UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GARMIN INTERNATIONAL, INC. AND GARMIN USA, INC.
Petitioners

v.

LOGANTREE, LP
Patent Owner

Case No. IPR2018-00564
Patent No. 6,059,576

DECLARATION OF DR. ANDREW C. SINGER

I, Andrew C. Singer, hereby declare the following:

I. INTRODUCTION

1. I, Andrew C. Singer, have been retained by counsel for Petitioners as a technical expert in the above-captioned case. Specifically, I have been asked to render certain opinions in regards to the IPR petition with respect to U.S. Patent No. 6,059,576 ("the '576 patent"). I understand that the Challenged Claims are claims 20-26, 29, 104-107, 110, 113-122, 126-128, 134-138, and 175. My opinions are limited to those Challenged Claims.

2. My compensation in this matter is not based on the substance of my opinions or the outcome of this matter. I have no financial interest in Petitioners. I am being compensated at an hourly rate of $500 for my analysis and testimony in this case.

3. In reaching my opinions in this matter, I have reviewed the following materials:

- EX1001 – U.S. Patent No. 6,059,576 to Brann ("the '576 patent");
- EX1003 – File History of Reexamination Request No. 90/013,201 ("'576 patent reexamination file history");
- EX1004 – U.S. Patent No. 5,978,972 to Stewart et al. ("Stewart");
- EX1006 – U.S. Patent No. 5,546,609 to Rush, III ("Rush");
- EX1007 – U.S. Patent No. 5,197,489 to Conlan ("Conlan");
- EX1008 – U.S. Patent No. 5,474,083 to Church et al. ("Church");
- EX1009 – U.S. Patent No. 5,976,083 to Richardson et al. ("Richardson");
- EX1011 – J.R.W. Morris, "Accelerometry – A Technique for the Measurement of Human Body Movements," J. Biomechanics, Vol. 6, Pergamon Press (1973, pp. 729-736) ("Morris");
- EX1012 – U.S. Patent No. 3,797,010 to Adler et al. ("Adler");

- EX1013 – U.S. Patent No. 5,803,740 to Gesink et al. ("Gesink");
- EX1014 – UK Patent Application No. GB 2,225,459A to Holder ("Holder");
- EX1015 – C. Verplaetse, "Inertial proprioceptive devices: Self-motion-sensing toys and tools," IBM Systems Journal, Vol. 35, Nos. 3&4 (1996, pp. 639-650) ("Verplaetse");
- EX1016 – Alan Freedman, *The Computer Desktop Encyclopedia*, The Computer Language Company Inc. (1996) ("Freedman");
- EX1017 – Robert C Cantu, *Head injuries in sport*, Br J Sports Med 30 (289-296; 1996) ("Cantu");

A. Background and Qualifications

4. I am currently a Professor in the Department of Electrical and Computer Engineering, where I hold a Fox Family endowed Professorship. I also serve as Director of the Technology Entrepreneur Center for the College of Engineering at the University of Illinois at Urbana Champaign.

5. I received a Bachelor of Science degree in Electrical Engineering and Computer Science from Massachusetts Institute of Technology in 1990; a Master of Science degree in Electrical Engineering and Computer Science from Massachusetts Institute of Technology in 1992; and a Ph.D. in Electrical Engineering from Massachusetts Institute of Technology in 1996.

6. Since 1990, I have been active in the signal processing and communications fields. I have authored and/or co-authored numerous publications, including books and refereed journal publications and conference articles on the topic of signal processing and communication systems and devices.

A focus of many of these publications is on methods for improving efficiency, reducing power and preserving battery life in such systems.

7. I have designed, built, and patented various components of communication and signal processing systems. These include various radio-frequency, SONAR, LIDAR, air-acoustic and underwater acoustic signal processing systems as well as wire-line, wireless, optical and underwater acoustic communication systems. An important aspect in many of these systems is the design of low power systems and the use of algorithms and methods to reduce power and preserve battery life.

8. I have taught both undergraduate and graduate level courses in signal processing, and communication systems. For example, I have taught Digital Signal Processing and Embedded DSP Laboratory classes. Additional examples of courses I have taught at the University of Illinois at Urbana Champaign include: Advanced Digital Signal Processing; Digital Signal Processing; Digital Signal Processing Laboratory; Probability with Engineering Applications; Random Processes; Optical Communication Systems; Advanced Lectures in Engineering Entrepreneurship; Embedded DSP Laboratory; Developing Design Thinking; Technology Commercialization; and Senior Design Laboratory. I have also overseen numerous PhD and Master's students researching topics related to signal processing and communication systems.

9. I was the co-founder and CEO of Intersymbol Communications, Inc., a communications component manufacturer focused on the development of signal processing-enhanced components used in optical communication networks. Intersymbol Communications, Inc. was acquired by Finisar Corporation, the world's largest supplier of optical communication modules and subsystems.

10. I was appointed the Director of the Technology Entrepreneur Center (TEC) in the College of Engineering, where I direct a wide range of entrepreneurship activities. The TEC directs the campus-wide Illinois Innovation Prize, celebrating our most innovative students on campus, as well as our annual Cozad New Venture Competition. I am also the Principal Investigator for the National Science Foundation's Innovation Corps Sites program at the University of Illinois, working with faculty and student startup companies.

11. My research and commercial experience led to my authoring of numerous papers. I have authored over 200 papers on digital signal processing and communication systems, several of which were voted "Best Paper of the Year" by technical committees of the IEEE. Citing these and other contributions, I was elected Fellow of the Institute of Electrical and Electronics Engineers ("IEEE") "for contributions to signal processing techniques for digital communication." I was also selected as a Distinguished Lecturer of the Signal Processing Society.

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