Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
LightSquared Request to Modify Its ATC Authorization	)	IB Docket No. 12-340
	)	
	)	IBFS File Nos. SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SAT-MOD-20101118-00239; SES-MOD-20121001-00872
	)	
LightSquared Technical Working Group Report	)	IB Docket No. 11-109
	)	
LightSquared Petition for Rulemaking to Allocate the 1675-1680 MHz Band for Terrestrial Mobile Use	)	RM-11681
	)	
Request by OP LLC for Extension or Waiver of the Construction Deadline Concerning its 1670-1675 MHz Band License	)	WT Docket No. 12-327

REPLY COMMENTS OF LIGHTSQUARED INC.

Jeffrey J. Carlisle
Executive Vice President, Regulatory Affairs
and Public Policy
LIGHTSQUARED INC.
10802 Parkridge Boulevard
Reston, VA 20191
703-390-2001

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Summary

The LightSquared Uplink Assessment details why LightSquared's authorized terrestrial uplink operations do not pose any risk to the operation of GPS receivers. In contrast, the few parties that criticize LightSquared's analysis (the "GPS Parties") utterly fail to demonstrate any issue of concern or justification for upsetting the Commission's prior findings regarding those uplink operations, or to explain why further evaluation of LightSquared's terrestrial uplink operations at this late hour is necessary when:

- The Commission *already* completed an extensive rulemaking—nearly a decade ago—that examined the implications of terrestrial operations in the uplink portion of the L Band and concluded that such operations pose no risk to GPS receivers; as a result the Commission licensed LightSquared to conduct such operations;

- The specific technical parameters within which LightSquared handset uplinks will operate were negotiated with and agreed to by the GPS industry over a decade ago and endorsed by National Telecommunications and Information Administration ("NTIA") shortly thereafter, and LightSquared has unilaterally agreed to even stricter parameters in the context of a grant of its pending license modification applications;

- Neither the initial comments in response to the recent Public Notice, nor the extensive record that otherwise exists in these proceedings, provides any affirmative showing that LightSquared's terrestrial uplink operations pose a threat to the operation of GPS receivers; instead, the GPS Parties essentially criticize LightSquared for failing to prove a negative—namely, that there is absolutely no scenario under which GPS receivers (the design and operation of which they control) might prove incompatible with the operation of LightSquared handsets;

- Hundreds of millions of terrestrial wireless (PCS and AWS) handsets and small satellite terminals—many of which are mounted in safety-of-life applications: (i) operate *today* in very close physical proximity to GPS receivers, (ii) are permitted by the Commission's rules to emit much higher levels of power into/next to the GPS band than LightSquared handsets would emit, and (iii) have operated for many years without impeding the successful reception of GPS signals.

- A 2005 report funded by the Federal Aviation Administration ("FAA") concluded that many phones, laptops, and other wireless consumer devices used on board airplanes produce power levels that exceed by a factor of 2 to 300 times the power limits that would govern the operation of LightSquared handsets, and operate without compromising GPS receivers on those same aircraft; this operational

history demonstrates that the speculation of the GPS Parties is wholly unsubstantiated; and

- The Commission can ensure that LightSquared handsets—which are still being developed—comply with the applicable power limits through the equipment authorization process such that (consistent with longstanding Commission precedent) there is no basis to demand an unprecedented evaluation now of various types of end user equipment that have not yet been produced.

Accordingly, there is no need for the Commission to evaluate further the compatibility of GPS receivers with LightSquared's authorized L-Band terrestrial uplink operations. LightSquared therefore urges the Commission to promptly: (i) confirm that the conditions set forth in the *Conditional Waiver Order* are either fully satisfied or not applicable with respect to the L-Band operations proposed in LightSquared's pending license modification applications, and (ii) grant those applications.

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REPLY COMMENTS OF LIGHTSQUARED INC.

LightSquared Inc., on behalf of its subsidiary, LightSquared Subsidiary LLC (collectively, "LightSquared"), replies to the comments filed in response to the Public Notice issued by the Commission on August 7, 2013 in the above-referenced proceedings.[1] That Public Notice seeks comment on a technical analysis prepared by LightSquared with respect to its L-Band terrestrial uplinks (*i.e.*, handset transmissions), which LightSquared had prepared in consultation with other government interests (the "LightSquared Uplink Assessment").[2] The LightSquared Uplink Assessment follows from LightSquared's extensive efforts (starting even before the filing of its comprehensive proposal almost a year ago) to resolve objections about its

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1 *See* Comments Sought on LightSquared Subsidiary LLC *Ex Parte* Filing, DA 13-1717 (Aug. 7, 2013) ("Public Notice").

2 *See* LightSquared Assessment of Uplinks in the 1626.5-1660.5 MHz Band, *attached to* Letter from LightSquared Subsidiary LLC to FCC, IB Docket No. 12-340 (Jul. 15, 2013) ("LightSquared Uplink Assessment").

terrestrial downlinks (*i.e.*, base station transmissions) that have delayed the deployment of terrestrial wireless broadband and driven the company into bankruptcy.

More specifically, at the request of several U.S. government interests, LightSquared performed an analysis that confirms the compatibility of its terrestrial wireless handset operations in the uplink portion of the L Band at 1626.5-1660.5 MHz with GPS receivers. LightSquared refined that analysis after factoring in comments from those government interests, and filed that revised analysis with the Commission at the request of certain of those interests (in the form of the LightSquared Uplink Assessment). Notably, no similar technical analysis exists elsewhere in the record, presumably because LightSquared's authorized use of the 1626.5-1660.5 MHz band for uplinks from low-powered handsets never has been a serious concern in the almost 13 years that have elapsed since the Commission first began the process of authorizing terrestrial uses of L-Band mobile-satellite service ("MSS") spectrum in 2001.

In fact, hundreds of millions of terrestrial wireless (PCS and AWS) handsets and small satellite terminals (i) currently operate in very close physical proximity to GPS receivers, (ii) are permitted by the Commission's rules to emit much higher levels of power into/next to the GPS band than LightSquared handsets would emit, and (iii) have successfully operated (for decades in many cases) without impeding the successful reception of GPS signals.[3] Many such devices are mounted in safety-of-life applications. The operation of LightSquared handsets cannot reasonably be expected to produce a different result.

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[3] *See* Response of LightSquared, IB Docket No. 12-340, at Exh. A & B (Jan. 11, 2013) ("LightSquared Modification Application Response"); LightSquared Reply Comments, IB Docket No. 12-340, at 19-23 & Exh. 1 (Jan. 4, 2013) ("LightSquared Modification Application Reply Comments").

Thus, it is not at all surprising that nothing in the initial comments filed in response to the Public Notice (or elsewhere in the record) contradicts the compatibility showing made in the LightSquared Uplink Analysis. Only three parties—the GPS Innovation Alliance ("GPSIA"),[4] the General Aviation Manufacturers Association ("GAMA"),[5] and Greenwood Telecommunications Consultants LLC ("Greenwood" and, together with GPSIA and GAMA, the "GPS Parties")[6] raise any concerns about LightSquared's analysis. But none of those parties presents a shred of evidence that GPS receivers would not be compatible with LightSquared's terrestrial uplink operations. Rather, those parties either advocate for new power limits for the L Band, or essentially criticize LightSquared for failing to prove a negative—namely, that there is absolutely no scenario under which the operation of GPS receivers (the design of which is entirely outside LightSquared's control) might prove incompatible with LightSquared handsets. Placed in context, it becomes apparent that the GPS Parties are simply attempting to delay the resolution of LightSquared's pending license modification applications—and the comprehensive solution reflected therein—until the LightSquared bankruptcy process concludes, in the apparent hope that the company never is able to deploy its authorized broadband network. Accordingly, LightSquared urges the Commission to act now, in reliance on extensive record evidence, rather than delaying further and thus effectively allowing the GPS industry to dictate the outcome of this proceeding. More specifically, LightSquared respectfully requests that the Commission promptly: (i) confirm that the conditions set forth in the *Conditional Waiver Order* are either

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4 *See* Comments of the GPS Innovation Alliance, IB Docket No. 12-340 (Sept. 6, 2013) ("GPSIA Comments").

5 *See* Comments of the General Aviation Manufacturers Association, IB Docket No. 12-340 (Sept. 6, 2013) ("GAMA Comments").

6 *See* Comments of Greenwood Telecommunications Consultants LLC, IB Docket No. 12-340 (Sept. 6, 2013) ("Greenwood Comments").

fully satisfied or not applicable with respect to the L-Band operations proposed in LightSquared's pending license modification applications; and (ii) grant those applications.

I. BACKGROUND

A. The Commission Concluded a Rulemaking Almost a Decade Ago that Examined, in Comprehensive Fashion, the Implications of Terrestrial Operations in L-Band Spectrum

In the late 1990s, LightSquared determined that adding a terrestrial element to its business would optimize use of its authorized L-Band spectrum and facilitate the introduction of a communications network with superior reliability and coverage. In 2001, LightSquared sought Commission authority to deploy such a terrestrial system. In response, the Commission initiated a rulemaking proceeding in 2001, sought and received significant public comment, and concluded in 2003 that an MSS operator should be permitted to conduct certain terrestrial operations in any portion of its authorized satellite frequencies.[7] In 2004, the Commission licensed LightSquared to provide certain terrestrial services,[8] and in 2005, during the reconsideration phase of the rulemaking, decided to permit the operation of an unlimited number of 1 watt terrestrial handsets in the uplink part of the L Band.[9]

Among other things, that decade-old rulemaking considered whether LightSquared's uplink operations would pose any risk to GPS receivers.[10] As the Commission concluded in 2003, GPS receivers—including receivers used on aircraft—would be adequately

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7 *See Flexibility for Delivery of Communications by Mobile Satellite Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band*, 18 FCC Rcd 1962 (2003) ("*2003 ATC Order*").

8 *See Mobile Satellite Ventures Subsidiary LLC*, 19 FCC Rcd 22144 (2004) ("*MSV ATC Order*").

9 *See Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L Band, and the 1.6/2.4 GHz Bands*, 20 FCC Rcd 4616 (2005), at ¶ 50 ("*2005 ATC Order*").

10 *See 2003 ATC Order* ¶¶ 180-184.

protected as long as L-Band terrestrial terminals comply with applicable power limits. Those power limits, established in 2002 and formally adopted by the Commission the following year, tightened in 2009, and further tightened this year through LightSquared's unilateral commitment, were developed with the active participation of the GPS industry. Indeed, the GPS industry *repeatedly* supported the technical parameters of LightSquared's network, and the tightened power limits, which were refined time after time to address concerns raised by GPS interests.

B. The GPS Industry Has Negotiated Suitable Power Limits with LightSquared Multiple Times in the Past Decade

More specifically, LightSquared's initial March 1, 2001 application for terrestrial authority prompted discussions between LightSquared and the GPS industry, which led to the adoption of negotiated power limits intended to ensure the compatibility of GPS receivers with LightSquared's terrestrial operations, including uplinks from its handsets.[11] A 2002 joint GPS industry-LightSquared agreement memorialized those technical limits in order to "protect the GPS service's present and future operations and to provide a stable environment for the development and operation of [LightSquared's] proposed system."[12] The analysis underlying that agreement "considered all relevant issues concerning potential interference to GPS," and reflected the agreement of "[a]ll relevant stakeholders," as identified by the GPS industry.[13] In light of the agreement, in early 2004 the U.S. GPS Industry Council ("USGIC") advocated that

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11 *See* Letter from Mobile Satellite Ventures L.P. and the U.S. GPS Industry Council to FCC, IB Docket No. 01-185, at 1 (July 17, 2002) ("*2002 MSV-GPS Joint Letter*").

12 *See* Petition for Reconsideration of the U.S. GPS Industry Council, IB Docket No. 01-185, at 2 (June 11, 2003).

13 *Id.* at 4.

the Commission grant LightSquared's application for authority to conduct terrestrial operations in the L Band.[14]

A similar pattern emerged following LightSquared's 2009 request that the Commission modify that authority following the execution of the LightSquared-Inmarsat Cooperation Agreement so as to facilitate the deployment of 4G LTE wireless service over LightSquared's network.[15] In response to that license modification request, the GPS industry sought to ensure the compatibility of GPS receivers with the planned operation of LightSquared's "femtocells" and PC data cards communicating with femtocells.[16] Again, these concerns were resolved through an agreement with the GPS industry that LightSquared would comply with further negotiated power limits.[17] More recently, after engaging in dozens of meetings and conference calls with the GPS industry with respect to its pending license modification applications, LightSquared unilaterally agreed to comply with even more stringent power limits than it had agreed to before.[18]

In short, for over a decade, the GPS industry worked with LightSquared to develop mutually-acceptable technical parameters for LightSquared's terrestrial operations that would ensure, according to the GPS industry itself, a suitable level of protection for GPS receivers. Moreover, the GPS industry described the Commission's initial grant of

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14 See Letter from the U.S. GPS Industry Council to FCC, IBFS File No. SAT-MOD-20031118-00333 (Mar. 24, 2004) ("USGIC Letter").

15 *See SkyTerra Subsidiary LLC*, 25 FCC Rcd 3043 (2010).

16 *See* Comments of the U.S. GPS Industry Council, IBFS File No. SAT-MOD-20090429-00047, at 2-3 (Jul. 10, 2009).

17 *See* Letter from the U.S. GPS Industry Council and SkyTerra Subsidiary LLC to FCC, IBFS File Nos. SAT-MOD-20090429-00046, at 1 (Aug. 13, 2009).

18 *See* Letter from LightSquared to FCC, IB Docket No. 11-109 (Aug. 7, 2013) ("LightSquared Power Limit Letter").

LightSquared's terrestrial authority as validation of LightSquared's "adherence to best commercial practices" with respect to protecting GPS interests.[19]

C. The Technical Parameters of LightSquared's Terrestrial Uplinks Have Become More Benign in the Past Decade

It bears emphasis that in the years since the salient technical parameters of LightSquared's terrestrial uplink operations first were approved by the Commission and the NTIA in 2004, and agreed to by the GPS industry, there has been no change in the nature or scope of terrestrial uplink operations—other than commitments by LightSquared that make that operating environment even more benign.

Notably, in 2004, NTIA conducted a technical analysis of LightSquared's proposed terrestrial uplink operations, including an analysis of the potential impact on GPS receivers, and expressed that it had no concern with the "*unlimited* reuse of [LightSquared's] satellite spectrum for ATC operations" as long as no other co-channel MSS network was affected.[20] Those concerns about other co-channel MSS networks were resolved by the execution of the LightSquared-Inmarsat Cooperation Agreement. Subsequently, NTIA reaffirmed that the power limits to which LightSquared had agreed were sufficient to ensure the compatibility of GPS receivers with terrestrial user terminals in the L Band.[21]

Nevertheless, in the past few years, LightSquared has worked diligently with the Commission, NTIA, other government agencies, the GPS Parties and their constituents, and other stakeholders to resolve the GPS-related concerns that have given rise to LightSquared's

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19 *See* USGIC Letter at 1.

20 *See* Letter from NTIA to FCC, IBFS File No. SAT-MOD-20031118-00333, at 2 (Apr. 21, 2004) (emphasis supplied).

21 *See* Letter from NTIA to FCC, IBFS File Nos. SAT-AMD-20031118-00332 and SAT-MOD-20031118-00333, at 3 (May 25, 2005).

current circumstances. In addition to changing the band in which it plans to operate its base station downlinks in response to those concerns, and in an effort to curtail any further objections by the GPS industry to the pending license modification applications, LightSquared unilaterally committed this year to (i) accelerate by five years its compliance with certain limits on permissible levels of energy generated into the GPS band, and (ii) reduce by 80 percent the power level of the energy generated within LightSquared's authorized L-Band frequencies.

The following table summarizes the salient terrestrial uplink parameters: (i) assumed by the NTIA in 2004 in the course of evaluating LightSquared's applications for terrestrial authority; (ii) applicable to LightSquared after the Commission finalized its service rules for terrestrial operations in MSS spectrum in 2005; and (iii) reflected in LightSquared's current operating plans and its pending license modification applications.[22]

	NTIA (2004)	**FCC (2005)**	**LightSquared (2013)**
Maximum Mobile User Terminal Power	30 dBm (1 W)	30 dBm (1 W)	23 dBm (0.2 W)
Maximum Number of Mobile User Terminals	Unlimited	Unlimited	Based on demand
Wideband OOBE Limit (1559-1605 MHz)	-70 dBW/MHz	-90 dBW/MHz (first 5 years after deployment) -95 dBW/MHz (thereafter)	-95 dBW/MHz (upon deployment)

The above table clearly depicts why the operating environment with respect to terrestrial uplinks from the L Band is even more benign than it was a decade ago.

Similarly, the record underlying the rulemaking proceeding on terrestrial use of the L Band demonstrates that, since 2003, there has been no doubt that the use of terrestrial handsets would be concentrated in populated areas, where the L Band would be heavily used for terrestrial applications. For example, the *2003 ATC Order* noted that one of the key benefits of

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[22] *See* LightSquared Power Limit Letter.

terrestrial operations would be to allow MSS spectrum to be used more intensively in "geographic areas that can be more efficiently served by ATC."[23] Indeed, the Commission anticipated that, in some cases, an operator could use "the large majority of its channels and time for ATC."[24] Moreover, the agreement between LightSquared and the GPS industry reflected the likelihood that mobile user terminals (as well as base stations) would be deployed ubiquitously. Tellingly, in 2003 the USGIC observed that the agreement had been reached after taking into account the "increased user density from *potentially millions of MSS mobile terminals operating in ATC mode*."[25]

D. The Conditions in the 2011 *Conditional Waiver Order* Were Not Intended to Address LightSquared Terrestrial Uplink Operations Because Such Uplink Operations Simply Were Not a Concern

Neither the terms of the 2011 *Conditional Waiver Order* nor the license modification application underlying that order had any impact on the compatibility of GPS receivers with LightSquared's terrestrial uplink operations. The *Conditional Waiver Order* involved only a "limited waiver" that allowed LightSquared end-users to purchase "terrestrial-only" handsets but did not impact prior analysis of the technical compatibility of LightSquared's terrestrial uplink operations and GPS receivers.[26] Indeed, the *Conditional Waiver Order* has no bearing on the fundamental technical parameters of LightSquared's network, and no conceivable impact whatsoever on the parameters salient to an analysis of compatibility of GPS receivers with LightSquared's terrestrial uplink operations.

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23 *See 2003 ATC Order* ¶ 99.

24 *See 2005 ATC Order* ¶ 20; *see also id.* at ¶ 21 ("[W]e cannot predict what eventualities may cause traffic loading to increase or decrease, or how such loads will be distributed between ATC transmitters and MSS handsets.").

25 *See* Reply to Comments of the U.S. GPS Industry Council, IB Docket No. 01-185, at 2 (Sept. 4, 2003) (emphasis supplied).

26 *LightSquared Subsidiary LLC*, 26 FCC Rcd 566 (2011) ("*Conditional Waiver Order*").

In fact, the conditions in the *Conditional Waiver Order* simply were not intended to address LightSquared terrestrial uplink operations. This conclusion is consistent with views expressed by NTIA, the GPS industry, and the Commission itself.

1. NTIA.

In evaluating the application underlying the *Conditional Waiver Order*, NTIA focused on LightSquared base stations. As NTIA expressed in a January 2011 letter to the Commission:

> It is NTIA's view that the Federal and non-Federal GPS users and GPS manufacturers thought this [interference] problem was manageable under the original MSS/ATC concept where there would be a limited number of ***base stations***. But as the number of [LightSquared] terrestrial ***base stations*** increases and/or the duty cycle of ***base stations*** transmissions increases to support the proposed LightSquared terrestrial network, NTIA is concerned that the likelihood of GPS and GNSS receiver in-band interference will also increase. While the distance where this interference occurs may vary based on the specific types of GPS applications considered, ***base stations*** situated in urban areas may never be far from GPS capable handsets. Furthermore, the large installed base of GPS-dependent devices makes this situation difficult to change over the short term."[27]

2. The GPS Industry.

In commenting on the application underlying the *Conditional Waiver Order*, the GPS industry also focused on LightSquared base stations. For example, USGIC incorporated by reference its comments in the parallel *MSS Flexibility Proceeding*, which discussed the need to protect GPS receivers against "strong" signals from the adjacent 1525-1559 MHz band, where ***base stations*** would transmit.[28] The USGIC claimed that GPS receivers might not be able to

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27 *See* Letter from NTIA to FCC, IBFS File No. SAT-MOD-20101118-00239, at 3 (Jan. 12, 2011) (emphasis supplied).

28 *See, e.g.,* Comments of the U.S. GPS Industry Council, IB Docket No. 10-142, at 11-12 (Sept. 15, 2010) (discussing alleged impact on GPS receivers of a terrestrial transmitter

avoid overload from a ***base station*** transmitter in that adjacent band.[29] Moreover, the solutions proposed by the USGIC focused on: (i) tightening the power limit for ***base stations*** in frequencies adjacent to the GPS band, and (ii) reducing ***base station*** power based on the number of such transmitters in a given area.[30]

3. The Commission.

In granting the application underlying the *Conditional Waiver Order*, the Commission described LightSquared base stations as the source of GPS concerns. In particular: (i) the Commission noted that "[s]everal commenters raise concerns about potential interference to GPS receivers and other devices that may result from operation of LightSquared's ***base stations*** . . . ;"[31] (ii) the Commission explicitly referenced NTIA's January 2011 letter—regarding base station concerns—in discussing the potential impact on GPS receivers of more granting the requested waiver;[32] and (iii) in discussing LightSquared's desire to resolve outstanding GPS issues, the Commission observed LightSquared's statement that "it takes the concerns raised by the GPS community about possible overload of GPS devices by LightSquared's ***base stations*** very seriously."[33]

This focus on base stations informed the specific conditions imposed on LightSquared in the *Conditional Waiver Order*. Notably, those conditions provide that: (i) the LightSquared Technical Working Group ("TWG") "focus on analyzing a variety of types of GPS

"authorized to operate at 1555 MHz at 30 dBW"), *appended to* Comments of the U.S. GPS Industry Council, IBFS File No. SAT-MOD-20101118-00239 (Dec. 2, 2010).

29 *Id.* at 12 (asserting that GPS receivers would have insufficient selectivity to reject power from a terrestrial transmitter authorized to operate at 1555 MHz at 30 dBW).

30 *Id.* at 13-14.

31 *Conditional Waiver Order* ¶ 39 (emphasis supplied).

32 *Id.*

33 *Id.* ¶ 40 (emphasis supplied).

devices for their susceptibility to overload interference from LightSquared's terrestrial network of ***base stations***;"[34] (ii) LightSquared's first monthly TWG progress reports "at a minimum include ***base station*** transmitter characteristics, categories of GPS devices and their representative performance characteristics, and test plans and procedures;"[35] and (iii) the final TWG report "include[] the working group's analyses of the potential for overload interference to GPS devices from LightSquared's terrestrial network of ***base stations***, technical and operational steps to avoid such interference, and specific recommendations going forward to mitigate potential interference to GPS devices."[36]

Since the issuance of the *Conditional Waiver Order*, the Commission has continued to describe base stations as the sole source of any remaining concerns. For example, public notices related to the TWG process mandated by the *Conditional Waiver Order* confirm that its purpose was to address ***base station*** concerns. As the public notice released by the Commission to solicit comment on the final TWG report: "The [*Conditional Waiver Order*] condition required submission of a final report that includes the working group's analyses of the potential for overload interference to GPS devices from LightSquared's terrestrial network of ***base stations***, technical and operational steps to avoid any such interference, and specific recommendations going forward to mitigate potential interference to GPS devices."[37]

Similarly, the Commission's public notice issued by the Commission in February 2012 with respect to LightSquared's terrestrial authorizations rested solely on concerns involving base stations. That public notice observes that:

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34 *Id.* ¶ 42 (emphasis supplied).

35 *Id.* ¶ 43 (emphasis supplied).

36 *Id.* (emphasis supplied).

37 *See Comment Deadlines Established Regarding the LightSquared Technical Working Group Report*, DA 11-1133, at 1 (Jun. 30, 2011) (emphasis supplied).

- "[L]ate in 2010, during the waiver proceeding on requirements for mobile devices, the GPS community had raised for the first time concerns that LightSquared's terrestrial ***base stations*** (that is, its cell towers) would cause widespread overload interference to GPS receivers and other GPS devices."[38]

- "In response to those newly expressed concerns about ***base stations***, the [*Conditional Waiver Order*] prohibited LightSquared from going forward and launching its competitive 4G LTE service."[39]

- "[A]lthough the GPS community raised overload interference issues in connection with the 2011 [*Conditional Waiver Order*], the interference addressed by the [Feb. 14, 2012] *NTIA Letter* is associated with LightSquared's planned terrestrial ***base stations rather than the mobile handsets at issue in the [Conditional Waiver Order]***."[40]

This description is underscored by the congressional testimony of Commission staff. Notably, testimony in September 2012 before the House Oversight and Investigations Subcommittee described base stations as the source of the GPS concern. In particular, Commission staff noted that:

- "[I]n November 2010, ***the GPS industry was not complaining about out of band emissions or interference caused by handsets***, or the power levels authorized for the L-band – they were instead notifying us of their own receivers potentially picking up signals from the neighboring band."[41]

- "In July 2010, the Commission initiated a rulemaking to provide greater flexibility to deploy terrestrial service in the MSS bands, including the L-band. In September 2010, *for the first time*, the USGIC filed comments raising the possibility of receiver overload interference to GPS receivers at a distance of about 100 meters ***from ATC base stations***."[42]

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38 *See International Bureau Invites Comment on NTIA Letter Regarding LightSquared Conditional Waiver*, DA 12-214, at 3 (Feb. 15, 2012) (emphasis supplied).

39 *Id.* (emphasis supplied).

40 *Id.* at 4 (emphasis supplied).

41 See Joint Written Statement of Julius P. Knapp, Chief, OET, FCC, and Mindel De La Torre, Chief, International Bureau, FCC, Before the House Oversight and Investigations Subcommittee, at 3 (Sept. 21, 2012) (emphasis supplied).

42 *Id*. at 9 (emphasis supplied).

In short, there is widespread recognition that the *Conditional Waiver Order* has no impact on the compatibility of GPS receivers with LightSquared's terrestrial uplink operations, and thus in no way constrains terrestrial uplink operations in the L Band.

E. LightSquared's Pending License Modification Applications Have No Impact on the Compatibility of LightSquared's Terrestrial Uplink Operations with GPS Receivers

In September 2012, LightSquared made a series of filings that comprise a comprehensive proposal to address the concerns raised by the GPS industry with respect to LightSquared's downlinks in the 1525-1559 MHz portion of the L Band, while allowing LightSquared otherwise to implement its terrestrial 4G wireless network. In the license modification applications filed as part of that comprehensive proposal, LightSquared seeks to modify its existing authority to conduct terrestrial downlink operations in the L-Band spectrum at 1525-1559 MHz by: (i) permanently relinquishing its authority to conduct terrestrial operations at 1545-1555 MHz (the "Upper 10 MHz")—the part of LightSquared's downlink band that is closest to the GPS band—thus providing GPS receivers an additional 10 MHz guardband from terrestrial services; and (ii) in lieu of any terrestrial use of the Upper 10 MHz, employing alternative (non-L-Band) spectrum, comprised of a contiguous 10 MHz band at 1670-1680 MHz, to provide the needed coverage for LightSquared's terrestrial network.

For over a year, LightSquared has met with officials from the Department of Defense, Department of Transportation, NTIA, and the Commission to review and explain the proposals reflected in license modification applications. Furthermore, since the filing of those applications, LightSquared has had dozens of meetings and calls with GPS companies to review and explain the proposals reflected therein. LightSquared has addressed every technical concern presented to it regarding the coexistence of GPS receivers with use of LightSquared's spectrum

for terrestrial wireless broadband, and has not been provided any analysis or other evidence that there are further substantiated technical objections to that terrestrial network use.

Critically, though, at no point did LightSquared propose *any* modification of its existing authority to conduct uplink operations in the 1626.5-1660.5 MHz band. Rather, LightSquared merely sought, to the extent necessary, confirmation that the condition set forth in paragraph 43 of the *Conditional Waiver Order* is satisfied or not relevant with respect to such uplink operations (which would allow LightSquared to proceed with plans to use that spectrum to support commercial service).

II. THE RECORD ESTABLISHES THAT LIGHTSQUARED'S TERRESTRIAL UPLINK OPERATIONS POSE NO RISK TO GPS RECEIVERS

A. The LightSquared Uplink Assessment Underscores Prior Analysis Showing that GPS Receivers—Including those Receivers Associated with the Operation of Aircraft—Can Operate Alongside LightSquared Handset Uplinks

The LightSquared Uplink Assessment details why LightSquared's authorized terrestrial uplink operations do not pose any risk to the operation of GPS receivers, including GPS receivers associated with aircraft operations. The Assessment evaluates a number of use cases and demonstrates, across all such cases, that compatibility with GPS receivers would be assured. And this showing is fully consistent with the *2003 ATC Order*—which concluded that L-Band terrestrial handsets would not pose any risk to GPS receivers as long as the handsets comply with applicable power limits—as well as the technical analysis underlying that order.

Significantly, both the Assessment and the *2003 ATC Order* are fully consistent with conclusions reached by the National Aeronautics and Space Administration ("NASA") in a March 2005 report funded by the FAA that analyzed the potential impact on aircraft communication and navigation radios of various consumer electronic devices that are operated

on board aircraft, including while in flight (the "FAA/NASA Report").[43] The FAA/NASA Report assessed whether power emitted by various tested devices would exceed relevant protection standards, thus compromising the operation of critical aviation radios, including GPS receivers. The FAA/NASA Report clearly shows that the power emitted by PCS band cellphones and by laptops/PDAs (including devices that can be used *while in flight during safety-of-life situations* in both transmitting and non-transmitting modes) is well in excess of the strict limits with which LightSquared has agreed to comply. Yet, these devices were able to meet the applicable RTCA specifications, and more importantly did not cause any known interference to aircraft radios—including GPS receivers. The following figures compare the power emitted into the GPS band by various mobile devices.

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[43] *See* Truong X. Nguyen, Sandra V. Koppen, Laura J. Smith, Reuben A. Williams, and Maria Theresa P. Salud, *Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios*, NASA/TP-2005-213537 (2005), *available at* http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20050111570_2005111233.pdf (attached hereto as Exhibit C) ("FAA/NASA Report"). The report was "funded by the Federal Aviation Administration as part of FAA/NASA Interagency Agreement DFTA03-96-X-90001, Revision 9 . . ."). *Id.* at ii.

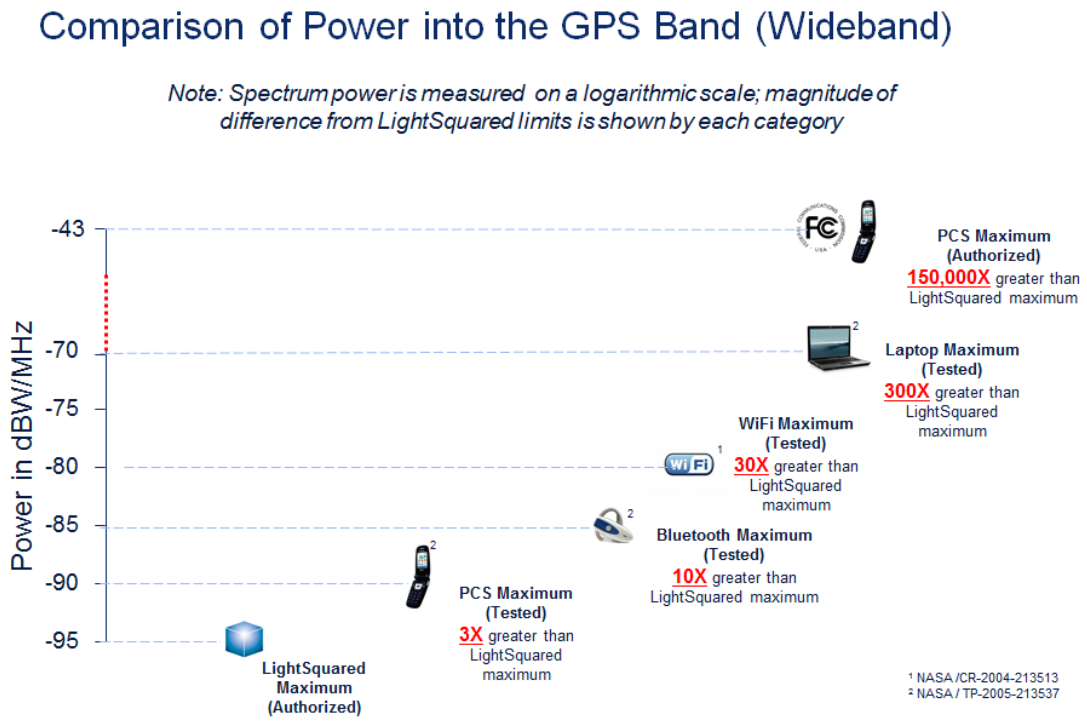

Figure 1

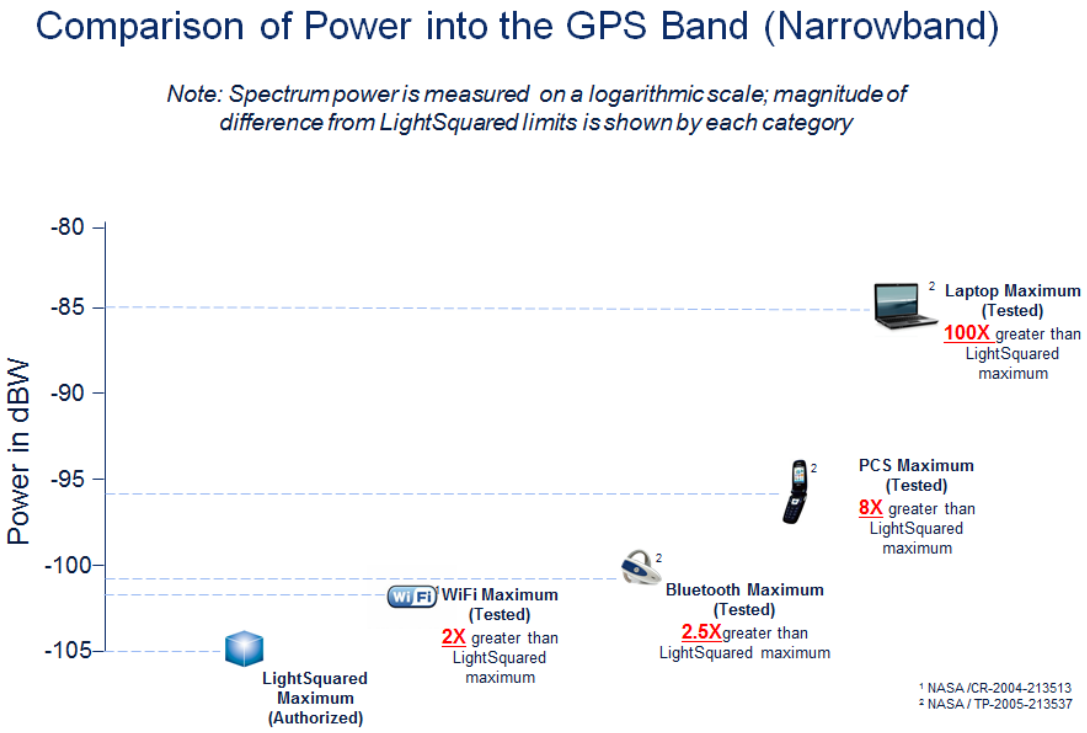

Figure 2

It should be no surprise that devices operating at significantly higher power levels than those at which LightSquared handsets would operate long have coexisted with GPS receivers. As GPSIA recently observed before the Commission, "[t]he spectral environment below 3 GHz has changed dramatically" over the past thirty years. Whereas "in 1981 it would have been unheard of for a passenger on a commercial aircraft to have an electronic device on his or her person emitting intentional or unintentional energy," today "it is not uncommon for nearly every passenger on a commercial flight to have one or more such devices (tablets, phones, laptops, handheld gaming devices, etc.)."[44] The FAA/NASA Report effectively confirms that this changed environment has not compromised the ability of GPS receivers to operate, validates the specific analysis in the LightSquared Uplink Assessment, and shows that GPS receivers would be as well (if not more) protected from LightSquared handsets as from a variety of other mass-market devices that have operated on board aircraft for well over a decade without issue.[45] Indeed, the power limits that would govern the operation of LightSquared terrestrial handsets are more stringent than those imposed by Commission rules on a wide variety of mobile devices and other consumer products, and thus are more than sufficient to ensure compatibility with GPS receivers.

In fact, the FAA/NASA Report recognizes that unlicensed "Part 15" devices are subject to power limits that are less restrictive than those applicable to LightSquared.[46] Those devices are permitted to operate throughout the radiofrequency spectrum (with the exception of

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44 *See* Comments of GPSIA, GN Docket No. 13-185, at 7 (Sept. 18, 2013).

45 *See* LightSquared Uplink Assessment at 15; *see also* Jad Mouawad and Nick Bilton, *F.A.A. Nears New Rules on Devices*, N.Y. TIMES (Sept. 22, 2013), *available at* http://www.nytimes.com/2013/09/23/technology/faa-nears-new-rules-on-devices.html?pagewanted=all&_r=0.

46 *See* FAA/NASA Report at Table 3.6-2; *see also* 47 C.F.R. §§ 15.109 and 15.209.

certain restricted bands) and are used on aircraft while in flight. Moreover, unlike LightSquared handsets, Part 15 devices cannot be managed by any network operator and no one has control of those devices once they enter the retail chain. Yet, these devices have operated in accordance with FCC power limits for years without creating any known issue with GPS receivers on aircraft.

B. The GPS Parties Provide No Basis for Concluding that LightSquared Handsets Pose a Risk to GPS Receivers

1. The GPS Parties Offer No Affirmative Showing To Validate their "Concerns"

Tellingly, the GPS Parties offer no affirmative showing to try to establish that LightSquared's terrestrial uplink operations pose any risk to GPS receivers. Indeed, no party has *ever* offered such a showing, even though the technical issues raised by this proceeding have been subject to public scrutiny for more than 13 years. Instead, the GPS Parties essentially criticize LightSquared for failing to prove a negative—namely, that there is absolutely no scenario under which GPS receivers might prove incompatible with LightSquared handsets. This improper standard is both unreasonably onerous and inconsistent with the *Conditional Waiver Order*, which (i) imposed the burden of producing relevant technical evidence upon both LightSquared *and* the GPS industry,[47] and (ii) required only that LightSquared complete the TWG process "to the Commission's satisfaction" prior to commencing commercial operations.[48] LightSquared submits that, given the strength of the record evidence, the Commission's previous findings in the *2003 ATC Order*, and the Commission's 2004 decision to license the terrestrial

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47 *Conditional Waiver Order* ¶ 41 (envisioning a TWG process in which "information, including proprietary information, can be shared among participants . . . .") and ¶ 42 (noting that "the Commission expects full participation by the GPS industry in the working group and expects the GPS industry to work expeditiously and in good faith with LightSquared to ameliorate the interference concerns").

48 *Id.* ¶ 41.

uplink operations at issue, it is reasonable to expect the GPS Parties to bear the burden of establishing that: (i) the *Conditional Waiver Order* in any way impacts the technical parameters of LightSquared's authorized terrestrial uplink operations (as shown above, it does not), or (ii) such operations would create an unacceptable risk to GPS receivers.

In any event, and as demonstrated fully in the Exhibits A and B hereto, the technical observations offered in the GPS Parties' comments are seriously flawed and, even if assumed valid, would not undermine the ultimate conclusion in the LightSquared Uplink Assessment that LightSquared's planned terrestrial uplink operations are compatible with GPS receivers. For example, many of GPSIA's criticisms focus on secondary analyses offered by LightSquared for the sole purpose of demonstrating that by relaxing certain conservative assumptions, the safety margin enjoyed by GPS receivers would be even greater than that found in the primary analysis of the LightSquared Uplink Assessment (which reflects those conservative assumptions).[49] Similarly, while GPSIA purports to correct aspects of the LightSquared Uplink Assessment,[50] GPSIA fails to demonstrate that such "corrections" have any significant impact on the bottom-line conclusion that there is no GPS receiver compatibility issue.

Also misguided is the suggestion that LightSquared's use of the 90th percentile point of the cumulative distribution function for certain variables impacting transmit power

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49 *See, e.g.*, GPSIA Comments at 8 (taking issue with LightSquared's use of "probabilistic methods" of analysis), 17-18 (asserting that LightSquared's use of antenna pattern measurements from RTCA are "more favorable to LightSquared than the model actually employed in the RTCA analyses"), and App. A, Section II.

50 *See id.* at 22.

"invites interference in 10% of locations."[51] This suggestion incorrectly assumes that the power level at the 90th percentile point is that at which an operational impact could occur. There is no basis for making that assumption; thus, the fact that transmit power would be below the specified point in 90 percent of suburban/urban locations does not imply that a problem would exist in the other 10 percent of locations. This suggestion ignores the independent variables other than transmit power (*e.g.*, antenna coupling loss, body absorption, duty cycle, etc.) that impact the potential for GPS receivers to experience incompatibilities.

2. The GPS Parties Ignore Other Evidence Showing that LightSquared's Terrestrial Uplink Operations Pose No Risk to GPS Receivers

More fundamentally, the GPS Parties ignore all of the other bases upon which the Commission can and should (i) conclude that there are no identified issues with LightSquared's terrestrial uplink operations and (ii) dismiss the GPS Parties' claims as unfounded.

Among other things, the GPS Parties' claims with respect to alleged "overload" caused by LightSquared handsets can and should be dismissed in light of the millions of MSS terminals authorized to operate in close proximity to GPS receivers in the 1626.5-1660.5 MHz band (*e.g.*, Inmarsat and LightSquared METs) and even closer to GPS in 1610-1626.5 MHz band (*e.g.*, Globalstar and Iridium METs). Those MSS terminals operate in close proximity to GPS receivers and at substantially higher transmit power levels than LightSquared's terrestrial mobile handsets, without any known issues. This "real-word" experience necessarily would trump any "paper" analysis of hypothetical scenarios *even if the GPS Parties had presented one*. As such, there is no need for the Commission to continue to entertain the GPS Parties' unfounded

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[51] *See id.* at App. B, Section I.A.2; *see also* Greenwood Comments at 2 (asserting that "there is little comfort" in the fact that "90% of cases would be below peak OOBE power," because the remaining "10% can represent in aggregate terms millions of devices").

allegations in this regard.[52] The GPSIA simply ignores the compelling evidence showing that METs have operated near GPS receivers for many years without creating any issue—a demonstration that LightSquared made nine months ago.

The "real world" case for dismissing the GPS Parties' claims with respect to alleged "out-of-band" impact from LightSquared handsets is just as compelling. As in the "overload" context, the best indication that L-Band terrestrial network operations would not pose any OOBE threat to GPS receivers extends from real-world experience with other mobile transmitters operating in the vicinity of such receivers. *Hundreds* of millions of METs and terrestrial wireless devices have operated successfully throughout the United States in and around the 1626.5-1660.5 MHz band for decades, and at significantly higher power levels than those with which LightSquared has agreed to comply, without creating any issues for GPS receivers.[53] Again, the GPSIA wholly ignores the compelling evidence showing that METs have operated near GPS receivers for many years without creating any issue.

This experience is reflected in the findings of the FAA/NASA Report. As discussed above, that report evaluated whether mobile wireless devices and other consumer electronics that are used on board airplanes pose any threat to the GPS receivers mounted in those same aircraft and used in critical safety-of-life applications. The report shows that those devices could exceed by significant margins the restrictive power limits that govern the operation of LightSquared handsets while still satisfying the relevant RTCA specification and providing

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52 *See* LightSquared Modification Application Reply Comments at 19-24; LightSquared Modification Application Response at Exh. B (showing Inmarsat MET used in close proximity to GPS receiver).

53 *Id.*

adequate protection to aircraft GPS receivers.[54] In other words, many devices emit much higher power levels into the GPS spectrum than LightSquared handsets would, yet have operated successfully and without issue for many years in the vicinity of aircraft GPS receivers (including during flights).

Furthermore, the LightSquared Uplink Assessment clearly shows that the power limits with which LightSquared will comply are more than sufficient to ensure the compatibility of GPS receivers. Compliance with those power limits will be ensured both by the terms of LightSquared's authorizations and the use of the equipment authorization process (which would apply to each LightSquared handset type).[55] The GPS Parties have produced no evidence to the contrary.

3. The GPS Parties Ignore Their Prior Endorsement of LightSquared's Terrestrial Operations In Accordance with Power Limits that They Negotiated

It also is significant that the GPS industry itself negotiated and agreed to power limits that are less restrictive than those that would govern the operation of LightSquared handsets under the proposal submitted by LightSquared on August 7, 2013.[56] At the time those limits were agreed, the GPS industry expressed its view that the limits would protect GPS receivers and that its underlying agreement with LightSquared "considered all relevant issues concerning potential interference to GPS," and reflected the agreement of "[a]ll relevant stakeholders," as identified by the GPS industry.[57]

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54 *See* FAA/NASA Report at 87-88.

55 *See generally* 47 C.F.R. Pt. 2 Subpt. J.

56 *See* LightSquared Power Limit Letter.

57 *See* Petition for Reconsideration of the U.S. GPS Industry Council, IB Docket No. 01-185, at 4 (June 11, 2003).

4. The GPS Parties' Suggestion that the LightSquared Uplink Assessment Is Insufficient Because No Actual LightSquared Handsets Were Tested Is Unavailing

Equally unavailing is the suggestion that the LightSquared Uplink Assessment is somehow wanting because it "overgeneralizes" and no actual LightSquared handsets were tested.[58] The Assessment is based on the power emitted by any given handset, and applies equally to all devices that emit the specified power levels—a capability that can be confirmed in the equipment authorization process after LightSquared handsets are actually designed and manufactured. Moreover, certain of the GPS Parties are simply incorrect when they indicate that NPEF testing identified some problem with LightSquared handsets that LightSquared has failed, as of yet, to address:[59] (i) NPEF did not test any LightSquared handsets; (ii) NPEF testing was only to determine the 1 dB desense point of GPS receivers; and (iii) NPEF assumed that an unrealistic level of power would be generated near GPS receivers.[60]

C. There is No Need To Revisit the Conclusions Reached in the Commission's Prior Rulemaking

The GPSIA suggests that the submission of the LightSquared Uplink Assessment somehow requires the Commission to initiate a new rulemaking proceeding to "re-evaluate the purposes for which spectrum was initially licensed."[61] Simply stated, there is no need for such a rulemaking *because the Commission already completed just such a rulemaking almost a decade ago.* As explained above, that rulemaking resulted in a finding by the Commission that GPS

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58 *See* GPSIA Comments at 20 (asserting that LightSquared "overgeneralizes" by using a single type of cellular handset).

59 *Id.* at 9.

60 *See* Comments in Opposition of LightSquared Inc., IB Docket 11-109, at Tech. App., Exh. A, Att. A-1 (Mar. 16, 2012).

61 GPSIA Comments at 5.

receivers—including precision receivers used on aircraft—are adequately protected as long as L-Band terrestrial terminals comply with applicable power limits. That remains the case today.

Furthermore, neither the *Conditional Waiver Order* nor the LightSquared pending modification applications in any way impact LightSquared's planned terrestrial uplink operations—which were reviewed and authorized by the Commission almost a decade ago—or the more general conclusions reach in the Commission's prior rulemaking. Thus, there is no need or basis for "refreshing" that rulemaking now. Importantly, nothing in the *Conditional Waiver Order* gives the GPS industry the right to demand that the Commission extend this proceeding where sufficient record evidence already exists to inform a decision by the Commission. In this regard, it bears emphasis that the *Conditional Waiver Order* provides that LightSquared will be allowed to proceed with the implementation of its network "once the *Commission*, after consultation with NTIA, concludes that the harmful interference concerns have been resolved and sends a letter to LightSquared stating that the process is complete;"[62] the "sign-off" of the GPS industry simply is not required.

Similarly, and as discussed at length above, there is no basis for the Commission to revisit whether the power limits applicable to LightSquared's authorized uplink operations are sufficient. In this regard, Greenwood's suggestion that the Commission's rules be "modernized" so as to impose a strict -105 dBW/MHz limit on LightSquared is without any foundation.[63] Indeed, Greenwood appears to offer its proposal primarily in order to ensure "consistency" with

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62 *Conditional Waiver Order* ¶ 43 (emphasis supplied).

63 *See* Greenwood Comments at 1.

a similar proposal it made in the AWS-4 proceeding, which the Commission rejected in that context.[64] The same result is appropriate here.

III. CONCLUSION

Given the strength of the record evidence demonstrating *conclusively* that LightSquared's terrestrial uplink operations do not pose any risk to GPS receivers, there simply is no need for the Commission to evaluate further the compatibility of GPS receivers with L-Band terrestrial uplink operations. Accordingly, LightSquared urges the Commission to promptly: (i) confirm that the conditions set forth in the *Conditional Waiver Order* are either fully satisfied or not applicable with respect to the L-Band operations proposed in LightSquared's pending license modification applications, and (ii) grant those applications.

Respectfully submitted,

/s/ Jeffrey J. Carlisle

Jeffrey J. Carlisle
Executive Vice President, Regulatory Affairs
and Public Policy
LIGHTSQUARED INC.
10802 Parkridge Boulevard
Reston, VA 20191
703-390-2001

September 23, 2013

64 *See Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, 27 FCC Rcd 16102 (2012).

Exhibit A: Refutation of GPSIA Technical Assertions

The GPS Innovation Alliance ("GPSIA") appended two technical appendices to its comments that purported to provide a "specific critique" of LightSquared's Aviation and General Navigation Use Cases. This exhibit sets forth LightSquared's responses to the technical assertions made in those appendices. In each case, the technical assertion made by GPSIA is in bold italics and LightSquared's response follows in plain text.

Aviation Use Case

I. Analysis of Users Inside Aircraft

A. Analysis relies heavily on path loss measurements conducted in a NASA study and referenced in RTCA/DO-235B. One of the self-identified shortcomings of the NASA study is that the path loss measurements have not been performed in a sufficient number of aircraft to adequately characterize worst case scenarios in the fleet.

LightSquared Response: There has never been any evidence presented by GPSIA or others that LightSquared handsets operating at the power levels agreed by LightSquared would be capable of emitting power sufficient to cause overload or OOBE problems in any aviation devices. Despite this, GPSIA attempts to single out LightSquared, proposing that it should be required to perform analyses on a seemingly endless number of airframes in order to prove that a problem does not exist.

What the GPS interests fail to disclose is that it has already been conclusively demonstrated that the power levels of LightSquared's handsets and their related out of band emissions would be far lower than many other devices used in and around aircraft for decades. Mobile earth terminals authorized at much higher power levels successfully operate in close proximity to GPS receivers (and many times incorporate GPS receivers) over the 1610-1626.5 MHz band that is immediately adjacent to the RNSS band, as well as over the 1626.5-1660.5 MHz band in which LightSquared plans to operate. Moreover, devices transmitting on PCS frequencies, as well as a wide variety of laptop computers and personal electronic devices that are regularly used on board aircraft have been shown by FAA/NASA to produce levels of emissions in the GPS band that are significantly higher than those that uplinks from LightSquared handsets would produce. Nevertheless, GPS receivers on aircraft function properly in this existing radiofrequency environment.

GPSIA has recently acknowledged the prevalence of such devices onboard aircraft and their contribution to the RF environment:

> *In 2013 it is not uncommon for nearly every passenger on a commercial flight to have one or more such devices (tablets, phones, laptops, handheld gaming devices, etc.). The dramatic increase in the number of intentional and unintentional radiators has led to a marked rise in ambient RF energy and an elevated noise floor in many environments that would have been pristine in 1981. See Comments of GPSIA, GN Docket No. 13-185, at 7 (Sept. 18, 2013).*

However, GPSIA is insisting that LightSquared be judged at the "pristine…1981" level that GPSIA describes without acknowledging the much different "2013" environment they describe in this other proceeding.[1] This is further evidence of GPSIA's strategy to hold LightSquared to a different and much higher standard than licensees and equipment providers that have sold hundreds of millions of devices with worse performance with respect to the GPS band than LightSquared.

B. In particular, the LightSquared analysis uses numbers from a Boeing 737-200 aircraft, a large aircraft that would generally have higher path loss than would be found in smaller aircraft such as regional jets. A separate report cited by the NASA study showed average (not minimum) path loss for a Canadair regional jet was 53.5 dB, more than 20 dB less than the average path loss from Boeing 737-200 measurements. Regulators should not expect that this analysis will hold for regional jets, and it is definitely not valid for smaller rotorcraft and general aviation aircraft.

LightSquared Response: See response in the immediately preceding section. The point of using the 737, which is among the most widely used commercial aircraft in history, was to show that positive margin that exists *even in a case where an impossibly large number of LightSquared users and aggregate power levels are assumed*. Again, no evidence has been offered that LightSquared handsets used onboard an aircraft would cause receiver overload or OOBE problems for a certified aviation GPS device. In such a case, it makes no sense to engage in theoretical analysis of additional aircraft.

C. LightSquared books a 3 dB coupling loss for handset antennas; however, no adjustments were made to the NASA measurements to account for the transmit and receive antenna gain, so these factors are already accounted for in the path loss measurements. Booking an additional 3 dB is double counting antenna effects.

LightSquared Response: GPSIA is simply mistaken. As GPSIA notes, "no adjustments were made to the FAA/NASA measurements to account for the transmit and receive antenna gain…." Since FAA/NASA did not account for a transmit antenna gain, LightSquared must do so in order to calculate the correct effective isotropic radiated power (EIRP) that would be emitted from the LightSquared handset. To ignore the handset antenna gain would overstate the EIRP produced by the device. The 3 dB coupling loss (-3 dBi UE antenna gain towards the window), assumed by LightSquared, is typical of most handsets. This reduces the device EIRP from a 23 dBm maximum value at the input to the handset antenna to 20 dBm once it leaves the antenna and enters free space – the point from which the FAA/NASA measurements were taken.

GPSIA also fails to note that even if the 3 dB antenna coupling loss were (incorrectly) disregarded, the LightSquared analysis still shows that positive margin exists for the aviation GPS device.

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[1] In GN Docket No. 13-185, the GPSIA argues for an OOBE limit of -95 dBW/MHz be applied to future AWS-3 licensees, yet it maintains in the instant proceeding, with absolutely no basis either in policy or physics, that LightSquared devices operating at this level are somehow incompatible with GPS systems.

D. LightSquared provides an alternate scenario that supposedly represents seven users "randomly" scattered around the cabin; however this "random" distribution uses an "average path loss" figure of 74.0 dB. Aggregating seven users with this power level results in lower total interference power than might be expected from a single user operating in a window seat in the first few rows of an aircraft. This type of random analysis is not appropriate for any operation raising safety of life concerns.

LightSquared Response: This use case was generated by LightSquared to show the difference between a reasonable number of LightSquared users at random locations, and the unrealistic and beyond-worst-case scenario of 63 users occupying all available window seats (which had lower path loss to the aircraft GPS antenna than the other seats). Significantly, both scenarios show significant positive margin; with the greatest amount of margin existing with the realistic use case. In other words, there is no conceivable GPS problem in either case.

II. Analysis of Aircraft in Flight/Users on Ground

A. This is essentially a reworking of the RTCA/DO-327 handset analysis, which was inconclusive.

LightSquared Response: GPSIA incorrectly asserts that the RTCA analysis was "inconclusive." In fact, the RTCA report concludes that "[a]ll the values, including those for a general set of RFI sources …are within the environmental limit."[2] The report does acknowledge the truism that LightSquared devices, like every other type of RF emitter, can cause an increase in the extant environmental noise, but there was no finding that LightSquared devices contributed to environmental noise disproportionately.

Notably, the OOBE limits from LightSquared devices are practically identical to those that GPSIA urged the FCC to establish for the AWS-4 band less than twelve months ago (and for the AWS-3 band just last week). GPSIA does not even attempt to explain why the limits on power emitted into the GPS band that it admits are sufficient for AWS-4 and AWS-3 are somehow problematic when applied to LightSquared. It also does not answer the question of how LightSquared's operation can be problematic when FAA/NASA has conclusively shown that there are a multitude of consumer devices used on board aircraft, since the 1990s at least, that have emissions into the GPS band that are far stronger than any that could be generated by LightSquared's handsets.

[2] RTCA DO-327, Section 4.7.

B. LightSquared backs off an additional 10 dB due to UE power reduction. This power reduction was explicitly rejected in RTCA/DO-327 and is not appropriate for an OOBE analysis because OOBE can be caused by unintentional emissions from the equipment that are independent from the fundamental emission. LightSquared claims that measurements made on UE show that there is a dB for dB reduction in OOBE based on UE transmit power and attempts to use this information to rationalize UE power reduction. It provides a plot of what appears to be a measurement of OOBE power at three different transmit powers as evidence. However, no information is provided to identify the particular UE, and it is clear from the data that only one specific handset was measured. This scant evidence should not be considered representative of the broad range of user equipment.

LightSquared Response: GPSIA misses the point of LightSquared providing this additional data in the first place. LightSquared has said that if power reduction had been properly considered, that LightSquared emissions, *which were already determined not to be problematic in this use case*, would be even lower. In other words, there is no conceivable GPS problem regardless of whether this power reduction factor is used.

Furthermore, GPSIA is completely mischaracterizing the initial RTCA action with respect to OOBE and UE power. The RTCA would not accept the OOBE and UE power correlation in the absence of empirical data, which was not available to LightSquared at that time. Subsequent to the conclusion of the RTCA assessment, LightSquared was able to perform laboratory tests that concluded, as one would expect,[3] that that there is a relationship between UE power reduction and a reduction in OOBE. It should be noted that similar findings were adopted by CSMAC in their study of the potential interference from commercial devices into government systems.

C. It further reduces the power by another 4.6 dB to account for mean transmit power instead of maximum power.

LightSquared Response: Again, GPSIA ignores the point that even without these additional factors, DO-327 has not shown any conflict with LightSquared's handset operation of its uplink spectrum. Like the other points made by LightSquared, there are additional factors that were not considered by RTCA, which would contribute additional margin, thus further ensuring the compatibility of GPS receivers with of LightSquared's intended uplink operations.

The justification for using the mean transmit power lies simply with the extraordinarily large population of users. In any statistical analysis, when the population involves a large number of statistically independent samples (in this case, power received from hundreds of devices), the use of the mean value is justified as the probability of an aggregate outlier value (high or low relative to the normalized mean value) approaches zero.

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[3] These results are as predicted since LightSquared OOBE is dominated by intermodulation, which is due to the low frequency offset relative to GPS. As such an OOBE reduction that is *at least* dB-for-dB is expected purely from a physics perspective and is confirmed by the testing.

D. It also reduces the number of handsets transmitting to a particular base station, setting the number at 18 rather than 300 (or 1000), and books another 17 dB of reduction.

LightSquared Response: This calculation of additional margin is perfectly reasonable as it is physically impossible for the large number of users asserted by GPSIA to use a single cell site simultaneously for active transmissions. Even with the erroneous assumption of hundreds of simultaneous users, the RTCA analysis still demonstrates the compatibility of certified GPS devices with LightSquared handsets. However with more reasonable numbers of users (which were also adopted by CSMAC for the purposes of interference analysis), it is demonstrated that significant additional margin exists.

E. These assumptions have not been accepted by the FAA; rather, the assumptions simply represent LightSquared's optimistic interpretation of the CSMAC report.

LightSquared Response: LightSquared's interpretation of the CSMAC report is factual; it is neither optimistic nor pessimistic. As GPSIA is well aware, the CSMAC working group effort was not even underway at the time of the RTCA analysis and thus its results could not properly inform the RTCA analysis at the time. LightSquared has merely updated the record to reflect highly relevant and useful data currently being relied upon by a variety of U.S. government agencies that demonstrate that additional margin exists that provides an extra layer of assurance that LightSquared's use of its uplink spectrum is fully compatible with existing aviation standards.

III. Analysis of Single User on Stairs of Regional Jet

A. LightSquared banks 9.5 dB for power reduction based on the CSMAC report. This is not appropriate in the general case of multiple users, and it certainly is not appropriate for analyzing a single user.

LightSquared Response: GPSIA provides no justification for their objection to this value. In fact, the value used here by LightSquared is highly conservative as the power would be even lower than this in 95% of instances in which this scenario would occur. It must also be noted that this use-case does not involve any safety of life applications as the aircraft is obviously parked when a user is in this position—standing on the stairs of a regional jet.

B. LightSquared is assuming a +20 dBm maximum transmit power rather than +23 dBm. In table 6, it notes that this -3 dB adjustment is made to account for -3 dBi average UE antenna gain. (By contrast, LightSquared addresses this problem in its GLN analysis and adds 3 dB to account for UE antenna gain. This is another example of its selectively applying various corrections to present data in the best possible light.)

LightSquared Response: GPSIA is incorrect in its assertion that a 3 dB adjustment is not warranted. As noted above, this reduction is necessary in order to properly account for the difference between transmitter power out of the device power amplifier and the emitted power (the EIRP) that occurs after the antenna. In small, handheld devices, an assumption of a 3 dB antenna coupling loss has significant precedence.

The reason this was not factored *the same way* in the GLN analysis is simple; the orientation between the LightSquared user and the GPS device in the GLN case could vary greatly

in both the vertical and horizontal plane as both the LightSquared and GLN device could be at a variety of orientations. Thus in the GLN cases, a cumulative distribution function of actual antenna gains (obtained from measurements or product specifications) was constructed in order to account for this extreme variability. In the case of someone standing on the stairs leading to an aircraft, the aircraft antenna is always at a fixed position, and the LightSquared user antenna orientation is more predictable; the analysis is therefore much simpler.

C. LightSquared assumes a 10 dB coupling loss for the GPS receive antenna assuming that the user is more than 30 degrees below the receive antenna horizon. It also assumes 3m separation between the handset and GPS receive antenna. These are not reasonable assumptions for all aircraft types. In the photo provided to illustrate the scenario (Appendix 5, figure 1, p 1), multiple aircraft receive antennas are visible on the aircraft fuselage in very close proximity (< 3m) to the passenger door.

LightSquared Response: LightSquared stands by the scenario as constructed. GPSIA has provided no evidence to suggest that this is not a typical scenario. Furthermore, the use case analysis demonstrates substantial positive margin, so any minor changes to the path geometry would not impact the overall finding of compatibility.

IV. Analysis of Nearby Emitters at Gate

A. In this analysis, LightSquared takes credit for 9.5 dB of power reduction by using the 95th percentile value from the CSMAC CDF curve for suburban environments. This is inappropriate for an OOBE analysis, and it is larger than the computed 7.3 dB of "margin" for the OOBE analysis.

LightSquared Response: GPSIA has provided no evidence as to why the values derived by CSMAC are not appropriate in this use case. Airport passengers are typically in a suburban environment, which was an assumption adopted by RTCA in DO-327 (indeed many major airports could mimic a dense-urban environment, where the device power would be further reduced) and the work performed by CSMAC is highly useful in assessing the expected LightSquared device power. Furthermore, empirical data confirms, and CSMAC's Working Group 1 concurred, that there is a close relationship between device power and OOBE levels. Thus, the assumptions made by LightSquared are perfectly appropriate for this use case.

GPSIA's "concern" about LightSquared OOBE is disingenuous at best as they simply ignore the fact that they agreed to levels in the AWS-4 proceeding in late 2012 (and proposed last week levels for AWS-3) that are practically identical to LightSquared's requirement (which GPSIA likewise endorsed in 2005). Additionally, GPSIA does not discuss the fact that there are devices with much higher emissions into the GPS band than a LightSquared device in an airport environment including PCS phones, laptops and other intentional and unintentional "Part 15" RF emitters. One cannot legitimately express a concern about OOBE from a LightSquared device without first accounting for the existence of these other emitters into the GPS band which are much more powerful and numerous than LightSquared.

B. LightSquared is assuming a +20 dBm maximum transmit power rather than +23 dBm. In table 6, it notes that this -3 dB adjustment is made to account for -3 dBi average UE antenna gain. (By contrast, LightSquared addresses this problem in its GLN analysis and adds 3 dB to account for UE antenna gain. This is another example of its selectively applying various corrections to present data in the best possible light.)

LightSquared Response: Please see LightSquared's response in Section III above.

C. For the five users on the jetway, LightSquared is booking between 5.5 and 6.2 dB of loss from the GPS receive antenna because the users are at or below 5 degrees from the horizon of the GPS antenna. It provides no basis for this assumption, and it seems contrary to a realistic configuration of aviation facilities at the gate.

LightSquared Response: LightSquared believes that its assumptions with respect to this use case are accurate and there has been no data provided by GPSIA to the contrary. The antenna pattern provided in RTCA DO-235B, Fig. G-13 was used for all GPS antenna gain values in this use case. The users in the jetway were assumed to be at elevation angles of -3^0 to -7^0 referenced to the GPS antenna, the specific angle depending on the location of the user. The users are assumed to be at 4 m (min) to 10 m (max) (uniformly distributed at 1.5 m separation), and 0.5 m below the GPS antenna. Hence, the elevation angle to GPS antenna varies from -7 degrees to -3 degrees, and gain varies from -6.2 dBi to -5.5 dBi.

D. For the 25 other users in the terminal, LightSquared is booking 3 dB of loss for the GPS receive antenna, claiming that the GPS receive antenna has -3 dBi of gain for signals below 45 degrees elevation relative to the horizon. None of the applicable MOPS for GPS receive antennas (DO-228, DO-301) supports this assumption, and LightSquared applies an invalid model to support its points. LightSquared bases this assumption on antenna gain pattern measurements reported in RTCA/DO-253B (Appendix G, Figure G-13, p. G-12). These antenna measurements are used by RTCA to validate a model of GPS antenna gain for signals below the horizon and are not intended to be representative of maximum antenna gain above the horizon. For maximum GPS receive antenna gain above the horizon, the analyses in both RTCA/DO-235B and RTCA/DO-327 use a model derived from the published performance standards for GPS receive antennas. The model actually used in the RTCA analysis predicts a maximum GPS antenna gain of -0.2 dBi at 45 degrees of elevation rather than the more favorable -3 dBi claimed by LightSquared.

LightSquared Response: Even assuming that GPSIA is correct in their analysis, this would simply erode the positive margin calculated by LightSquared by 2.8 dB, but still would leave significant positive margin in both the overload and OOBE calculations remaining. Thus, GPSIA's criticism has no impact on the ultimate conclusions reached in LightSquared's analysis.

E. A limit of -206.5 dBW/Hz is used for OOBE. This is either based on the initial acquisition interference limit with no accounting for the 6 dB safety margin, or it is based on a GPS tracking limit with 6 dB of safety margin. In the TWG and RTCA work, there was concern for both acquisition performance and the 6 dB safety margin, which would set the limit at -212.5 dBW/Hz. LightSquared objected strongly to this limit, and it was not explicitly stated in the TWG report.

LightSquared Response: LightSquared used -206.5 dBW/Hz modeled on RTCA DO-327 [p. 30], where this was considered the objective "environmental limit" for determining the OOBE impact of LightSquared terrestrial devices. There is no discussion in DO-327 of reducing this further for any reason. GPSIA's claim regarding the TWG final report is unclear and does not have any bearing on this calculation.

General Navigation Use Case

I. LightSquared's "worst-case" overload analysis is insufficiently narrow.

A. LightSquared assesses interference based on the 90th percentile point of a CDF for a suburban use case provided in a CSMAC handset analysis.

1. LightSquared's inappropriate application of CSMAC assumptions to this analysis notwithstanding, a worst-case analysis must consider rural use cases as well.

LightSquared Response: LightSquared carefully constructed its use cases and utilized conservatively appropriate assumptions. It would appear from its objection here, and throughout this appendix, that GPSIA would like LightSquared to prove a negative by examining an infinite number of use cases and would like LightSquared to use only the very worst case assumptions layered one on top of another.

In fact, in assessing the potential impact of LightSquared operations on aviation systems, the FAA specifically chose to utilize suburban morphologies as well in its DO-327 analysis. LightSquared adopted this same approach in order to provide a meaningful and straightforward analysis.

The insistence by GPSIA that the CSMAC rural power levels be considered is simply a naked attempt to eliminate any positive margin demonstrated by LightSquared's analysis, without acknowledging the need to offset this by other factors that were not required to be quantified in the suburban analysis. Variables such as signal loss due to obstructions from the human body and other environmental elements as well as power reduction due to transmit duty cycle are all factors that would be required to be quantified in a rural scenario. However, GPSIA and its members have only offered up the variables that would reduce (or eliminate) potential margin, without proposing the corresponding (and necessary) values that would serve to contribute offsetting margin. The fact that GPSIA demands that only one side of the equation be evaluated is further evidence of their desire only to disrupt and delay the process in the hopes of obstructing any viable path forward. This approach is contrary to responsible spectrum policy and should be rejected.

2. The CSMAC data is based on spatial sampling of handset power in a given geographic region. Consequently, for suburban use cases, by using the 90th percentile point of the CDF, LightSquared invites interference in 10% of locations. This is not a worst case analysis.

LightSquared Response: The assertion offered up by GPSIA in this case would not even pass muster in a high school statistics class. GPSIA is attempting to draw a conclusion based only on a single variable within an equation that has multiple independent variables. There is absolutely no basis for their assertion that interference would occur in 10% of locations. LightSquared has stated that its power would be no higher than this specific level in 90% of (suburban/urban) locations. GPSIA completely ignores the independent antenna coupling loss calculations that have been quantified for this analysis, which reduce the device power level probability even further (to 4-6%). This is before considering other independent factors that would further reduce the handset power. For example, body absorption was not included in the LightSquared analysis, even though a user is in close proximity to the LightSquared device; with 6

dB of body loss being a reasonable assumption. Furthermore, it is rare for an LTE uplink to transmit at 100% duty cycle. A 30% duty cycle, which is far more typical, would reduce the average power by a further 5 dB. Thus, there is easily 11 dB of extra margin that LightSquared did not include in its analysis; which makes the results even more conservative to the benefit of the GPS community.

B. LightSquared uses probabilistic methods to predict an antenna coupling factor between a single antiquated handset and a particular 25mm L-band patch antenna.

1. Such analysis ignores the wide variety of GPS receivers, handsets, and their various antenna types.

LightSquared Response: A Toro patch antenna was selected for this analysis as it is believed to be very commonly used in GLN applications by various vendors. The antenna performance is representative of other GLN antennas that were analyzed. For the LightSquared handset, a Samsung i500 handset was used as an example. This phone has a stub antenna, which has a *higher* average gain averaged over 3D, or total radiated power (TRP), than the internal (patch) antennas found in most modern handsets. Thus, it represents a very conservative set of assumptions in the favor of GPS interests.

2. Such probabilistic methods mask the worst-case interference that can occur when there is bore-sight orientation between receive and transmit antennas—a plausible scenario for GLN devices and LightSquared handsets.

LightSquared Response: Interference analysis for non-safety-of-life routinely uses probabilistic methods. LightSquared is not breaking any new ground here. In fact, LightSquared has chosen exceedingly conservative values within the analysis; all to the benefit of GPS devices. GPSIA is asserting that bore-sight-to-bore-sight must be the basis of analysis, which is simply not reasonable.

3. In its computation of the CDF for antenna coupling between the antiquated handset and 25mm GPS patch antenna, LightSquared fails to account for the fact that Right-Hand Circularly Polarized ("RHCP") L- band antenna gain cannot be compared directly to the linear handset antenna gain. Further, a fixed polarization loss offset cannot adequately represent the linear gain of the L-band antenna in all orientations.

LightSquared Response: LightSquared has used a 1.5 dB polarization mismatch, not 3 dB, for the reasons cited by GPSIA above. Contrary to GPSIA's claims however, fixed polarization losses of similar values have precedence in practical use cases when the full decoupling between linear and circular cannot be booked due to non-boresight angles of arrival. For example the FCC booked a similar value in the original 2003 ATC order. In its January 2012 assessment of LightSquared's terrestrial network, the FAA accepted the booking of 1.7 dB for polarization mismatch loss, based on a GPS antenna model accepted by the FAA, wherein the response for H-pol was 6 dB lower than V-pol over all elevation angles, less than 10 degrees.

4. LightSquared bases its analysis on a CDMA handset from 2006 that still uses an external antenna.

LightSquared Response: An external antenna has higher total radiated power than an internal antenna and therefore represents a more conservative case for an interference analysis—one that favors GPS.

C. In its analysis, LightSquared inappropriately normalizes the antenna gain of the GPS devices tested at WSMR.

1. LightSquared used the gain pattern of a single 25mm patch antenna to normalize the gains of a variety of GPS devices tested at WSMR, many of which do not even use patch antennas.

LightSquared Response: LightSquared has utilized the best publicly available GPS antenna information in its analysis. GPSIA has criticized the use of this without providing any substantiating evidence as to why this is inappropriate. GPSIA has routinely been critical of specific LightSquared assumptions, yet has chosen to make no information publicly available with respect to the performance of its devices, including its antenna characteristics.

2. The point of the WSMR testing was to test complete devices, including the antenna, to remove the uncertainty associated with predicting the performance of various antenna types, orientations, etc.

LightSquared Response: In the WSMR test facility, GPS devices were oriented so that their maximum gain was directed at the LightSquared downlink transmit antenna (and approximately 45º offset from the LightSquared uplink transmit antenna inside the test chamber). This setup was necessary in order to accurately evaluate GPS devices in a consistent manner with received signals that were well above the measurement noise floor. In applying these test results to use cases, where a variety of antenna orientations are to be considered, it is necessary to calculate a correction factor to normalize the data so that it is not skewed by the particular lab orientations of the test signals.

3. A worst-case analysis should utilize the maximum gains of both antennas under consideration, unless it can be conclusively demonstrated that the antennas cannot be oriented in such a way so as to produce maximum coupling.

LightSquared Response: Bore-sight-to-bore-sight is one of a practically infinite number of possible antenna orientations. An “only worst-case” assessment by GPSIA would have no more validity than an “only best-case” assessment. Instead, the appropriate methodology is to consider a set of likely cases of directional coupling, within a larger probabilistic analysis, as has been performed by LightSquared.

II. LightSquared inadequately addresses OOBE problem with General Navigation receivers.

A. LightSquared's brief statement (pg. 7) notes that "none of the GPS devices would have experienced interference due to OOBE at these power levels." This statement is not borne out by the analysis in its appendix. That analysis shows only 0.5 dB of margin for OOBE with a suburban use case. Simply updating the analysis to reflect the rural use case would cause widespread failure due to OOBE.

LightSquared Response: As stated previously, it is not necessary to conduct an OOBE analysis that substitutes rural power levels for the appropriately conservative suburban assumption. This is true for two reasons:

i. Other loss assumptions due to body absorption, UE duty cycle and other factors were not considered and would be more than sufficient to make up for any additional power encountered in a rural use case

ii. The FAA/NASA Report shows conclusively that LightSquared emissions into the GPS band are far less significant than emissions from a variety of other devices (regardless of morphology) that have been operating near GPS receivers in many cases for twenty years or longer, including PCS phones, Bluetooth headsets and laptop computers. It makes no sense to single out LightSquared devices for further study when it is clear that its emissions will be significantly lower than those produced by these other consumer devices.

Additionally, GPSIA fails to mention that it endorsed nearly identical OOBE levels into the GPS band from operators on AWS-4 spectrum less than twelve months ago – and proposed these same levels for AWS-3 spectrum just last week. It provides no explanation why these levels are not suitable for LightSquared terrestrial handsets – because no such justification exists.

III. LightSquared optimistically presents the results of its analysis.

A. Despite LightSquared's overly broad assumptions about a suburban use case, improper normalization of antenna gain, and probabilistic assumptions about antenna orientation, its analysis still concludes that 10% of the devices tested at WSMR would fail due to overload alone.

LightSquared Response: 10% of devices that were tested at WSMR would have experienced a 1 dB change in C/N_0 using the assumptions contained in the analysis. It is disingenuous and misleading for GPSIA to suggest that this small change in the signal-to-noise ratio would result in 10% of all GPS devices failing due to overload:

i. There is no evidence whatsoever that the "worst-performing" GPS devices--those that that experienced a 1% change in C/N_0--have any significant market share either currently or when they were first sold. Actual population of these GPS devices today could be infinitesimal.

ii. The GPS industry never provided the identity or market share information for any devices tested. LightSquared is prohibited from revealing their identities due to the restrictive non-disclosure agreements it was required to sign by the GPS industry in order to observe testing and have access to test results.

iii. The GPS industry has never demonstrated any correlation between a 1 dB change in C/N_0 and an operational impact on receiver performance. They cannot do so because no such relationship exists.

iv. Other factors such as body loss, duty cycle and separation distance would add significant margin to the results, likely bringing the percentage down to zero.

B. A 10% failure rate is inacceptable in navigation services, particularly when safety of life is at issue.

LightSquared Response: GPSIA continues to intentionally confuse the situation in order to insert doubt into an otherwise obvious conclusion that GPS receivers are compatible with LightSquared's intended use of uplink spectrum. As explained above, there is no basis for their claim that 10% of devices would "fail" due to LightSquared's use of its uplink spectrum. GPSIA completely mischaracterizes a table from the WSMR test program and inaccurately applies that to the larger population of GPS devices in use.

Further, GPSIA invokes the safety of life argument for general location/navigation devices which is not appropriate. In cases where GPS is used for *aviation safety applications while airborne*, even more conservative assumptions have been applied by LightSquared as a result.

Finally, it is simply impossible to reconcile the fact that there are hundreds of millions of devices in operation in and around GPS units with OOBE characteristics that are orders of magnitude higher than the maximum permitted from LightSquared devices, with the argument that LightSquared's OOBE is somehow uniquely a problem for GPS. The reality is that, just as GPS receivers are compatible with the operation of hundreds of millions of end-user-devices from other service providers, GPS receivers are compatible with the emissions from LightSquared's handsets.

C. LightSquared does not consider the aggregate case of OOBE + Overload in a single band. Instead, it presents its results in piecemeal fashion, ignoring the reality of the interference its network would cause.

LightSquared Response: GPSIA has now introduced a new argument that they have not attempted previously in the past 13 years. GPSIA provides no substantiation for the assertion that OOBE and overload combined presents a unique use case. Such a situation, if it truly does exist, can only be assessed if there is access to detailed information of actual receiver designs, which the GPS industry has steadfastly refused to make public. This is another example of GPSIA offering up vague criticisms, only to provide no substantiating evidence in support.

D. LightSquared does not consider the aggregate case of OOBE + Overload in the multiple uplink and downlink bands it plans to utilize in its deployment, further understating the system's interference potential.

LightSquared Response: GPSIA does not mention which downlink spectrum it is specifically concerned with, so one must assume they are referring to the 1670-1680 MHz spectrum proposed by LightSquared in the instant application for modification. However, GPSIA does not provide any technical basis for this assertion. As such it is simply not possible to respond to a claim that is expressed in such vague terms.

IV. A true worst-case analysis reveals much greater concerns for GPS receivers in proximity to LightSquared handsets.

A. Simply correcting LightSquared's analysis for worst-case power in a rural case and removing its incorrect normalization of GPS antenna gain reveals that many of the devices tested at WSMR would suffer harmful interference from overload caused by a single LightSquared handset band.

LightSquared Response: GPSIA constructs an absurd use case where multiple worst-case assumptions are layered one on top of another in order to paint a dire picture. However, this is not how responsible interference analysis is conducted, and for good reason. A reliance on layered worst-case assumption would lead to wide swaths of spectrum being left unnecessarily fallow with to a very low probability of any actual problem. Indeed, this is clearly GPSIA's intent in order to establish a guard band around GNSS, the size of which is completely beyond reason. This very issue was the subject of serious analysis by industry and government stakeholders as part of the CSMAC working group process. In identifying realistic assumptions, they refuted a layered worst-case philosophy because it is incompatible with responsible spectrum management.

B. Correcting LightSquared's analysis for the shortcomings described above with respect to the OOBE problem reveals that all devices within a few meters of a LightSquared handset would suffer harmful interference due to an increase in the noise floor.

LightSquared Response: GPSIA is completely wrong in this assertion as it continues to fail to explain the following with respect to LightSquared's OOBE:

i. How is LightSquared's OOBE different from that of the AWS-4 band for which GPSIA in late 2012 endorsed limits practically identical to those of LightSquared? How is this different from the limits the GPSIA proposed for the AWS-3 band just last week?

ii. How is LightSquared's OOBE able to impact GPS devices more acutely than the higher emissions generated by PCS cell phones, Bluetooth devices and laptop computers?

The reality is, of course, that this cannot be explained, and so GPSIA does not make any attempt to do so. Instead, it continues on its quest to create an expansive guard band around the spectrum on which its unlicensed devices operate by attempting to hold LightSquared to a different, and impossibly higher, standard than is applied to any other licensee.

Exhibit B: Refutation of Technical Assertions of Other GPS Parties

This exhibit sets forth LightSquared's responses to technical assertions made by the General Aviation Manufacturers Association ("GAMA") and Greenwood Telecommunications Consultants LLC ("Greenwood"). In each case, the technical assertion made by GAMA and/or Greenwood is in bold italics and LightSquared's response follows in plain text.

I. GENERAL CRITICISMS OF LIGHTSQUARED METHODOLOGY

A. ***Using the CSMAC methodology, LightSquared effectively invites interference with GPS receivers in 10 percent of all locations, which is unacceptable. (Greenwood at 2)***

LightSquared Response: See Exhibit A, General Navigation Use Case, § I.B.

B. ***OOBE generated from a LightSquared handset may be spurious in nature. As a result, the OOBE may be unrelated and independent from a handset's intentionally radiated emissions. It therefore is inappropriate for LightSquared to assume that it can probabilistically reduce OOBE proportionally with in-band radiated power. (Greenwood at 3)***

LightSquared Response: See Exhibit A, Aviation Use Case, § II.B.

C. ***By assuming obstructions in the signal path, LightSquared's analysis does not accurately predict OOBE/overload issues arising where no obstruction is present. (Greenwood at 2)***

LightSquared Response: Greenwood is mistaken in its assertion that obstructions were assumed to be in the signal path in the use cases presented. In the aviation case, only *in situ* measurements were taken in an actual aircraft – with no assumptions whatsoever being added for body loss. In the GLN case, there were no assumptions made in the analysis for any obstructions, though it is clear that such obstructions typically exist in almost all operating environments and, as such, would further contribute to the positive margins already calculated.

D. ***The OOBE onset threshold should be set at -178 dBm/Hz for GNSS, not the -174 dBm/Hz used in the LightSquared Uplink Assessment. (Greenwood at 2-3)***

LightSquared Response: As discussed in the LightSquared Uplink Assessment, the OOBE threshold of -174.5 dBm/Hz was the level used in the Agreement between LightSquared and the GPS industry to calculate the recommended UE OOBE specification of -95 dBW/MHz. *See Interference Analysis of Out-of-Band Emissions (OOBE) Limits to GPS from Ancillary Terrestrial Mobile Satellite Services in the L-Band*, IB Docket No. 01-185 (Aug. 8, 2002) ("This link budget starts with a receiver sensitivity to broadband interference (-144.5 dBW/MHz) that is typical for the GPS technology used in E911 cellular handsets, and is 4 dB lower than for the more robust aviation GPS receivers . . .").

E. ***OOBE limits should not be based on "average" output power or transmission duty cycle, as intermittent spikes in noise could adversely affect a number of different types of GPS receivers. (Greenwood at 3)***

LightSquared Response: Greenwood is mistaken on this point as well. In its analyses, LightSquared used power levels that were significantly above "average" or mean levels, using 90th percentile values for GLN assessments and 95th percentile values for aviation assessments. Furthermore, LightSquared did not include in its calculations any values for transmit duty cycle, though it did note that duty cycles rarely approach 100% values (and not for significant durations when they do), which would serve to provide additional margin beyond the levels calculated in its assessments.

II. AVIATION USE CASE-SPECIFIC ARGUMENTS

A. ***The Aviation Use Case includes assumptions that have not been subjected to review and comment by the aviation community, including regulators. (GAMA at 3)***

LightSquared Response: LightSquared's analysis demonstrates conclusively that there is no uplink interference potential for safety-of-life aviation applications. There has been no data introduced into the record to the contrary, so there is nothing further that needs to be done by the aviation community in order for LightSquared to be allowed to utilize its uplink spectrum for terrestrial purposes as it has been authorized to do for the higher-power satellite purposes for nearly two decades.

B. ***The NASA study recognizes that its interference path loss measurements are limited to the Boeing 737-200 and were not conducted for other aircraft types. In particular, the NASA Study measurements are not applicable to the much smaller aircraft used in general aviation. Accordingly, reliance on NASA path loss measurements to assert that interference from LightSquared handsets operating on aircraft will not exceed the FAA's specified limits does not hold. (GAMA at 3).***

LightSquared Response: See Exhibit A, Aviation Use Case, § I.A.

C. ***LightSquared has double counted the antenna effects by using a fixed Tx/Rx antenna coupling loss of 3 dB, because the NASA path loss measurements already included a 3 dB credit for the coupling loss (Gama at 3-4)***

LightSquared Response: See Exhibit A, Aviation Use Case, § I.C.

D. ***LightSquared's analysis uses a "random" distribution of seven LightSquared handsets around an aircraft cabin. Such a distribution understates the interference potential, because, as LightSquared's analysis demonstrates, a single user operating in a window seat in the first few rows of an aircraft would have higher interference potential than the 74.0 dB produced in LightSquared's "random" distribution. (GAMA at 4)***

LightSquared Response: See Exhibit A, Aviation Use Case, § I.D.

E. ***LightSquared relies on below-the-horizon antenna pattern measurements from RTCA to estimate GPS receive antenna coupling loss between the horizon and 45 degrees of elevation. (GAMA at 5)***

LightSquared Response: See Exhibit A, Aviation Use Case, § IV.D.

F. ***To account for User Equipment antenna gain, LightSquared assumes a +20 dBm maximum transmit power for a single user rather than +23 dBm, which demonstrates LightSquared's willingness to apply corrections to data so as to present it in the best possible light to LightSquared. (GAMA at 4-5)***

LightSquared Response: See Exhibit A, Aviation Use Case, § III.B.

G. ***LightSquared makes assumptions that are not suitable for all aircraft types. In particular, the Uplink Assessment assumes (i) a 10 dB coupling loss for the GPS receive antenna on the basis that the user is more than 30 degrees below the receive antenna horizon, and (ii) a three-meter separation between the handset and GPS receive antenna. (GAMA at 5)***

LightSquared Response: See Exhibit A, Aviation Use Case, § III.C.