International Journal of Science and Advanced Innovative Research
ISSN: 2536-7315 (Print) 2536-7323 (Online)
Volume 4, Number 1, March 2019
http://www.casirmediapublishing.com

Effects of Temperature Variation on Quality of Signal Reception of Direct Broadcasting Satellite (DBS) System in some selected towns of Nasarawa State, Nigeria

*[1]Ndanusa, B., [2]Loko, A. Z. & [3]Kwaha, B, J.
[1] Department of Physics, Ibrahim Badamasi Babangida University, Lapai, Niger State,
[2] Department of Physics, Nasarawa State University, Keffi, Nasarawa State.
[3] Department of Physics, University of Jos, Plateau State, Nigeria
*Email: bndanusa@ibbu.edu.ng, bndanusa@gmail.com

ABSTACT

This research work examines the effects of variation in temperature on signal reception of Direct broadcasting satellite (DBS) on Ku-Band in some selected towns in Nasarawa State, Nigeria. Data used were obtained through experimental approach of recording both relative humidity and the quality of signal received from DBS at 12.517GHz at regular interval of one hour covering two climatic conditions (Rainy and Dry seasons) in 2018. The data obtained from field was used and daily and monthly averages were evaluated. The result showed a consistence in the values of temperature across the three towns (Akwanga, Keffi and Lafia) under study largely to the fact they lie within same coordinates. All the towns experience gradual rise in temperature value as the hours of the day progresses and declined again as night falls, largely due the absence of solar energy radiation at night. While, this was observed, the quality of signal reception reduces from its highest value in January to its lowest value in month of August. The result showed that, the state has temperature values of 38°C and 23°C as high and low values respectively. The averaged value for the whole states showed a weak negative correlation coefficient value of -0.298 and coefficient of determination (R^2) value of 0.077 when fitted into linear regression between temperature and the quality of signal reception within the study area
Keyword: Temperature, direct broadcasting satellite, signals reception quality, Akwanga, Keffi and Lafia.

INTRODUCTION

Weather and climate affect day-to-day activities and lifestyles from the clothes we wear to the buildings we design, the food and energy we produce and consume. Climate-environment relationship and impacts on human activities are predicted to change dramatically if global warming accelerates at the rates currently proposed. One of such impact is on satellite TV signal distortions as well as video quality and clarity (Ikuomola, 2011). Changes in the weather condition affect the quality of the satellite television signal reception though this occurs rarely, and lasts only a short period (Wole, 2015 & Nweke, 2017). For the majority of users, it is heavy rains that can attenuate signal enough to result in noticeable degradation of image quality. In extreme cases, the reception can be effectively disrupted. The level of concern about the possibility of signal degradation/loss in a particular area depends on (i) regional yearly rainfall figure, (ii) location in the satellite footprint and (iii) height of the satellite above the horizon. (Ezekoye, 2007) noted that radio waves which are the ultimate wave used in telecommunication suffer lots of disturbances as a result of the irregular behaviour of the ionosphere which is caused by erratic solar radiation from the sun. Direct broadcasting satellite service refers to the satellite television (TV) systems in which the subscribers or end users receive signal directly from the geostationary satellite orbit (GEO) dedicated for such purposes. These signals are broadcast in digital format at microwave frequencies (Elbert, 2008). The service providers make use of satellite link to transmit their signal to the entire world through space known as atmosphere consists of a mixture of ideal gases with molecular nitrogen and oxygen as

International Journal of Science and Advanced Innovative Research
ISSN: 2536-7315 (Print) 2536-7323 (Online)
Volume 4, Number 1, March 2019
http://www.casirmediapublishing.com

predominant in volume, while carbon-dioxide, water vapour and ozone as minor constituents play crucial roles, is the thin layers of gases, commonly referred to as air that surround the earth and retained by the earth's gravity; seals the planet and protects us from the vacuum and electromagnetic radiations given off by the sun (David, 2010). Radio wave propagation is influenced by the properties of the earth and the atmosphere. The curvature of the earth and the condition of the atmosphere can refract electromagnetic waves either up, away from, or down toward the earth's surface (Adediji, 2014). The ionosphere reflects transmitted radio frequency waves back to Earth.

Materials and Methods

The equipment used for this work includes: HTC RH data logger for recording the values of temperature as shown in figure 1 and a complete set of direct-to home satellite kit (Antenna, signal Decoder and Scopes) shown in figure 2and 3 for the observation of the signal responses as a result of variation in solar radiation.

Figure 1: Temperature and Relative Humidity Data Logger

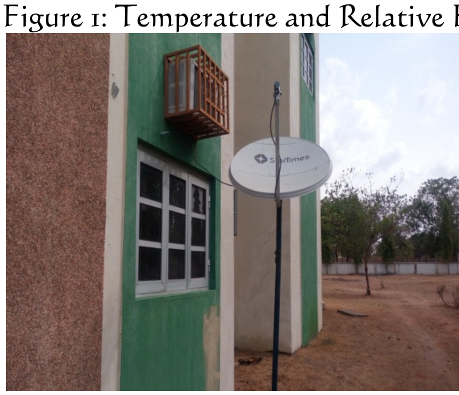

Figure 2: Parabolic Antenna

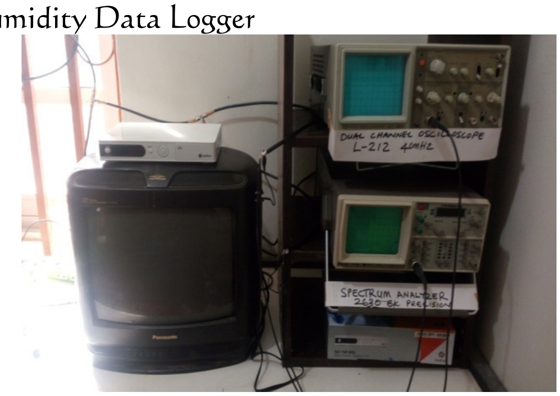

Figure 3 TV setup for observation

The experimental approach was adopted in which both temperature and signal reception pattern were recorded and regular interval of one hour for whole year. The work deployed experimental as well as statistical methods in the analysis. The data used were obtained from field and Nigeria Meteorology Agency (NiMet).
Nasarawa state is located in the North central region of Nigeria as shown in figure 4 with three major towns of Keffi, Akwanga and Lafia whose coordinates are as shown in table 2 choosing as the study area.

International Journal of Science and Advanced Innovative Research
ISSN: 2536-7315 (Print) 2536-7323 (Online)
Volume 4, Number 1, March 2019
http://www.casirmediapublishing.com

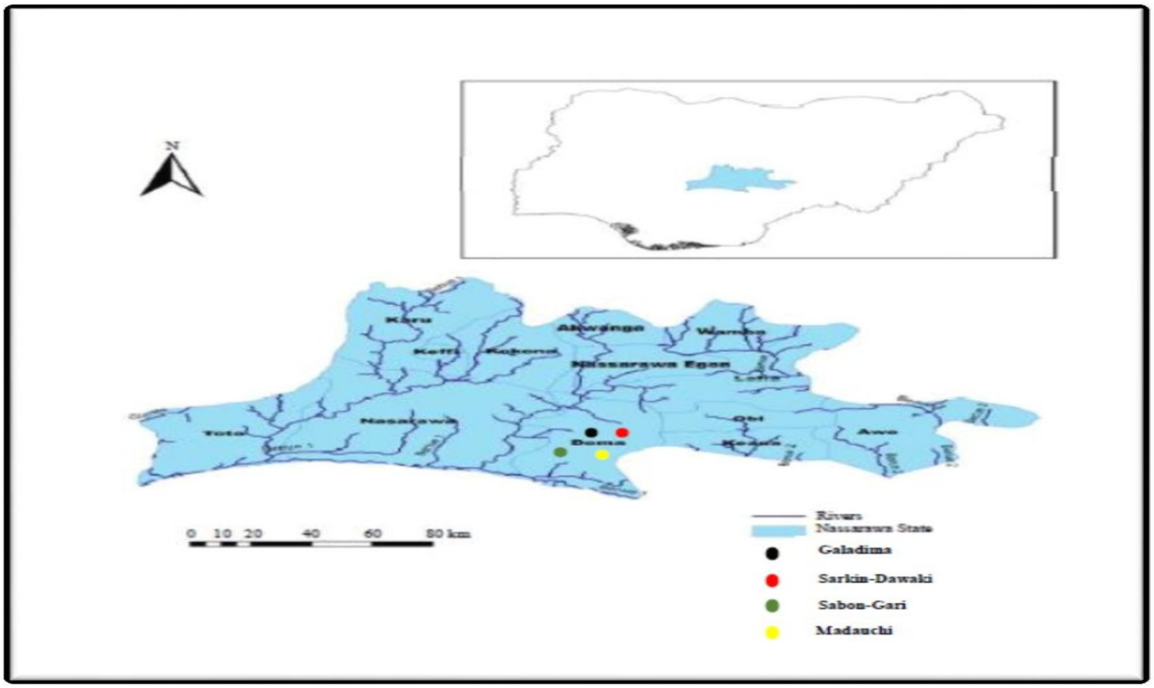

Figure 4: Map of Nigeria showing Nasarawa State the study area

Table 2: Towns and Coordinates of the study area

STATE	TOWN	LOCATION	ALTITUDE(m)
NASARAWA	Akwanga	8.917°N / 8.367°E	359
	Keffi	8.843°N / 7.871°E	338
	Lafia	8.492°N / 8.517°E	290

(Nimet, 2015).

RESULTS

The results obtained were as depicted in the figures listed. The average monthly values of temperature and signal quality over the study area are as shown in Figure 5 and 6 respectively, while, Figure 7 shows the hourly daily record of the variations recorded between 31st May, 2017 and 3rd June, 2017, while Figure 8 shows the average monthly record for the variation experienced and Figure 9 depicts the overall average value for the state. Figure 10 shows the correlation between the averaged values of the temperature and the signal quality

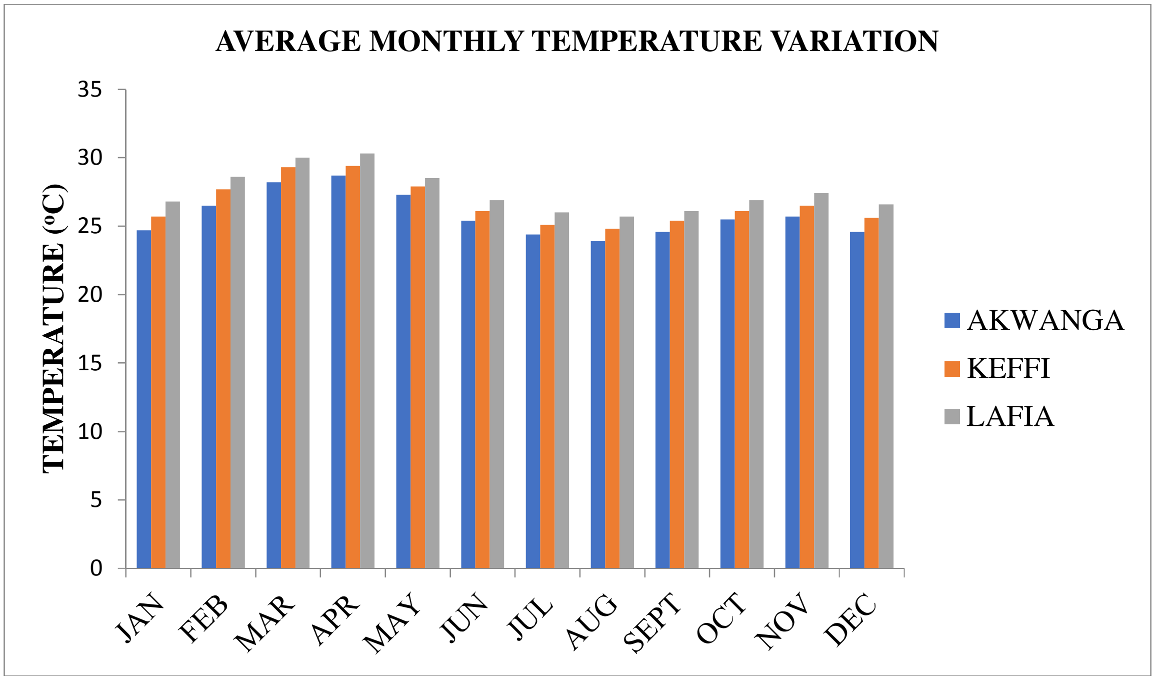

Figure 5: Average monthly variation in the temperature of the study area

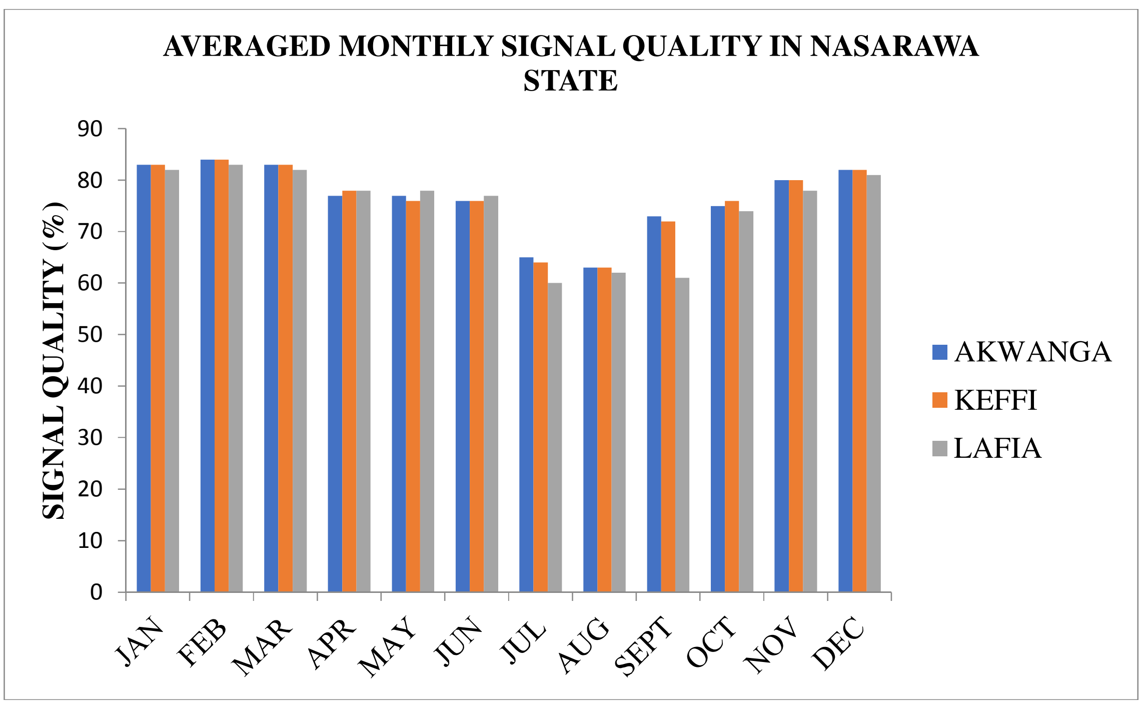

Figure 6: Average monthly variation in the signal quality of the study area

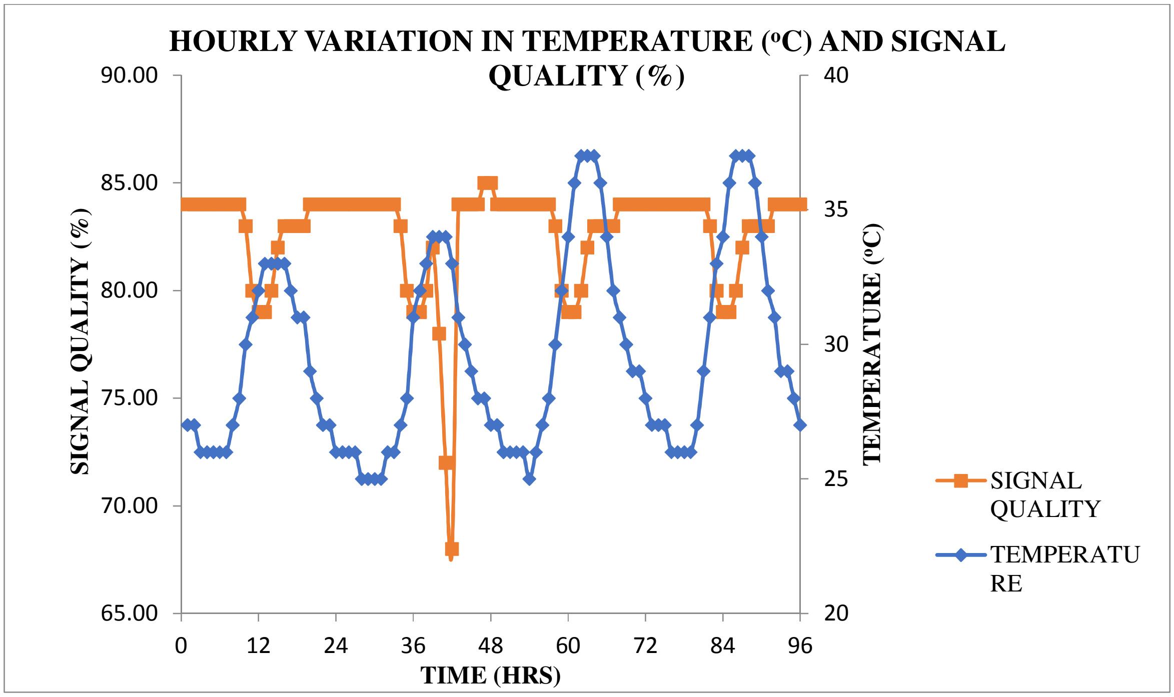

Figure 7: Hourly daily record of the temperature variations recorded between 31st May, 2017 and 3rd June, 2017

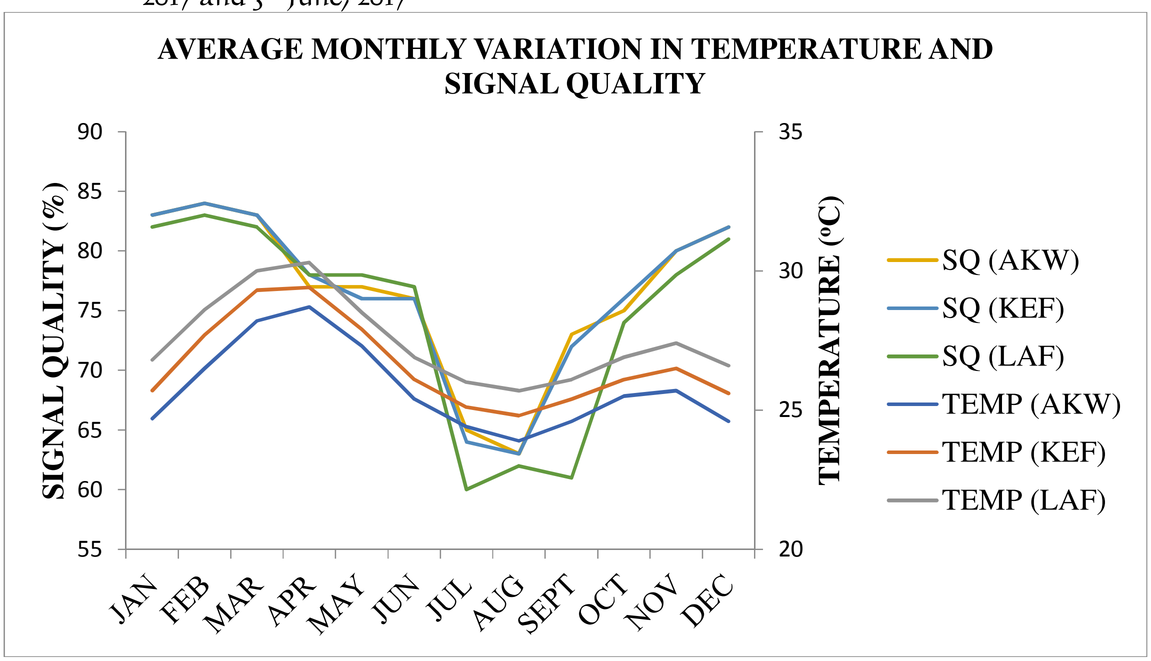

Figure 8: Average monthly variation in Temperature and the signal quality in of the study area

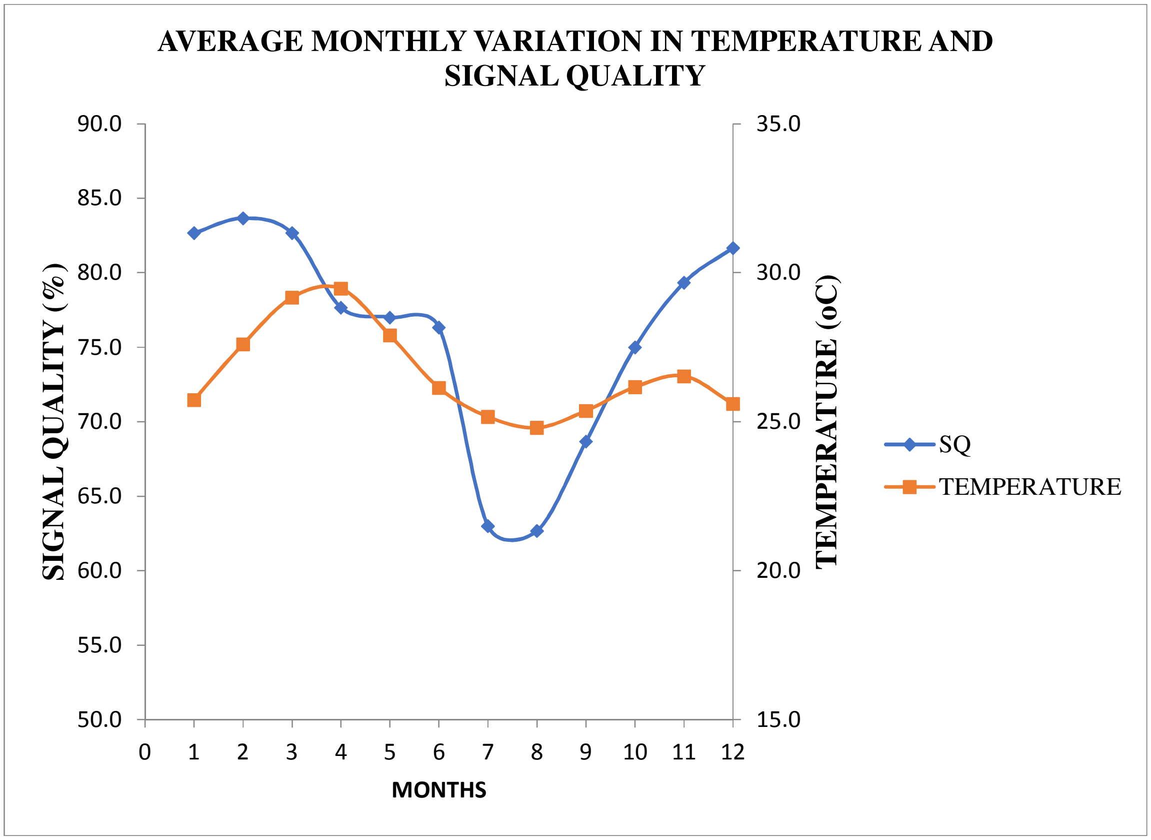

Figure 9: Average monthly variation in Temperature and the signal quality in the State

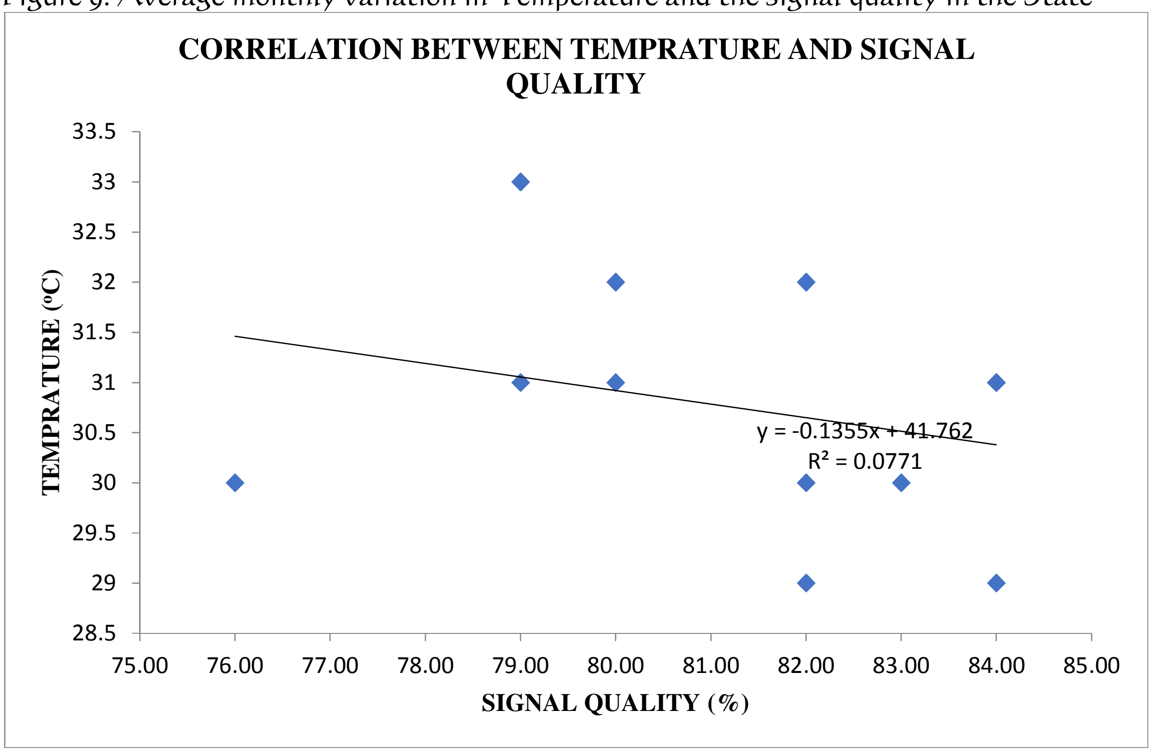

Figure 10: Correlation between the averaged values of temperature and the signal quality

DISCUSSION

The result obtained from the field shows that all areas under study have temperature variation that ranged between 17°C and 39°C spread over the whole year as minimum and maximum values respectively. Figure 7 shows that a rise in temperature in daytime between 12 noon and 4pm daily shows a slight fall in the quality of signal received and as the temperature value get lowered either in early hours of day or in night, the quality of signal received increases. The trend observed shows that temperature variation results into a variation in quality of signal received. This trend is also exhibited in Figure 8 and 9, though there exist some abnormalities seen intermittently, this is not as a result of variation in temperature that resulted into such sharp drop in the quality of signal received, but could be attributed to other factor(s) not under consideration as a variable e.g. rainfall, relative humidity, atmospheric pressure etc. Figure 10 shows that there exists a linear regression with R^2 value of 0.077 when fitted into a linear line of best of fit of relation $y = -0.135x + 41.76$ with temperature and signal quality as dependant and independent variables respectively. The best fit relation shows a negative slope trend implying that the relationship between the two parameters under observation shows an inverse correlation between them (i.e. the higher the temperature, the lower the percentage of the signal quality received, within the limit of temperature variation). The correlation between the two parameters has a negative correlation coefficient of -0.298 and by implication means a weak correlation.

CONCLUSION

The trend of the results obtained shows that there exists a negative correlation between these parameters (i.e. temperature and signal quality). As the temperature increases, the quality of signal received decreases. This feature was observed in all the locations of the study area. The correlation coefficient (r) and coefficient of determination (R^2) were -0.289 and 0.077 respectively. The value obtained shows a very weak correlation between the two parameters. Conclusively, the result obtained and analyzed shows that variation in temperature has 7.7% effect on the signal reception.

REFERENCES

Adediji, A. T., Mandeep, J. S. and Ismail, M. (2014). Meteorological Characterization of Effective Earth Radius Factor (*k*-Factor) Wireless Radio Link over Akure, Nigeria. *Metrology Society of India* 29 (2): 131-141

David, G. A. (2010). An Introduction to Atmospheric Physics, 2nd editition, Cambridge University Press, Edinburgh, UK, Pp 1- 2.

Elbert, B. R. (2008). Introduction to Satellite Communication, 3rd Edition, Artech House, Boston London.

Ezekoye, B. A. & Obodo R. M. (2007). The effects of solar radiations on Telecommunications, *the Pacific Journal of Science and Technology (PJST), 8(1): 109 – 117.*

Ikuomola AJ (2011). Wireless communication II; Course work developed for the National Open University of Nigeria, Lagos 6-140.

Nweke FU (2017). The effect of weather and fading rate in television transmission and reception. *Middle-East Journal of Scientific Research*. 25(10):1872-1875.

Wole O (2015). Digital TV talk: Why your TV signals are affected by rain. Eagle Online Newspaper, accessed 17th April 2018 @ The Eagle Online; 2015.