

ABSTRAK

YOLA OKTAVIA. Rancang Bangun Antena Mikrostrip *Multiband* Multi-Elemen Untuk RF *Energy Harvesting*. Dibimbing oleh RUSFA dan FALATEHAN.

Ketersediaan sumber energi listrik konvensional yang semakin terbatas mendorong pengembangan teknologi RF *energy harvesting* sebagai alternatif pemanfaatan energi dari gelombang radio di lingkungan. Salah satu komponen utama pada sistem tersebut adalah antena yang berfungsi menerima sinyal RF pada berbagai pita frekuensi. Penelitian ini bertujuan merancang, mensimulasikan, memfabrikasi, dan menguji antena mikrostrip *multiband* multi-elemen yang bekerja pada frekuensi 900 MHz, 1,8 GHz, dan 2,4 GHz sebagai antena penerima untuk aplikasi RF *energy harvesting*. Perancangan antena diawali dengan perhitungan dimensi teoritis, kemudian dilakukan simulasi dan optimasi menggunakan CST Studio Suite, dilanjutkan dengan fabrikasi menggunakan substrat FR4, serta pengujian menggunakan NanoVNA. Hasil simulasi menunjukkan bahwa antena memiliki nilai *return loss* sebesar -20,00 dB, -16,74 dB, dan -13,94 dB, dengan nilai VSWR masing-masing 1,20, 1,34, dan 1,50 pada frekuensi 900 MHz, 1,8 GHz, dan 2,4 GHz. Hasil pengukuran menunjukkan nilai *return loss* sebesar -14,12 dB, -12,57 dB, dan -14,86 dB, serta nilai VSWR sebesar 1,49, 1,51, dan 1,44 pada frekuensi yang sama. Perbedaan antara hasil simulasi dan pengukuran dipengaruhi oleh proses fabrikasi, seperti pencetakan pola, proses *etching*, pemotongan PCB, dan pemasangan konektor SMA. Berdasarkan hasil simulasi dan pengukuran, antena berhasil bekerja pada ketiga frekuensi target dan berpotensi digunakan sebagai antena penerima pada sistem RF *energy harvesting*.

Kata kunci: Antena mikrostrip, *multiband*, multi-elemen, RF *energy harvesting*, CST Studio Suite, NanoVNA.

ABSTRACT

YOLA OKTAVIA. Design and Development of a Multiband Multi-Element Microstrip Antenna for RF Energy Harvesting. Supervised by RUSFA and FALATEHAN.

The increasing demand for alternative energy sources has encouraged the development of Radio Frequency (RF) Energy Harvesting technology, which utilizes radio frequency signals available in the surrounding environment. One of the key components of this system is a receiving antenna capable of operating at multiple frequency bands. This study aims to design, simulate, fabricate, and evaluate a multiband multi-element microstrip antenna operating at 900 MHz, 1.8 GHz, and 2.4 GHz for RF Energy Harvesting applications. The antenna design was initiated by theoretical dimension calculations, followed by simulation and optimization using CST Studio Suite. The optimized design was then fabricated on an FR4 substrate and characterized using a NanoVNA. The simulation results achieved return loss values of -20.00 dB, -16.74 dB, and -13.94 dB, with VSWR values of 1.20, 1.34, and 1.50 at 900 MHz, 1.8 GHz, and 2.4 GHz, respectively. The measurement results showed return loss values of -14.12 dB, -12.57 dB, and -14.86 dB, with VSWR values of 1.49, 1.51, and 1.44 at the corresponding frequencies. The differences between the simulation and measurement results were mainly caused by the fabrication process, including pattern printing, PCB etching, PCB cutting, and SMA connector installation. Overall, the fabricated antenna successfully operated at the three target frequencies and demonstrated the potential to be used as a receiving antenna for RF Energy Harvesting systems.

Keywords: Microstrip antenna, multiband antenna, multi-element antenna, RF Energy Harvesting, CST Studio Suite, NanoVNA.