

**ANALISIS KARAKTERISTIK *PATH LOSS* DAERAH
PERAIRAN PADA WIFI 2,4 GHZ MENGGUNAKAN MODEL
*EXACT TWO-RAY GROUND REFLECTION***

LAPORAN TUGAS AKHIR

*Karya Ilmiah sebagai salah satu syarat untuk menyelesaikan jenjang strata satu
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Judul	Analisis Karakteristik <i>Path loss</i> Daerah Perairan Pada Wifi 2,4 GHz Menggunakan Model <i>Exact Two-Ray Ground Reflection</i>	Fadhel
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ABSTRAK Komunikasi nirkabel pada daerah perairan memiliki karakteristik propagasi yang berbeda dibandingkan lingkungan terestrial akibat adanya pantulan gelombang dari permukaan air yang memengaruhi pelemahan sinyal (<i>path loss</i>). Kondisi tersebut menyebabkan model propagasi ruang bebas (<i>Free Space Path loss</i> atau FSPL) tidak selalu mampu merepresentasikan karakteristik propagasi secara akurat. Penelitian ini bertujuan untuk menganalisis karakteristik <i>path loss</i> komunikasi WiFi 2,4 GHz pada daerah perairan, menentukan nilai <i>Path loss Exponent</i> (PLE) empiris, serta mengevaluasi kesesuaian model <i>Exact Two-Ray Ground Reflection</i> terhadap hasil pengukuran dengan menggunakan model FSPL sebagai pembanding. Akuisisi data dilakukan menggunakan sistem berbasis <i>Robot Operating System 2</i> (ROS 2) pada NVIDIA Jetson Orin Nano untuk merekam data <i>Received Signal Strength Indicator</i> (RSSI) dan koordinat GPS secara otomatis. Pengukuran dilakukan sebanyak delapan kali di Danau Maninjau. Data RSSI diproses menggunakan metode <i>Distance Binning</i> untuk memperoleh nilai <i>Local Mean</i>, kemudian dilakukan ekstraksi nilai PLE menggunakan regresi linier berdasarkan <i>breakpoint distance</i> teoritis sebesar 28,87 meter. Hasil penelitian menunjukkan bahwa sebanyak 2.187 sampel berhasil diproses menjadi 81 titik <i>Local Mean</i>. Nilai PLE yang diperoleh sebesar 0,0863 pada Region 1 dan 3,4014 pada Region 2. Setelah dilakukan kalibrasi menggunakan faktor <i>offset</i>, model <i>Exact Two-Ray Ground Reflection</i> menghasilkan nilai <i>Root Mean Square Error</i> (RMSE) sebesar 14,445 dB pada Region 1 dan 11,866 dB pada Region 2, lebih rendah dibandingkan model FSPL yang menghasilkan RMSE sebesar 21,649 dB dan 22,683 dB. Hasil tersebut menunjukkan bahwa model <i>Exact Two-Ray Ground Reflection</i> lebih mampu merepresentasikan karakteristik propagasi komunikasi WiFi 2,4 GHz pada daerah perairan dibandingkan model FSPL. Kata kunci: <i>path loss</i>, <i>Path loss Exponent</i>, <i>Exact Two-Ray Ground Reflection</i>, WiFi 2,4 GHz, daerah perairan.		

Title	<i>Analysis of Path loss Characteristics in Aquatic Environments for 2.4 GHz WiFi Using the Exact Two-Ray Ground Reflection Model</i>	Fadhel
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ABSTRACT <i>Wireless communication over aquatic environments exhibits propagation characteristics that differ from those in terrestrial environments due to signal reflections from the water surface, which affect signal attenuation (path loss). Consequently, the Free Space Path loss (FSPL) model does not always accurately represent the actual propagation characteristics. This study aims to analyze the path loss characteristics of 2.4 GHz WiFi communication over aquatic environments, determine the empirical Path loss Exponent (PLE), and evaluate the suitability of the Exact Two-Ray Ground Reflection model using the FSPL model as a baseline for comparison. Data acquisition was performed using a Robot Operating System 2 (ROS 2)-based system implemented on an NVIDIA Jetson Orin Nano to automatically record Received Signal Strength Indicator (RSSI) and GPS coordinate data. Field measurements were conducted in eight measurement Runs at Lake Maninjau. The collected RSSI data were processed using the Distance Binning method to obtain Local Mean values, followed by PLE extraction through linear regression based on a theoretical breakpoint distance of 28.87 m. The results show that 2,187 measurement samples were reduced to 81 Local Mean points. The extracted PLE values are 0.0863 for Region 1 and 3.4014 for Region 2. After applying offset-based calibration, the Exact Two-Ray Ground Reflection model achieved Root Mean Square Error (RMSE) values of 14.445 dB and 11.866 dB for Region 1 and Region 2, respectively, which are lower than those obtained using the FSPL model (21.649 dB and 22.683 dB). These results indicate that the Exact Two-Ray Ground Reflection model provides a more accurate representation of 2.4 GHz WiFi propagation characteristics over aquatic environments than the FSPL model.</i> Keywords: <i>path loss, Path loss Exponent, Exact Two-Ray Ground Reflection, 2.4 GHz WiFi, aquatic environment.</i>		