

Pengembangan Antena Wearable Wideband pada frekuensi 2,4 GHz dan 5,2 GHz = Development of Wearable Wideband Antenna in the Frequency Range of 2.4 GHz and 5.2 GHz

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Abstrak

Penelitian ini berfokus pada perancangan dan pengembangan antena tekstil wearable berbahan dasar jeans yang beroperasi pada dua pita frekuensi utama (2,4 GHz, 5,2 GHz). Antena ini dirancang untuk memenuhi kebutuhan aplikasi komunikasi nirkabel moderen untuk pita lebar, seperti dalam sektor Industrial, Scientific, and Medical (ISM), serta Wi-Fi. Studi ini mencakup tinjauan literatur, perancangan dan simulasi menggunakan perangkat lunak CST Suite Studio, serta fabrikasi dan pengukuran kinerja antena. Antena yang dirancang diharapkan memiliki karakteristik unggul seperti ringan, biaya rendah, kuat secara mekanis, mudah diproduksi, bebas perawatan, dan mudah dipasang. Evaluasi kinerja antena dilakukan dengan mengukur parameter seperti koefisien refleksi, bandwidth gain, dan pola radiasi. Selain itu, uji fleksibilitas antena dilakukan untuk memastikan keandalan kinerja dalam berbagai kondisi mobilitas pengguna. Antena ini mendukung berbagai standar Wi-Fi, termasuk IEEE 802.11a, 802.11n, 802.11ac, dan 802.11ax (Wi-Fi 6). Hasil pengukuran dari antena tekstil menunjukkan antena dapat bekerja di frekuensi 2,33 GHz-2,43 GHz dan 5,02 GHz-5,29 GHz dengan masing-masing bandwidth 100 MHz dan 270 MHz. Adapun hasil pola radiasi antena menunjukkan directional dan gain 1,51 dB dan 3,39 dB untuk frekuensi 2,4 GHz dan 5,2 GHz, hasil pengukuran ini sama dengan hasil simulasi. Kondisi di atas tercapai jika antena dalam keadaan planar.

.....This research focuses on the design and development of a wearable textile antenna made from denim fabric, operating in two primary frequency bands (2.4 GHz, 5.2 GHz). The antenna is designed to meet the needs of moderen wireless communication applications for broadband, such as in the Industrial, Scientific, and Medical (ISM) sectors, as well as Wi-Fi. This study includes a literature review, design and simulation using CST Suite Studio software, as well as fabrication and performance measurement of the antenna. The designed antenna is expected to possess superior characteristics such as being lightweight, low-cost, mechanically robust, easy to manufacture, maintenance-free, and easy to install. The performance evaluation of the antenna is conducted by measuring parameters such as reflection coefficient, bandwidth, gain, and radiation pattern. Additionally, flexibility tests of the antenna are performed to ensure reliable performance under various user mobility conditions. This antenna supports various Wi-Fi standards, including IEEE 802.11a, 802.11n, 802.11ac, and 802.11ax (Wi-Fi 6). The measurement results from the textile antenna, it works at frequencies 2.33 GHz-2.43 GHz and 5.02 GHz-5.29 GHz with bandwidths of 100 MHz and 270 MHz, respectively. The results of the antenna radiation pattern show directional pattern and the antenna gain of 1.51 dB and 3.39 dB for the 2.4 GHz and 5.2 GHz frequencies, these measurement results agree with the simulation results. Therefore the proposed antenna can be uses as candidate for wearable Wi-Fi applications. This conditions can be reach in planar condition.