

Aaron Bryce Carman

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Education

Ph.D. – Electrical Engineering <i>GPA: 4.00</i>	Texas Tech University	2020 - 2025
B.S. – Electrical Engineering <i>Summa Cum Laude with Honors</i> <i>GPA: 3.947</i>	Texas Tech University	2016 - 2020

Research Experience

Graduate Research Assistant, Texas Tech University 2020 - Present

- Developing and testing passive radar systems operating in the 5.8-GHz ISM band for noncontact motion and target detection leveraging ambient wireless signals. Analyzed the limitations of passive radar systems and proposed methods of maximizing the sensing ability. Developed passive radar beamforming theory using signal propagation and target models and experimentally verified the efficacy of the model using a custom-designed 16-channel beamforming passive radar. Guided visiting high school student's experiments on using passive sensors to monitor room occupancy.
- Developed and experimentally verified new FMCW radar sensing architectures for dynamic analog clutter removal using feedforward cancellation leveraging microwave passive components. Developing novel circuits to create programmable true-time delay for FMCW clutter cancellation.
- Designed high-voltage analog CMOS circuits after implementing a private Cadence Custom IC design server to programmatically drive a 32x32 optical phased array with μm -scale pitch. Developed high-efficiency optical, phased array, and semiconductor simulations using COMSOL.
- Designed and analyzed a novel microwave pulse oximetry system and its interactions with biological tissue in COMSOL and unified FEM results with known radar signal models.

Undergraduate Research Assistant, Texas Tech University 2018 - 2020

- Developed a high-speed datalogger to accompany existing radar boards on drone flights to provide continuous data acquisition of baseband radar signals.
- Assembled and tested baseband and RF circuit boards for 24- and 5.8-GHz hybrid-mode radars.

Student Engineer, Southwest Research Institute, Defense and Intelligence Solutions 2019

- Led the reverse-engineering of legacy aircraft power supply schematics to characterize the operation and potential points of failure. Created specification documents after successful analysis using self-taught power electronics and electromagnetics and disseminated results to peers.
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Peer-Reviewed Publications

- [1] D. Thompson, **A. B. Carman**, and C. Li, "Feasibility Study of Employing MIMO SFCW Radar using Doppler Division Multiple Access," *2024 IEEE Texas Symposium on Wireless and Microwave Circuits and Systems*, Waco, TX, 2024 [Presented].
- [2] **A. B. Carman** and C. Li, "A Digital Beamforming Fast-Start Passive Radar for Indoor Motion Detection and Angle Estimation," *IEEE Transactions on Microwave Theory and Techniques*, [Accepted].
- [3] **A. B. Carman** and C. Li, "Low-Cost Fast-Start Amplifier Architecture for AC-Coupled Measurement of Low-Frequency Signals," *IEEE Sensors Letters*, vol. 8, no. 5, pp. 1–4, May 2024.
- [4] **A. B. Carman** and C. Li, "Reconfigurable FMCW Resolution Improvement Using Adaptive Cancellation," in *IEEE Microwave and Wireless Technology Letters*.
- [5] **A. B. Carman** and C. Li, "A Digital Beamforming Approach for Indoor Passive Sensing," *2024 IEEE Topical Conference on Wireless Sensors and Sensor Networks*, San Antonio, TX, 2024.
- [6] R. Ma, **A. B. Carman**, and C. Li, "Secure Occupancy Sensing with Passive Radar for Spectrally Congested Spaces," *2024 IEEE Topical Conference on Wireless Sensors and Sensor Networks*, San Antonio, TX, 2024.

- [7] **A. B. Carman** and C. Li, "Recent Progress in Passive Sensing Leveraging Advanced Circuit Design Techniques," *2023 Asia-Pacific Microwave Conference*, Taipei City, Taiwan, 2022.
 - [8] **A. B. Carman** and C. Li, "Null/Optimum Point Optimization for Indoor Passive Radar Motion Sensing," *2023 IEEE Radar Conference (RadarConf23)*, San Antonio, TX, 2022.
 - [9] **A. B. Carman** and C. Li, "Passive Multistatic Wireless Sensing Based on Discrete LNA/Mixer Co-Optimization and Fast-Startup Baseband Amplifier," *2023 IEEE Topical Conference on Wireless Sensors and Sensor Networks*, Las Vegas, NV, 2023.
 - [10] **A. B. Carman** and C. Li, "A Novel Wavelength-Division Differential Detection Technique for Microwave Pulse Oximetry," *2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Mexico, 2021.
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Patent Applications

- [1] US Patent Application: *Wide Bandgap Optical Phased Arrays (OPA's) and Methods Related Thereto*, Filing date: 2023-4-7.
 - [2] US Patent Application: *Fast Startup Baseband Amplifier*, Filing date: 2024-1-19.
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Research Interests

Passive radar signal and detection modeling, advanced beamforming techniques for passive radar systems, joint-sensing-communication techniques, and multistatic and MIMO radar sensing architectures.

Teaching Experience

Lecture Assistant, Texas Tech University

- Graded undergraduate and graduate homework, provided practical project guidance, and led special lectures to a wide range of students. Developed design tutorial videos using Cadence AWR, Cadence Virtuoso, and Lattice Diamond to introduce the software, assist students with design problems, and provide a public reference for the broader engineering community.
- Performed these duties in the courses Design and Analysis of Analog Integrated Circuits, Modern Radar Circuits and Systems, Introduction to VLSI Design, and Modern Digital System Design.

Tutor, Texas Tech University

- Provided supplemental instruction and one-on-one assistance to students on the topics of Modern Digital Systems and C++ software design. Organized and led review sessions prior to exams and project deadlines, and guided students with hands-on design projects.
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Honors and Awards

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| • TTU Doctoral Dissertation Completion Fellowship | <i>August 2024</i> |
| • Society of Automotive Engineers Doctoral Scholarship | <i>August 2023</i> |
| • NXP Foundation Graduate Fellowship | <i>August 2023-May 2025</i> |
| • Modern Radar Circuits and Systems: Best Design Project | <i>May 2021</i> |
| • NSF Graduate Research Fellowship Program Honorable Mention | <i>April 2021</i> |
| • TTU Distinguished Graduate Student Assistantship | <i>August 2020-Present</i> |
| • Microwave Solid-State Circuits: Best Design Project | <i>May 2020</i> |
| • TTU Program for Semiconductor Product Engineering Scholar | <i>January 2019-May 2022</i> |
| • TTU Electrical and Computer Engineering Merit Scholar | <i>August 2016-August 2020</i> |
| • TTU Haggerton Presidential Scholar | <i>August 2016-August 2020</i> |
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Professional Society Memberships

Institute of Electrical and Electronics Engineers (IEEE), IEEE Eta Kappa Nu Gamma Nu Chapter, IEEE Microwave Theory and Technology Society, IEEE Antennas and Propagation Society, IEEE Engineering in Medicine and Biology Society, IEEE Circuits and Systems Society, IEEE Instrumentation and Measurement Society, IEEE Young Professionals

Professional Service and Outreach

Ph.D. Mentor, Texas Tech University Anson L. Clark Scholar Program

- Mentored a visiting high school student through the Clark Scholar Program in university research techniques. Led the student's research activities and provided guidance in experimental testing, theory development, simulation development, and the publication of results.

Panelist, Texas Tech Rawls College of Business Research Commercialization

- Served as a panelist for the Spring 2023 STEM MBA Research Commercialization unified project focusing on passive radar sensing. Answered technical questions from a non-technical audience and provided feedback to students developing business strategies to commercialize passive radar.

Panelist/Speaker, Texas Tech Honors College Inquiry and Investigation Course

- Presented to a cohort of 12 undergraduate students of multiple disciplines on the benefits of undergraduate research opportunities and served as a panelist for the Spring 2021 Honors College course on engineering research alongside industry professionals.

President, IEEE Eta Kappa Nu, Gamma Nu Chapter

- Organized professional development and community outreach activities led by the student organization, coordinated responsibilities of seven student officers, and led the group to fiscal prosperity by minimizing unnecessary purchases, maximizing new membership, and instilling fiscal responsibility into the next generation of officers. Maintained the reputation of the organization by ensuring that all prospective members exhibit integrity and academic merit.

STEM Instructor, Science Spectrum, Lubbock, TX

- Developed and led a two-day curriculum to introduce students as young as 8 years old to engineering and programming using the Arduino platform.