DESAIN DAN FABRIKASI ANTENA *ARRAY* MIKROSTRIP BERBASIS *SLOT* DAN *DEFECTED GROUND STRUCTURE* UNTUK PARAMETER LORA 902-928 MHZ

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ABSTRAK

Kebutuhan sistem komunikasi berjangkauan jauh dan berdaya rendah mendorong pemanfaatan protokol LoRa (902–928 MHz) untuk pemerataan infrastruktur telekomunikasi di Indonesia. Penelitian ini merancang, mensimulasikan, dan memfabrikasi antena *array* mikrostrip berbasis *slot* dan *Defected Ground Structure* (DGS) pada substrat FR-4 (εr = 4,27; h = 1,6 mm) untuk memenuhi parameter kerja LoRa. Kombinasi *slot, array,* dan DGS diterapkan secara bertahap menggunakan simulasi CST *Microwave Studio*, kemudian divalidasi melalui pengukuran *Vector Network Analyzer* (VNA). Konfigurasi akhir (*Slot* + *Array* + DGS) pada simulasi menghasilkan *return loss* −30,47 dB, VSWR 1,063, *realized gain* 2,865 dBi, dan *bandwidth* 26 MHz pada 916 MHz. Antena hasil fabrikasi menghasilkan *return loss* −25,95 dB, VSWR 1,103, dan *bandwidth* 20,8 MHz dengan resonansi pada 932,8 MHz, atau bergeser +1,83% dari simulasi akibat toleransi fabrikasi PCB dan variasi permitivitas substrat. Antena fabrikasi tetap fungsional pada pita 921–928 MHz dengan pola radiasi *directional*, sehingga layak digunakan sebagai alternatif antena sistem komunikasi berbasis LoRa.

Kata Kunci : Antena Mikrostrip, *Array, Slot, Defected Ground Structure*, LoRa

DESIGN AND FABRICATION OF A SLOT-BASED AND DEFECTED GROUND STRUCTURE MICROSTRIP ARRAY ANTENNA FOR LORA PARAMETERS AT 902-928 MHZ

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ABSTRACT

The need for long-range, low-power communication drives the use of the LoRa protocol (902–928 MHz) to expand telecommunication infrastructure in Indonesia. This study designs, simulates, and fabricates a slot-based microstrip array antenna with a Defected Ground Structure (DGS) on an FR-4 substrate (εr = 4.27; h = 1.6 mm) to meet LoRa operating parameters. The slot, array, and DGS methods were applied incrementally using CST Microwave Studio and validated through Vector Network Analyzer (VNA) measurements. The final configuration (Slot + Array + DGS) achieved, in simulation, a return loss of −30.47 dB, VSWR of 1.063, realized gain of 2.865 dBi, and bandwidth of 26 MHz at 916 MHz. The fabricated antenna achieved a return loss of −25.95 dB, VSWR of 1.103, and bandwidth of 20.8 MHz, resonating at 932.8 MHz — a +1.83% shift from simulation caused by PCB fabrication tolerances and substrate permittivity variation. The fabricated antenna remains functional within the 921–928 MHz band with a directional radiation pattern, making it a viable candidate for LoRa-based communication systems.

Keyword : *Microstrip Antenna, Array, Slot, Defected Ground Structure, LoRa*