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On the Practical Assessment of Signal Strength of GSM Network Service Providers

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Abstract- This paper assessed the signal strength of GSM network service providers in Kwara State Polytechnic permanent site and Ara village. The latitude, longitude and elevation of the two reference locations where the study would be carry out were picked with Global Positioning System. The first location was at the gate of Kwara State Polytechnic permanent site at latitude $08^0\ 32^1\ 37.6^{11}$ and longitude $04^0\ 38^1\ 07.7^{11}$ and Ara village at latitude $08^034^1\ 27.9^{11}$ and longitude $04^0\ 38^1\ 17.3^{11}$ with elevation of 350 and 364 meters respectively. The signal strength of MTN, GLO, AIRTEL and ETISALAT networks were measured with TECNO D3 Android mobile receiver from the Base Transceiver Station (BTS) at intervals of 100 meters. The measured data were analysed graphically and compared with each other to see the performance of each of the GSM network operators in the study area. The results revealed that the performance of these network providers are yet to be adjudged satisfactory.

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On the Practical Assessment of Signal Strength of GSM Network Service Providers

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I. Introduction

The penetration of telecommunications has been found to have a significant positive impact on growth. Mobile penetration in particular, being easier and cheaper to supply than fixed telephony, can be expected to play a crucial role in the economic growth of African and other developing countries Sridhar, (2004). From time immemorial, information and communication have fashioned the basis of human existence. People want to communicate their family and friends and to be communicated. This desire has been a driving force, inspiring people to continuously seek for a new and effective means of dissemination of information to one another on real time basis irrespective of distance. 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. This first generation cellular telephone system, which was analog system, was launched in 1960s before digital communication became prevalent [Hillebrand, (2001), Popoola et al, (2009), Codebreaker, (2011), Redl, Weber, Matthias and Oliphant, (1995) and (1998)].

The rollout of GSM services across Kwara State and Nigeria at large has positively altered the socio-economic landscape of the State and has brought huge revenues to the operators as well as the government through tax and license fees (Popoola et al, 2009). Similarly, the citizenries 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. However, the principal development that mars these benefits is the aggressive complaining 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. 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) in Kwara State Polytechnic permanent site and Ara village with the view to address the complaint of the subscribers.

II. Materials and Method

Two reference locations were picked within the study area with Global Positioning System. The first location was at the gate of Kwara State Polytechnic permanent site at latitude 08^0 32^1 37.6 ^{11} and longitude 04^0 38^1 07.7^{11} and Ara village at latitude 08^034^1 27.9 ^{11} and longitude 04^0 38^1 17.3^{11} with elevation of 350 and 364 meters respectively. The gate of Kwara State Polytechnic permanent site that was picked as the first location consist of arrays of cell sites. The signal strength of MTN, GLO, AIRTEL and ETISALAT networks were measured with TECNO D3 Android mobile receiver from Base Transceiver Station (BTS) at intervals of 100 meters. The linear distance covered from the array of cell site was 3,100 meters. The primary data obtained were analysed graphically and compared with each other to see the performance of each of the GSM network operators in the study area.

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III. Results and Discussion

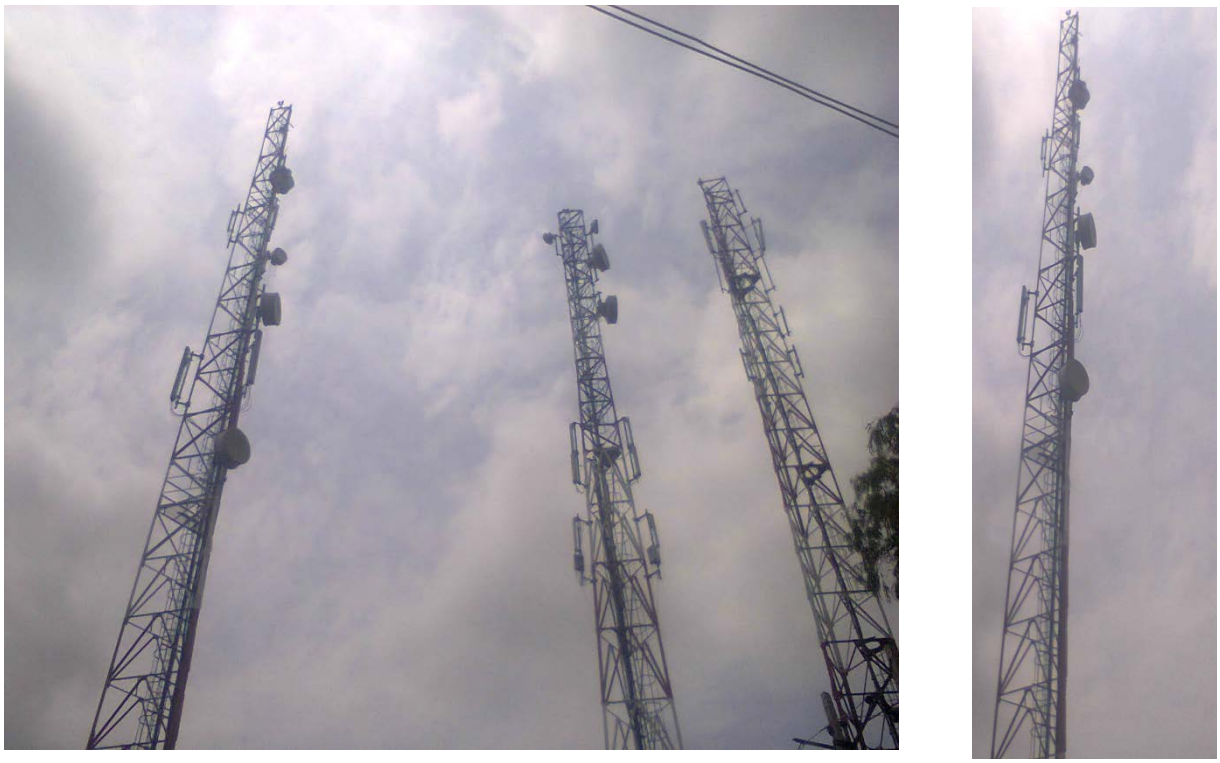

Figure 1: Array of cell sites in the study area

Figure 2 : Attenuating structures in the study area

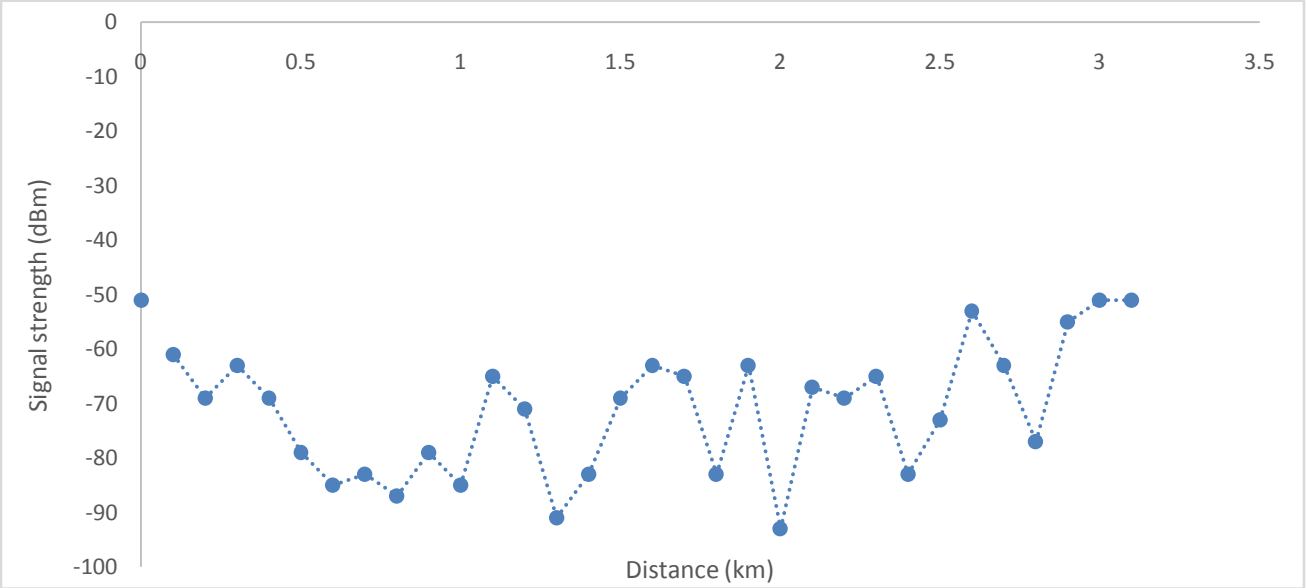

Figure 3 : Signal strength (dBm) against Distance (km) for MTN network

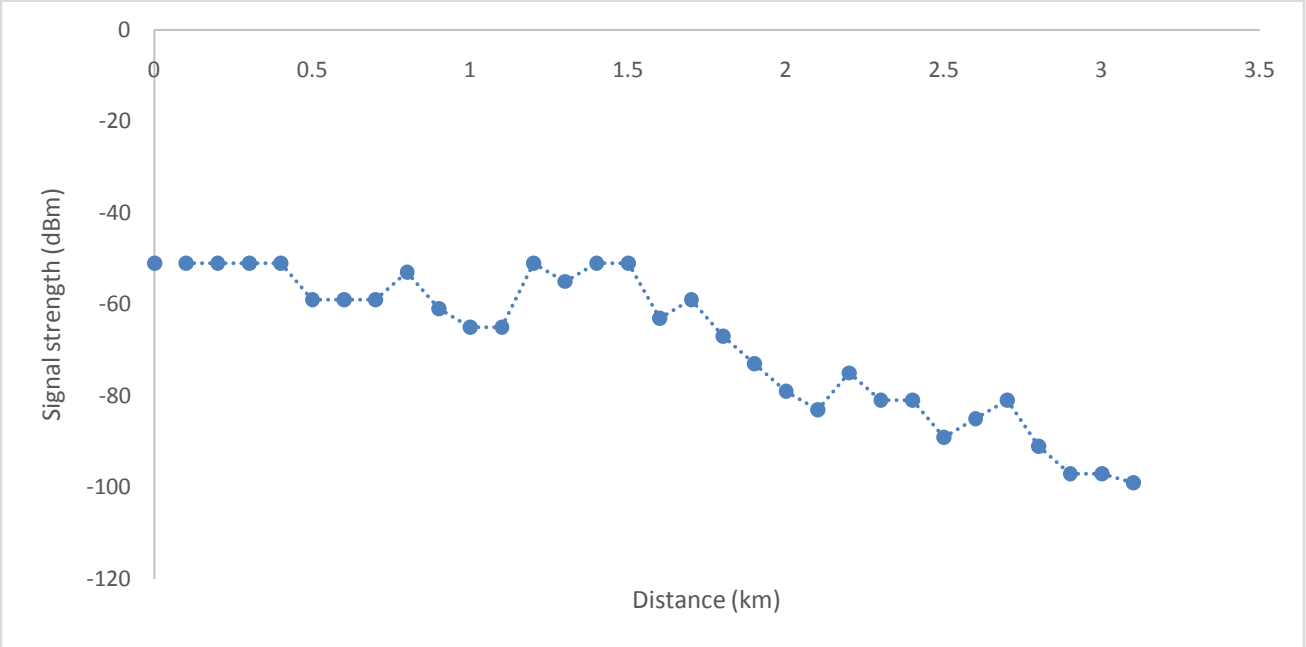

Figure 4 : Signal strength (dBm) against Distance (km) for AIRTEL network

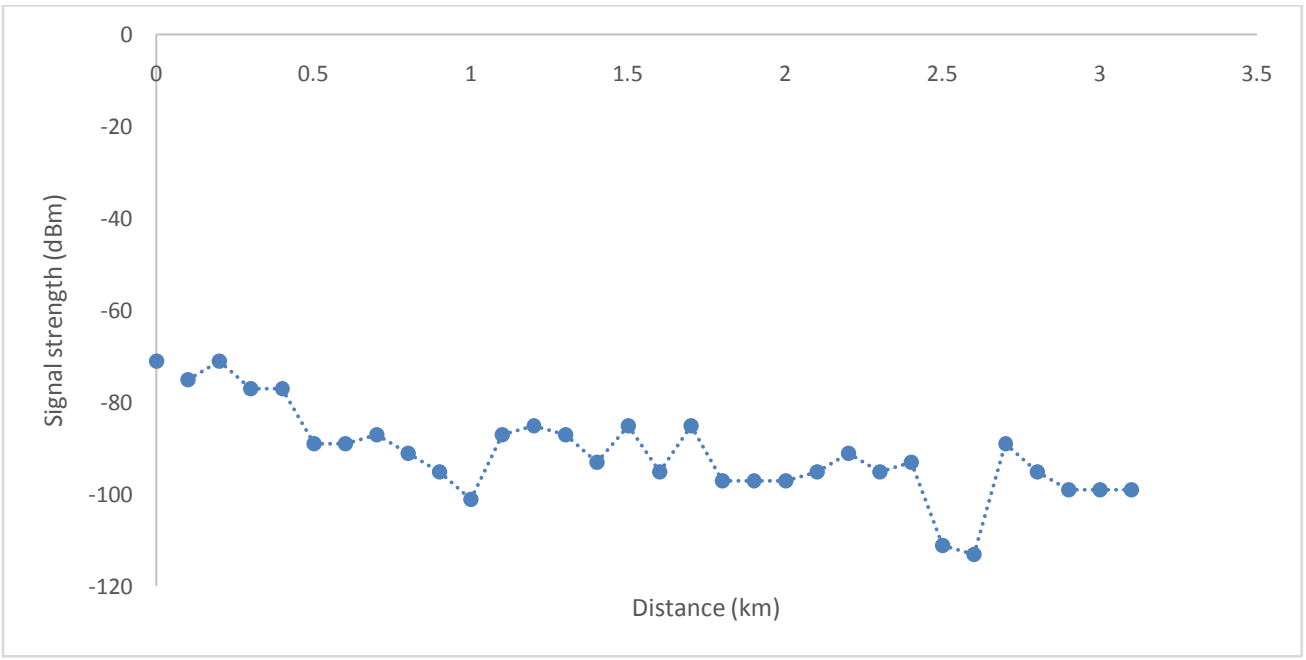

Figure 5 : Signal strength (dBm) against Distance (km) for GLO network

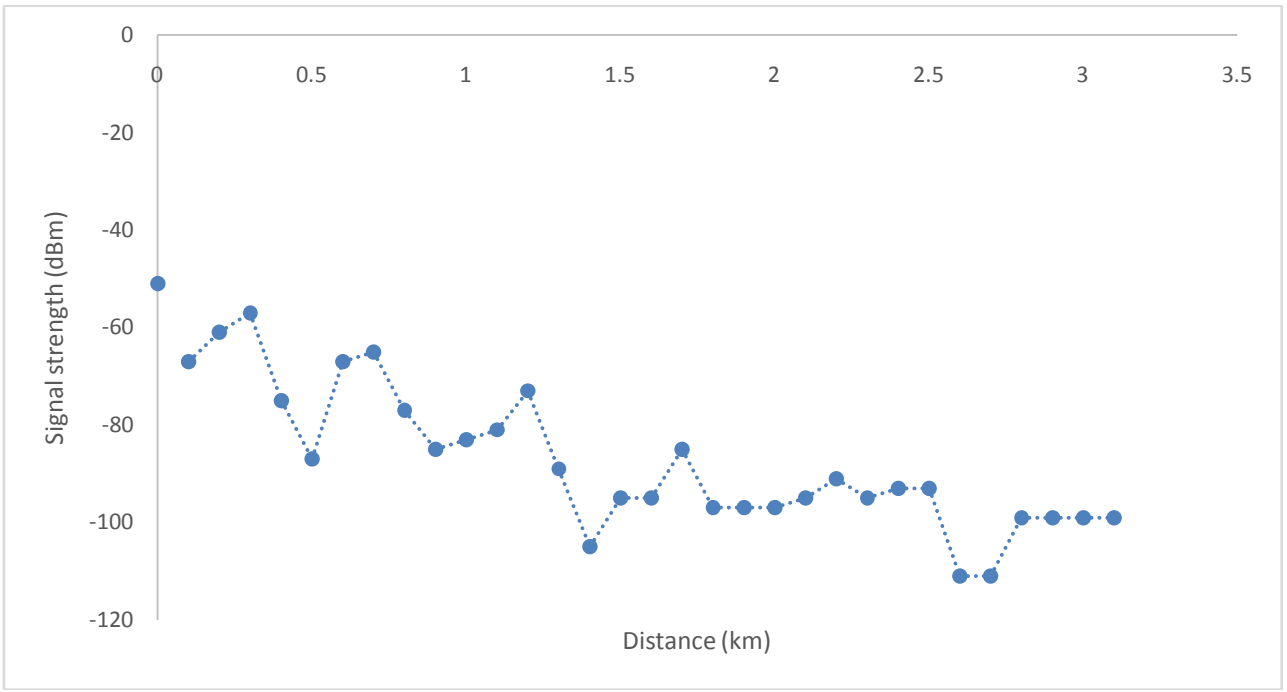

Figure 6 : Signal strength (dBm) against Distance (km) for ETISALAT network

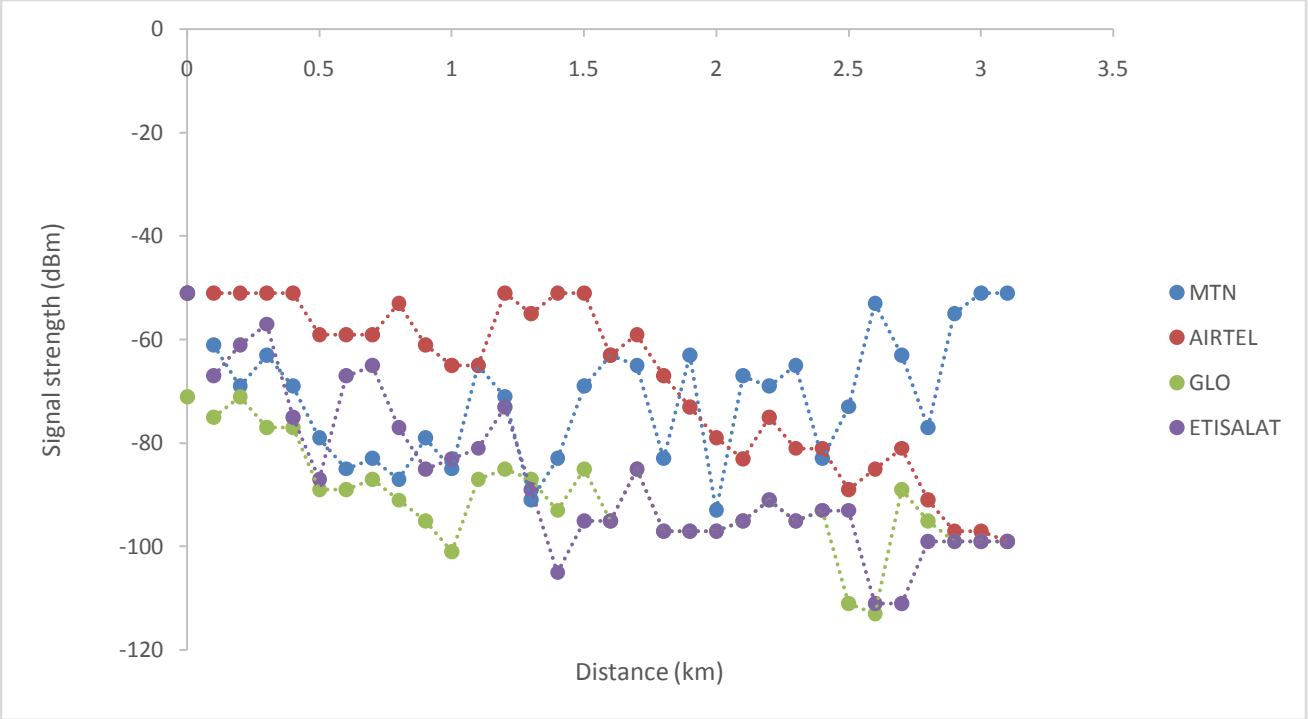

Figure 7 : Signal strength (dBm) against Distance (km) for MTN, AIRTEL, GLO and ETISALAT network

Figures 1 to 2 showed the array of cell site and the attenuating structures in the study area. Figures 4 to 7 showed the plot of signal strength (dBm) against Distance (km) for MTN, AIRTEL, GLO and ETISALAT networks. The minimum signal strength recorded for MTN is -93, AIRTEL is -97, GLO is -113 and ETISALAT is -111.From literature, it was established that gsmsignal strength of -105 to -100 dBm, call users experiences bad/drop call, -99 to -90 dBm, call users getting bad call or signal break up, -89 to -80, call users shouldn't have call problems, -79 to -65 dBm, call users experiences good call and over -65 dBm, the call is excellent. The minimum strength recorded for all the network providers in this area falls under the bad/drop call or user getting signal break up. Figure 7 compares the performance of each of the gsm network providers in the study area. With the observed values, there is no way the subscribers of all the network providers in this areas would not be encountering some bad call or signal break up.

The gsm signal fading could be associated to atmospheric ducting, ionospheric reflection and refraction and reflections from terrestrial objects such as mountain and high buildings and also to the thick vegetation in the study area. The signal strength limitation could also be associated to the uplink transmit power of the transmitters.

IV. Conclusion

Within the limits of the experimental error, the results of the signal strength measured during the field work for all the GSM networks in the study areas are unsatisfactory.

V. Recommendation

Based on the study carried out, we therefore recommend the following:

1. The GSM operators are advised to improve their quality of service to enhance mobile communication performance in the study area.
2. The GSM operators in this study areas are also advised to build more Base Transceiver Stations (BTSs) in order to increase their network coverage.
3. The thick vegetation in the study area needs to be cleared

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