

ABSTRAK

RANCANG BANGUN ANTENA OMNIDIRECTIONAL UNTUK SISTEM MONITORING FREKUENSI MENGGUNAKAN *REGISTER TRANSFER LEVEL SOFTWARE DEFINED RADIO*

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Monitoring spektrum frekuensi radio merupakan salah satu kegiatan yang penting dalam mendukung pengawasan penggunaan spektrum frekuensi serta menjaga kualitas komunikasi nirkabel. Sistem monitoring konvensional umumnya memerlukan perangkat dengan biaya yang relatif tinggi, sehingga diperlukan alternatif sistem yang lebih ekonomis namun tetap memiliki kemampuan pemantauan yang baik. Penelitian ini bertujuan untuk merancang dan membangun sistem monitoring frekuensi radio menggunakan antena omnidirectional yang diintegrasikan dengan perangkat Software Defined Radio (RTL-SDR), Raspberry Pi, dan perangkat lunak GQRX sebagai media penerima serta pemantau sinyal radio. Metode penelitian yang digunakan meliputi tahap perancangan antena omnidirectional, simulasi menggunakan CST Studio Suite, pembuatan antena, pengujian parameter antena menggunakan NanoVNA, serta implementasi sistem monitoring menggunakan RTL-SDR dan Raspberry Pi. Sinyal radio yang diterima oleh antena diperkuat menggunakan Low Noise Amplifier (LNA), kemudian diterima oleh RTL-SDR dan diproses pada Raspberry Pi melalui aplikasi GQRX untuk menampilkan spektrum frekuensi secara real-time. Sistem juga dilengkapi dengan modul GPS sebagai informasi lokasi pengambilan data dan dashboard website sebagai media monitoring hasil pengamatan. Hasil penelitian menunjukkan bahwa antena omnidirectional yang dirancang mampu bekerja sebagai antena penerima pada sistem monitoring frekuensi radio. Integrasi antara antena, LNA, RTL-SDR, Raspberry Pi, GQRX, GPS, dan dashboard website menghasilkan sistem yang mampu menerima, memantau, dan menampilkan informasi spektrum frekuensi radio secara real-time. Dengan memanfaatkan perangkat berbasis Software Defined Radio, sistem yang dikembangkan memiliki biaya implementasi yang relatif rendah, mudah dikembangkan, serta dapat digunakan sebagai media monitoring spektrum frekuensi radio.

Kata Kunci: Antena Omnidirectional, Monitoring Frekuensi Radio, RTL-SDR, Raspberry Pi, GQRX, Software Defined Radio (SDR), LNA, GPS, Dashboard Website.

ABSTRACT

DESIGN AND DEVELOPMENT OF AN OMNIDIRECTIONAL ANTENNA FOR A FREQUENCY MONITORING SYSTEM USING REGISTER TRANSFER LEVEL SOFTWARE DEFINED RADIO

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Radio frequency spectrum monitoring is an essential activity in supervising spectrum utilization and maintaining the quality of wireless communications. Conventional monitoring systems generally require relatively expensive equipment, making it necessary to develop a more cost-effective alternative while maintaining reliable monitoring performance. This study aims to design and develop a radio frequency monitoring system using an omnidirectional antenna integrated with a Software Defined Radio (RTL-SDR) device, Raspberry Pi, and GQRX software as the signal reception and monitoring platform. The research methodology consists of designing the omnidirectional antenna, conducting simulations using CST Studio Suite, fabricating the antenna, testing its parameters using a NanoVNA, and implementing the monitoring system using RTL-SDR and Raspberry Pi. The radio signals received by the antenna are amplified using a Low Noise Amplifier (LNA), processed by the RTL-SDR, and handled by the Raspberry Pi through the GQRX application to display the radio frequency spectrum in real time. The system is also equipped with a GPS module to provide location information for data acquisition and a web-based dashboard for monitoring and displaying the observation results. The results indicate that the designed omnidirectional antenna performs effectively as a receiving antenna for the radio frequency monitoring system. The integration of the antenna, LNA, RTL-SDR, Raspberry Pi, GQRX, GPS, and the web-based dashboard successfully enables the system to receive, monitor, and display radio frequency spectrum information in real time. By utilizing Software Defined Radio technology, the developed system offers a relatively low-cost implementation, is easy to expand, and can serve as an effective solution for radio frequency spectrum monitoring.

Keywords: *Omnidirectional Antenna, Radio Frequency Monitoring, RTL-SDR, Raspberry Pi, GQRX, Software Defined Radio (SDR), Low Noise Amplifier (LNA), GPS, Web-Based Dashboard.*