



**WISIGN: Development of a Solution for Spatial Wireless Network Design and Analysis
Using the Log-Distance Path Loss Model for Electromagnetic Wave Propagation
Simulation**

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Abstract

This project aims to develop a low-cost spatial wireless network design and analysis solution for planning and improving the communication quality of basic Wi-Fi systems. The solution can simulate signals in the form of 2D indoor heatmaps, utilizing the Log-Distance Path Loss model to simulate electromagnetic wave propagation according to the following equation $PL(dB) = PL(d_0) + 10n \log(\frac{d}{d_0})$ When implementing the developed solution for network planning within the study area at the Ratchawit All-Purpose Building, Princess Chulabhorn Science High School Mukdahan, signal coverage was evaluated based on predefined signal quality criteria (RSSI ≥ -67 dBm and SNR ≥ 25 dB). The results indicated that the solution significantly expanded RSSI signal coverage by 1.7 times compared to the traditional approach, demonstrating a statistically significant difference at $p < .01$. Furthermore, the SNR signal coverage was enhanced by 1.58 times over the baseline, which also exhibited a statistically significant difference at $p < .01$. Consequently, it can be concluded that the developed solution can be effectively deployed for practical spatial wireless network design and analysis.

Keywords: RSSI, SNR, Electromagnetic Waves, Signal Coverage, Access Point