

ABSTRAK

RIZKI AFANDI RAMBE. Rancang Bangun Antena Mikrostrip *Double Annular Ring Multiband* Untuk Peningkatan Sinyal Router Orbit Pada Jalur Pelayaran Tanjung Pinang-Batam. Dibimbing oleh Rusfa dan Falatehan.

Kualitas sinyal *Long Term Evolution (LTE)* pada jalur pelayaran Tanjungpinang–Batam masih belum optimal sehingga memengaruhi kestabilan komunikasi data. Penelitian ini bertujuan merancang, merealisasikan, dan menguji antena mikrostrip *double annular ring multiband* untuk meningkatkan kualitas sinyal *LTE* pada *Router Orbit* Telkomsel. Metode penelitian meliputi perancangan antena menggunakan *CST Studio Suite*, optimasi dimensi, fabrikasi menggunakan substrat FR-4, pengukuran karakteristik antena menggunakan *Vector Network Analyzer (VNA)*, dan pengujian lapangan pada jalur pelayaran Tanjungpinang–Batam. Hasil simulasi menunjukkan antena bekerja pada frekuensi 900 MHz, 1800 MHz, dan 2300 MHz dengan nilai *Return Loss* sebesar -20,97 dB, -12,17 dB, dan -10,98 dB serta *Voltage Standing Wave Ratio (VSWR)* sebesar 1,1; 1,6; dan 1,7. Hasil pengujian menunjukkan peningkatan kualitas sinyal dibandingkan antena internal dan antena eksternal pabrik, ditunjukkan oleh nilai *Received Signal Strength Indicator (RSSI)* sebesar -76,09 dBm, *Reference Signal Received Power (RSRP)* sebesar -96,91 dBm, *Reference Signal Received Quality (RSRQ)* sebesar -10,67 dB, dan *Signal to Interference Noise Ratio (SINR)* sebesar 4,4 dB. Temuan penelitian menunjukkan bahwa antena yang dirancang efektif meningkatkan kekuatan dan kualitas penerimaan sinyal *LTE* pada lingkungan perairan sehingga berpotensi menjadi solusi untuk mendukung komunikasi *broadband* pada jalur pelayaran.

Kata kunci: antena mikrostrip *double annular ring*, *LTE*, *multiband*, *Router Orbit*, Tanjungpinang–Batam.

ABSTRACT

RIZKI AFANDI RAMBE. *Design of a Multiband Double Annular Ring Microstrip Antenna for Orbit Router Signal Enhancement on the Tanjung Pinang-Batam Shipping Route*. Supervised by Rusfa dan Falatehan.

Long Term Evolution (LTE) signal quality along the Tanjungpinang–Batam shipping route remains suboptimal, affecting the stability of data communication. This study aims to design, fabricate, and evaluate a *multiband double annular ring microstrip antenna* to improve LTE signal quality on the Telkomsel Orbit Router. The research method consisted of antenna design using *CST Studio Suite*, dimension optimization, fabrication on an FR-4 substrate, antenna characterization using a *Vector Network Analyzer* (VNA), and field testing along the Tanjungpinang–Batam shipping route. Simulation results showed that the antenna operated at 900 MHz, 1800 MHz, and 2300 MHz with *Return Loss* values of -20.97 dB, -12.17 dB, and -10.98 dB, respectively, and *Voltage Standing Wave Ratio* (VSWR) values of 1.1, 1.6, and 1.7. Field test results demonstrated improved signal quality compared with the internal antenna and the factory external antenna, indicated by a *Received Signal Strength Indicator* (RSSI) of -76.09 dBm, *Reference Signal Received Power* (RSRP) of -96.91 dBm, *Reference Signal Received Quality* (RSRQ) of -10.67 dB, and *Signal-to-Interference-Noise Ratio* (SINR) of 4.4 dB. These findings indicate that the proposed antenna effectively enhances LTE signal strength and quality in maritime environments and has the potential to support reliable broadband communication along shipping routes.

Keywords: *double annular ring microstrip antenna, LTE, multiband , Orbit Router, Tanjungpinang–Batam.*