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# MEASUREMENTS AND ANALYSIS OF MOBILE SATELLITE SIGNAL PERFORMANCE USING HANDHELD GPS RECEIVER

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*Abstract*— There is need for experimental data in the less developed and developing countries such as Africa, Asia and Latin America for the study and analysis of mobile satellite signal performance for communication purposes. The experiments were carried out in open space area with no obstruction of the direct wave. Comparisons were made between the soft reformatted data obtained in Kano, Kota Samarahan in Sarawak and Fukuoka in Japan.

Data acquisition system developments were designed to manage the open space environment satellite propagation data for the less develop regions, whereby adaptive graphical user interface (AGUI) was designed and developed to records the propagations data. Therefore the recorded data will be used to evaluate the signal performance in term of SNR, azimuth angles and satellite elevation angles. Results obtained from analysis will be used to determine the characteristics of the open space environment. This method can be used to encourage more experimental works in the less develop countries. The analysis produced an important part in the studies of the signal performance.

The hyper-terminal intercepts and adaptive graphic user interface were used to evaluate the previous data acquisition system conducted in Fukuoka and Stuttgart. The analysis for ionospheric effect on Mobile Satellite (MS) was conducted by comparing data obtained in Kota Samarahan, Kano with the data obtained in Fukuoka Japan. The experimental work was conducted with reduced cost and simple equipments so as to encourage more experimental studies on MS signal performance. Future research studies can be done by designing a program that will link and monitor the pilot data acquisition system placed in remote areas. Rain sensor and satellite display view can be added to the AGUI.

*Keywords-component; Handheld GPS receiver; data acquisition systems; Mobile Satellite; GPS ;*

## I. INTRODUCTION

Communication satellites function as a microwave repeater station for the exchanging of the information between the users in different forms [1 - 3]. However, GPS (Global Positioning System) is best known as a worldwide positioning system and the main purpose is to provide accurate positioning location at all points on the earth's surface at all times [4 - 6]. It is intended mainly for defense purposes but the civilian community now constitutes the bulk of users. The satellites

constellation comprises 24 satellites such that at least 4 satellites are visible everywhere on earth at any time. The orbits are essentially circular at an altitude of about 20,200km, with orbital inclinations of 63° and with 12h (sidereal time) duration. In order to provide accurate data and cost effective, a portable and low cost data acquisition system experiment can be used to carry out measurement for different mobile satellite signals. The signal performance of the mobile Satellites (MS) is affected by factors such as ionosphere effect [7], tree-shadowed, building-shadowed and multipath, but this paper only concentrates on the satellite signals for an open space environment in which the arriving satellite signal does not experience significant fading effect due to trees or building.

Experimental data for MS signal is important in communication services. MS system was designed to promote communication to areas where terrestrial communications is not available. This serve as an alternative to the current communication system which normally has a potential to be develop again to support the ever increasing demand of personal and multimedia communication. The portable GPS receivers are increasingly popular among the outdoor users, though the handheld GPS receiver prices have dropped so anybody can afford to buy it.

The commercial hand held GPS receiver used in the experiment was Garmin receiver. The receiver antenna radiation pattern indicates that the antenna gain is 5 dBi [10] for a typical micro strip patch antenna having right-hand circularly polarized (RHCP). In order to have high-position accuracy experimental result, a positional experiment was conducted using open space position method. Many researches were conducted on held GPS receiver for precise positioning method mostly the research were on geo-catching, site location and point positioning [11]. This research was based on the data acquisition for experimental method. The receiver used for this experiment was not meant for laboratory purposes but it was designed mainly for navigational and position location [12]. The precise position technique in this paper employed two different approaches, the receiver azimuth position and elevation angle position to get the best experimental technical data.

The signal performance of the MS is affected by many factors such as ionosphere effect, trees shadowed; building shadowed and multipath effect, but this experimental research