



# MARK MCFARLAND, PE

**ELECTRICAL ENGINEER  
STATISTICIAN**

@ Mark@DiscoveryEngineering.net

(720) 593-1640

Boulder, Colorado

www.DiscoveryEngineering.net

*Making the complex understandable.*

## Practice Areas

- Electrical Engineering
- Cellular Evidence Mapping & Analysis
- Wireless Engineering
- Telecommunications Engineering
- Applied Research & Quality Sciences

## Credentials

- Licensed Electrical Engineer
- Nationally recognized expert
- Published in national & international peer-reviewed journals
- Speaker at national & international technical conferences
- BS, Electrical Engineering
- MEng, Telecommunications
- MEng, Engineering Management
- Six Sigma Master Black Belt (certification in quality sciences/statistics)
- Twenty-five years of experience



## Work History

Since 2015	<b>Founder &amp; CEO</b> Discovery Engineering, PLLC	Colorado
Since 2002	<b>Electronics Engineer</b> US Department of Commerce Institute for Telecommunication Sciences	Colorado
2000–2001	<b>Software Engineer</b> Motorola Broadband Communications	Pennsylvania
1996–2000	<b>Antenna Engineer</b> Lockheed Martin Missiles and Space	Pennsylvania

## Education

2017	<b>Master of Engineering</b> Engineering Management	University of Colorado
2015	<b>Six Sigma Master Black Belt</b> 24 graduate credit hours (8 semester courses) in applied statistics	University of Colorado
2007	<b>Master of Engineering</b> Telecommunications	University of Colorado
1997–2000	<b>MSEE Coursework</b> Nine trimester courses in microwave & control systems engineering	Drexel University
1996	<b>Bachelor of Science</b> Electrical Engineering	Lehigh University

## Forensic Engineering & Applied Research Expertise

### Electrical Engineering

I provide claims investigations, litigation support, and expert opinions to attorneys, insurance companies, and private parties for evaluation and analysis of electrical and electronic systems, appliances, and products.

### Cellular Evidence Mapping and Analysis

Understanding cell phone & base station records is critical for cases involving cellular evidence. I present the cellular record in easy to understand maps, animations, and timelines. These can show patterns of communications, whereabouts, and activity. I map & analyze records from all carriers.

### Wireless and Telecommunications Engineering

Over 25 years of experience in research, design, analysis, & measurement of cellular, GPS, 3G–5G, LTE, public safety comm systems, satellite, Internet, wireless, RF, Wi-Fi, radar, networks, data communications, communications protocols & standards, instrumentation, and control systems.

### Applied Research and Quality Sciences

Understanding *variability* is crucial to improving and controlling any process. I bring scholarship & practical experience in applied research & quality sciences to help clients understand variability and improve outcomes.

Studies show that 35–95% of all published scientific research cannot be reproduced [NAS, 2018]. The financial and legal consequences of arbitrary research methods and improper analyses are enormous. I can ensure that solid and defensible methods inform your decisions.



## License and Certifications

2006	Professional Engineer <small>PE-0040278</small>	State of Colorado
2016	Six Sigma Master Black Belt	University of Colorado
2016	Competent Communicator	Toastmasters International

## Training and Continuing Education


2020	Spectrum Analysis Fundamentals
2020	RF Fundamentals Seminar
2020	Signal Integrity Workshop
2019	LTE 5G Boot Camp
2019	Vector Signal Analyzer Training
2018	GPS and the Global Navigation Satellite System
2012–2015	Six Sigma Master Black Belt (Statistics: 24 graduate credit hours)
2015	Radiowave Propagation
2014	LTE Air Interface and Interference Considerations
2007	Regression, Contingency Tables, and Logistic Regression
2003	Ethernet Network Analysis and Troubleshooting
2003	Troubleshooting with the Sniffer Portable Network Analyzer


## Litigation History


- Mining Accident** Investigated underground mine communication system failure resulting in serious personal injury. (*Consultation*)
- Automotive Wireless** Investigated insurance claim that vehicle anomalies were caused by wireless key fob. (*Consultation & Report*)
- Securities Fraud** Investigated stock trades using spoofed computer MAC addresses resulting in alleged illegal stock manipulation. (*FINRA Arbitration; Consultation & Report*)
- Electric Shock** Investigated claim that electrical circuit breaker panel caused a shock, leading to serious personal injury. (*Consultation*)
- Cellular Mapping & Analysis** Mapped base station locations and provided opinion on the whereabouts of an individual's cell phone based upon service provider records.
- Distracted Driver** Analyzed mobile phone records to quantify voice, SMS, and data usage before and at time of an auto accident. (*Consultation & Report*)
- Social Media Metadata** Examined social media metadata, logs, cache, history, and device system records, as well as email metadata to provide an opinion on an individual's location. (*Consultation & Reports*)
- Software Licensing** Examined software licensing issues stemming from confusion regarding the technical terms of a *field of use* software license. (*Consultation & Report*)
- SMS/Texting/Social Media** Examined SMS texts and social media posts to determine their source. (*Consultation & Court Testimony*)
- Cellular Location Evidence Mapping & Analysis** Mapped location and provided opinion on the whereabouts of an individual's cell phone based upon cellular carrier records.


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## Refereed Publications

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1. R. T. Johnk, M. Powell, J. Griffith, M. McFarland, K. Baker, P. Daithanker, S. Samdian, L. Gopal, and S. Gavva, "In-building LTE testing at the University of Colorado," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Report TR-15-518, July 2015. Available: <http://www.its.bldrdoc.gov/publications/2807.aspx>
2. R. Achatz, M. McFarland, R. Dalke, P. McKenna, F. Sanders, and G. Sanders, "Effects of broadband radio service reallocation on S-band marine radars: Front-end overload," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Report TR-15-515, April 2015. Available: <http://www.its.bldrdoc.gov/publications/2798.aspx>
3. M. McFarland and R. Johnk, "Characterizing an S-band marine radar receiver in the presence of interference," in *Electromagnetic Compatibility (EMC), 2012 IEEE International Symposium on*, August 2012, pp. 579-583. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?partnum=6350926&searchProductType=IEEE%20Conferences>
4. R. Johnk, C. Hammerschmidt, M. McFarland, and J. Lemmon, "A fast-fading mobile channel measurement system," in *Electromagnetic Compatibility (EMC), 2012 IEEE International Symposium on*, August 2012, pp. 584-589. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?partnum=6350925&searchProductType=IEEE%20Conferences>
5. M. McFarland, M. Pinson, C. Ford, A. Webster, W. Ingram, S. Hanes, and K. Anderson, "Relating audio and video quality, using CIF video," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Memorandum 10-472, September 2010. Available: <http://www.its.bldrdoc.gov/publications/2547.aspx>
6. R. Johnk, J. Ewan, N. DeMinco, R. Carey, P. McKenna, C. Behm, T. Riley, S. Carroll, M. McFarland, and J. Leslie, "High-resolution propagation measurements using biconical antennas and signal processing," in *Electromagnetic Compatibility (EMC), 2010 IEEE International Symposium on*, July 2010, pp. 85-90. Available: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=5711252&contentType=Conference+Publications>
7. DHS Public Safety Communications, "Task-based tactical and surveillance video quality tests," Statement of Requirements, US Department of Homeland Security, DHS Technical Report DHS-TR-PSC-10-07, July 2010. Available: <https://www.hsdl.org/?abstract&did=16117>
8. C. Ford, M. McFarland, A. Webster, S. Hanes, M. Pinson, A. Webster, and K. Anderson, "Multimedia synchronization study," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Memorandum 10-464, February 2010. Available: <http://www.its.bldrdoc.gov/publications/2501.aspx>
9. F. Sanders, R. Johnk, M. McFarland, and R. Hoffman, "Emission measurement results for a cellular and PCS signal-jamming transmitter," National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Technical Report 10-465, February 2010. Available: <http://www.its.bldrdoc.gov/publications/2503.aspx>
10. M. McFarland, "A subjective video quality test method for the assessment of recorded surveillance video," in *Proceedings of the American Academy of Forensic Sciences*, vol. 15, February 2009, p. 158. Available: <http://www.aafs.org/sites/default/files/pdf/ProceedingsDenver2009.pdf>
11. C. Ford, M. McFarland, and I. Stange, "Subjective video quality assessment methods for recognition tasks," in *Proceedings of the SPIE*, vol. 7240, February 2009. Available: <http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=811708>





## Refereed Publications (continued)

12. ITU-T, *Subjective Video Quality Assessment Methods for Recognition Tasks*, International Telecommunications Union– Telecommunication Standardization Sector Recommendation P.912, August 2008. Available: <https://www.itu.int/rec/T-REC-P.912-200808-S/en>
13. M. McFarland, M. Pinson, and S. Wolf, “Batch video quality metric (BVQM) user’s manual,” National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, NTIA Handbook 06-441a, December 2006. Available: <http://www.its.bldrdoc.gov/publications/2476.aspx>

## Non-Refereed Reports


1. M. McFarland, “Cell Tower Report,” Discovery Engineering, Report to Leyden Rock Metropolitan District, December 2019.
2. M. McFarland, “Potential health hazards of radio frequency radiation,” Discovery Engineering, Report to Broomfield City Council, March 2016.
3. M. McFarland, “Faraday cages for electromagnetic shielding,” Discovery Engineering, Report to Broomfield City Council, March 2016.
4. M. McFarland, “Electromagnetic interference and the Permobil power wheelchair,” Discovery Engineering, Report to Broomfield City Council, March 2016.
5. M. McFarland, “A critique of the competitive value model for agricultural tractors,” University of Colorado, Whitepaper, September 2014, EMEN 5040: Quality, Strategy, and Value Creation.
6. M. McFarland, “An empirical study of the repeatability of the DSA testbed measurements,” National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Whitepaper, August 2010.
7. M. McFarland, “Stability, precision, and accuracy in VSA measurements,” National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Internal Report, August 2014.
8. C. Ford and M. McFarland, “New advances in the quality assessment of task-based video systems,” National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, Technical Report, March 2009, unpublished.
9. M. McFarland, “A subjective video quality test methodology for the assessment of recorded surveillance video,” Master of Engineering Thesis, University of Colorado, Boulder, CO, December 2007.


## Presentations and Talks


1. *Six Sigma Techniques to Validate and Generalize In-Building Path Loss Models*, International Union of Radio Science (URSI). January 2018, Boulder, CO.
2. *Statistical Learning to Classify Six In-Building Propagation Environments*, International Union of Radio Science (URSI). January 2018, Boulder, CO.
3. *Cell Towers: Their Present, Their Future*, Broomfield City Council meeting. March 2016, Broomfield, CO.
4. *In-Building Path Loss Model Analysis: Testing Assumptions and Identifying Outliers in Propagation Models*, International Union of Radio Science (URSI). January 2016, Boulder, CO. (session co-chair)
5. *In-Building Path Loss Modeling: An Application of Simple Linear Regression Analysis*, University of Colorado Boulder, Guest lecturer for graduate course in applied statistics. March 2015, Boulder, CO. (invited talk)


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## Presentations and Talks (continued)

6. *A Fast-Fading Mobile Channel Measurement System*, IEEE Antenna Measurement Techniques Association. April 2013, San Diego, CA. (Presented by B Johnk)
7. *Characterizing an S-band Marine Radar Receiver in the Presence of Interference*, IEEE International Symposium in Electromagnetic Compatibility. August 2012, Pittsburgh, PA.
8. *Engineering Licensure: from Point A to P.E.*, Metropolitan State College of Denver, Tau Alpha Pi National Honor Society 35<sup>th</sup> Annual Dinner and Awards Program. April 2012, Denver, CO. (invited talk)
9. *Engineering Licensure: from Point A to P.E.*, University of Colorado Boulder, Undergraduate Professional Seminar. November 2011, Boulder, CO. (invited talk)
10. *Assessing the Quality of Recorded Surveillance Video*, US Department of Homeland Security. February 2009, Boulder, CO. (invited talk)
11. *A Subjective Video Quality Test Method for the Assessment of Recorded Surveillance Video*, American Academy of Forensic Sciences. February 2009, Denver, CO
12. *Assessing the Quality of Recorded Surveillance Video*, Scientific Working Group on Imaging Technology. January 2007, Orlando, FL. (invited talk)

## Professional Affiliations

Since 2008 **National Society of Professional Engineers (NSPE) - Colorado**  
President, Vice President, Director, Secretary

Since 2018 **NSPE-Colorado Education Foundation**  
Trustee



Retained

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