

Vertically-Polarized Rhombic Antennas for Introductory Antennas Course

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This presentation will discuss the results of using vertically-polarized rhombic antennas for an introductory course on antennas. As stated in the CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS, 2025-2026 cycle (www.abet.org), student outcomes under Criterion 3 include “3. an ability to communicate effectively with a range of audiences.” and “6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.” This antenna is the basis for a comprehensive learning experience including numerical modeling, fabrication, and experimentation which coincides with the intent of these ABET student outcomes. Given its simple structure, the rhombic antenna can be tackled early in the course before moving on to more sophisticated antennas. The inspiration for this learning sequence came from a National Science Foundation REU Site: Bringing Us Together, Improving Communications and Lives EEC-1359476 project (C. Herbert, Y. Cohen, & T. P. Montoya, “Performance of Vertically-Polarized, Half-Rhombic Antennas Fabricated with Direct Write Technology,” 2014 South Dakota Undergraduate Research Symposium, Best Western Ramkota Conference Center, Pierre, SD, July 25, 2014).

The full-rhombic antenna shown in Fig. 1 is amenable to numerical modeling using the freeware Numerical Electromagnetics Code, version 2 (NEC-2). This introduces students to concepts important to the development of accurate numerical models such as segmentation of wires and implementation of feeds and loads. The outputs (e.g., input impedance, gain, and radiation patterns) from the numerical model allow students to gain experience with important antenna parameters as well as with data analysis and interpretation.

The half-rhombic antenna shown in Fig. 1 is straightforward to fabricate, requiring only commonly available materials (e.g., copper wire and resistors) and tools (e.g., ruler, wire cutter, and soldering iron). By carefully selecting the operational frequency range, the antennas can be built on a ground plane of reasonable size (e.g., 91 cm $\times$ 91 cm) and driven through an SMA bulkhead connector in a typical indoor lab room. An anechoic chamber is not required. Students make experimental measurements using a vector network analyzer and other readily accessible equipment. Further, they get experience in recording and communicating their results using logbook(s) and report(s).

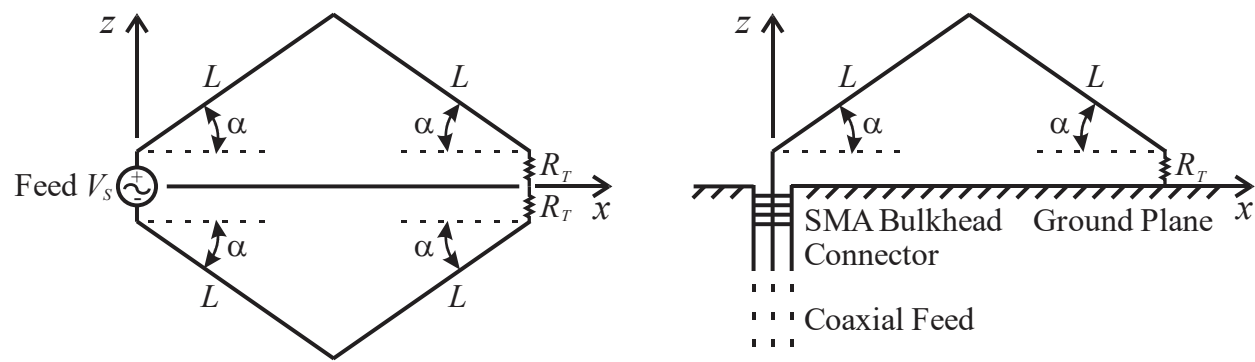


Figure 1. Full-rhombic (left) and Half-rhombic (right) antennas.