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**L. Barbee Ponder IV**  
General Counsel & Vice President Regulatory Affairs

October 28, 2015

*Via Electronic Filing*

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 Twelfth Street SW  
Washington, DC 20554

Re: *Ex Parte Notice: Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks – IB Docket No. 13-213*

Dear Ms. Dortch:

Globalstar, Inc. (“Globalstar”) hereby submits into the record the attached Supplemental Declaration of Kenneth J. Zdunek, Ph.D., Vice President and Chief Technology Officer of Roberson and Associates, LLC (“Roberson and Associates”). In this Declaration, Dr. Zdunek refutes various specious claims contained in letters filed recently by the Wi-Fi Alliance, the Hearing Loss Association of America (“HLAA”), and the Bluetooth Special Interest Group (“Bluetooth SIG”).<sup>1</sup> This information supplements Globalstar’s recent filing responding to the Wi-Fi Alliance’s demand that the Commission “close” the proceeding and thus deny consumers the dramatic benefits that would result from Globalstar’s planned Terrestrial Low Power Service (“TLPS”) operations on IEEE Channel 14.<sup>2</sup> Like the Wi-Fi Alliance, the Bluetooth SIG is composed of, and controlled by, corporations motivated by their own self-interests to maintain the status quo and stifle any new and innovative use of the Industrial, Scientific, and Medical (“ISM”) band regardless of the potential benefits to consumers. The Commission should reject their flawed arguments and move expeditiously to adopt its proposed rules in this proceeding.<sup>3</sup>

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<sup>1</sup> Letter from Edgar Figueroa, President and CEO, Wi-Fi Alliance, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Oct. 14, 2015); Letter from Lise Hamlin, Director of Public Policy, Hearing Loss Association of America, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Oct. 2, 2015); Letter from Mark Powell, Executive Director, Bluetooth SIG, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Oct. 23, 2015).

<sup>2</sup> Letter from L. Barbee Ponder IV, General Counsel & Vice President Regulatory Affairs, Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Oct. 19, 2015).

<sup>3</sup> *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks; Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service Systems*, Notice of Proposed Rulemaking, 28 FCC Rcd 15351 (2013).

Roberson and Associates has been a long-term technical advisor to Globalstar and helped conduct the demonstrations of TLPS technology at the Commission's Technology Experience Center ("TEC") in March 2015, and from May to August of this year conducted a real-world demonstration of TLPS at a college campus in Chicago, Illinois. Roberson and Associates has provided the Commission with technical reports regarding these demonstrations, including a September 10, 2015 declaration from Dr. Zdunek addressing the TLPS demonstration in Chicago.<sup>4</sup> In these reports, Roberson and Associates has explained the methodology for these demonstrations and described results that confirm the ability of TLPS to increase user throughput and overall system capacity in the 2.4 GHz ISM band without any detrimental impact on existing Wi-Fi operations or Bluetooth devices and services.

In his attached declaration, Dr. Zdunek rebuts a number of arguments in parties' recent filings. In response to the Wi-Fi Alliance, Dr. Zdunek states that the Chicago university deployment achieved its intended purpose, which was to establish the compatibility of TLPS with Wi-Fi as well as the advantages of operating on TLPS Channel 14 in coordination with a real-world, enterprise Wi-Fi network, including a material increase to downlink throughput. Dr. Zdunek explains that the Chicago demonstration yielded results that are representative of the impact of TLPS on real-world consumers, given that Roberson and Associates utilized consumer-grade client devices for all measurements in this demonstration. Dr. Zdunek also indicates that, contrary to the Wi-Fi Alliance's allegation, the university demonstration was fully transparent. Dr. Zdunek points out that the Wi-Fi Alliance overlooked key information provided in his September 10, 2015 declaration regarding that deployment, including access point power levels and speed test results. In addition, on a September 24, 2015 conference call with representatives of the Wi-Fi Alliance, Globalstar representatives and Dr. Zdunek responded to all of the Wi-Fi Alliance's questions regarding the Chicago demonstration results.

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<sup>4</sup> Letter from L. Barbee Ponder IV, General Counsel & Vice President Regulatory Affairs, Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Sep. 10, 2015), attaching report of Roberson and Associates, LLC, *Terrestrial Low Power Service (TLPS) Deployment and Summary Measurements* (May-August, 2015) and Declaration of Kenneth J. Zdunek, Ph.D., Vice President and Chief Technology Officer, Roberson and Associates, LLC (Sep. 9, 2015); Letter from Regina M. Keeney, Counsel to Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Mar. 27, 2015), attaching Kenneth J. Zdunek, Michael Needham, Nat Natarajan, Edward Porrett, Roberson and Associates, LLC, *Review of the Bluetooth SIG Ex Parte Filing of March 20, 2015 Titled: "Further Comments and Detailed Report from TLPS & Bluetooth Demonstrations FCC Technology Center – March 6, 2015"* (Mar. 27, 2015) ("March 27 Roberson Report"); Letter from Regina M. Keeney, Counsel to Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Mar. 10, 2015), attaching report of AT4 wireless, Inc. and Roberson and Associates, LLC, *Globalstar TLPS Operation Demonstration* (Mar. 6 and 9, 2015), and report of Michael Needham and Dr. Kenneth Zdunek, Roberson and Associates, LLC, *Bluetooth – TLPS Demonstrations at the FCC Technology Experience Center* (Mar. 10, 2015).

In response to HLAA and the Bluetooth SIG, Dr. Zdunek reiterates that the TLPS demonstrations at the FCC TEC and the Chicago TLPS deployment show that TLPS will successfully coexist with Bluetooth hearing aids and other Bluetooth devices and services in the 2.4 GHz band. At the FCC TEC, the Bluetooth SIG captured two three-minute recordings of audio streamed to Bluetooth-equipped hearing aids, one with TLPS operating and the other without TLPS. These recordings contained no discernible difference in audio quality. Tellingly, the Bluetooth SIG has failed to provide these audio files in response to Globalstar's request.<sup>5</sup> Roberson and Associates' demonstration at the FCC TEC, meanwhile, showed no effect from TLPS on the operation of multiple Bluetooth devices. Consistent with prior analysis from Roberson and Associates,<sup>6</sup> Dr. Zdunek concludes that TLPS does not pose a real-world threat to Bluetooth operations.

Globalstar urges the Commission to enable the significant consumer benefits made possible by this proceeding and to move forward, without further delay, to adopt the rules it proposed two years ago.

Respectfully submitted,

/s/ L. Barbee Ponder IV

L. Barbee Ponder IV

General Counsel

& Vice President Regulatory Affairs

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<sup>5</sup> See Letter from Regina M. Keeney, Counsel to Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Mar. 13, 2015) ("Globalstar has requested copies of these audio files along with the other data obtained. While Globalstar has been promised access to the data by the Bluetooth SIG, no such data has thus far been provided.").

<sup>6</sup> On March 27, 2015, Roberson and Associates comprehensively responded to flawed claims and arguments contained in a report from the Bluetooth SIG on the TLPS demonstrations at the FCC TEC. See March 27 Roberson Report, *supra* note 4.

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of	)	
	)	
Terrestrial Use of the 2473-2495 MHz Band for	)	IB Docket No. 13-213
Low-Power Mobile Broadband	)	
Networks; Amendments to Rules for the	)	
Ancillary Terrestrial Component of Mobile	)	
Satellite Service Systems	)	

**SUPPLEMENTAL DECLARATION OF KENNETH J. ZDUNEK, Ph.D.**

1. I am Vice President and the Chief Technology Officer of Roberson and Associates, LLC (“Roberson and Associates”). I received BSEE and MSEE degrees from Northwestern University, and a Ph.D. EE degree from Illinois Institute of Technology. I have over 35 years of experience designing, analyzing, and measuring the performance of wireless systems in both lab and real-world environments.
2. Prior to joining Roberson and Associates, I was Vice President of Network Research at Motorola. While at Motorola I was an architect of cellular and public safety wireless networks, and was awarded 17 patents in the wireless field. I was elected a Fellow of the IEEE (Institute of Electrical and Electronic Engineers), and am a Registered Professional Engineer in the State of Illinois.
3. Concurrent with my position at Roberson and Associates, I am an Adjunct Professor in the Electrical and Computer Engineering Department at the Illinois Institute of Technology, where I do research in the areas of RF spectrum sharing, measuring and

optimizing spectrum utilization, and cognitive radio; I teach a graduate course in wireless systems design.

4. In the time period May-August 2015, engineers under my direction at Roberson and Associates deployed wireless local area network access points using the IEEE 802.11n protocol on Channel 14 at a university student center in Chicago at 3201 South State Street. The deployment was conducted with the cooperation and assistance of the university Office of Technology Services, which maintains and manages the campus Wi-Fi network.
5. The purpose of the deployment was to (1) assess the ability of Globalstar's proposed Terrestrial Low Power Service ("TLPS") operations to successfully coexist with the existing Wi-Fi network in the student center, specifically with devices utilizing the IEEE 802.11n protocol on Channel 11 in the 2.4 GHz Industrial, Scientific and Medical ("ISM") band, (2) assess the coexistence of TLPS operations with Bluetooth devices and services, and (3) assess the ability of TLPS operations on IEEE Channel 14 to increase the user throughput and overall system capacity of the existing Wi-Fi network.
6. On September 10, 2015, I provided a declaration (executed September 9, 2015) regarding the facts and parameters of the network demonstration at the university student center ("September 10 Declaration") as well as a report titled "Terrestrial Low Power Service (TLPS) Deployment and Summary Measurements" ("September 10 Report") describing the compatibility measurements, demonstrations, and results of the deployment.
7. As described more fully in the September 10 Declaration and the September 10 Report, the addition of TLPS operations on Channel 14 increased the aggregate throughput of the

consumer devices participating in the demonstration by an average of 92%, with no perceptible impact on other unlicensed services.

Response to Recent Filing by Wi-Fi Alliance

8. On October 14, 2015, the Wi-Fi Alliance submitted an ex parte communication to the Commission regarding the demonstrations conducted in Chicago that raised certain criticisms and asserted that the demonstration falls short of “what might reasonably be expected in a meaningful test” of the impact of Globalstar’s proposed TLPS on existing Wi-Fi operations. With this supplemental declaration, I respond to these criticisms and demonstrate that they are unsubstantiated and without merit.
9. The Wi-Fi Alliance asserts that only enterprise-class access points were used in the demonstration, and alleges that these units are not representative of consumer-grade access points, which may have different receive filtering than enterprise-class access points. The Wi-Fi Alliance asserts that this equipment was deliberately chosen to produce a result favorable to Globalstar.
10. In response, it is readily seen that in the downlink throughput measurements performed to assess the compatibility of TLPS with operations on IEEE Channel 11, any degradation in operation is produced in the receiving device (*i.e.*, client device), not at the access point. Therefore, the receiver filter characteristics of the access points used in the downlink throughput tests have no impact on the measurement results.
11. It was clearly stated in my September 10 Declaration, and reiterated during the September 24, 2015 teleconference referenced by the Wi-Fi Alliance in its filing, that consumer-grade client devices were used for all measurements in the university demonstration. These client devices included Microsoft Surface 3, Microsoft Surface

Pro, Google Nexus 7, Apple iPhone 4, and Apple iPad devices. Since it is the characteristics of the client device that are relevant for the downlink tests, the Wi-Fi Alliance's criticism that consumer-grade devices were not evaluated in the demonstration is without merit.

12. In further response to the criticism that equipment was deliberately chosen to produce a favorable result, it must be reiterated that Roberson and Associates deployed TLPS into an existing network where the access points operating on Channels 1, 6, and 11 were already in place. There was no intentional selection of access points to ensure a positive result. As previously stated, the intended purpose of the May-August deployment at the educational setting in Chicago was to establish the compatibility and advantages of operating on Channel 14 in coordination with such a real-world, operating, enterprise Wi-Fi network. The trial deployment and demonstrations achieved this purpose, demonstrating the real-world compatibility of TLPS with Wi-Fi. The Chicago deployment therefore went beyond the TLPS demonstration at the FCC Technology Experience Center ("TEC") in March 2015, which was a more controlled "walled-garden" type environment. Nevertheless, the Chicago measurements and compatibility results were entirely consistent with those exhibited at the FCC TEC.
13. Thus, the Wi-Fi Alliance's criticism that equipment was deliberately chosen to produce a favorable result is false. The use of consumer-grade Wi-Fi client devices and the deployment of TLPS occurred within an existing, representative Wi-Fi deployment. There was no premeditated selection of the existing access points to achieve a positive result.

14. In its filing, the Wi-Fi Alliance further asserts that the university demonstration was not transparent. The Wi-Fi Alliance alleges that little or no information about the access point power levels, the Wi-Fi and TLPS load factors, and the data types used during the demonstration was provided. This assertion, however, overlooks the details provided in the September 10 Report together with my September 10 Declaration.
15. Regarding power levels of the access points, the Addendum to my September 10 Declaration states that the power levels of IEEE Channel 14 (TLPS) and Channels 1, 6, and 11 were the same as established by RSSI measurements taken in the student center environment. In the September 24 teleconference with the Wi-Fi Alliance referenced in their filing, I further stated that the power levels of the Channel 14 access points were 200mW EIRP, identical to the levels used in the March 2015 FCC demonstration. The Wi-Fi Alliance did not acknowledge this fact in its filing.
16. Regarding the Wi-Fi and TLPS load factors, the September 10 Report filed together with my September 10 Declaration states that openly available speed tests were used in the demonstrations and measurements. The speed tests produce the maximum possible throughput on the access point and clients. The resulting specific, quantitative throughput levels of the individual clients and the combined throughput (load) on the Wi-Fi channels and TLPS that result from the speed tests are clearly indicated in graphs and tables in the September 10 Declaration.
17. Regarding the data types used in the demonstration, the September 10 Report further states that specific, openly available speed tests were used in the demonstrations and quantitative throughput measurements. For the qualitative demonstrations, the specific applications used are clearly identified.

18. For the reasons described above, the Wi-Fi Alliance's assertions that the equipment for the demonstration was deliberately chosen to produce a positive result, and that the demonstrations at the university student center were not transparent, are false, misleading, and unsupported. The key conclusion of the demonstration - that TLPS enhances the capacity and throughput of an existing Wi-Fi network without any negative impact on the existing network - withstands the challenge of the Wi-Fi Alliance filing.

Response to Filing by Hearing Loss Association of America

19. In its most recent filing posted to the FCC proceeding on October 2, 2015, the Hearing Loss Association of America ("HLAA") asserts that "Globalstar has not submitted testing that demonstrates its [proposed TLPS service] will not interfere with hearing aids and assistive devices."
20. HLAA's assertion regarding the absence of test data for hearing aids and assistive devices is incorrect. Roberson and Associates recognizes the importance of Bluetooth-equipped hearing aids to those persons who are hearing impaired, and, for this reason, it cooperated fully with the Bluetooth SIG in conducting measurements and qualitative evaluation of Bluetooth-equipped hearing aids at the FCC TEC demonstration in March 2015.
21. At the FCC TEC, the Bluetooth SIG captured two three-minute recordings of received audio streamed to Bluetooth equipped hearing aids. One recording was captured while IEEE Channels 1, 6, and 11 were operating, and a second recording was captured while Channels 1, 6, and 11 were operating simultaneously with TLPS operations on Channel 14. The loading condition on all the channels was a continuous rate of 3.75 Mbps, a rate that could be visually confirmed by all observers and that was higher than that of video

streaming requested by the Bluetooth SIG.<sup>1</sup> The transmitted power level of each of the access points in the FCC TEC was 200 mW EIRP, a level agreed to by the Bluetooth SIG prior to the measurements and confirmed by the FCC personnel. When the audio recordings were played to the audience in the TEC, including numerous Commission engineers, no discernible difference in quality between the two recordings was observed.

22. We have requested that the Bluetooth SIG provide the two audio files played during the FCC TEC demonstration, but to date Bluetooth SIG has not produced this data.
23. Roberson and Associates also conducted its own demonstrations of the operation of Bluetooth and Bluetooth Low-Energy equipped devices at the FCC TEC.<sup>2</sup> The operation of Bluetooth stereo speakers, a Bluetooth-equipped computer mouse, and a Bluetooth heart-rate monitor were demonstrated in the presence of operations on IEEE Channels 1, 6, and 11 and both with and without operations on TLPS Channel 14. The flawless operation of these Bluetooth devices at the FCC TEC both with and without TLPS was recorded, and a video of the demonstration is available online.<sup>3</sup>
24. Furthermore, Roberson and Associates evaluated the performance of several Bluetooth devices at the university student center in Chicago, and found that TLPS operations did not impact Bluetooth operations when IEEE Channels 1, 6, and 11 were simultaneously operating with a high-traffic load along with TLPS operations on Channel 14.<sup>4</sup>

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<sup>1</sup> 3 Mbps is the typical rate of a 1080p streaming service such as Netflix.

<sup>2</sup> See [http://www.globalstar.com/en/tlps\\_doc/Globalstar\\_Ex\\_Parte\\_Letter-TLPS\\_Demonstration\\_Packet\\_031015.pdf](http://www.globalstar.com/en/tlps_doc/Globalstar_Ex_Parte_Letter-TLPS_Demonstration_Packet_031015.pdf)

<sup>3</sup> See <http://www.globalstar.com/en/index.php?cid=6202>

<sup>4</sup> See [http://www.globalstar.com/en/ir/docs/Globalstar\\_Ex\\_Parte\\_Notice\\_090915\\_FINAL.PDF](http://www.globalstar.com/en/ir/docs/Globalstar_Ex_Parte_Notice_090915_FINAL.PDF)

25. Based on all the Bluetooth test data collected in multiple environments, we conclude that TLPS does not pose a real-world interference threat to the operation of Bluetooth devices or Bluetooth-equipped hearing aids. In an ex parte filing dated March 27, 2015, Roberson and Associates fully responded to criticisms of its demonstrations and its conclusions regarding the March 2015 testing of Bluetooth devices and Bluetooth-equipped hearing aids at the FCC TEC.<sup>5</sup>

26. Bluetooth-based devices' successful coexistence in the unlicensed ISM band with other uses such as Wi-Fi and TLPS is not surprising given the robust nature of the physical and error control layers of the Bluetooth specification, which has been specifically designed to operate in an environment with other users. At the physical layer, the use of narrowband signals that frequency-hop at a rate of up to 1600 times per second allows Bluetooth devices to utilize frequency and temporal gaps that exist even when the frequency band is utilized by TLPS and other unlicensed devices. In addition, the Bluetooth protocol employs sophisticated error correction and control techniques to eliminate or mitigate the impact of impairments that may occur at the physical layer.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct to the best of my knowledge, information and belief.

Executed this 28th day of October, 2015.



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Kenneth J. Zdunek, Ph.D.

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<sup>5</sup> See [http://www.globalstar.com/en/ir/docs/Globalstar\\_Ex\\_Parte\\_Letter032715.pdf](http://www.globalstar.com/en/ir/docs/Globalstar_Ex_Parte_Letter032715.pdf)