviation-related commercial activity.

No requirement exists to test certified aviation receivers

It is unclear why LightSquared proposes testing to develop an interference tolerance mask test for certified aviation receivers, when these receivers are already tested and certified to an internationally adopted aviation standard used by domestic and foreign-based aircraft operators and manufacturers. Certified aviation GPS receivers already meet RTCA Minimum Operational Performance Standards (MOPS) for immunity to interference from adjacent band signals, and LightSquared recognizes that standard RTCA tests include C/N₀ measurements as one of the many performance metrics used to certify devices. The LightSquared Plan is limited by design to capture the performance of only a “small sample of certified aviation devices” as a function of a constant LTE signal at different levels. The FAA, however, has noted that RF environmental characteristics cannot be assumed to remain constant, necessitating additional margins for safety and making questionable the whole exercise being proposed by LightSquared: “…maintaining the in-air power level limit presents a severe challenge, as the surrounding environment, LightSquared’s network, and aviation operations are all dynamic and continue to change (e.g., helicopter MediVac or search-and-rescue need to be able to operate anywhere.)”

LightSquared’s proposed testing of certified aviation receivers in isolation of existing international aircraft performance standards makes no sense, and essentially asks the Commission to unilaterally modify an existing international standard to allow a US-only application. If adopted by the Commission, such an uncoordinated and unprecedented unilateral move would set a dangerous precedent for other international standards across multiple industries.

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4 RTCA is chartered by the FAA — founded as the Radio Technical Commission for Aeronautics in 1935 — to operate Federal advisory committees, employing a consensus-driven process to generate minimum performance standards for aircraft systems and equipment. These performance standards form the basis for FAA regulatory requirements and are also used internationally to ensure aviation performance is harmonized across all aircraft.

5 See LightSquared Plan, p. 14, § 3.2.3

6 Id., p. 14, §3.2.2.

Ignoring existing GPS interference standards

LightSquared states that the purpose of the LightSquared Plan is to measure the impact and collect data related to certain KPIs “that a GPS device user may experience when L-band LTE downlink and uplink signals are present.” In short, LightSquared proposes to make the end user-experience as purportedly expressed through KPIs central to any analysis of deriving a GPS receiver interference tolerance mask, rather than the objective and standardized criterion that is well-established. Indeed, this proposed subjective process goes against all existing and recognized GPS interference immunity testing already used by the existing GPS receiver manufacturers. In proposing this testing methodology, LightSquared is attempting to modify an existing, and well recognized, standard in an effort to serve its own requirements with potentially adverse impact on the flying public (not to mention on other industries and pursuits relying upon aviation).

Firstly, the well-established metric of an interference-to-noise power ratio of –6 to –10 dB has been adopted domestically and internationally as an appropriate basis for developing an interference protection criterion for GPS receivers and various other radio services operating between 30 MHz and 30 GHz. Indeed, in 2012 the National Space-Based Positioning, Navigation, and Timing Systems Engineering Forum (NPEF) found interference in 75% of General Navigation GPS receivers, which saw a 1 dB increase in the GPS receiver noise when being tested with the lower 10 MHz signal (1526-1536 MHz) being proposed by LightSquared. An increase in noise floor has also been adopted as the key interference protection criterion on repeated occasions, and is also recognized in the ITU-R for recommended protection of certain types of GPS receivers, noting that “the accepted approach is to define the aggregate

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8 LightSquared Plan, p. 2, §1.1
9 See NTIA Report 05-432, Interference Protection Criteria: Phase 1 - Compilation from Existing Sources (October 2005), at ii. (“NTIA reviewed publications of national, international, public and private organizations to compile established IPC [interference protection criteria] for various radio services operating between 30 MHz and 30 GHz. The results are presented in this Phase 1 report. One common feature was that for continuous, long-term interfering signal levels, nearly all established IPC were based on an interference-to-noise power ratio of –6 to –10 dB.) The upper, least restrictive end of this range, an interference-to-noise power ratio of –6 dB is equivalent to an increase of 1 dB in C/N0. See also id. at p. 3-2, §3.3 (“The ITU has developed IPC in the form of I levels for both GPS and GLONASS receivers that are contained in Part 5 of the M series of ITU-R Recommendations. The RTCA has developed IPC for aviation GPS receivers that are also based on I criteria.”)
10 NPEF, Follow-on Assessment of LightSquared Ancillary Terrestrial Component Effects on GPS Receivers (Jan 6, 2012) at 35 (found harmful interference experienced by 75% of General Navigation GPS receivers tested based on “a 1 dB increase in the GPS receiver noise, with the lower 10 MHz (1526-1536 MHz) signal.”).
12 ITU-R Recommendation M.1903-0: Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1 559-1 610 MHz (Jan. 2012); see also GPS Alliance Comments on DOT Test Plan, supra, Annex-1.
interference power density threshold at a level that will not raise the total noise floor by more than 1 dB above the environmental noise floor.”

For certified aviation receivers, the protection criteria are based on acquisition mode threshold power density level of aggregate wide-band interference at the passive antenna output. Furthermore, for receivers used for aviation navigation, an additional safety margin of 6 dB is also required, and single-to-multiple emitter margin also needs to be applied. Therefore, it cannot be emphasized enough that testing of certified aviation GPS receivers is acceptable only if the exact test procedures and criteria specified in the relevant RTCA MOPS for GPS are employed.

For these reasons, the Joint Aviation Parties believe there is absolutely no requirement to test certified aviation receivers, and that that the 1 dB degradation to C/N₀ metric, as implemented in the DOT Test Plan, continues to be the only credible method to assess an interference tolerance mask for other GPS receivers. Given how GPS receivers operate, an increase in the receiver’s noise floor by ~25 %, or 1 dB is a more appropriate measure than the use of KPIs as suggested by the LightSquared Plan. This standard provides a readily identifiable and predictable metric that all interested parties can take into account now and in the future.

Limited selection of devices

The LightSquared Plan is based, among other things, on the assumption that its selection of test receivers is adequately representative of equipment in use. Yet LightSquared proposes to measure the impact on two models of certified aviation GPS receivers, and only 43 GPS receivers across all usage categories. For what is proposed as a method of defining the definitive performance of all GPS receivers, the small selection of devices chosen is insufficient. The limited selection fails to fully represent existing system performance across multiple manufacturers, configurations, installations, operating environments, and usage models, especially given the LightSquared Plan’s focus on subjective KPIs rather than an objective interference criterion.

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13 ITU-R Recommendation M.1903-0: Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1 559-1 610 MHz (Jan. 2012); Annex 2 § 2.3.

14 On November 12, 2015, LightSquared filed with the Commission a set of reply comments it had filed on November 9, 2015, to the comments of others regarding the DOT Draft Test Plan contending that use of a noise floor increase approach ignores the fact that ITU Recommendations that GPS Innovation Alliance and others rely upon begin with user-measurable criteria from which interference levels are derived, not the other way around. See Attachment to Letter from Gerald J. Waldron, Covington & Burling, LLP, Counsel to LightSquared, to Marlene H. Dortch, Secretary, Federal Communications Commission, filed in IB Docket No. 12-340, et al., dated November 12, 2015, pp. 2-4 (“LightSquared DOT Reply”). However, what LightSquared ignores is the fact that the 1 dB metric is the result of a process. In other words, the work that LightSquared would have the industry and agencies undertake to arrive at that standard has already been done, which is why the 1 dB standard is so widely recognized and used.

15 The primary measurement of GPS is the timing of sub-nanosecond bit transitions in the navigation signal, and GPS systems operate below the thermal noise floor and require a much wider bandwidth than terrestrial communications systems to receive the extremely weak radio signal from the GPS satellites.
An example of this limited selection process can be found in LightSquared’s proposal to test the certified aviation receivers. Not only is any attempt to redefine the existing standards for certified aviation receivers by this method entirely inappropriate for the reasons noted above, but only two certified aviation receivers with an identical antenna configuration were chosen to impose a new standard on all other certified aviation receivers, namely, the Garmin GTN 625 and Avidyne IFD 440 models. LightSquared does not explain why these devices were selected for testing, or how they can be representative of certified aviation receivers as a whole – as the LightSquared Plan evidently presumes – given the wide variety of such receivers that are in the marketplace today. ASRI’s preliminary research has found many different certified aviation GPS receivers are fitted by the major aircraft manufacturers, and with a multitude of different antennas dependent on aircraft size and purpose. Furthermore, the two receivers selected by LightSquared currently are not even being implemented by the world’s two largest aircraft manufacturers.

The unexplained and seriously flawed selection process of GPS receivers used by LightSquared in the case of certified aviation GPS receivers raises significant questions about the credibility of the whole LightSquared Plan. This is in addition to LightSquared’s unwarranted proposal to test existing certified aviation receivers that already comply with a much more in-depth and established testing standard.

Attempts to redefine harmful interference without adequate consideration of implications

The LightSquared Plan claims to use the Commission’s definition of harmful interference found in Part 2 of the Commission’s Rules as its guide: “Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service.” But, contrary to LightSquared’s claims, the Commission’s definition of harmful interference is deliberately not tied to any specific criteria. Similarly, there is no additional guidance concerning any specific metrics under this definition in the ITU-R regulations, which is the direct source for the Part 2 definition the Commission adopted. However, LightSquared seems intent on trying to redefine the interpretation of harmful interference for its own ends, without adequate consideration of the impact to aviation GPS systems and air safety and efficiency, as served by the existing standard, let alone the even wider implications to other radiocommunication systems and GPS applications. Further, as explained above, the domestic and international protections for GPS are based on a criterion that is designed to ensure interference levels do not rise to a harmful level, regardless of systems and applications in which GPS receivers are and may be utilized.

In addition, LightSquared’s suggestion that harmful interference be defined by degradation to one or more particular KPIs among a limited range of devices (and applications) fails to account not only for the myriad devices and applications to which they are put, but also for future innovation and existing interference into the GPS band. This includes both known and currently

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16 LightSquared Plan p. 4, § 2.3.
17 47 C.F.R. §2.201 (definition of “harmful interference”).
18 See LightSquared Plan, p.5.
unknown applications that could take advantage of ever increasing accuracy of the position, navigation and timing functions of GPS. As GPS receiver technology evolves and corresponding accuracy improves, new applications will emerge, and any receiver interference tolerance mask derived now must not be so aggressive as to frustrate the introduction of new designs and technological advances.

Conclusion

In conclusion, LightSquared’s proposed plan is insufficient in its scope of devices, attempts to redefine existing internationally recognized standards using its own metrics, and asks the Commission to open Pandora’s Box by attempting to define harmful interference using LightSquared’s self-serving criteria. The Joint Aviation Parties are also concerned how a plan that has no support at all from any significant GPS manufacturer can be seen as a credible option, especially given the recent support and input into the proposed test plan of the DOT. Most telling, the LightSquared approach attempts to unilaterally redefine international aircraft performance and equipment standards for a safety critical system without any international coordination. This is despite a well-established set of existing international standards for certified aviation receivers having already been tested and implemented in many different aircraft as specified in the RTCA MOPS.

The LightSquared Plan would fundamentally be unable to derive a GPS receiver interference tolerance mask in a credible manner, by ignoring an objective industry standard that has been used both domestically and internationally for a large number of systems that have already been deployed. Therefore, the DOT Test Plan, as modified by the suggestions of GPS industry stakeholders, is the only credible approach for GPS receiver testing.

Respectfully submitted,

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