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Model Study for Outdoor Data Transmission Performance

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***Abstract*— Network performance for outdoor transmissions are varies according to different environment especially when there was obstacle along the transmission path and therefore the expected performance for outdoor transmissions is unpredictable. These unpredictable performances of outdoor data transmission forced Internet Service Providers (ISPs) to use stronger or better routers to establish the data transmission link. So, the initial investment for the project in a rural area will be higher than urban area due to long-range outdoor transmissions. Normally, this cost will be absorbed by the customers, who will be paying higher subscription fees. But, the income of residents in rural areas is lower than urban areas and the ISP is forced to absorb the extra initial investment by prolonging the projects' breakeven point. Therefore, this study aimed to a model for estimating average data speed for outdoor Wi-Fi data transmission. The average data speed of outdoor Wi-Fi data transmission was modelled by conducting experiments that simulate real-world wireless transmission. The experiments were conducted by selecting suitable transmitter and receivers. The obstacle used in the experiment was made from aluminum plate which has high attenuation for wireless signals. The experimental data were further validated with actual testing with real-world obstacles. The average percentage error for the outdoor Wi-Fi average data speed model was 24.97%.**

Keywords—Outdoor Data Transmission, average data speed, experimental results and validations.

I. INTRODUCTION

In this modern era, we are moving towards high-speed Internet such as 5G network. Current research mostly concentrated on establishing a more reliable or better performance high-speed Internet[1, 2]. High-speed Internet enables global communications or even business opportunities across the boundaries, but rural area seems disconnected to the current society and unable to enjoy the benefits from high-speed Internet[3]. High speed Internet can provide rural areas with better health services, improved market penetration, better government transparency and higher educational levels. The question here is why high-speed Internet unable to promote in those rural areas and how we can assist in Internet penetration rate? The Malaysia government promised and executed a few projects to improve the Internet penetration rate in the country[4]. The Sarawak government invested in a total of 5000 telecommunication towers to enhance the network penetration throughout the state[5]. All these efforts exerted are aimed to reduce the burden of ISP on development of rural areas. Rural areas seem to be abandoned and ignored by ISP due to unforeseen risk and low return of investment (ROI)[6]. The main concerns of ISP for every project are financial sustainability, reputation and risk. The profitability and ease of projects for development of urban areas are better than rural areas. Development of rural areas often involved extra efforts in total cost estimations and project design. Rural connectivity requires stronger and longer backhaul link to overcome some issue such as signal fading, signal blocking and Fresnel zone requirement. The router used in rural areas need to be stronger than urban area in term of antenna gain and transmission power to maintain the performance of the network to be at or above acceptable expectation. So, the initial investment for the project in a rural area will be higher than urban area. Normally, this cost will be absorbed by the customers, who are paying higher subscription fees. But, the income of residents in rural areas is lower than urban areas and the ISP is forced to absorb the extra initial investment by prolonging the projects' breakeven point. By using a suitable cost estimating model, the ISPs can be clear of some uncertain risks and implement suitable risk management plans[7]. Therefore, this paper aims to develop a suitable model for outdoor data transmission performance.

II. DEVELOPING A MODEL FOR OUTDOOR DATA TRANSMISSION

A. Transmitter and receiver

A suitable transmitter or receiver should be used in order to control the initial investment of the wireless network to be or below acceptable budget. An incompatible transmitter or receiver will also affect the overall performance of