DESAIN DAN FABRIKASI ANTENA *WEARABLE* MIMO DENGAN METODE PARASITIK DAN *DEFECTED GROUND STRUCTURE* PADA FREKUENSI 3.5 GHZ

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ABSTRAK

Antena *wearable* semakin banyak dikembangkan untuk mendukung perangkat, sensor, dan alat komunikasi yang dapat dikenakan pengguna secara fleksibel dan nyaman. Seiring perkembangan teknologi komunikasi seluler seperti 5G (*fifth-generation*) yang mendukung laju data tinggi, antena *wearable* dapat dipadukan dengan teknologi *Multiple Input Multiple Output* (MIMO) yang mampu meningkatkan kapasitas kanal dan kecepatan transmisi data. Salah satu pita utama yang dialokasikan untuk teknologi 5G adalah frekuensi 3.5 GHz, sehingga dipilih sebagai frekuensi kerja pada penelitian ini. Penelitian ini merancang antena mikrostrip *wearable* MIMO dua port berbasis substrat jeans yang bekerja pada frekuensi 3.5 GHz. Untuk meningkatkan kinerjanya, diterapkan metode *Defected Ground Structure* (DGS) dan elemen parasitik. Antena dirancang dan disimulasikan menggunakan Ansys HFSS, kemudian difabrikasi dan diukur untuk validasi. Hasil simulasi desain antena akhir berdimensi 48 mm x 32 mm menunjukkan *return loss* -36.173 dB, VSWR 1.032, *mutual coupling* -30.414 dB, *gain* 3.844 dBi, *bandwidth* 466 MHz, efisiensi radiasi 89.217%, ECC mendekati nol, *diversity gain* 10 dB, dan pola radiasi *omnidirectional*. Antena tetap memiliki kinerja yang baik saat kondisi *bending*, dan hasil pengukuran mendekati nilai simulasi. Hasil dari antena yang dirancang memenuhi target spesifikasi dan kinerja antena *wearable* MIMO.

Kata kunci: antena *wearable***,** DGS, MIMO, parasitik, 5G

DESIGN AND FABRICATION OF A WEARABLE MIMO ANTENNA USING PARASITIC AND DEFECTED GROUND STRUCTURES AT 3.5 GHZ

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ABSTRACT

Wearable antennas are increasingly being developed to support devices, sensors, and communication tools that users can wear flexibly and comfortably. With the advancement of mobile communication technologies such as 5G (fifth-generation), which supports high data rates, wearable antennas can be integrated with Multiple Input Multiple Output (MIMO) technology, capable of increasing channel capacity and data transmission speeds. One of the main frequency bands allocated for 5G technology is 3.5 GHz, which was therefore selected as the operating frequency for this study. This study designed a two-port MIMO wearable microstrip antenna based on a denim substrate operating at 3.5 GHz. To improve its performance, the Defected Ground Structure (DGS) method and parasitic elements were applied. The antenna was designed and simulated using Ansys HFSS, then fabricated and measured for validation. The simulation results for the final antenna design with dimensions of 48 mm x 32 mm show a return loss of -36.173 dB, a VSWR of 1.032, mutual coupling of -30.414 dB, gain of 3.844 dBi, bandwidth of 466 MHz, radiation efficiency of 89.217%, ECC approaching zero, diversity gain of 10 dB, and an omnidirectional radiation pattern. The antenna continues to perform well under bending conditions, and the measurement results are close to the simulation values. The results of the designed antenna meet the target specifications and performance requirements for a wearable MIMO antenna.

Keywords**:** *wearable antenna,* MIMO, DGS, *parasitic,* 5G