Antennas and RF Systems Workshop

Dates: September 14 - 25 2026
Location: New Mexico

Overview

This two-week workshop develops core foundational skills in antenna design and construction, small antennas with matching networks, as well as RF systems and testing. This is a hands-on course with lots of practical exercises. Week one focuses on antenna design/construction and RF concepts. Basic antennas from the fundamental dipole to gain-making antennas and arrays are designed and thoroughly tested. RF concepts are emphasized to provide students with a solid understanding of RF propagation, path loss, and link margin, as well as expert level test/verification of antenna and RF components. Week two continues the RF concepts to include small antennas and matching networks. Students will become proficient with the use of the Smith chart to create matching networks, evaluate antenna performance, and build small antennas for custom integration. The last two days of the course will involve challenge projects that will bring all the concepts together.

Week 1: Antenna Design and RF Theory

The first week is structured to build the students knowledge of how radio waves work, along with an understanding of path loss and link margin. The intuitive and interactive techniques used to teach this complex subject helps students gain extraordinary insight into RF system performance. Antenna design and construction involves basic and intermediate level antenna concepts designed to build an understanding of the basic radiating element, as well as designing, testing, and implementing more advanced structures. The first week is full of practical applications, design/construction of a variety of antennas, test and comparison to theory, and implementation. This week is perfect for beginners as well as advanced level students. We strive to challenge students of all levels by customizing projects and lessons to maximize the outcome for all students.

Week 2: Matching Networks and Small Antennas

The second week will cover RF circuits and antennas with an emphasis on matching networks and small antennas. Students will gain a detailed understanding of the Smith chart, and these skills will be applied to practical applications. Students will build matching networks for several antenna types, and measurements will be made to provide an understanding of the inherent losses as well as the benefits of using small antennas. Matching networks for commercial chip antennas and filters are included. In addition, basic RF circuit design principles will be covered to include inductor/capacitor circuits, amplifiers, filters, and transmission lines. Component selection will be covered with respect to general rules when building RF circuits. Online applications will be introduced as a means of solving matching problems, and results will be compared to measurements. Finally, all the concepts from the two-week cycle will be brought together in a series of field exercises which are designed to enforce all of the concepts in an interactive way so that students can build antennas into challenging hosts and fully test performance.

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Topics Covered

- Basic antenna theory
- Soldering training/practice
- Lectures on Standing Wave Ratio
- Equipment familiarization
- Fundamental Dipole Theory
- Construction and testing of the fundamental dipole
- Waves and Wave Interference
- Baluns
- Methods of feeding a half-wave radiator
- Gamma match
- J-Pole design and construction
- Multipath interference
- Demonstrations
- Range Testing
- Baluns, continued…. The half wave balun
- Bi and Tri-Folded dipoles
- Folded Dipole Theory, Design, and Construction
- Construction of ½ wave radiator with gamma match
- Monopole antennas
- Inverted L and F
- Construction and testing of Monopoles
- Sleevex
- Gain Making Antennas
  - Reflector Antennas
  - Arrays
  - Yagis
  - Horns
  - Dish
- Splitters/Combiners
- Construction of Loop Antennas
- Slot Antennas
  - Bondo Slot Concealment
  - Construction of Slot Antennas
- Construction of arrays
- Circular Polarization
- Patches
- Concealment Techniques
- Construction of GPS circular polarized antenna
- Construction of patch antennas
- RF Systems
  - Construction of system consisting of antenna, filters, amplifier (LNA and BDA)
    - Full system testing
  - Professional RF Testing
    - Filters
    - Amplifiers
    - Coax cable losses
    - Attenuators
    - S-Parameter measurements.
- The Smith Chart
  - Fundamental understanding of the Smith Chart and applications
- Matching Networks
  - Design using Smith Chart
  - Design and construct matching networks for the following:
    - Filter
    - Chip antenna
    - Small PCB antennas
      - Meander
      - Inverted F
- Design and construction of small antennas in concealment packages
  - Range testing
    - Predict power received at 1km distance, then measure it and compare.

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Venue

The course is held at large ranch in southeast New Mexico. We have a ten-year history of holding antenna/RF courses at this venue for government and commercial groups. The remote location is well-established for this type of training, and it has proven to lend itself well to intense focus and continual learning throughout the course. The expansive 100,000 acre ranch has very low environmental RF noise, which allows for accurate measurements and correlation
to calculations. This is very beneficial to the learning process. Students will be housed on-site with individual rooms, and meals are provided on-site at the per-diem rate.