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Investigation of Signal Strength of Global System for Mobile (GSM) Networks, within the Federal Polytechnic Ado-Ekiti, Ekiti State

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ABSTRACT: One of the biggest complaints mobile users make and which is very frustrating is having poor signal, not being able to make a call, missing calls and having slow internet speeds. These complaints cut across all spheres of life with the institutions not being excluded. There is therefore a strong need to study the quality of services (QoS) offered by mobile telephone operators in Nigerian using the four (4) core networks that is: MTN Nig., GLO Nig., AIRTEL and ETISALAT operating within the Federal Polytechnic Ado-Ekiti, Ekiti State Nigeria. The measurements were taken using RF 3-axis electromagnetive field strength meter which is a wide band device for monitoring high frequency radiation in the range of 50Hz-3.5GHz and INFINIX 507 Android mobile receiver with special App "network cell life app'' The measurements were performed in X.Y.Z coordinates of the incoming signal. The result shows that all the GSM networks within the institution with the exception of Glo Nig. fell below the good signal range. It was suggested that system upgrading be carried out on the existing infrastructures and cleared signal rout of obstructions.

KEYWORDS: GSM Networks, QoS, measurements, The Federal Polytechnic, Ado-Ekiti, System upgrading, EMF strength meter

I.INTRODUCTION

From time immemorial, information and communication has fashioned the basis of human existence. People want to communicate with their family and friends and to be communicated and also transact business at a lesser risk. This desire has been a driving force, inspiring people to continuously seek for a new and effective means of disseminating information to one another on real time basis irrespective of distance (Popoola *et al*, 2009). Anifowose,(2013) asserted that communication involves the process by which information and understanding are transferred from one person to another. It is the basis for all human interaction for all functional groups.

The penetration of telecommunication has been found to have a significant impact on communication worldwide (Okereke, 2018). Mobile communication is easier and cheaper to supply and acquire than fixed telephone and it plays crucial role in the advancement of education and economic growth of any nation. Omenesa,(1997) deduced that GSM, Radio and Television remains a medium of development. Communication is usually been employed by the development officers or experts for the dissemination of relevant development messages. The development in technology ushered in this desire with advent of the first generation cellular telephone systems that enable people to communicate with one another irrespective of time and place (Sridhar, 2004). Chisita,(2010) opined that mobile ICT's has also imparted heavily on access to information relating to markets, weather and other essential services because these information can easily be accessed through the use of mobile phones. Though the rollout of GSM services across Ekiti State in particular and Nigeria at large has positively altered the socio - economic landscape of the state and nation and has brought improvement in revenues; there are still huge challenges facing the GSM network providers as subscribers' complaints keep building up on daily basis (Popoola *et al*, 2009). One of the biggest complaints mobile users make and which is very frustrating is having poor signal, not being able to make a call, missing calls and having slow internet speeds,(Ekejiuba etal,2015) For businesses not being able to receive calls can mean revenue loss and upset customers (www.mobilenetworkguide.com.au). Despite all these, GSM is still the most popular standard for mobile phones in the world (Ekejiuba, 2016).

Signal strength measurement is very important in Global System for Mobile (G.S.M) network services; it helps in detecting the degradation in the level of signal strength which can be as a result of the topography, weather, and other effect (Anderson et al, 2009).Also, Daniel et al (2016) in their findings said signal strength is defined as received strength indicator. Received signal of mobile subscribers(MS) from the base station determines the quality of reception.

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Mobile technologies such as Global System for Mobile Communications (GSM) are now commonly used in almost every part of the world to provide voice telephone services. In order for a mobile subscriber to access voice telephone services, a network or infrastructure must be put in place to enable this access. The GSM system is based on two way radio communication between a mobile handset and the nearest base station. Each base station can serve a line length of up to 4km in each direction; depending upon the topography. The area covered by base station is referred to as a "cell", and cells are interlinked to create the cellular network. The cell coverage area is determined by the base station output power and the environment. Things such as trees, hills, buildings and land formations will have an effect on the coverage area (www.mobilenetworkguide.com.au).

In communication there are series of threat which affect the effectiveness of communication but the major one is "attenuation" which is a loss of signal due to atmospheric effect and this can be reduced through signal monitoring and measurement (Josiane *et al*, 2009). Similarly, the citizens have benefited immensely from the services, not only as a means of communication but it has also provided job opportunities for thousands of people in the state (Okereke, 2018; Codebreaker, 2011)).However, the principal development that mars these benefits is the aggressive complaints raised by GSM subscribers regarding poor quality of services (QoS) rendered by the GSM operators in the study area. The most pathetic aspect of it is the fact that all the GSM subscribers irrespective of the operator are being affected. Accurate measurement of the received signal over a range and the use of this information to characterize the coverage area and performance of the antenna is very important (Frank, 2008).
Based on this ugly experience, this study was embarked upon to examine the causes of this problem and find ways of ameliorating the observed defects. The paper therefore measures signal strength of GSM networks (MTN, AIRTEL, GLO and ETISALAT) at the Federal Polytechnic Ado-Ekiti, Ekiti State Nigeria. The quest to be connected and remain connected has led to the installation of various GSM network base stations across the country. One of such are the ones mounted at the Federal Polytechnic Ado Ekiti, Ekiti state Nigeria.

II. THE STUDY AREA

The Federal Polytechnic Ado-Ekiti,Ekiti State, falls within the South Western Geo-political zone of Nigeria. The terrain is surrounded by rocky hills. The hills are approximately 30m-35m high above sea level in the neighbouring environment few kilometers around the institution. In the area where the measurements were conducted, the average highest buildings were 9.5m, with trees and building scattered round the settlement. The institution has four Schools such as School of Engineering (SOE), School of Science and Computer Studies (SCCS), School of Business Studies (SOB),and School of Environmental Technology (SOT); and hostels tagged Lagos hostel and Abuja hostel respectively.

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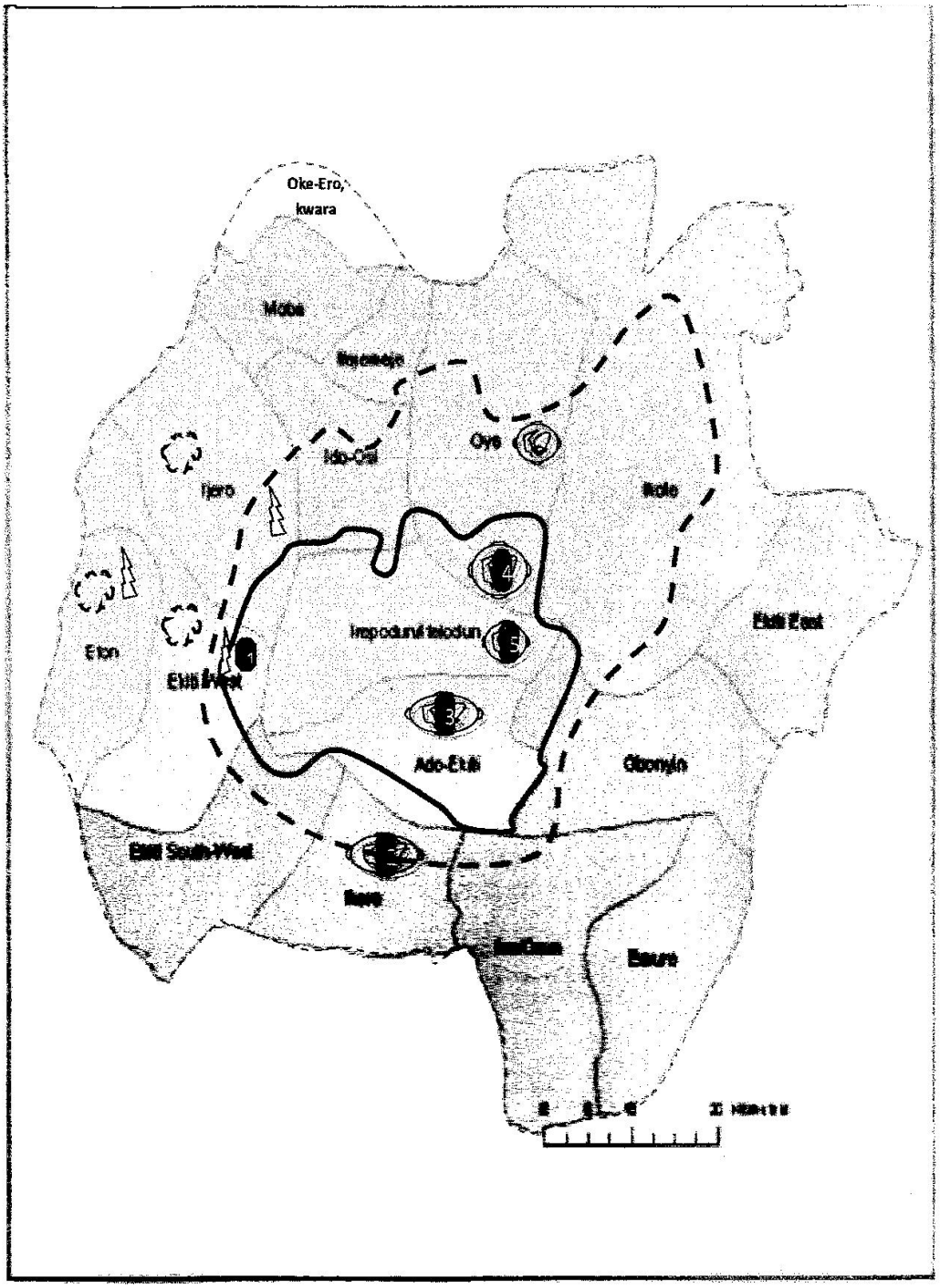

Fig 2.1: Polar map showing Ekiti State topography

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KEY

	MOUNTAIN
	HIGH (SETLEMENT)
	VALLEY(SETTLEMENT)
	SERVICE AREA I
	SERVICE AREA II
-----	FRINGE AREA
1	AMUTUTU SETTLEMENT(ARAMOKO)
2	OLASUNTA HILL
3	OLOTA MOUNTAIN
4	BEHIND ARE PALACE
5	OTUGBA ROCK

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Figure 2.2: Pictorial view of base station at Federal Polytechnic, Ado Ekiti.

A.CALL DROPS AND IMPLICATIONS

Quality of service is an important key performance indication that is used in determining the efficiency of an industry in term of service rendered. In Telecommunication system accessibility, retain ability and connection quality are three major factors used in evaluation quality of service of an operator.

III. RESEARCH METHODOLOGY

A. MATERIALS USED

The materials used in measurement of the signal strength within the study areas are the super scientific 3-Axis RF Meter model 840047 designed for measuring and monitoring Radio–Frequency electromagnetic field strength. The meter is

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calibrated precisely over the frequency range of 50 MHz to 3.5 GHz and INFINIX 507 Android mobile receiver with special app "network cell life app".

B. MEASUREMENT PROCEDURE

The signal strength of MTN, GLO, AIRTEL and ETISALAT networks were measured with digital strength meter and INFINIX 507 Android mobile receiver from the Base Transceiver Station (BTS) at intervals of 50 meters. The measured data were analyzed graphically and compared with each other to see the performance of each of the GSM network operators in the study area. The measurements were taken from various locations across the study area at different time and season. The X,Y,Z are used to determine or locate a particular direction where the radio frequency are needed to be mounted on the masks at the base station.

IV. RESULTS AND DISCUSSIONS

In all the base stations within the area of study and time of data collection, good signal strengths were recorded. The reason why the line graph falls on each other was because of the signal in the base stations is stronger than signals far away from the base stations. The measured signals are analyzed using the following parameters:
-50dBm: Excellent signal strength, -60dBm: Good signal, -67dBm: Reliable signal strength, -70dBm: Not a strong signal, -80dBm: Unreliable signal strength will not suffice for most service and -90dBm: Low connectivity (www.tested.com). From fig 4.1, it can be deduced that from the base station, the signal strength reading for MTN network ranges from -53dBm to -59dBm. Hence, it shows that the signal is good. From fig 4.2, it was deduced that from the base station, GLO network at the base station is within the good signal range (-50dBm) all through. From fig 4.3, it can be deduced that from the base station, AIRTEL network falls outside the range of good signal, which amounts to the instant call drops experienced by its users; this is why there is a low patronage of AIRTEL service within the campus. Fig 4.4 shows that the ETISALAT network from the base station is also outside the range of good signal, which means that there is a need to boost the frequency bandwidth by the operator; to improve the signal strength.

For other measurements carried out further away from the base station, the following observations were made.It can be observed from the graph in fig 4.5, that the MTN signal strength is not good as it falls outside the good range. Hence the incessant complains about the poor MTN network services in the campus. From fig 4.6: GLO network is still maintaining the range of good signal (-50dB).From fig 4.7: However, AIRTEL network is managing to fall in the good range, From fig 4.8: ETISALAT has the range of good signal anyway, it cannot be compared with GLO network. From the above results analysis, far field from the base station measurements shows the need for improvement of network signals for MTN and ETISALAT and also AIRTEL network providers especially in School of Engineering. From the data collated, analysis as shown in the above figures, it was observed that GLO network provider is the best network to be suggested for subscriber in the School of Engineering, the network is the strongest among all other networks with minimum signal strength of -44dBm and the maximum of -58dBm and also in all other locations like Centre for Communication and Technology (CICT) Area, Lagos Hostel, and Abuja Hostel. GLO network provider is the best and therefore, there is need for improvement of GSM network for MTN, AIRTEL, and ETISALAT at Federal Polytechnic Ado Ekiti.

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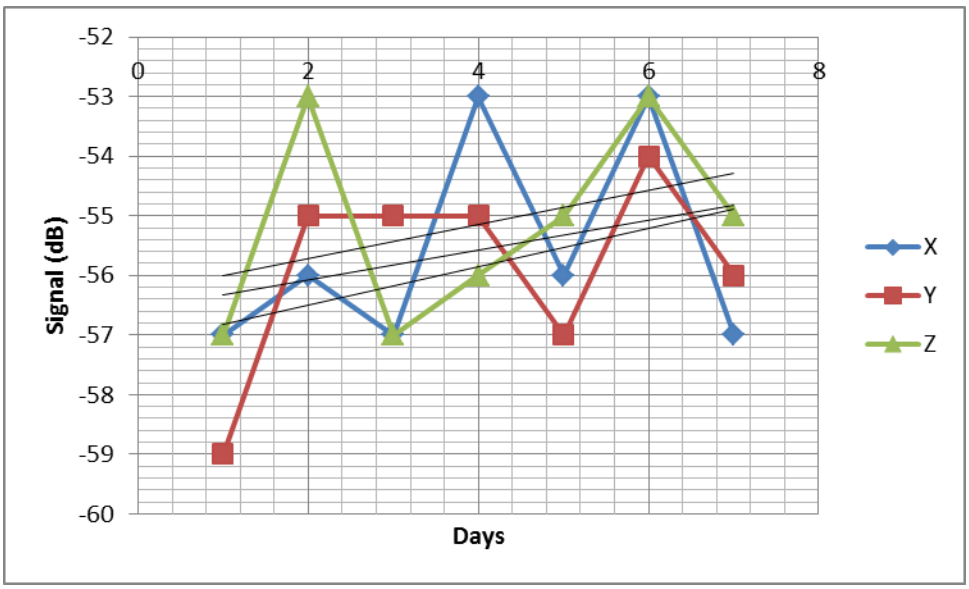

Fig 4.1: Graph of MTN signal (dB) against the days

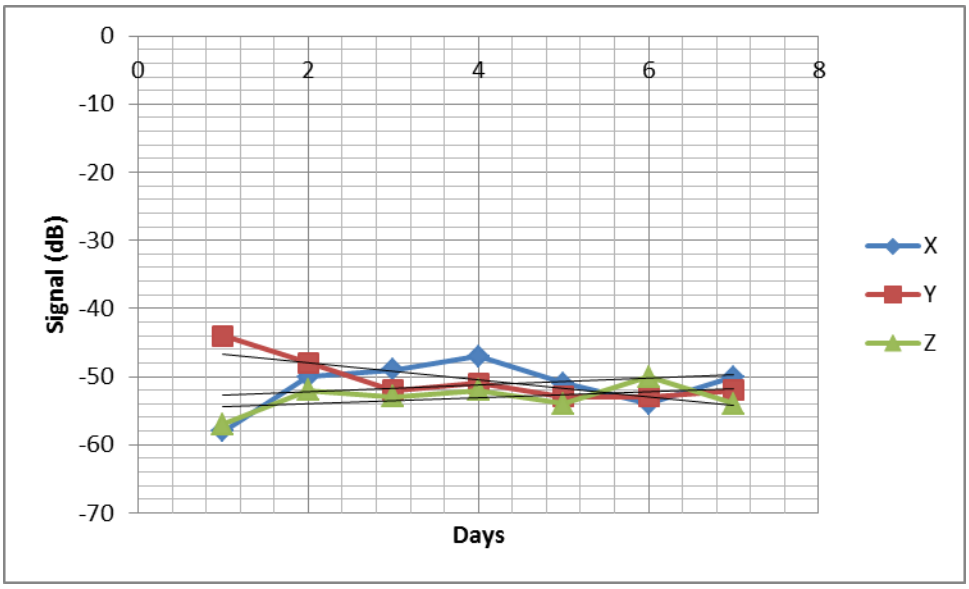

Fig 4.2: Graph of GLO signal (dB) against the days

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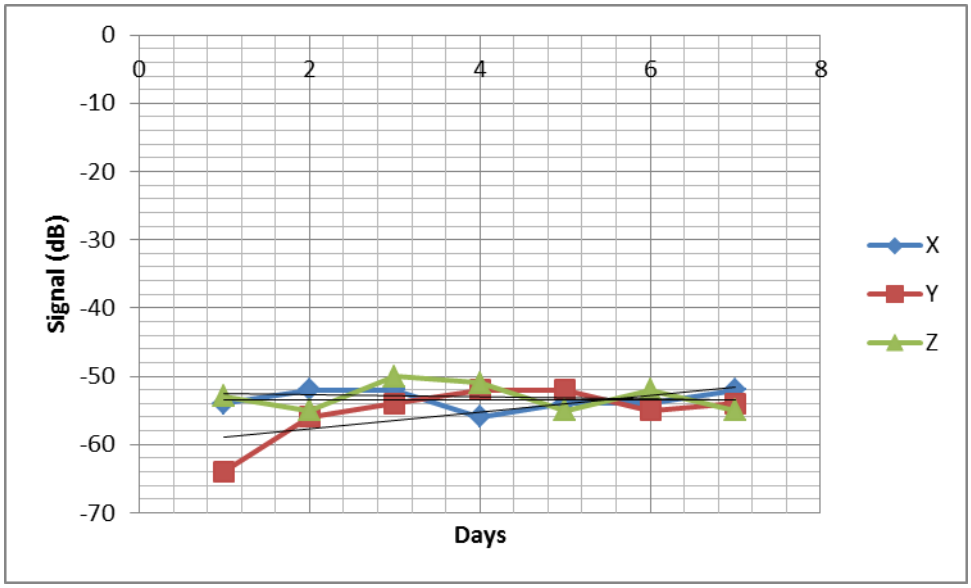

Fig 4.3: Graph of AIRTEL signal (dB) against the days

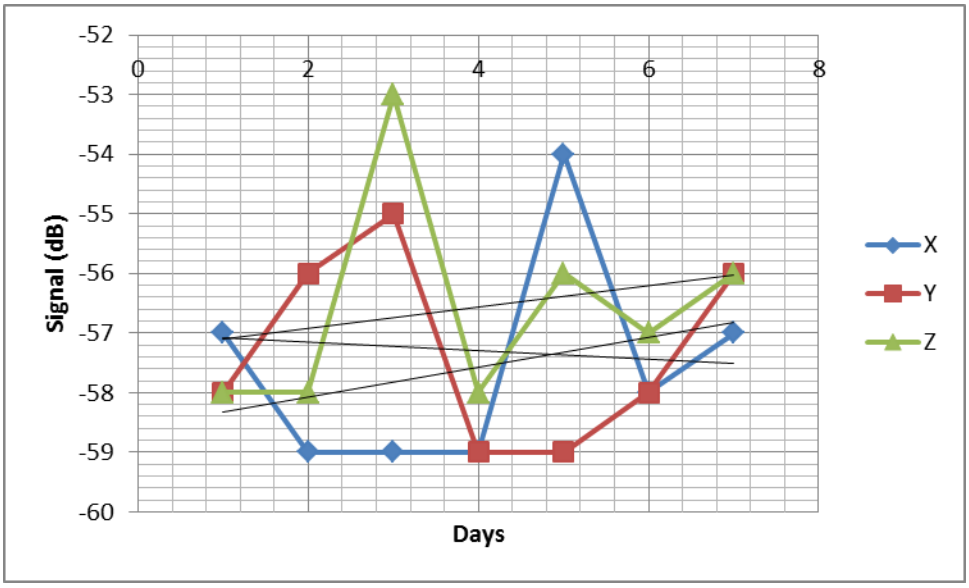

Fig 4.4: Graph of ETISALAT signal (dB) against the days

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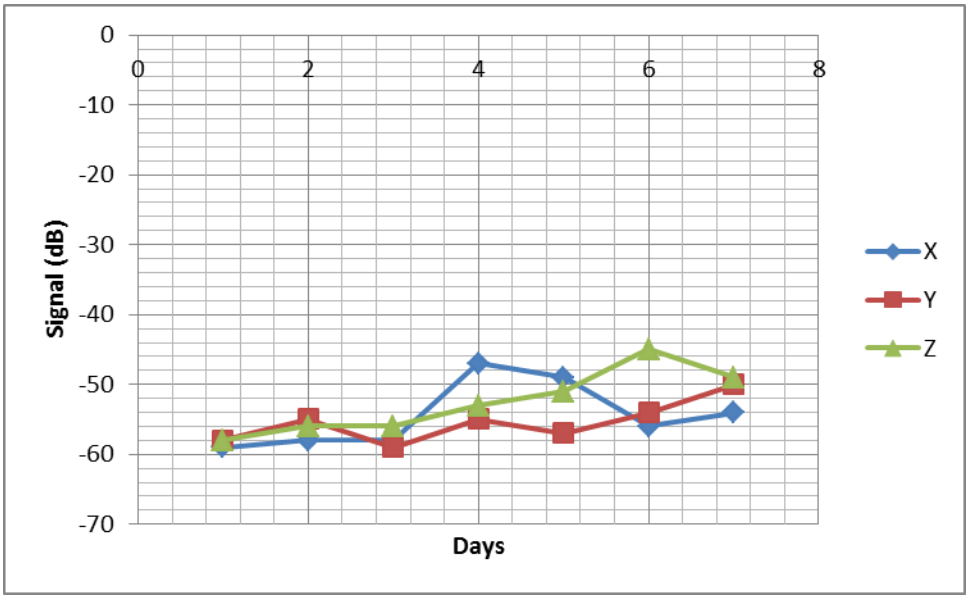

Fig 4.5: Graph of MTN signal (dB) against the days

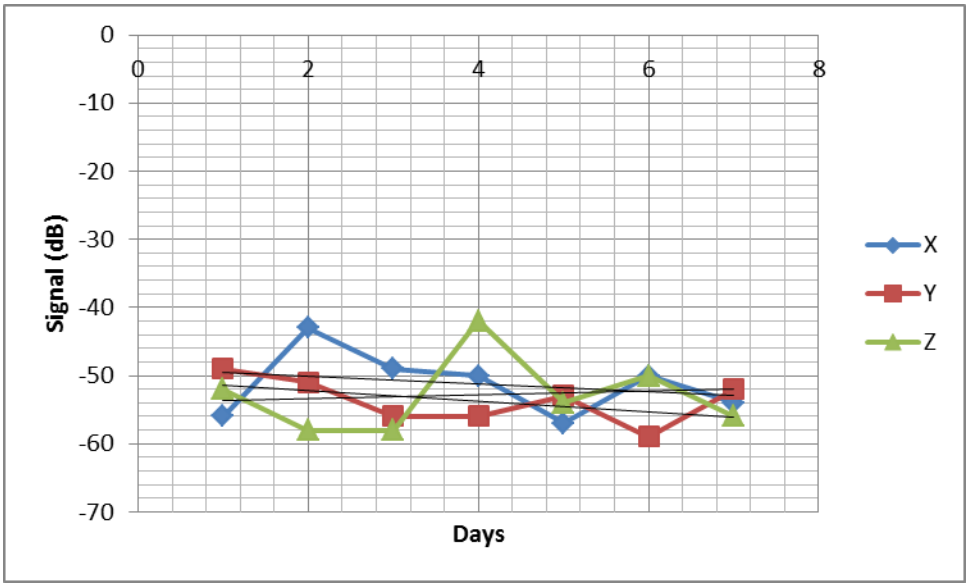

Fig 4.6: Graph of GLO signal (dB) against the days

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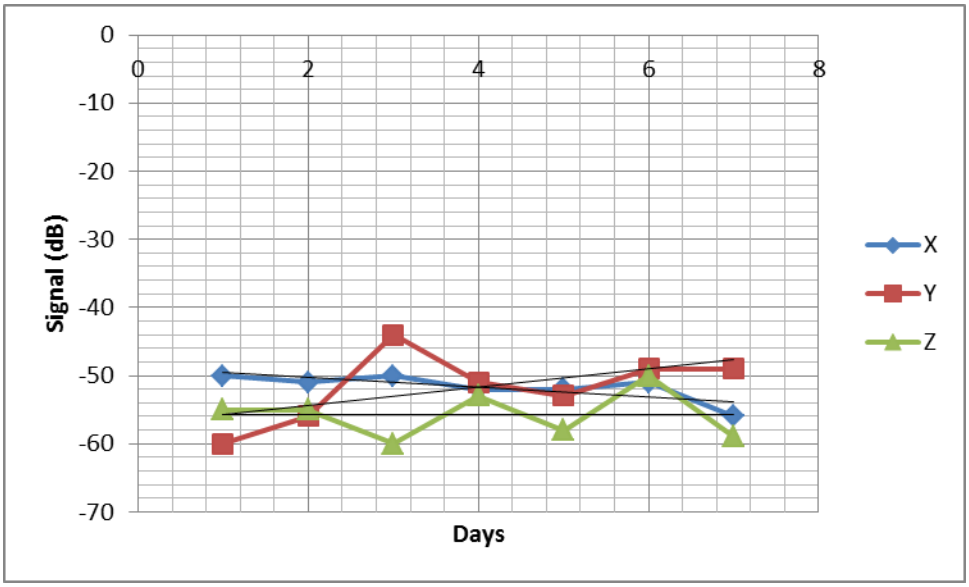

Fig 4.7: Graph of AIRTEL signal (dB) against the days

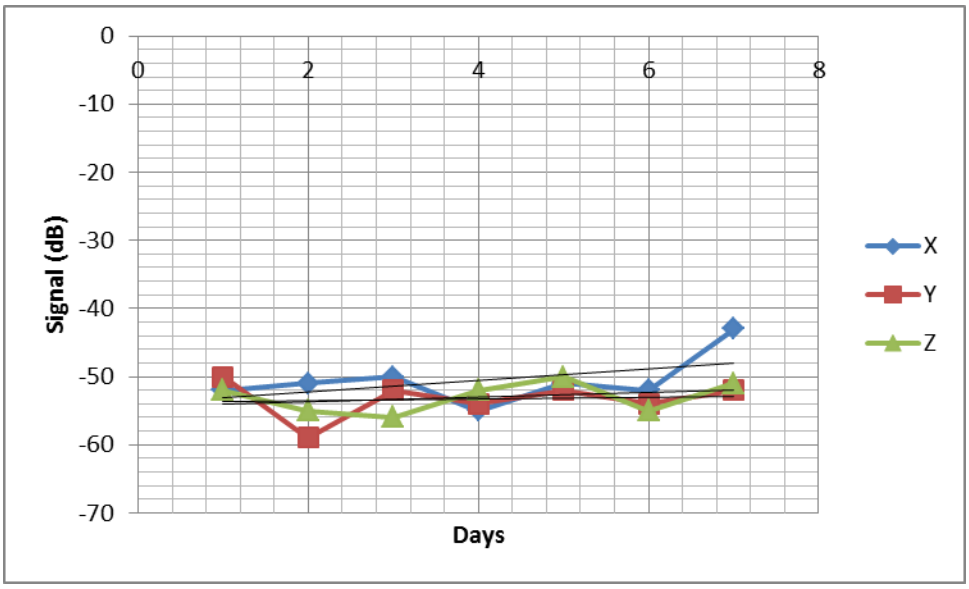

Fig 4.8: Graph of ETISALAT signal (dB) against the days

V. CONCLUSION

The study within the limits of experimental errors, has confirmed through the collated data and analysis the poor network services being experienced by network subscribers within the institution and its environs. This indeed has negative impact on calls and internet accessibility within the Campus.

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VI. RECOMMENDATION

Based on the study carried out, I therefore recommend the followings that:

i. The GSM operators are encouraged to improve their quality of service to enhance mobile communication performance in the study area.

ii. The GSM operators in this study area are also advised to build more Base Transceiver Stations (BTSs) in order to increase their network coverage.

iii. The thick vegetation in the study area needs to be cleared and signal rout should be devoid of high buildings.

iv. Government should show more commitment to the private sector as observed by Jake (2016); for them to be able to contribute innovative solutions that allows consumers to benefit more from Information Communication Technology (ICT) advancement. This of course will bring efficiency and productivity in the Telecom sector and by extension enhance economic growth.

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