Service Network Bars Analysis in a Campus Environment.

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ABSTRACT

This study is aimed at evaluating GSM signal strength in terms of network service bars and to determine the frequency of the occurrence of the network service bars, also to report on the quality of service of the networks. The analysis and evaluation will provide useful information that will improve the signal strength quality in Epe. Measurement was done using a Nokia L200 cell phone having provision for three SIM slots. Data was collected from measurement at two main locations on the Lagos State University, Epe Campus. Two main areas were used for the study; the Hostel area and the Library area. A total of 300 observations were made for three operators for a total of five days. Results show that GSM signal strength is fair in the Library area of the campus environment, but not sufficient enough in the hostel arena and this could not meet up with customer satisfaction.

(Keywords: GSM, network bars, signal strength, BSTs, operators)

INTRODUCTION

Research on network service bars has been ignored for some time in this part of the world. The reason may be challenges in securing cell phone making use of more than one SIM slot provision. Transmission and detection of communication signals consisting of electromagnetic waves that travels through the air in a straight line or by reflection from the ionosphere or from a communications satellite.

The major problem of those who depend on radio communication is the loss of signal in propagation environment such as building, trees, basements and other features reduces signal strength due to attenuation which hinders communication.

Communication satellites relay voice, video, and data signals between widely separated fixed locations (e.g., between the switching offices of two different national telephone networks), between a fixed location and numerous small fixed or mobile receivers in a designated area (e.g., direct satellite broadcasting of television programming), and between individual mobile users (e.g., aircraft, ships, motor vehicles, and personal handheld units). The technique involves transmitting signals from an Earth station to a region of Earth. Receiving stations within this region pick up the signals, thus completing the link.

In the 60-90's Nigeria depended on conventional telephone system technology (Shoewu, et al., 2008) as the only means of communication which was not sufficient to the subscribers in the country. But with the introduction of GSM technology in 2001 communication became cheap, readily available and accessible (Adebayo and Edeko, 2005) to almost every Nigerian.

The specific frequency bands open to civilian satellite communication are assigned by the International Telecommunication Union, base in Geneva. Each band consists of an uplink (Earth-to-satellite) frequency and a downlink (satellite-to-Earth) frequency. The two bands that have been in use longest, and still carry the most traffic, are the C band, with uplink frequencies centered on 6 gigahertz and downlink frequencies centered on 4 gigahertz, and the Ku band, with uplink/downlink frequencies centered on 14/11 gigahertz. In order to relay signals in these frequencies, a typical communications satellite is equipped with several transponders, or repeaters. Each transponder consists of a receiver tuned to the uplink band, a frequency shifter that lowers the received signals to the downlink band, and a power amplifier that produces an adequate transmitting power. Multiple transponders allow a single satellite to provide a combination of wide-area beams for

broadcasting and narrow-area "spot" beams for point-to-point communication.

The strength of a signal reaching the intended area on Earth's surface depends on several factors. One is the satellite transmitter power, which is subject to such limitations as the maximum practical size and weight of the solar panels that can be put into the desired orbit and the fairly low efficiency of the transmitter in converting input power into radiated power. Because the strength of a transmitter's signal decreases in proportion to the square of the distance from the transmitter, the satellite's altitude has a great effect on the received signal strength. For example, the signal from a satellite orbiting at an altitude of 30,000 km (18,600 miles) is only 1/10,000 as strong as a signal from an identical satellite orbiting 100 times closer (at 300 km altitude).

To waste as little as possible of a transmitter's radiated power, it is advantageous to employ a narrow beam, pointed toward only those regions with which communication is desired. In order to achieve this concentration of power, the satellite's antenna must be quite large-as much as 2.5 meters (8 feet) in diameter. A typical satellite antenna (Parson and Gardiner, 2009) is parabolic in shape, its concave surface reflecting microwave energy that is directed toward it by a complex array of feed horn antennas.

METHODOLOGY

In this exercise, specific location was chosen to monitor the GSM signal strength using mobile unit (MU). The assessments may be slightly accurate considering many factors. The SIM CARD for the three GSM operators was inserted into the mobile unit (Nokia L200) which enables us to monitor the signal strength of the three GSM operators concurrently. In the measurement it was observed that the MU display maximum of five (5) and minimum of one (1) GSM network service bars depending on the signal strength detected at a given time, this shows that the strongest signal strength is 5 bars while the weakest is 1 bar. The measurement was conducted at the hostel area and the library of Lagos State University, Epe Campus in the month of February, 2011 for the period of ten (10) days.

INVESTIGATED ENVIRONMENT

A site exercise was done using Nokia L200 as a mobile unit with a triple SIM card capability, to monitor the signal strength of three networks; they are Glo, MTN and Air-tel. For this study Glo, MTN and Air-tel are respectively called operator A, operator B, and operator C respectively.

Data were obtained around the Library and hostel area of Lagos State University, Epe Campus for a period of ten (10) days. The first five days was done in the hostel and the last five (5) days was done in the library, for each day the exercise was done between the hours of 8:00am and 5:00pm

DATA COLLECTION

The table represents the numbers of bars for the service network bars collected in the hostel and the library area of LASU, Epe campus.

Table 1

Time	Monday			Tuesday			Wednesday			Thursday			Friday		
	Operators			Operators			Operators			Operators			Operators		
	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A
8:00am	3	2	5	4	1	5	3	3	5	3	3	5	5	3	5
9:00am	4	1	5	1	2	5	3	1	5	2	1	5	4	3	5
10:00am	3	2	5	4	3	5	4	3	5	4	3	5	3	4	5
11:00am	1	2	5	3	3	5	4	3	5	4	4	5	3	4	5
12:00pm	4	4	5	3	2	5	5	3	5	4	3	5	3	2	5
1:00pm	5	2	5	3	3	5	4	1	5	3	2	5	3	2	4
2:00pm	3	2	5	4	2	5	3	2	5	2	2	5	4	2	2
3:00pm	4	2	5	1	2	5	3	3	5	4	5	3	5	1	5
4:00pm	5	2	5	4	2	5	3	2	5	4	2	5	5	1	5
5:00pm	4	2	5	3	3	5	3	1	5	3	2	4	3	2	5

Table 2

Time	Monday			Tuesday			Wednesday			Thursday			Friday		
	Operators			Operators			Operators			Operators			Operators		
	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A
8:00am	3	3	2	4	5	3	5	4	5	5	5	5	4	5	5
9:00am	3	4	3	5	5	1	5	4	5	5	5	5	5	5	5
10:00am	5	4	4	5	4	2	4	3	5	5	5	5	4	5	5
11:00am	5	3	5	4	5	5	3	3	3	5	5	5	4	3	5
12:00pm	4	5	4	5	2	3	5	5	5	5	4	4	3	3	2
1:00pm	4	5	2	5	5	2	4	4	3	5	5	4	5	5	4
2:00pm	4	5	4	5	5	1	4	5	5	4	4	5	4	4	5
3:00pm	5	5	3	3	4	3	5	5	4	3	5	5	5	5	5
4:00pm	3	5	2	2	4	3	4	5	5	5	5	5	4	5	4
5:00pm	5	5	5	5	4	3	5	5	5	3	4	3	4	4	4

DATA ANALYSIS

Data were collected at specific location that is the hostel and library area of Lagos State University, Epe every 1 hour for the period of ten (10) days, five (5) days at each location. The data were analyzed as shown in tables and figures below, which were further transformed into network bars angle formation to determine the frequency of the occurrence of the network bars using the expression below (Adu, 2004):

$$SS_{GSM} = \frac{360n}{N}$$

Where SS_{GSM} is the GSM signal strength in degrees, n is the number of a network service bars that appears at the instance of measurement and N is the total number of network service bars in ten (10) days for each operator.

Before transforming the GSM network service bars obtained into angle information, data obtained is too large and the analysis will be cumbersome, hence the data is grouped. The assignment of the data are as follows, let A = 5 bars while B, C, D, and E be equal to 4, 3, 2, and 1, respectively.

TABLES AND GRAPHS

Table 1 and 2 are reduced to a more accessible table using the assign letters to represent service bars, which are shown below. Tables 3 and 4 use compressed data from Tables 1 and 2, therefore for the simulation, assign for bars 1, 2, 3, 4, and 5 are letters, E, D, C, B, and A. respectively.

Table 3

SS	Monday			Tuesday			Wednesday			Thursday			Friday			Total		
	Operators			Operators			Operators			Operators			Operators			Operators		
	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A
A	2	1	9	0	0	10	1	0	10	0	1	8	3	0	8	6	2	45
B	4	0	1	4	0	0	3	0	0	5	1	1	2	2	1	18	3	3
C	3	0	0	3	4	0	6	5	0	3	3	1	5	2	0	20	14	1
D	0	8	0	1	5	0	0	2	0	2	4	0	0	4	1	3	23	1
E	1	1	0	2	1	0	0	3	0	0	1	0	0	2	0	3	8	0
Total	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	50	50	50

Table 4

SS	Monday			Tuesday			Wednesday			Thursday			Friday			Total		
	Operators			Operators			Operators			Operators			Operators			Operators		
	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A
A	4	6	2	6	5	1	5	5	7	7	7	7	3	6	6	25	29	23
B	3	2	3	2	4	0	4	3	1	1	3	2	6	2	3	16	14	9
C	3	2	2	1	0	5	1	2	2	2	0	1	1	2	0	8	6	10
D	0	0	3	1	1	2	0	0	0	0	0	0	0	0	1	1	1	6
E	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Total	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	50	50	50

Table 5

SS	Monday			Tuesday			Wednesday			Thursday			Friday			Total		
	Operators			Operators			Operators			Operators			Operators			Operators		
	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A	G	M	A
A	6	7	11	6	5	11	6	5	17	7	8	15	6	6	14	31	31	68
B	7	2	4	6	4	0	7	3	1	6	4	3	8	4	4	34	17	12
C	6	2	2	4	4	5	7	7	2	5	3	2	6	4	0	28	20	11
D	0	8	3	2	6	2	0	2	0	2	4	0	0	4	2	4	24	7
E	1	1	0	2	1	2	0	3	0	0	1	0	0	2	0	3	8	2
Total	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	100	100	100

The table above represents summary of Tables 3 and 4, for the simulation assign. For bars 1,2,3,4 and 5 letters E,D,C,B and A respectively.

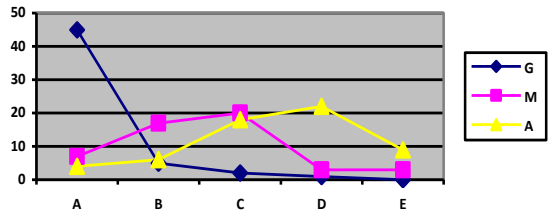

Figure 1: Graph for Table 3.

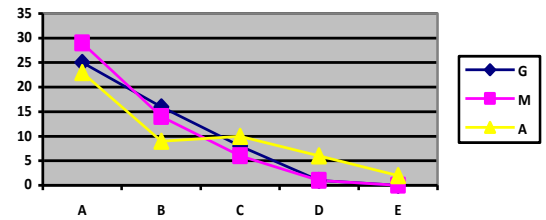

Figure 2: Graph for Table 3.

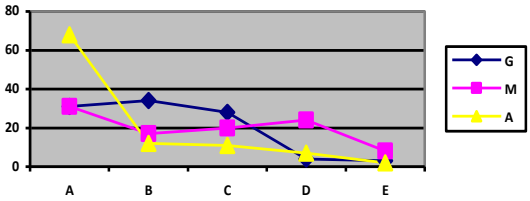

Figure 3: Graph for Table 5.

Table 6 below shows the signal strength angle calculation, derived using the formula:

$SS_{GSM} = 360n/N$

Table 6

S.S.	Operators				
	G	M	A	a = G+M+A	a^0
A	31	31	68	130	156
B	34	17	12	63	75.6
C	28	20	11	59	70.8
D	4	24	7	35	42
E	3	8	2	13	15.6
Total	100	100	100	300	360

RESULTS, INTERPRETATION, AND ANALYSIS

The result obtained in the exercise for the first five (5) days at the hostel area is shown in Table 1 while for last five (5) days at the library is shown in Table 2, Table 3 and Table 4 were obtained by grouping the number of occurrence of the network service bars, each of the network service was counted based on the number of appearance noted and presented in the tables while Table 5 is an addition of network service bars column wise from Table 3 and 4 which specify the frequency of occurrence of the network service bar for the period in which the exercise was conducted. Table 6 shows how the network bars is transformed into network service bar angle information using the above equation.

CONCLUSION

GSM signal strength has been investigated in Lagos State University, Epe, Lagos State, Nigeria for a period of ten (10) days. Total of 300 observations were made, 100 samples for each operator. Through this study 4 bars and 5 bars appeared were made more frequent, which is sufficient to meet up with the subscribers requirement in Epe town, but as the number of subscribers increases, more BSTs should be added.

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