Building a Compact High-Performance UHF Array with AN-SOF: A 4-Element Biquad Design

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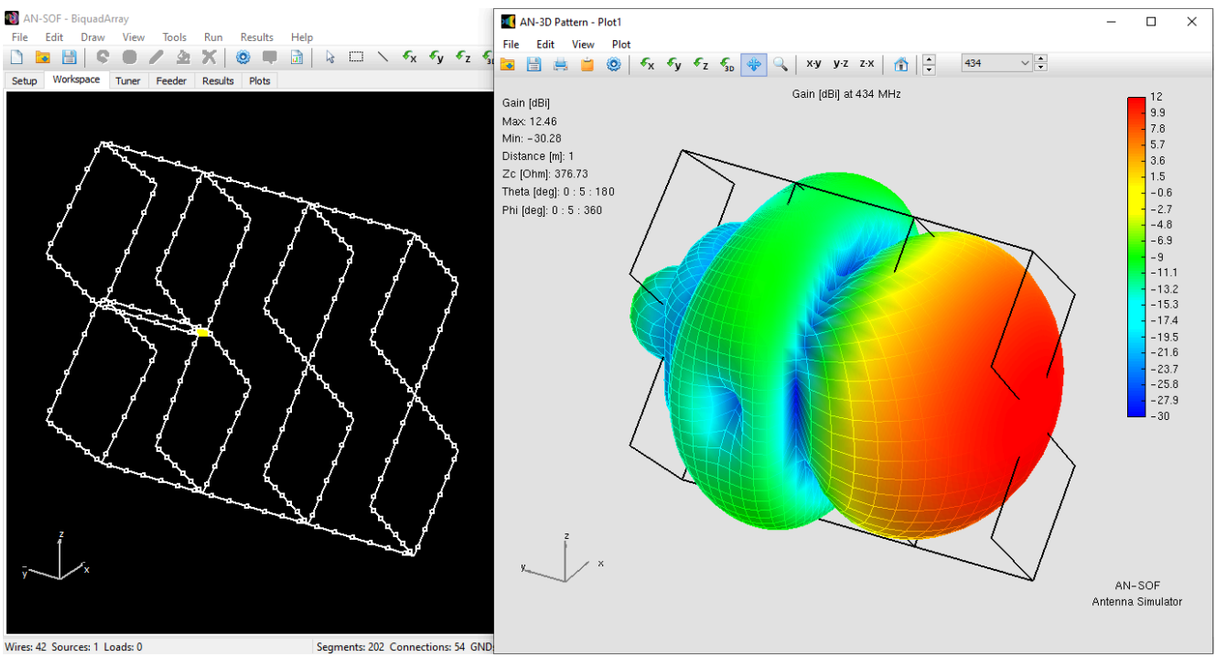
Need a compact directional antenna for your UHF needs? This 4-element Biquad antenna, designed with AN-SOF, packs a powerful punch in a relatively small space. Perfect for UHF applications where space is at a premium!



> n today's world, the demand for high-performance antennas that occupy **minimal space** is ever-growing. This is particularly true for **UHF** (Ultra-High Frequency) applications, where size constraints can be a significant challenge.

Biquad antenna arrays offer a promising solution, providing excellent performance in **a compact form factor**. This article explores the design and simulation of a 4-element Biquad antenna array for UHF using AN-SOF antenna simulation software.

Design and Simulation with AN-SOF

The 4-element Biquad antenna array is a unique design that leverages the properties of **biquad** elements. Each biquad is constructed from two **square conductive loops** arranged in a **diamond shape**. The overall array incorporates a **driven** element, a **reflector** element, and two **director** elements, following a

configuration similar to **Yagi-Uda** antennas. This configuration allows for directional radiation and gain enhancement.

A crucial aspect of this design is the use of a **bifilar transmission line** connecting the driven element to the reflector. This two-wire transmission line plays a vital role in achieving a desired input impedance of practically **50 + j0 Ohms**. This impedance matching characteristic enables direct connection with a standard 50 Ohm coaxial cable, simplifying antenna integration into existing UHF systems. Additionally, the dimensions of the antenna in the AN-SOF model have been scaled to achieve resonance at the center frequency of **434 MHz**.

AN-SOF simulation software proves to be a valuable tool for designing and analyzing this 4-element Biquad antenna array. Its user-friendly interface streamlines the design process and facilitates the evaluation of the antenna's performance characteristics.

Simulated Performance Characteristics

The simulated performance of the 4-element Biquad antenna array is highly promising. Here's a breakdown of its key characteristics:

- **Bandwidth:** This antenna exhibits a bandwidth of **4%**, ensuring efficient operation within a specific UHF frequency range while maintaining a Voltage Standing Wave Ratio (VSWR) below 2 for good signal transmission.
- **Gain:** The antenna boasts a gain of **12 dBi**, indicating its ability to amplify the transmitted signal in the desired direction.
- **Beamwidth:** The radiation pattern exhibits a beamwidth of **50 degrees** in both the horizontal and vertical planes. This characteristic provides a good balance between directivity and coverage area.
- **Front-to-Back Ratio:** The antenna demonstrates a front-to-back ratio of **21 dB**. This value signifies a significant suppression of signals radiated in the undesired direction behind the antenna.

Visualizing Performance with AN-SOF

The accompanying image provides a comprehensive view of the antenna's performance characteristics simulated using AN-SOF. The image showcases several key elements:

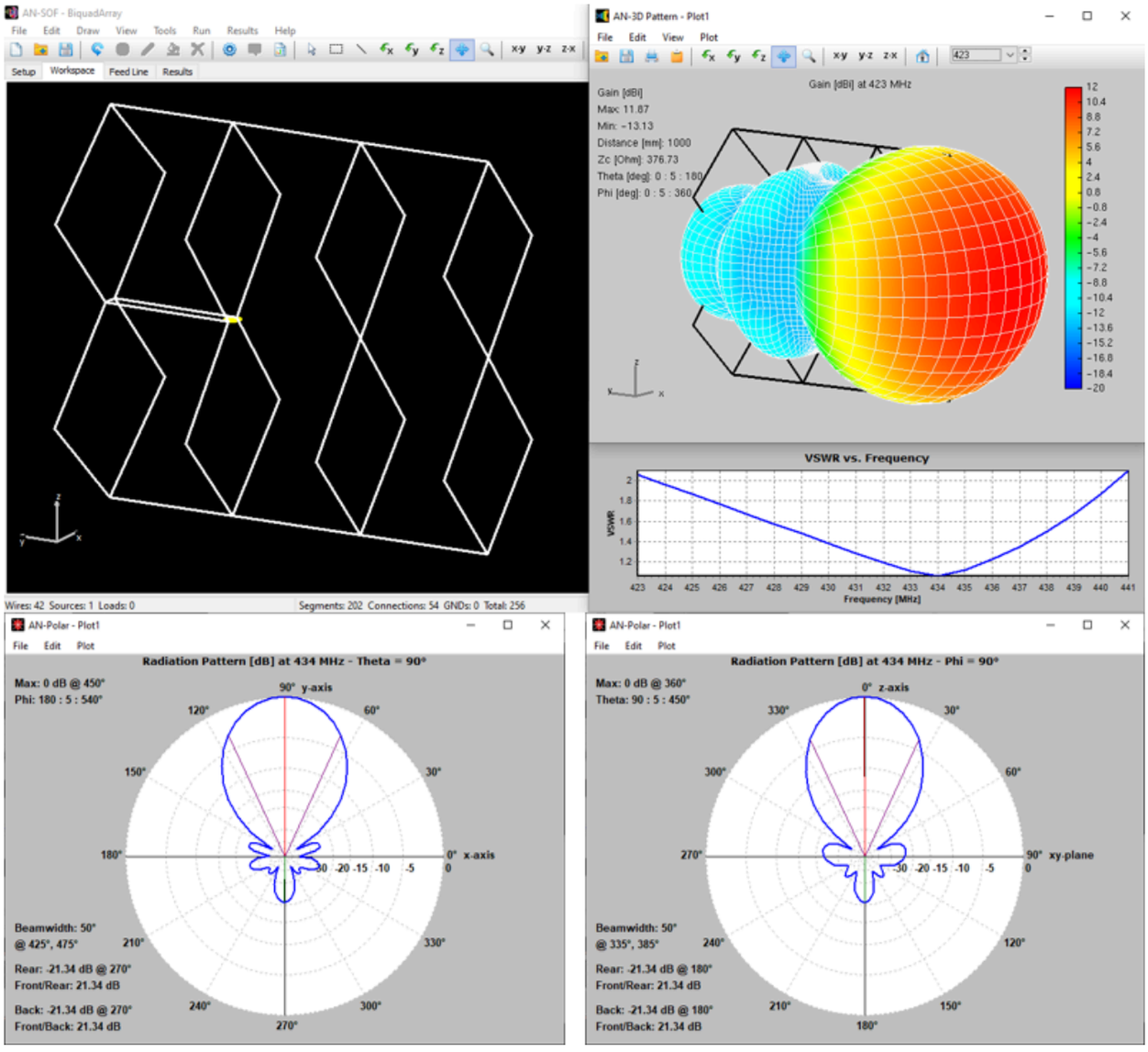
- In the upper left corner, the **AN-SOF model** of the 4-element Biquad antenna array is displayed, offering a visual representation of the antenna's geometry.
- The upper right portion of the image depicts the **3D radiation pattern**. This plot visualizes the antenna's gain in dBi across different directions.
- Below the 3D radiation pattern lies the **VSWR curve**. This curve provides insights into the impedance matching characteristics of the antenna across the operating frequency range.
- The bottom left and right sections of the image showcase **polar plots** representing the horizontal (H: Theta = 90 degrees) and vertical (V: Phi = 90 degrees) slices of the radiation pattern, respectively. These plots offer a detailed view of the antenna's radiation intensity in the horizontal and vertical planes. It's important to note the **symmetrical** nature of the radiation pattern based on these H and V slices, signifying consistent performance across both planes.

Conclusion: A Viable UHF Antenna Solution

The findings from this article demonstrate the potential of the 4-element Biquad antenna array as a viable solution for UHF applications. The antenna's compact size, efficient operation in the UHF band, and impressive performance characteristics, including good gain, beamwidth, and front-to-back ratio, make it a compelling choice for various UHF communication systems.

Next Steps

Building upon the promising results obtained through simulation, future endeavors could involve further optimization of the design for specific application requirements. Additionally, fabricating and testing a real-world prototype of the antenna would provide valuable insights into its real-world performance and validate the simulation results.



This image presents the simulated performance characteristics of a 4-element Biquad antenna array designed with AN-SOF software.

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About the Author

Tony Golden

ANTENNA SIMULATION ENGINEER & PHYSICS PH.D. With over 25 years of experience in Computational Electromagnetics, I'm a dedicated researcher specializing in antenna modeling and design. As the founder of Golden Engineering LLC, I develop intuitive yet powerful simulation tools to help RF engineers optimize designs, educators demonstrate concepts, and hobbyists bring antenna projects to life.

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