UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN HONDA MOTOR CO., INC.,

Petitioner,

v.

NEO WIRELESS, LLC,

Patent Owner.

IPR2023-00791

DECLARATION OF DR. R. MICHAEL BUEHRER IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,075,941

I. Engagement

1. I have been retained by Petitioner American Honda Motor Co., Inc. to provide this declaration concerning the technical subject matter relevant to a petition for inter partes review of U.S. Patent No. 10,075,941 ("'941 patent").

2. I am over 21 years of age and otherwise competent to make this Declaration. I make this Declaration based on facts and matters within my own knowledge and on information provided to me by others.

3. Specifically, I was asked to review the declaration of Dr. Sarah Kate Wilson that was submitted by the petitioner in IPR2022-01537 as Exhibit 1003 ("the Wilson Declaration") and form an opinion of whether I agreed with the facts, analysis, and conclusions in that declaration.

4. 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 Petitioner.

5. In writing this declaration, I have considered my own knowledge and experience, including my work experience in the field of electrical and computer engineering and my experience working with others involved in this field, including in the design and analysis of integrated circuit systems and subsystems.

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II. Background and Qualifications

A. Educational Background

6. My academic and professional background is in Electrical and Computer Engineering, and I have been working in those fields since the completion of my Ph.D. over 20 years ago. The details of my background and education, and a listing of all publications that I have authored, are provided in my Curriculum Vitae. See Appendix A. Below, I provide a short summary of my education and experience that I believe to be most pertinent to the opinions I have formed in this case.

7. I received a B.S. in Electrical Engineering from The University of Toledo in 1991, an M.S. in Electrical Engineering from The University of Toledo in 1993, and a Ph.D. in Electrical Engineering from Virginia Polytechnic Institute and State University in 1996. The focus of my graduate work was wireless communication systems. My Ph.D. thesis involved the application of multiuser detection (an advanced signal processing approach to interference mitigation) to CDMA-based cellular systems.

8. After completion of my Ph.D. in 1996, I joined Bell Laboratories, the research division of Lucent Technologies, where I worked for five years as a Member of Technical Staff and later as a Distinguished Member of Technical Staff. My work there focused on developing advanced technologies for cellular

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telecommunications, including for 3G cellular standards. For example, while at Bell Labs, I developed and implemented algorithms for intelligent antenna systems which increased the voice capacity (i.e., number of simultaneous phone calls) and data capacity of cellular systems. These algorithms were included in Lucent Technologies' 3G CDMA cellular base station. I also developed techniques known as transmit diversity techniques which increased reliability (i.e., reduced the probability of a dropped call) of cellular systems. These transmit diversity techniques were standardized in the 3GPP2 cellular standard known as cdma2000. During that time, I supported the standardization of my ideas by writing contributions to the working groups developing the standards and attending standards meetings. In particular, I participated in the 3GPP2 standardization process. During that time, I worked with colleagues to include my ideas on the use of transmit diversity in CDMA systems in the 3GPP2 standard.

9. I am currently a Professor in the Bradley Department of Electrical and Computer Engineering at Virginia Polytechnic Institute and State University, where I have taught and conducted research in the area of wireless communications for nearly 20 years. Specifically, I have taught courses which cover wireless communications and signal processing (including the underlying concepts) at the undergraduate and graduate levels. For example, I teach a sophomore-level course which introduces the concepts of signals and systems, a

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junior-level course which introduces the basic concepts of communication systems, senior-level and graduate-level courses which cover advanced digital communication topics, and also graduate-level courses which teach the advanced technologies underlying the latest wireless systems, such as Fourth and Fifth Generation (4G/5G) cellular communication standards (e.g., LTE, LTE-Advanced, New Radio) and Wi-Fi. I also teach graduate courses on advanced topics such as Information Theory, Machine Learning Applied to Communication Systems, Spread Spectrum Communications and CDMA.

10. From 2014 until 2022, I also served as the director of Wireless @ Virginia Tech, a comprehensive research group focusing on wireless communications which consists of 14 faculty members and approximately 85 graduate students. My specific research focuses on advanced wireless communications and geolocation techniques. This research has examined both advanced theoretical concepts as well as the application of these concepts to the latest wireless standards. As an example of the latter, I (along with my students) have conducted research applying multiuser/multi-antenna signal processing to LTE. I have also applied advanced geolocation techniques to LTE systems.

11. My research work has been funded by national agencies including the National Science Foundation (NSF), the Defense Advanced Research Projects

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Agency (DARPA), the Office of Naval Research (ONR), the Army Research Lab, the Air Force Research Lab as well as many industrial sponsors.

12. During 2009, I was a visiting researcher at the Laboratory for Telecommunication Sciences (LTS), a Federal Research Lab which focuses on telecommunication challenges for national defense. While at LTS, my research focus was in the area of cognitive radio with a particular emphasis on statistical learning techniques.

13. I have authored and co-authored over 250 publications in my area of expertise, which have been published in the leading journals in my field including IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Transactions on Information Theory, Proceedings of the IEEE, and IEEE Transactions on Signal Processing, and at all of the major conferences in my field. This research has been cited over 11,000 times. A complete list of my publications over the last 25 years is included in my Curriculum Vitae.

14. I am a Fellow of the IEEE (so named "for contributions to wideband signal processing in communications and geolocation"). I was a co-recipient of the Vanu Bose Award for the best paper at the 2021 Military Communications Conference.

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15. In 2010, I was awarded the Ellersick Best Paper Award in the Unclassified Technical Program, at the IEEE Military Communications Conference. I received the SDR Forum Best Paper Award in 2007 and the Outstanding Paper Award at the SDR Forum in 2008. I received the Dean's Award for Teaching Excellence in April 2014 and the Dean's Award for Outstanding New Assistant Professor, College of Engineering in 2003. While at Bell Laboratories, I was awarded the Bell Labs President's Silver Award for outstanding research contributions and the 1999 Best Paper Award in the Bell Labs Technical Journal.

16. As a consultant, I have examined in detail various aspects of the physical layer, MAC layer, RLC layer, and RRC layer including both user data transmission and the control signaling of the standards for 2G, 3G, and 4G cellular systems. I have also specifically studied the standardization process in 3GPP as it relates to the standardization of a particular aspect of 4G (LTE). I have also taught short-courses in the areas of cellular systems, geolocation and Wi-Fi communications.

17. I also hold 18 issued patents in the area of wireless communications, many of which relate to cellular communication systems.

18. I formerly served as an area editor for IEEE Transactions on Wireless Communications supervising a team of 12 editors. I also recently served

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as a guest editor for a special issue of the Proceedings of the IEEE. I was formerly an associate editor for IEEE Wireless Communications Letters, IEEE Transactions on Vehicular Technologies, IEEE Transactions on Communications, IEEE Transactions on Signal Processing, and IEEE Transactions on Education.

19. Additionally, I formerly served as the guest editor for the IEEE Journal on Special Topics in Signal Processing. I served as the Technical Program Chair for the Signal Processing for Communications Symposium at the 2017 IEEE International Conference on Communications. Previously, I was the Organizer and Technical Co-Chair for both the 2015 and 2016 IEEE Global Communications Conference Workshop on Localization and Tracking: Indoors, Outdoors and Emerging Networks (LION). I have also served on the technical program committees of several other conferences and workshops in my field.

20. A complete copy of my curriculum vitae, which includes a list of my publications and contains further details on my education, experience, publications, patents, and other qualifications to render an expert opinion, is attached as Appendix A.

III. Information Considered

21. In drafting this declaration and forming the opinions therein, I relied on my years of education, research, and industry and academic

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experience, including my direct experience and contributions in the area of wireless networks.

22. I reserve the right to supplement this declaration in response to additional evidence that may become known.

23. In connection with any testimony I may be asked to give to the Patent Trial and Appeal Board, I may use as exhibits various documents that relate to matters set forth in this declaration.

IV. Opinions

24. After considering the Wilson Declaration, I agree with the facts, analysis, and conclusions in the Wilson Declaration, and I adopt the testimony in sections VIII-X of the Wilson Declaration as my own for purposes of this proceeding.

25. I declare all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 3/29/23 By: _____
Dr. R. Michael Buehrer

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APPENDIX A

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R. Michael Buehrer, FIEEE

Virginia Polytechnic Institute and State University
The Bradley Department of Electrical and Computer Engineering
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Blacksburg, Virginia 24061
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Education

June 1996	Virginia Polytechnic Institute and State University, The Bradley Department of Electrical and Computer Engineering, Bradley Fellowship, Ph.D.
August 1993	The University of Toledo, Department of Electrical Engineering and Computer Science, M.S.
June 1991	The University of Toledo, Department of Electrical Engineering and Computer Science, B.S.

Employment

Aug. 2012 - Present	Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Director of *Wireless @ Virginia Tech*
Aug. 2006 – Aug. 2012	Associate Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
Aug. 2009 – Dec. 2009	Visiting Researcher at the Laboratory for Telecommunication Sciences (LTS) a federal research lab which focuses on telecommunication challenges for national defense.
Aug. 2001 – Aug. 2006	Assistant Professor, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
Aug. 2001 – Present	Independent Consultant, self-employed.
Aug. 1996 – Aug. 2001	Member Technical Staff, Bell Laboratories, Lucent Technologies, promoted to Distinguished Member of Technical Staff in September 2000.
Sep. 1993 – Jun. 1996	Graduate Research Assistant, Virginia Polytechnic Institute and State University, Bradley Department of Electrical and Computer Engineering, Mobile and Portable Radio Research Group.
May 1994 – Aug. 1994	Senior Engineer, Stanford Telecommunications, Advanced Programs.
Sep. 1991 – Aug. 1993	Graduate Research Assistant, The University of Toledo, Department of Electrical Engineering and Computer Science, Communications Research Group.

Honors and Recognitions

- Fellow of the IEEE (So named "for contributions to wideband signal processing in communications and geolocation")
- Vanu Bose Best Paper Award *IEEE Military Communications Conference (MILCOM)* 2021.
- Dean's Award for Teaching Excellence - April 2014.
- Ellersick Best Paper Award in the Unclassified Technical Program, *IEEE Military Communications Conference (MILCOM)* 2010.
- SDR Forum Best Paper Award, 2007.
- Outstanding Paper Award, SDR Forum, 2008.
- Dean's Award for Outstanding New Assistant Professor, College of Engineering, 2003.
- Dean's List for Teaching Effectiveness (teaching evaluation greater than 3.6) 16 out of 18 semesters list was published.
- Nominated for Teaching Certificate, College of Engineering, Spring 2004 and Spring 2005.
- Bell Labs President's Silver Award for outstanding research contributions.
- 1999 Best Paper Award for *Bell Labs Technical Journal.*

Patents

- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, "Estimating the Location of a Wireless Terminal Based on Cooperative Measurements," *US Patent No. 10,527,708* , January 7, 2020.
- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, "Estimating the Location of a Wireless Terminal Based on Radio-Frequency Pattern Matching and Cooperative Measurements," *US Patent No. 9,989,620 B1*, June 5, 2018.
- S. D. Gordon, R.M. Vaghefi, and R.M. Buehrer, "Estimating the Location of a Wireless Terminal Based on Radio-Frequency Pattern Matching and Cooperative Measurements," *US Patent No. 9,596,571 B1*, March 14, 2017.
- R.M. Buehrer, R.A. Soni, and J.A. Tsai, "Methods and Apparatus for Downlink Diversity in CDMA Using Walsh Codes," *U.S. Patent No. 7,400,614 B2*, July 15, 2008.
- R. D. Benning, R. M. Buehrer, Mark H Kramlm, and P. A. Polakos, " Space-Time Spreading and Phase Sweep Transmit Diversity", *US Patent No. 7,042,955 B2*, May 9, 2006.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, " Biased Phase Sweep Transmit Diversity", *US Patent No. 7,035,599 B2*, April 25, 2006.
- R. D. Benning, R. M. Buehrer, P. A. Polakos, and R. A. Soni, "Split Shift Phase Sweep Transmit Diversity, " *US Patent No. 6,980,778 B2*, December 27, 2005.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, " Symmetric Sweep Phase Sweep Transmit Diversity", *US Patent No. 6,920,314*, July 19, 2005.
- R.M. Buehrer, S.P. Nicoloso, R.A. Soni, and D. Uptegrove, "Cellular Communications System And Related Methods", *US Patent No. 6,801,791*, October 5, 2004.

- R.M. Buehrer, S.-C. Liu, S.P. Nicoloso, and D. Uptegrove, "Method of channel estimation and compensation based thereon," *U.S. Patent No. 6,542,560*, April 1, 2003.
- R.M. Buehrer and S.-C. Liu, "Code division multiple access system and method of operation with improved signal acquisition and processing," *U.S. Patent No. 6,549,565*, April 15, 2003.
- R.D. Benning, R.M. Buehrer, and R.A. Soni, "Apparatus and method of enhancing transmit diversity," U*.S. Patent No. 6,594,226*, July 15, 2003.
- R.M. Buehrer, S.-C. Liu, S.P. Nicoloso, and D. Uptegrove, "Iterative channel estimation and compensation based thereon," *U.S. Patent No. 6,614,857*, September 2, 2003.
- R.M. Buehrer and R.A. Soni, "Methods And Apparatus For Downlink Diversity In CDMA Using Walsh Codes", *U.S. Patent No. 6,515,978*, February 4, 2003.
- R.M. Buehrer, S. Gollamudi, and S.P. Nicoloso, "Multistage interference cancellation for CDMA applications using M-ary orthogonal modulation," *US Patent No. 6,363,103*, March 26, 2002.
- S.A. Allpress, R.M. Buehrer, and R.A. Soni, "Receiver Architecture Employing Space Time Spreading and Orthogonal Transmit Diversity Techniques," *US Patent No. 6,317,410 B1*, November 13, 2001.
- S.A. Allpress, R.M. Buehrer, Quinn Li, Ramesh Nallepilli, and R.A. Soni, "Transmitter Architecture Employing Space Time Spreading and Orthogonal Transmit Diversity Techniques," *US Patent No. 6,392,988*, May 21, 2001.
- R.M. Buehrer, M.D. Hahm, S.C. Liu, and S.P. Nicoloso, "Base Station System Including Parallel Interference Cancellation Processor," *US Patent No. 6,157,847*, December 5, 2000.

Teaching

Undergraduate Courses

- Engineering Exploration
- Electric Circuits
- Signals and Systems
- Introduction to Communications
- Digital Communications
- Analog and Digital Communication Laboratory – *developed this course with $70k grant from the State of Virginia.*

Graduate Courses

- Spread Spectrum Communications – *developed this course for the ECE department. It is now a permanent offering.*
- Advanced Digital Communications
- Multi-Channel Communications (Course covers the fundamentals of OFDM and MIMO techniques the underlying technologies for 4G cellular communications) – *developed this course for the ECE dept.*
- Information Theory
- Machine Learning for Communication Systems

Teaching Evaluations (through Spring 2011)

- Average student evaluation – 3.8/4.0 (17 courses, 450 students)
- Dean's List (student evaluation > 3.6) in 16 of 18 semesters of teaching

Short Courses Given

- Position Location
- Position Location using Ultra-Wideband Signals
- Radio Resource Management in CDMA Systems
- WiFi – An introduction to WLANs
- OFDM – Multicarrier transmission for high data rate systems; Application to 4G (LTE) cellular and Wi-Fi
- Ultra Wideband Communications
- Multi-Input Multi-Output (MIMO) Communication Systems; Application to 4G (LTE/LTE-Advanced) cellular and Wi-Fi

Advising

Current

- Charlie Thornton, " Distributed Cognitive Radar," Ph.D. candidate, expected graduation May 2023.
- William Howard, " Distributed Learning Approached for Cognitive Radar and Radio," Ph.D. candidate, expected graduation December 2023.
- Don-Roberts Emenonye, " Machine Learning Approaches to Remote Rehabilitation," Ph.D. candidate, expected graduation December 2023.
- Sam Shebert, "Automatically Classifying Modern Communication Waveforms," Ph.D. candidate, expected graduation May 2024.
- Megan Moore, "Machine Learning in Wireless Communications," Ph.D. candidate, expected graduation May 2025.
- Haozhou Hu, "Geolocation via Landmarks," Ph.D. candidate, expected graduation May 2025.
- Gaurav Duggal, "Combined Radar and Communications Signals for Geolocation," Ph.D. candidate, expected graduation May 2025.
- Harish Dureppagari, "Emergency Localization using UAVs and Collaborative Localization," Ph.D. candidate, expected graduation May 2026.

Former

- Jianyuan Yu, "Wireless Sensing and Fusion using Deep Neural Networks," Ph.D., August 2022.
- Yue Xu, " Deep Recurrent Q Networks for Dynamic Spectrum Access in Dynamic Heterogeneous Environments with Partial Observations," Ph.D. , August 2022.
- Chris O'Lone, "Statistical Analysis of Geolocation Fundamentals Using Stochastic Geometry," Ph.D. December 2020.
- Jeff Poston, "ILoViT: Indoor Localization via Vibration Tracking," Ph.D. March 2018.
- Mahi Abdelbar, "Applications of Sensor Fusion in Classification, Localization and Mapping," Ph.D. February 2018.
- Mico Woolward, "SUPPLEMENTING LOCALIZATION ALGORITHMS FOR INDOOR FOOTSTEPS," Ph.D., July 2017.
- Daniel Jakubisin, "Advances in Iterative Probabilistic Processing for Communication Receivers," Ph.D., April, 2016, *currently employed by The Hume Center*.
- Jeannette Nounagnon "Using Kullback-Leibler Divergence to Analyze the Performance of Collaborative Positioning,", Ph.D., April, 2016, *currently employed by ComSat*.
- SaiDhiraj Amuru, "Intelligent Approaches for Communication Denial," Ph.D., September, 2015, *currently employed by Samsung*.
- Javier Schloemann, "Fundamental Analyses of Collaborative and Noncollaborative Positioning," Ph.D., August, 2015, *currently employed by Northrup-Grumman*.
- Reza Vaghefi, "Cooperative Positioning in Wireless Sensor Networks Using Semidefinite Programming," Ph.D., December 2014, *currently employed by Blue Danube Labs*.
- Jeong-heon Lee, "Physical Layer Security for Wireless Position Location in the Presence of Location Spoofing," Ph.D., March 2011, *currently employed by Samsung*.
- Haris I. Volos, "Cognitive Radio Engine Design For Link Adaptation," Ph.D., September 2010, *currently employed by the University of Arizona.*
- Tao Jia, "Collaborative Position Location for Wireless Networks in Harsh Environments," Ph.D., March 2010, *currently employed by Qualcomm, Inc.*
- Heba Shaban, "A Novel Highly Accurate Wireless Wearable Human Locomotion," Ph.D., April 2010, *currently employed by Arab Academy of Science and Technology.*
- Haesoo Kim, "Cooperative Communications," Ph.D., August 2008, *currently employed by LG Electronics.*
- Rekha Menon, - "Interference Avoidance based Underlay Techniques for Dynamic Spectrum Sharing," Ph.D., April 2007, *currently employed by Tyco Electronics*.
- Swaroop Ventkatesh, "The Design and Modeling of Ultra-Wideband Position-Location Networks," Ph.D., February 2007, *currently employed by Marvel Semiconductor*.
- Jihad Ibrahim, "Algorithms and Architectures for UWB Receiver Design," Ph.D. January 2007, *currently employed by MathWorks*.
- Chris Anderson, "A Software Defined Ultra Wideband Transceiver Testbed for Communications, Ranging, or Imaging," Ph.D., September 2006, *currently an Associate Professor at the US Naval Academy.*
- Samir Al-Ghadhban - " Multi-layered Space Frequency Time Codes," Ph.D. October, 2005, *currently an associate professor at King Fahd University*.

- Jing Jiang – "Increasing the Capacity of Wireless Data Systems - A Cross Layer Perspective," Ph.D., July 2004, *currently employed by Texas Instruments*.
- Jiann-An Tsai – "Overloaded Array Processing Using Interference Cancellation," Ph.D., May 2002. *Currently employed by Samsung*.
- Sebastian Rodriguez, "Value of Machine Learning and Cognition on Target Tracking," M.S., June 2022.
- C. Tanner Fredieu, "Spectrum Awareness: Deep Learning and Isolation Forest Approaches for Open-set Identification of Signals," M.S. May 2022.
- Dhwan Wanjara, "A Python Software Library to Improve the Accessibility of the Apple Watch as a Research Tool," M.S. May 2022.
- Daniel Tait, " Electromagnetic Vector-Sensor Direction-of-Arrival Estimation in the Presence of Interference," M.S. August 2020.
- Don-Roberts Emenonye, " Application of Machine Learning to Multi-Antenna Transmission and Machine Type Resource Allocation," M.S. July 2020.
- Charlie Thornton, " Learning Schemes for Adaptive Spectrum Sharing Radar," M.S. May 2020.
- Mark Kozy, "Creation of a Cognitive Radar with Machine Learning: Simulation and Implementation," M.S., May 2019.
- Bryse Flowers, "Adversarial RFML: Evading Deep Learning Enabled Signal Classification," M.S., June 2019.
- Parker White, "Constrained Clustering for Frequency Hopping Spread Spectrum Signal Separation," M.S., August 2019.
- Ersin Selvi, " Cognitive Radar Applied To Target Tracking Using Markov Decision Processes," M.S. December 2017, *currently employed by Raytheon*.
- Ali Gaber Mohamed, "Navigating via Discrete Astronomical Radio Sources: Geolocation Using Fringe Rates," M.S. April 2017, *currently employed by Alexandria University*.
- Eric Sollenberger, "Iterative Leakage-Based Precoding for Multiuser-MIMO Systems," M.S., May, 2016, *currently employed by Qualcomm, Inc.*.
- Kevin McDermott, "On the Improvement of Positioning in LTE with Collaboration and Pressure Sensors," M.S., May, 2015, *currently employed by Northrup Grumman*
- Tori Jewell, "Use of GIS in Radio Frequency and Positioning Applications,", M.S. June 2014.
- Jacob Overfield, "The Impact of MIMO on Signal Localization," MS, May 2013, *currently employed by n-ask, inc.*
- Zachary Biskaduros, "Collaborative GPS," MS, June 2013, *currently employed by n-ask, inc.*
- Hunter DeJarnette, "Measuring Noise in the VHF Band and Its Effect On Low SNR Signal Detection," MS Thesis, September 26, 2012, *currently employed by Johns Hopkins Applied Physics Lab.*
- Benton Thompson, "Characterization and Improvement of the Collaborative and Non-Collaborative Position Location Problems," MS, August 2011, *currently employed by G3, Inc*.
- Corey Cooke, "Attenuation Field Estimation using Radio Tomography," MS, August 2011, *currently a Ph.D. student at Georgia Tech.*
- Harpreet Dhillon, "The Optimal Sum-Rate of Multi-Band MIMO Interference Channel," MS, July 2010, *currently an Assistant Professor at Virginia Tech.*

- Justin Kelly, "The Value of Collaboration in Dynamic Spectrum Access," MS, July 2009, *currently employed by the Department of Energy*.
- Matthew Roney, "Dual-Channel Direction Finding in Multipath Channels," M.S. candidate, *currently employed by DRS Signal Solutions*.
- Jesse Reed, "Approaches to Multiple-source Localization and Signal Classification," MS, May, 2009, *currently employed by Arinc, Inc.*
- Chang Li, "Non-contact Estimation of Respiration and Heartbeat Rate using Ultra Wideband," MS, August 20, 2008, *currently employed by Qualcomm, Inc.*
- Arjun Bhupathi Raju, "Characterization of Uplink Transmit Power and Talk-Time in WCDMA Networks", MS, July 15, 2008, *currently employed by Qualcomm, Inc.*
- Rajaraman Parameswaran – "Effects of user and spatial diversity on high data rate wireless systems," M.S., August 2005, *currently employed by Qualcomm Inc*.
- Nathan Harter, "Single Channel Direction Finding in Multipath Channels," M.S., April 2007, *currently employed by IO-Max*.
- John Keaveny – "The Implementation of Single-Channel Direction Finding," M.S., February 2005. *Currently employed by Boeing.*
- Brian Donlan, "Ultra-wideband Narrowband Interference Cancellation and Channel Modeling for Communications," M.S., January 2005, *currently employed by IOMAX USA.*
- Vivek Baradwaj, "Ultra-Wideband for Communications: Spatial Characteristics and Interference Suppression," M.S., April 2005. *Currently employed by Qualcomm, Inc.*
- Liu Yang, "On the Applicability of the Tap-delay Line Model to UWB Channel Modeling," M.S., August 2004, *currently employed by Microsoft.*
- Dan Hibbard, "The Impact of Bandwidth on Indoor Communication System Performance," M.S., May 2004. *Currently employed by Raytheon.*
- Nishant Kumar – "MAC and Physical Layer Design for Ultra-Wideband Communications," M.S., May 2004. *Currently employed by Staccato Communicaitons.*
- Samir Ginde – "A Game-theoretic Analysis of Link Adaptation in Cellular Radio Networks," M.S., May 2003. *Currently employed by Qualcomm, Inc.*
- Rahul Mahajan – "Cross Layer Optimization: System Design and Simulation Methodologies," M.S., December, 2003. *Currently employed by Qualcomm, Inc.*
- Aaron Orndorf, "Transceiver Design for Ultra Wideband Communications," M.S., completed May 2004.
- David McKinstry – "Channel Models and Receivers for Ultra Wideband Communications," M.S., May 2003. *Currently employed by Johns Hopkins Applied Physics Lab.*
- Venkatasubramanian Ramasamy – "MC-CDMA/OFDM and Adaptive Antennas," M.S., June 2002. *Currently employed by Apple.*
- Ray Chan – "Link Adaptation for Public Safety Wireless Information Networks," M.S., June 2003. *Currently employed by Northrup Grummond Corp.*
- Payal Jain – "Software Radio Implementation of Adjustable High Data Rate Receivers," M.S., November 2002. *Currently employed by Digital Receiver Technology, Germantown, MD.*

Funded Research

1. Title: "Development of Machine Learning Methodologies for Radar Signal Classification,"
   Sponsor: Alion,
   Fudning: $118,000,
   Period of Performance: January 26, 2023 – December 31, 2024
   Percent: 100

2. Title: "Prototyping 5G-enabled Indoor Geolocation System for Fire Fighters using UAVs,"
   Sponsor: National Institutes of Standards and Technology (through George Mason University),
   Fudning: $849,994,
   Period of Performance: June 1, 2022 – May 31, 2025
   Percent: 34

3. Title:" SWIFT: Electronically-Reconfigurable Surfaces for Improved Coexistence Between Radio Astronomy and Satellite Communications Systems,"
   Sponsor: National Science Foundation,
   Funding: $748,463,
   Period of Performance: September 1, 2021 - August 31, 2024.
   Percent: 50%.

4. Title:" Collaborative Research: CNS Core: Medium: Localization in Millimeter Wave Cellular Networks: Fundamentals, Algorithms, and Measurement-inspired Simulator,"
   Sponsor: National Science Foundation,
   Funding: $635,000,
   Period of Performance October 2021 – September 2025.
   Percent: 33%.

5. Title:" SWIFT: SMALL: Interference Canceling for Improved Coexistence for Passive and Active Radio Systems,"
   Sponsor: National Science Foundation,
   Funding: $499,999,
   Period of Performance January 2021– January 2024.
   Percent: 50%.

6. Title: "SCH:INT: Collaborative Research: Semi-Automated Rehabilitation in the Home,"
   Sponsor: National Science Foundation,
   Funding: $1.1M
   Period of Performance: August 2020 – July 2024,
   Percent: 10%

7. Title: "Vector Sensor Processing in the Presence of Multipath"
   Sponsor: Applied Signals Intelligence
   Funding: $170,000
   Period of Performance: April 2020 - April 2021.
   Percent: 90%

8. Title: "Machine Learning Approaches to Optimize Army Radar, Communication and EW Systems"
   Sponsor: Army Research Lab
   Funding: $975,000
   Period of Performance: May 11, 2020 - May 10, 2024.
   Percent: 100%

9. Title: "Vector Sensor Processing in the Presence of Interference"
   Sponsor: Applied Signals Intelligence
   Funding: $232,193

Period of Performance: December 20, 2018 - April 30, 2019.
Percent: 60%

10. Title: "Digital Beamforming and Interference Mitigation for MIMO Systems "
    Sponsor: GIRD Systems
    Funding: $1,575,398
    Period of Performance: October 17, 2018 - October 16, 2021.
    Percent: 50%

11. Title: "Cognitive Radar for C-SCoRE: Enhancing Radar Functionality though Interference Analysis and Avoidance,"
    Sponsor: Georgia Tech Research Institute (AFRL)
    Funding: $285,000
    Period of Performance: December 15, 2018 – May 30, 2022
    Percent: 100%

12. Title: "Collaborative Learning for Harmonious Coexistence of Heterogeneous Wireless Networks"
    Sponsor: Defense Advanced Research Projects Agency
    Funding: $1,999,994
    Period of Performance: January 1, 2017 - December 30, 2019.
    Percent: 25%

13. Title: "MU-MIMO Channel Characterization"
    Sponsor: GIRD Systems
    Funding: $117,712
    Period of Performance: April 1, 2017 - March 31, 2019.
    Percent: 100%

14. Title: "Cognitive Radio Approaches to Optimize Army Radar Systems"
    Sponsor: Army Research Lab
    Funding: $250,000
    Period of Performance: January 1, 2018 - December 30, 2020.
    Percent: 100%

15. Title: "Cognitive Radio Approaches to Optimize Army Radar and Communication Systems"
    Sponsor: Army Research Lab
    Funding: $190,282
    Period of Performance: January 1, 2017 - December 30, 2017.
    Percent: 50%

16. Title: "Hyper-wideband Communications"
    Sponsor: Defense Advanced Research Projects Agency
    Funding: $182,451
    Period of Performance: May 1, 2015 - April 30, 2016.
    Percent: 50%

17. Title: "IUSE: Gamification of Wireless Communication Testbeds for Authentic STEM Learning"
    Sponsor: National Science Foundation
    Funding: $626,665
    Period of Performance: Sept. 1, 2014 - Aug. 31, 2017.
    Percent: 20%

18. Title: "Advanced Cognitive Radio Design using SDRs"
    Sponsor: Lockheed Martin Advanced Technologies
    Funding: $494,600
    Period of Performance: April 1, 2014 – Sept. 30, 2015
    Percent: 100%

19. Title: “SDR Technology Development Support”
    Sponsor: DoD
    Funding: $375,000
    Period of Performance: 5/1/14 – 4/30/14
    P.I.: J.H. Reed
    Percent: 30%

20. Title: “Improving Cellular Positioning through Collaboration”
    Sponsor: Polaris Wireless
    Funding: $82,813
    Period of Performance: 11/01/2013 - 10/31/2014
    Percent: 100%

21. Title: “Advanced Wireless Systems and Technologies”
    Sponsor: DoD
    Funding: $3,883,320
    Period of Performance: 07/01/2012 - 06/30/2014
    P.I. R.W. McGwier
    Percent: 10%

22. Title: “Cognitive Radio Development”
    Sponsor: Lockheed Martin – Advanced Technologies Lab
    Funding: $325,000
    Period of Performance: 7/1/2012 – 12/31/2013
    P.I. R.M. Buehrer
    Percent: 50%

23. Title: “Next Generation Secure, Scalable Communication Network for the Smart Grid”
    Sponsor: Oak Ridge National Labs
    Funding: $626,671
    Period of Performance: 1/1/2011-10/31/2012
    PI – R.M. Buehrer
    Co-PI: J.H. Reed
    Percent: 50%

24. Title: “Software Defined Radio Waveform and Device Development And Component Deployment Using Ossie”
    Sponsor – DoD (Maryland Procurement Office)
    PI – RM Buehrer
    Period of Performance: Aug. 1, 2010 – July 31, 2013
    Funding: $299,227
    Percent: 100%

25. Title: “SDR Technology Development Support”
    Sponsor – DoD (Maryland Procurement Office)
    PI – R.M. Buehrer and J.H. Reed
    Funding: $638,653
    Period of Performance: 9/30/2010 – 4/30/2014
    Percent: 75%

26. Title: “Signal Processing Research”
    Sponsor: Aerospace Corp.
    PI: T.C. Clancy
    Co-PI: R.M. Buehrer
    Period of Performance: 1/1/2011 – 10/31/2011
    Funding: $130k
    Percent: 50%

27. Title: “IHCS: Proactive Cross-Layer Adversary Localization for Hostile or Harsh Wireless Environments”
    Sponsor: National Sceince Foundation
    Funding: $494,788
    Period of Performance: 5/1/08 – 4/30/11
    PI: Y. Yang
    Co-PI’s: R.M. Buehrer and J.M. Park
    Percent: 33%

28. Title: “A Fundamental Analysis of Spectrum Sharing”
    Sponsor: Qualcomm, Inc.
    Funding: $120,000
    Period of Performance: 5/1/08 – 4/30/10
    PI: Buehrer
    Co-PI’s: Y. Yang
    Percent: 85%

29. Title: “Reasoning and Learning in Adaptive Wireless Networks”
    Sponsor: BBN/DARPA
    Funding: $605,000
    Period of Performance: 10/1/07 – 3/31/10
    PI: L. DaSilva
    Co-PI’s: R.M. Buehrer, C. Bostian, A. MacKenzie, and J.H. Reed
    Percent: 25%

30. Title: DRS Graduate Fellowship
    Sponsor: DRS Signal Solutions
    Funding: $76,000
    Period of Performance: 9/01/07 – 8/30/09
    PI: R.M. Buehrer
    Percent: 100%

31. Title: U-PoLo Nets – Position Location in Harsh Environments
    Sponsor: National Science Foundation
    Funding: $175k
    Period of Performance: 8/1/05 – 7/30/08
    PI: R.M. Buehrer
    Percent: 100%

32. Title: NeTS ProWiN: An Open Systems Approach for Rapid Prototyping Waveforms for Software Defined Radio
    Sponsor: National Science Foundation
    Funding: $1M
    Period of Performance: 8/1/05 – 7/30/09
    PI: J.H. Reed (lead), R.M. Buehrer, and W.H. Tranter
    Percent: 33%

33. Title: Node and Network Benefits of Improved RF Characteristics in CDMA Cellular Networks
    Sponsor: ParkerVision
    Funding: $131,474
    Period of Performance: 11/1/07 – 10/31/08
    PI: R. M. Buehrer
    Percent: 100%

34. Title: UWB Propagation in Office Environments
    Sponsor: Freescale Semiconductor
    Funding: $35,000
    Period of Performance: 5/1/05 – 4/30/06

PI: R. M. Buehrer
Percent: 100%

35. Title: Networking Issues for Peer-to-Peer VoIP Link for Radio Interoperability, Fire Management and Security
Sponsor: Catalyst Communications
Funding: $67,500
Period of Performance: 1/1/05 – 5/15/05
PI: S.M. Midkiff (lead) and R.M. Buehrer
Percent: 33%

36. Title: AWINN: Advanced Wireless Networking for the Navy
Sponsor: ONR
Funding: $3M
Period of Performance: 12/20/04 – 6/19/06
PI: Warren Stutzman
Co-PI's: J.H. Reed, Scott Midkiff, R. M. Buehrer, W.H. Tranter, Peter Athanas, Tom Hou, Binoy Ravindran, Rick Habayeb
Percent: 10%

37. Title: Ultra Wideband Communications Systems
Sponsor: ASPIRES
Funding: $118,360
Period of Peformance: 7/1/03 – 6/30/04
PI: R. M. Buehrer
Percent: 100%

38. Title: UWB Communications
Sponsor: Motorola
Period of Performance: 12/15/03 – 12/14/04
Funding: $35,000
PI: Buehrer
Percentage: 100%

39. Title: Simulation of Ultra Wideband Communications
Sponsor: ITRI
Funding: $10,000
Period of Performance: 9/1/03 – 12/31/03
PI: R.M. Buehrer
Percent: 100%

40. Title: Receiver Design for Ultra Wideband Communications
Sponsor: ITRI
Funding: $15,000
Period of Performance: 9/1/03 – 12/31/03
PI: R.M. Buehrer
Percent: 100%

41. Title: Indoor Propagation
Sponsor: Qualcomm, Inc.
Funding: $14,000
Period of Performance: 12/1/03 – 5/15/04
PI: R.M. Buehrer
Percent: 100%

42. Title: Single Channel Direction Finding
Sponsor: DRS Technologies
Funding: $91,000

Period of Performance: 10/18/02 – 10/17/05
PI: R. M. Buehrer
Percent: 100%

43. Title: Flexible High Data Rate Transmission for Wireless Data Applications
Sponsor: BAE Systems
Funding: $29,000
Period of Performance: 10/18/01 – 10/17/02
PI: R. M. Buehrer
Percent: 100%

44. Title: UWB Propagation Measurements, Modeling, and Communication System Enhancements
Sponsor: Defense Advanced Research Projects Agency
Funding: $688,620
Period of Performance: 5/13/02-5/12/03
PI: R.M. Buehrer
Co-PI: A.S. Safaai-Jazi, W. Davis, D. Sweeney
Percentage: 35%

45. Title: Modeling and Simulation for the FCS Development Environment
Sponsor: Boeing
Funding: $127,022
Period of Performance: 5/1/02 - 4/1/03
PI: W. H. Tranter
Co-PI: R. M. Buehrer, A. Annamalai
Percentage: 33%

46. Title: The Benefits of Multiple Antennas at the Handset for Cellular CDMA
Sponsor: e-Tenna Corporation
Funding: $15,000
Period of Performance: 5/15/02 – 8/14/02
PI: R. M. Buehrer
Percent: 100%

47. Title: MPRG Affiliates Program
Sponsor: Analog Devices, ARO, Cingular, DRS Technologies, General Motors, General Dynamics, Huawei Technologies, Hughes, Lucent Technologies, Motorola, Qualcomm, Raytheon, Samsung, SW Bell, Texas Instruments, et. al.
Funding: $2M
Period of Performance: 8/25/01 – 5/15/11
PI: J.H. Reed
Co-PI's: R.M. Buehrer, W.H. Tranter, S.W. Ellingson, others
Percent: 20%

Book Publications

S. Zekavat and R.M. Buehrer, editors, Position Location - Theory, Practice and Advances, Second Ed., Wiley-IEEE, 2019.

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H. Shaban, M. A. El-Nasr, and R. M. Buehrer, "A Full-Body Wireless Wearable UWB-Based Human Motion Capture and Gait Analysis System," Chapter 20 in E-Healthcare Systems and Wireless Communications: Current and Future Challenges, pp. 434-459, Prof. Mohamed K. Watfa, Editor.

Journal Publications

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R.M. Buehrer, S.C. Kwatra, and J. Kim, "A Satellite/Terrestrial Hybrid System for the National Research and Education Network," *15th AIAA International Communications Satellite Systems Conference*, San Diego, CA, March 1994.

M. Keaton, R.M. Buehrer, S.C. Kwatra, and J. Kim, "A Wideband Communications Satellite for the National Research and Education Network," *1993 IEEE Global Communications Conference*, Houston, TX, vol. 3, 1644-1648, December 1993.

M. Keaton, R.M. Buehrer, S.C. Kwatra, and J. Kim, "Network Requirements for a Satellite Based National Research and Education Network," *1993 IEEE Military Communications Conference*, Boston, MA, vol. 3, pp. 993-997, November 1993.

Technical Reports

National Research Council. 2009. "Toward a Universal Radio Frequency System for Special Operations Forces", Washington, D.C.: The National Academies Press.

R. M. Buehrer, W.A. Davis, A. Saffai-Jazi, and D. Sweeney, "Ultra-wideband Propagation Measurements and Modeling - Final Report," submitted to DARPA as part of the NETEX Program.

R. M. Buehrer, A. Safaai-Jazi, W. A. Davis, D. Sweeney, "Path Loss Calculations for Ultra-wideband Signals in Indoor Environments," invited contribution to the International Telecommunications Union, Document Number USWP 3K-1, October 26, 2003.

15 technical memoranda in the areas of multiuser detection, intelligent antennas, and OFDM for Bell Labs – Lucent Technologies. Titles and abstracts are proprietary information.

Professional Affiliations

- *Fellow*, Institute of Electrical and Electronics Engineers (IEEE)
- Member, IEEE Communications Society
- Member, IEEE Vehicular Technologies Society
- Member, IEEE Signal Processing Society
- Member, Eta Kappa Nu
- Member, Tau Beta Pi
- Member, Pi Mu Epsilon

Selected Professional Activities

- Area Editor, *IEEE Transactions on Wireless Communications*, 2017 - present.
- Guest Lead Editor, *IEEE Journal on Special Topics in Signal Processing*, special issue on non-cooperative position location networks.
- Guest Editor, *Proceedings of the IEEE*, special issue on cooperative localization.
- Associate Editor, *IEEE Wireless Communications Letters*, 2010 - 2014
- Associate Editor, *IEEE Transactions on Communications*, 2009 - 2014
- Associate Editor, *IEEE Transactions on Wireless Communications*, 2005 - 2012, 2015 - 2017
- Associate Editor, *IEEE Transactions on Vehicular Technologies*, 2005 - 2009
- Associate Editor, *IEEE Transactions on Signal Processing*, 2006-2007
- Associate Editor, *IEEE Transactions on Education*, 1997-2000
- Organizer and Technical Co-Chair, 2015 IEEE Global Communications Conference Workshop on Localization and Tracking: Indoors, Outdoors and Emerging Networks (GC - LION '15), December 6, 2015.
- "Signal Processing for Communications" symposium co-chair for IEEE ICC 2017

- Symposium co-chair for IEEE ICC 2017 Signal Processing for Communications Symposium
- Technical Program Co-Chair, WPNC 2013.
- Technical Program Chair for UWBST2003.
- Technical Program Committee, 2008-2016 IEEE Global Communications Conference
- Technical Program Committee, 2007-2016 IEEE International Conference on Communications
- Technical Program Committee, IEEE RWS 2006
- Technical Program Committee, IEEE 2006 International Conference on Ultra Wideband
- Technical Program Committee, IEEE Vehicular Technology Conference 2006 - Fall
- Technical Program Committee, 2004 IEEE International Workshop on Ultra Wideband Systems / Ultra Wideband Systems and Technologies.
- Technical Program Committee, 2004 IEEE Radio and Wireless Conference (RAWCON), September 2004.
- Technical Program Committee, 2005 Wireless Communications and Networking Conference.
- Reviewer for *IEEE Journal on Selected Areas in Communications*, *IEEE Transactions on Communications, IEEE Transactions on Vehicular Technology, IEEE Communications Letters, IEEE Transactions on Signal Processing, ETRI Research Journal, Army Research Office, State of Tennessee*
- Session Chair, IEEE Vehicular Technology Conference – Fall 2002

Selected Consulting

- Lutron Electronics
  - Provided recommendations on the design and testing of indoor wireless networks, August - Sept. 2019.
  - Evaluated RF coexistence plan, March 2020.
  - Evaluated RF coverage and planning techniques for 2.4GHz indoor networks, September - October 2021.
- Polaris Wireless - Provided an evaluation of Z-axis estimation algorithm, Sept-Oct 2018.
- ENSCO, Inc. – Provided an evaluation of spread spectrum ranging system. March 2011.
- FCC – Delivered short courses on various topics in wireless communications including WiFi, spread spectrum, and 3G technologies. Summer 2004, Summer 2005.

Selected Expert Witness Experience

- Ericsson vs. Apple
  - Law firm: Fish and Richardson
  - Represented: Apple
  - Analyzed technical aspects of various patents to aid validity/invalidity and infringement/non-infringement analysis. Included both Inter Partes Review proceedings and ITC case. **Was deposed multiple times. Testified at trial.**
  - Dates: September 2021 - December 2022

- Godo Kaisha IP Bridge vs. Nokia
  - Law firm: Alston & Bird
  - Represented: Nokia (defendant)
  - Served as expert witness for non-infringement and invalidity.
  - Case No. 2:21-CV-215-JRG
  - Technology: Sounding Reference Signal, RACH, ACK/NACK and CQI reporting in cellular networks. **Was deposed.**
  - Dates: September 2021 - November 2022
- Honeywell, Int'l., Inc., et. al. vs. Sisvel International
  - Law firm: K&L Gates
  - Represented: Honeywell (Petitioner)
  - Served as expert in Inter Partes Review proceedings. Wrote declaration supporting petitioner. **Was deposed.**
  - IPR2021-00640
  - Technology: Cell selection and reselection in Radio Resource Control
  - Dates: December 2021 - Current
- Thales, et. al. vs. Sisvel International
  - Law firm: AddyHart
  - Represented: Thales (Petitioner)
  - Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner. **Was deposed.**
  - IPR2021-00639
  - Technology: Data connection management.
  - Dates: December 2021 - Current
- ZTE, et. al. vs. Sisvel International
  - Law firm: Banner-Witcoff
  - Represented: ZTE (Petitioner)
  - Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner.
  - IPR2021-00639, IPR2021-00640
  - Technology: Cell selection and reselection in Radio Resource Control; Data connection management.
  - Dates: January 2021 - April 2021
- HP, Inc. vs. Ozmo
  - Law firm: DLA-Piper
  - Represented: HP
  - Served as testifying expert
  - 6:21-cv-00383-ADA
  - Technology: Wireless local area and personal ara networks (WLANs and WPANs)
  - Dates: August 2021 - October 2021
- Samsung vs. Ericsson

  - Law firm: Fish & Richardson
  - Represented: Samsung
  - Wrote declarations for IPR filings.
  - IPR2021-00615, IPR2021-00685
  - Technology: Cellular communications
  - Dates: January 2021 - April 2021

- Tesla, Inc. vs. Optis
  - Law firm: Munger, Tolles, & Olson
  - Represented: Tesla (defendant)
  - Case 2:20-cv-00310
  - Served as testifying expert witness
  - Technology: Control channels/information in cellular systems
  - Dates: November 2020 - March 2021

- Apple, Inc.
  - Law firm: Wilmer-Hale
  - Wrote declaration in support of request for ex parte reexamination
  - Reexam Control Numbuer 90/014,653
  - Technology: Control information in cellular systems
  - Dates: November 2020 - January 2021

- Phillips vs. Garmin
  - Law firm: Alston-Bird
  - Represented: Garmin (defendant)
  - Served as testifying expert witness for Federal Trade Commission proceedings
  - Technology: Local and Cellular Wireless Connections in Personal Emergency Response Systems
  - District: FTC
  - Dates: June - July 2020

- ZTE vs. Sisvel International
  - Law firm: Banner-Witcoff
  - Represented: ZTE (Petitioner)
  - Served as expert in Inter Partes Review proceedings. Wrote declarations supporting petitioner. **Was deposed.**
  - IPR2020-01070, IPR2020-01071
  - Technology: Radio Resource Control
  - Dates: March 2020 - May 2021

- Apple, Inc. vs. Optis
  - Law firm: Wilmer-Hale
  - Represented: Apple (Plaintiff)
  - Served as testifying expert witness for litigation. **Was deposed. Testified at trial.**
  - Case 2:19-cv-66 (E.D. Tex.)

  - Technology: Control information in cellular systems
  - District: Eastern District of Texas
  - Dates: July 2019 - August 2020.

- Apple, Inc. vs. Wi-LAN
  - Law firm: DLA Piper
  - Represented: Apple (Plaintiff)
  - Served as testifying expert witness for litigation. **Was deposed. Testified at trial.**
  - Technology: Resource Allocation in Wireless Systems
  - District: Southern District of California
  - Dates: January '19 - January '20

- TELUS Communications, Bell Mobility, and Rogers Communications vs. WiLAN, Inc.
  - Law firm: Torys, LLP.
  - Represented: TELUS Communications, Bell Mobility, and Rogers Communications
  - Served as testifying expert. Analyzed certain patents (and the prior art) and provided technical reports on sufficiency, validity and potential double-patenting.
  - Technology: Resource allocation in wireless networks
  - Dates: January 2019 - November 2019

- Samsung vs. Sharp
  - Law firm: Fish and Richardson
  - Represented: Samsung
  - Analyzed technical aspects of patent to aid validity/invalidity analysis.
  - Technology: Feedback in MIMO-OFDM systems
  - Dates: April 2019 - July 2019

- American Patents, LLC vs. HP, Inc.
  - Law firm: DLA Piper
  - Represented:HP, Inc.
  - Analyzed technical aspects of two patents to aid validity/invalidity analysis.
  - Case 18-cv-700 (E.D. Tex.)
  - Technology:MIMO/OFDM synchronization in cellular systems
  - Dates: June 2019

- Blackberry vs. Uniloc, LLC.
  - Law firm: Oblon
  - Represented: Blackberry (Petitioner)
  - Wrote declaration to the USPTO concerning the disclosure of certain features of two patents in previous references.
  - Technology: Traffic mapping between logical channels and transport channels in wireless systems
  - Dates: June 2019.

- Apple, Inc. vs. Wi-LAN
  - Law firm: DLA Piper

  - Represented: Apple (Plaintiff)
  - Served as testifying expert witness for litigation (non-infringing alternatives). **Was deposed. Testified at trial.**
  - Case 3:14-cv-2235-DMS-BLM
  - Technology: Resource Allocation in Wireless Systems
  - District: Southern District of California
  - Dates: November '17 - July '18

- Apple, Inc., LG Electronics Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. vs. Uniloc, LLC.
  - Law firm: Fish and Richardson
  - Represented:Apple, Inc., LG Electronics Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (Petitioner)
  - Wrote declarations to the USPTO concerning the disclosure of certain features of two patents in previous references.
  - IPR2019-00219, IPR2019-00222
  - Technology: Traffic mapping between logical channels and transport channels in Wireless Systems; Multi-mode transceivers
  - Dates: September 2018 - November 2019.

- CCE vs. Apple, Inc.
  - Law firm: DLA Piper
  - Represented: Apple (Defendant)
  - Served as testifying expert witness for litigation (infringement analysis). **Was deposed.**
  - 2:15-cv-00576-RWS-RSP
  - Technology: Power Headroom Reporting in Cellular Systems
  - District: Eastern District of Texas
  - Dates: January 2017 - July 2017

- Nokia Technologies vs. Apple, Inc.
  - Law firm: Wilmer-Hale
  - Represented: Apple (Defendant)
  - Served as testifying expert witness for litigation (infringement analysis)
  - Technology: antennas for handheld mobile devices
  - District: Eastern District of Texas
  - Dates: January 2017 - June 2017

- Core Wireless vs. Apple, Inc.
  - Law Firm: Wilmer-Hale
  - Represented: Apple (Defendant)
  - Role: Served as testifying expert witness for litigation (infringement and validity analysis). **Was deposed. Testified at trial.**
  - Case 5:15-cv-5008
  - Technology: Control Channels and Frame Stealing in 2G (GSM) cellular networks.
  - District: The US District Court for the Northern District of California

  - Dates: May 2015 - December 2016.

- AMERICAN SYSTEMS vs. US Navy
  - Law Firm: Miles and Stockbridge
  - Represented: AMERICAN SYSTEMS (Plaintiff)
  - Role: Served as testifying expert witness for litigation (case settled prior to expert reports being filed).
  - Technology: Wireless mesh networks.
  - Dates: Nov. 2014 - June 2015.

- TruPosition,Inc. vs. LM Ericsson Telephone Company, et. al.
  - Law Firm: Constantine-Cannon LLP
  - Represented: TruePosition (Plaintiff)
  - Role: Served as testifying expert witness for litigation. Case settled prior to depositions being taken.
  - Case 2:11-cv-04574-RK
  - Technology: Cellular-based geolocation for 4G (LTE) cellular networks.
  - District: The US District Court for the Eastern District of Pennsylvania
  - Dates: March 2013 - July 2014.

- Andrew, LLC vs TruPosition, Inc.
  - Law Firm: Patterson Belknap Webb & Tyler LLP
  - Represented: Andrew, LLC (Plaintiff)
  - Role: Served as testifying expert witness for patent litigation. **Was deposed.**
  - Civil Action 09-669
  - Technology: Cellular-based (2G, 3G) geolocation.
  - District: The US District Court for the District of Delaware
  - Dates: Nov. 2009 - March 2010.

- TCL vs. Ericcson
  - Law Firm: Sheppard Mullin
  - Provided Services for: TCL (Plaintiff)
  - Role: Served as consulting expert witness for essentiality analysis.
  - Technology: digital communications in 2G, 3G, and 4G cellular systems.
  - District: The US District Court for the Central District of California
  - Dates: March 2015 - December 2015.

- Univ. of Minnesota vs. Sprint
  - Law Firm: McGuire-Woods
  - Provided Services for: Sprint (Defendant)
  - Role: Served as consulting expert for validity analysis.
  - Technology: 4G cellular networks.
  - Dates: October 2015 - January 2016.

- Eon Corp, IP Holdings, LLC vs Research In Motion Corporation, et. al.
  - Law Firm: Sidley-Austin

  - Provided Services for: Research in Motion Corporation (Defendant)
  - Served as consulting expert for patent litigation
  - Technology: Cellular technologies
  - Dates: March 2012
- InterDigital vs. Nokia
  - Law Firm: Alston-Bird LLP
  - Provided Services for: Nokia
  - Served as a consulting expert
  - Technology: Cellular CDMA and power control
  - Date: Oct. 2011 - Dec. 2011.
- SPH America, LLC vs Acer, Inc.
  - Law Firm: Spotts Fain PC
  - Provided Services for: UT Starcomm
  - Role: Served as a consulting expert for patent litigation
  - Technology: CDMA (spread spectrum) and 3G cellular technologies.
  - Dates: Jan. 2011 - March 2011

References

Available upon request.