INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN: 2278 – 0211 (Online)

Performance Evaluation of Service Quality of GSM Network Provider in Lagos, South-West Nigeria.

Omasheye Okiemute Roberts
M.Sc student, Department of Physics, University of Benin, Edo State, Nigeria
Dr Kolagbodi Eguriase Rowland
Senior lecturer ,Department of Energy/Petroleum studies, Novena University, Ogume, Delta State, Nigeria

Abstract:

In this research, a performance evaluation of a GSM Network provider was carried out in Lagos, South-West Nigeria. The research is aimed at evaluating the Quality of Service (QOS) provided by a GSM Network Operator in relation to the standards specified by Nigerian Communication Commission (NCC) which is the main regulatory body for telecommunication operations in Nigeria. The Network performance was evaluated on the bases of six major Key Performance Indicators (KPIs) i.e., Call drop rate(CDR), Handover failure rate(HFR), Handover success rate(HSR), Call complete rate(CCR), Call setup success rate(CSSR) and Call setup failure rate(CSFR).

The result of the research showed that the GSM Network provider failed to achieve the QOS benchmark setup by NCC in all the KPIs parameters measured.

Keywords: *GSM, Tele-density, Telecommunications, Quality of service, Call Drop Rate, Call setup success rate.*

1.Introduction

When Nigeria gained her independence in 1960, there were only 18,724 functional telephone lines for an estimated population of 45 million, which was a "Tele-density" ratio of 0.04 telephones per 100 people. During the thirty-odd years of military rule, there was very little by way of investment in telecommunications, and other sectors did not fare any better.

According to the International Telecommunication Union, by 1996 Nigeria's tele-density ratio was a mere 0.36.It rose slightly to 0.4 by 1999; according to the Nigeria Communication Commission (NCC). Nigeria's tele-density is a far cry from the African average of 1.67. Even the NCC admits that Nigeria has had a very limited telephone network for many years, and the waiting list is estimated at over 10 million people, who have applied to the incumbent monopoly, NITEL (established in 1985) for services.

However, with the liberalization of the telecommunication industry in 2001, the story changed dramatically. The tele-density ratio had tripled within just one year of GSM operation. By May 2005 Nigeria, with an estimated population of 128,771,988, had more than 9 million GSM subscribers, making the country one of the fastest growing GSM markets in the world. At the moment, there are four major GSM operators in Nigeria: MTN, AIRTEL, GloMobile and ETISALAT.MTN enjoy the greatest patronage, with over 4 million subscribers. It was predicted that between 2003 and 2006, Nigeria's GSM market would be Africa's fastest-growing mobile market, and this prediction had been fulfilled. The competition is getting fiercer by the day as operators have to compete desperately for the same potential subscribers.

Four years after the start of the GSM era in Nigeria, the focus is gradually shifting from providing coverage to providing quality service. The euphoria of owning a phone set is gradually giving way to complaints of dropped calls and congestion.

The operators are fast realizing that they are in a highly competitive environment where subscribers can make or break them. Dissatisfaction by subscribers gives rise to a high rate of subscriber churn and low revenue for the operator. The performance of the network has a direct impact on the revenues. The NCC is bringing pressure to the operators to step up the quality of service offered Nigerians and had even gone a step further to award contracts to private companies to conduct comparative analyses of the quality of service offered by each of the operators. The NCC is further threatening to sanction any operator that fails to pay attention to quality. It therefore behoves all the operators to ensure that the subscribers enjoy the best of service [1]

This research is aimed at evaluating the quality of service provided by a GSM Network Operator in Lagos, South-West Nigeria with emphasis on Handover failure rate, Handover success Rate, Call complete rate, Call setup success rate, Call setup failure rate and Call drop rate. The data for the evaluation of the above measured parameters will be obtained from field measurement using TEMS Investigation software. Thereafter, the result of the research will be compared with those specified by the Nigerian Communications Commission (NCC).

2.Methodology

The research was conducted using a drive test tool. The drive test tool used was Ericsson TEMS investigation software. The accessories required for Ericsson TEMS investigation tool include: a laptop, TEMS phone, GPS, and power supply unit (PSU). The laptop houses the operating system and the Ericsson TEMS software. The TEMS phone is used to initiate calls during the data collection. The GPS enables the system to locate the longitude and latitude of the place. The power supply unit provides the power required by the whole system.

The above mentioned drive test accessories were connected as shown in figure 1

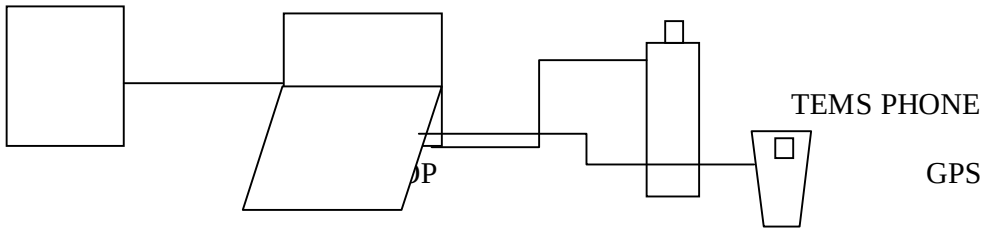

Figure 1. Schematic diagram of the experimental setup

3.Measurement Procedure

With the entire system above mounted on a vehicle, we drove through major roads of Lagos on routes covering the cell and all neighbouring cells. During the drive test, calls were initiated by the TEMS phone until it was established and the resulting key performance indicators (KPIs) of the Network such as Handover successes, Completed calls, Call setup successes, Call setup failures, dropped calls and many other Radio frequency parameters were recorded by the TEMS software.

The Key performance Indicators(KPIs) data obtained from field measurement using the TEMS Investigation Software is presented in table 1

Event Overview	
KPIs	**Count**
Number of Handover attempts	826
Number of Handover successes	786
Number of Handover failures	40
Number of call attempts	275
Number of call completed (Successful call end - to – end)	221
Number of dropped calls	11
Number of call setup	232
Number of blocked calls	43

Table 1: KPIs data obtained from field measurement

4.Results And Analysis

Based on the Call setup success rate, Call drop rate, Call setup failure rate, Handover success rate, Handover failure rate and Call complete rate parameters, the quality of the network were analysed using the following expression:

4.1.Call Setup Success Rate (CSSR)

In telecommunications, the call setup success rate (CSSR) is the fraction of the attempts To make a call that result in a connection to the dialled number.

The call setup success rate is one of the key performance indicators (KPI) used by the network operators to assess the performance of their networks. It is assumed to have direct influence on the customer satisfaction with the service provided by the network and its operator [3]. It is expressed in percentage as:

$$\text{CSSR} = \frac{\text{Number of Call setup}}{\text{Number of Call attempt}} \text{ x } 100\%$$

4.2.Dropped Call Rate (CDR)

In telecommunications, the dropped-call rate (DCR) is the fraction of the telephone calls which, due to technical reasons, were cut off before the speaking parties had finished their conversation and before one of them had hung up (dropped calls) This fraction is usually measured as a percentage of all calls [4]. It is expressed in percentage as:

$$CDR = \frac{\text{Number of Dropped Calls}}{\text{Number of Call Setup}} \times 100$$

4.3.Call Setup Failure Rate (CSFR)

This refers to the number of call setup failure divided by the total number of call attempts. It is also called the Blocking Probability and expressed in percentage as [5]:

$$CSFR = \frac{\text{Number of Blocked calls}}{\text{Number of Call attempt}} \times 100\%$$

4.4.Handover Success Rate (HSR)

Handover success rate refers to the percentage of handovers that are successfully completed out of the total handover requests made [6].It is expressed in percentage as:

$$HSR = \frac{\text{Number of Handover successes}}{\text{Number of Handover attempts}} \times 100\%$$

4.5.Handover Failure Rate (HFR)

Handover failure rate is important indicator to monitor mobility. Handover failure means that MS try to make a Handover (inter/intra cell) but for some reason it fails [7]. It is expressed in percentages as:

$$HFR = \frac{\text{Number of Handover failures}}{\text{Number of Handover attempts}} \times 100\%$$

4.6.Call Complete Rate (CCR)

These are calls that were successfully set up and received by the called party including the release failed calls [6].It is expressed in percentage as:

$$CCR = \frac{\text{Number of Call Completed}}{\text{Number of Call attempt}} \times 100\%$$

Using the formulas above, the values of the CSSR, CDR, CSFR, HSR, HFR and CCR is presented in table 2.

KPIs	**Values**
CDR	4.74%
HSR	95.16%
CSSR	84.36%
CSFR	15.64%
CCR	80.36%
HFR	4.84%

Table 2: KPIs Values

The Quality of service benchmark set up for Network Operators by Nigerian Communications Commission (NCC) [2] are presented in table 3.

Quality Parameter	**Target Value**
Call drop rate	2%
Handover success rate	98%
Call setup success rate	98%
Call setup failure rate	4%
Call complete rate	96%
Handover failure rate	2%

Table 3: NCC KPIs Benchmark

The comparison plot of the measured QOS Parameters and the QOS Benchmark setup by NCC is presented in figure 2.

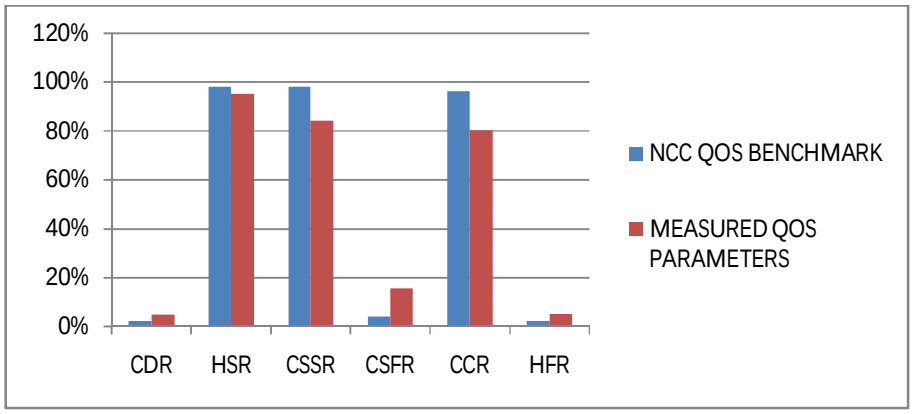

Figure 2: Comparison plot of NCC QOS Benchmark and Measured QOS Parameters.

5.Conclusion

In this research, the QOS Benchmark setup for GSM Network providers by NCC have been analysed with measured QOS Parameters of a GSM Network in Lagos, South-West Nigeria. The result showed that the GSM Network Operator failed to achieve the QOS Benchmark setup by NCC in all the KPIs parameters measured.

From the result of the research, there is need for system optimization of the investigated Network in order to improve the QOS in Lagos.

6.Reference

1. GIS and GSM Network Quality Monitoring: A Nigerian Case Study .Available from: http://www.directionsmag.com/articles/gis-and-gsm-network-quality-monitoring-anigerian-case-study/123278
2. Nigerian Telcos and the NCC Fine | Telecommunication in Nigeria .Available from: http://www.telecomsinnigeria.com/2012/06/nigerian-telcos-and-ncc-fine.html
3. Call Setup Success Rate - Wikipedia, the free encyclopedia. Available from: en.wikipedia.org/wiki/Call_Setup_Success_Rate
4. Dropped-call rate - Wikipedia, the free encyclopedia.Available from: en.wikipedia.org/wiki/Dropped-call_rate
5. Shoewu, O. and Edeko, F.O, 2011. Outgoing call quality evaluation of GSM network services in Epe, Lagos State. American Journal of Scientific and Industrial research.p 416.
6. QUALITY OF SERVICE - Communications Commission of Kenya.Available from:http://www.cck.go.ke/consumers/other_info/downloads/quality_of_servicefull.pdf
7. NSN - Performance Troubleshooting -CS - HO Failure v0.2 - Scribd.Available from:http://www.scribd.com/doc/104790770/NSN-Performance_Troubleshooting-CS-HO-Failure-v0-2