

ABSTRAK

IMPLEMENTASI *PHASED ARRAY ANTENNA* DALAM JARINGAN 4G BERBASIS *SOFTWARE-DEFINED RADIO*

(2025 : 68 Halaman + 17 Gambar + 6 Tabel + 9 Lampiran)

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Penelitian ini mengkaji penerapan *Phased Array Antenna* pada jaringan 4G berbasis *Software-Defined Radio* (SDR) untuk meningkatkan kualitas transmisi data melalui teknik *beamforming*. Antena dirancang menggunakan metode mikrostrip array dengan substrat FR4 dan disimulasikan melalui *CST Studio Suite* untuk memastikan parameter *Return Loss*, VSWR, dan pola radiasi optimal. Hasil simulasi menunjukkan frekuensi resonansi pada 2.658 GHz dengan *Return Loss* sebesar -31.37 dB dan VSWR 1.05. Namun, hasil pengujian menggunakan *Spectrum Analyzer* menunjukkan performa nyata antena paling optimal pada rentang 800 MHz – 1.9 GHz, dengan daya sinyal maksimum sebesar -9.40 dBm pada 1.1 GHz. Antena kemudian diintegrasikan dengan USRP B210 dan platform SDR berbasis SRSRAN dan Open5GS untuk membentuk jaringan 4G mini. Hasil integrasi menunjukkan kecepatan unduh maksimal 78.6 Mbps, unggah 28.5 Mbps, dan koneksi stabil hingga radius 5-7 meter. Penerapan *beamforming* dengan *phased array* berhasil meningkatkan efisiensi arah pancaran sinyal, meningkatkan kualitas layanan, dan memperkuat cakupan jaringan di area terbatas. Perbedaan hasil simulasi dan realisasi disebabkan oleh faktor fabrikasi, kualitas konektor, dan karakteristik material FR4.

Kata Kunci: *Phased Array Antenna*, 4G LTE, *Software-Defined Radio* (SDR), USRP B210, *Beamforming*, *CST Studio Suite*.

ABSTRAK

IMPLEMENTATION OF PHASED ARRAY ANTENNA IN 4G NETWORK BASED ON SOFTWARE-DEFINED RADIO (2025: 68 Halaman + 17 Gambar + 6 Tabel + 9 Lampiran)

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This research examines the application of Phased Array Antenna in Software-Defined Radio (SDR)-based 4G networks to improve data transmission quality through beamforming techniques. The antenna is designed using the microstrip array method with FR4 substrate and simulated through CST Studio Suite to ensure optimal Return Loss, VSWR, and radiation pattern parameters. The simulation results show the resonant frequency at 2.658 GHz with a Return Loss of -31.37 dB and VSWR of 1.05. However, test results using the Spectrum Analyzer show the antenna's real performance is most optimal in the 800 MHz - 1.9 GHz range, with a maximum daya sinyal of -9.40 dBm at 1.1 GHz. The antenna was then integrated with USRP B210 and SDR platforms based on SRSRAN and Open5GS to form a mini 4G network. The integration results show a maximum download speed of 78.6 Mbps, an upload speed of 28.5 Mbps, and a stable connection up to a radius of 5-7 meters. The application of beamforming with phased array successfully increases the efficiency of signal beam direction, improves service quality, and strengthens network coverage in limited areas. The differences in simulation and realization results are due to fabrication factors, connector quality, and FR4 material characteristics.

Keywords: *Phased Array Antenna, 4G LTE, Software-Defined Radio (SDR), USRP B210, Beamforming, CST Studio Suite.*