Comparative Coverage Area Analysis of Selected TV Stations in an Urban Environment in Nigeria

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Abstract

Television broadcasting is one of the means of disseminating information to the public in every nation of the world. This work is aimed at comparing coverage areas of selected TV stations in an urban environment. In this work, two TV stations were considered for investigation and it involves the measurements of the field strength from these broadcasting stations. The field measurement took place in an urban propagation scenario in Abuja at 645.00MHz (station 1) and 698.00MHz (station 2). The measurements were taken for each TV station with a handheld RF field strength spectrum analyzer and a Garmin 72H GPS receiver. The field strength values were used to classify the environment under investigation into primary, secondary and fringe areas. Furthermore, signal strength coverage contour was created using ArcGIS 10.2 and overlaid on the digitized map of Abuja to show the extent of signal coverage exhibited by these TV stations in Abuja.The result form these research work shows that Television coverage in Abuja exhibited by these TV stations under investigation is insufficient as they may need antenna boosters.

Keywords: **Television, field strength, coverage areas, contour, antenna boosters.**

1.Introduction

The television broadcasting system is one of the means of disseminating information to the public in every nation of the world. With the advent of television broadcast system, audio and video signals can be received by a wide range of people through standard TV receiver. In the television broadcast industry, the quality of service rendered within its coverage area is of paramount and crucial importance to the end-user. Therefore, coverage assessment and analysis are important as they provide broadcasters, regulatory agencies and end-users with information on television coverage *(Gosh et al, 2012)*. Coverage area is a region where a radio or any transmitted signal can be received. Coverage areas are classified into primary, secondary and fringe coverage areas as reported by *(Ajayi and Owolabi, 1979)*. Television stations broadcast programmes through radio signals. These signals are beamed from the station's transmitting antenna at considerable height above earth surface and received by a receiving antenna *(Irina,*

2006; Chrysikoset et al., 2009; Emmanuel et al., 2009).

The radio wave propagation or pathloss models, the properties of the base station and the properties of the mobile station are required to calculate the radio coverage area for a chosen base station *(Chhaya, 2012)*. The fundamental principle in the design of any wireless communication system is the design of transmission

2. Materials and Methods

i. **Field Strength Measurement:** In this paper, we investigated the extent of TV coverage using two TV stations. The field strength from these TV broadcasting stations were measured along five different routes, starting from each of the broadcasting stations. The measurement were taken with the aid of a handheld RF field strength spectrum analyzer and a Garmin 72H GPS receiver. The spectrum analyzer gave the signal strength value in dBuV while the GPS gave the coordinates of the sample points.

ii. **Classification of Coverage Areas**: For the tremendous and significant roles played by Television broadcasting to the generality of the

strategy that will optimize the coverage and minimize interference *(Faruk et al,2013)*. The development of efficient transmission, operation and management of wireless system technologies requires a greater precision on the estimation of the system signal. This is usually done in order to obtain total coverage.

The methodologies adopted in this work are as follows:

people of a nation, researchers are in continuous research work to determine the actual coverage area of broadcasting stations and the level of signal variability with distance from transmitting stations. A coverage area is a region where a radio or any transmitted signal can be received. The field strength values obtained from measurements were used to classify coverage areas into primary, secondary and fringe areas. The primary coverage area corresponds to areas with at least a received field strength value of 40dBµV. The secondary coverage area corresponds to areas where field strength is between20dBµV and 39dBµV inclusive, while the fringe

coverage area corresponds to areas with field strength less than 20dBμV *(Ajayi and Owolabi, 1979)*. The classification into grade of service were used to plot pie charts as depicted in figures 1 – 10.

iii. **Development of a Contour Map**: A contour map is defined as a line that runs along points of equal elevation or values. It is another means through which radio signal information could

be predicted *(Andreas et al., 2012)*.In doing this, areas with the same signal strength can be easily seen when overlaid on a map. To achieve this, ArcGIS 10.2 software was deployed. Figures 11 and 12 shows the digitized map of Abuja showing station 1 signal coverage contour and station 2 signal coverage contour overlaid respectively.

3. Results and Discussion

3.1 Data Analysis

Coverage Classification: The classification into grade of service were used to plot pie-charts as shown in figures 1-10.
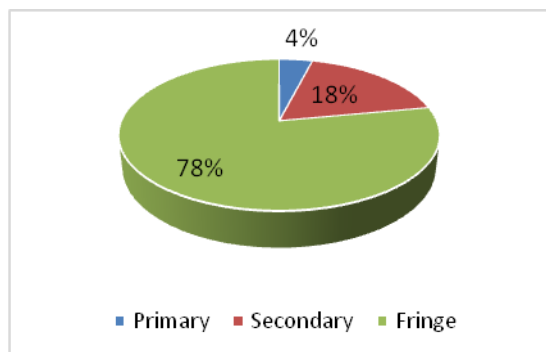
Coverage analysis for route 1

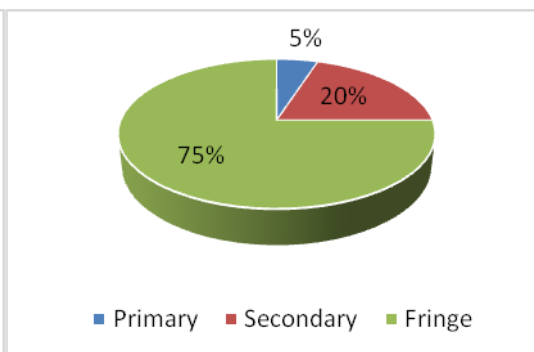**Figure 1:** Coverage analysis for station 1   **Figure 2:** Coverage analysis for station 2

Coverage analysis for route 2
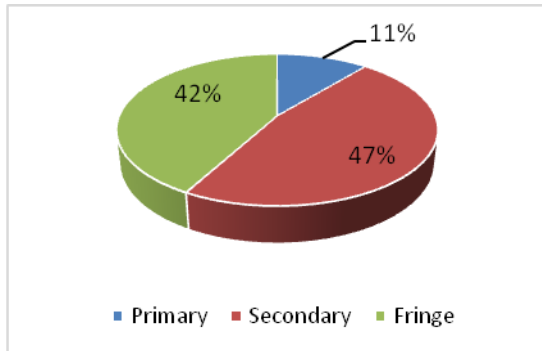

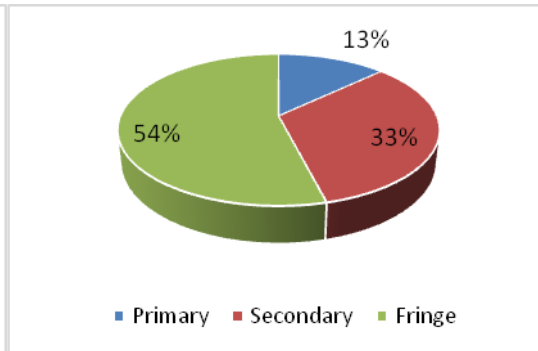**Figure 3:** Coverage analysis for station 1

Figure 4: Coverage analysis for station
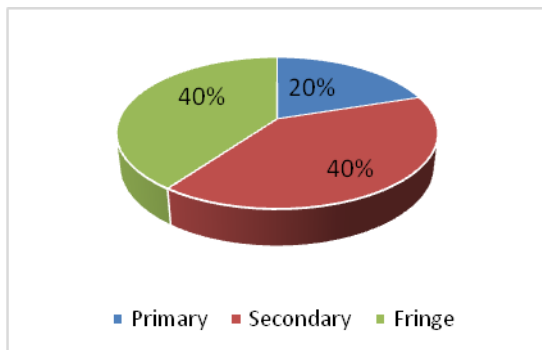
Coverage analysis for route 3

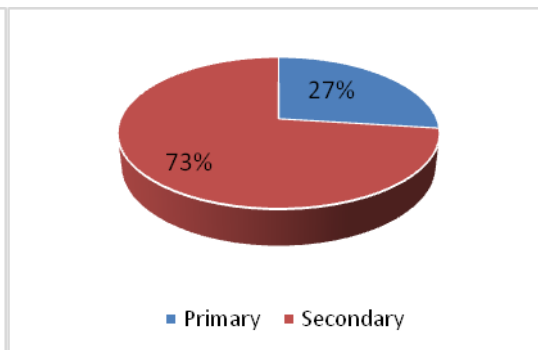**Figure 5:** Coverage analysis for station 1

Figure 6: Coverage analysis for station 2

Coverage analysis for route 4
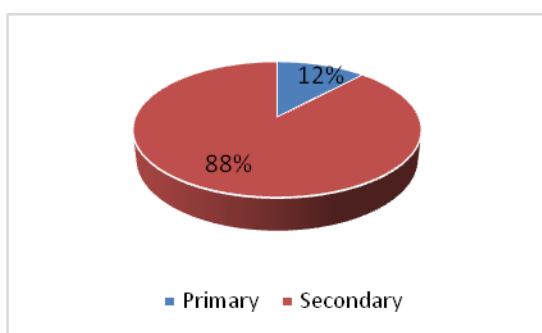

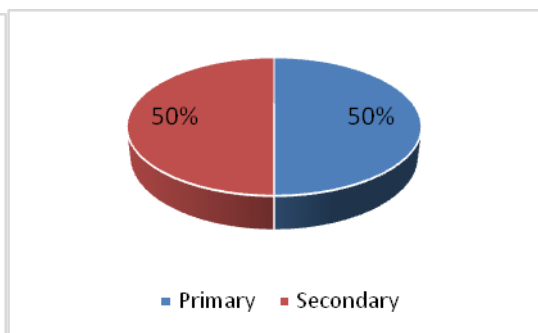**Figure 7:** Coverage analysis for station 1

Figure 8: Coverage analysis for station 2
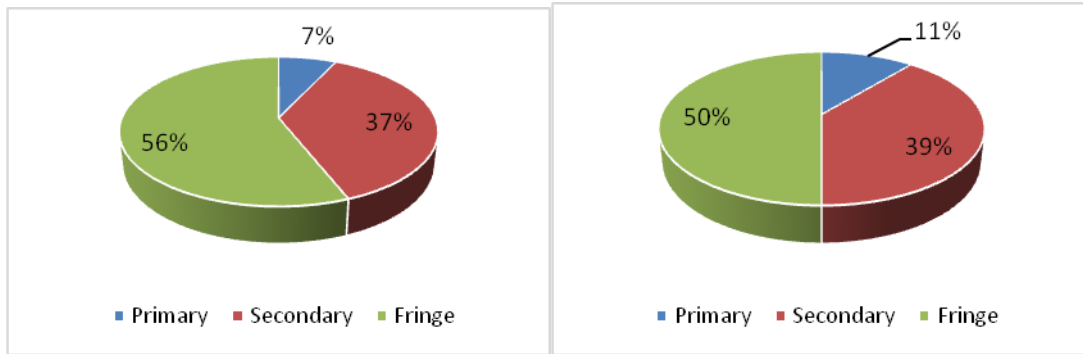
Coverage analysis for route 5

Figure 9: Coverage analysis for station 1   **Figure 10:** Coverage analysis for station 2

Coverage Contour Maps: The signal coverage contour overlaid on digitized map of Abuja are shown in Figures 11 - 12.
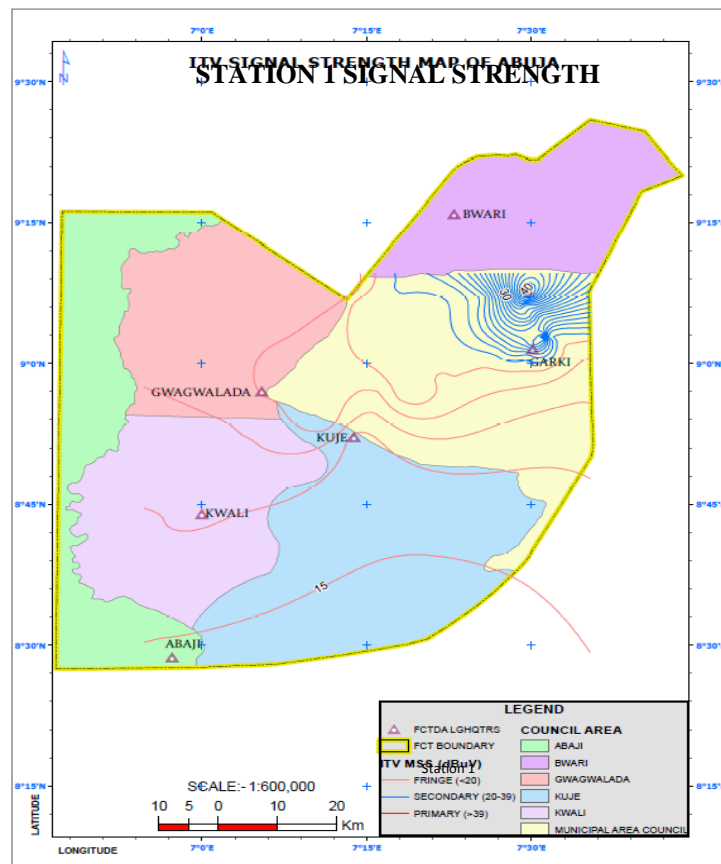

Figure 11: Digitized map of Abuja showing station 1 Signal coverage contour overlaid.
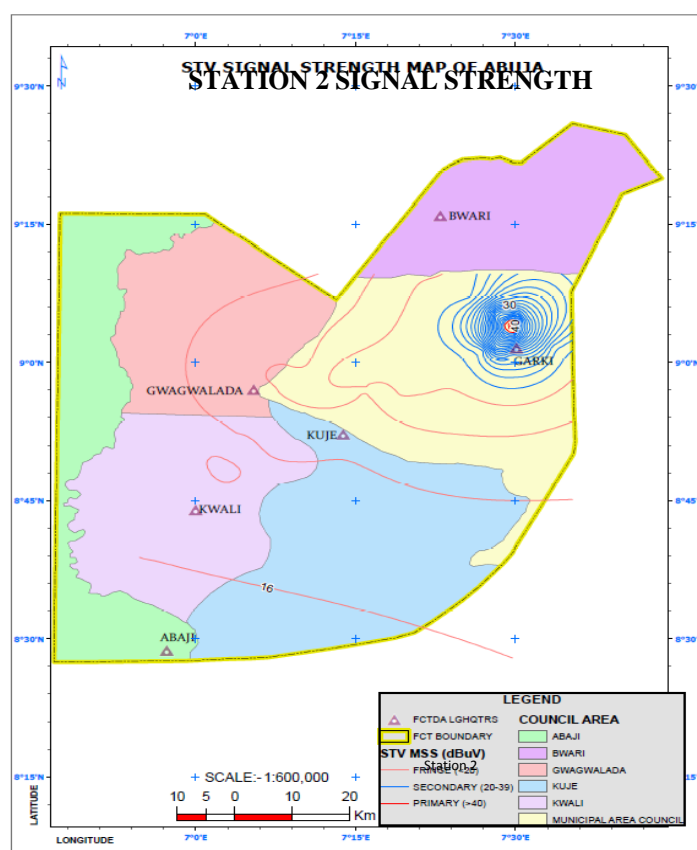
Figure 12: Digitized map of Abuja showing station 2 Signal coverage contour overlaid.

3.2 Discussion of Results

This research work is aimed at investigating Television coverage at 645.00MHz and 698.00MHz in a metropolitan environment. To achieve this, the field strength from the two TV stations were measured along five routes. A handheld RF field strength meter which gives signal strength values in dBμV was used in addition to a GPS receiver, which give the coordinates of the sample points. The field strength values obtained were used to categorize coverage areas into primary, secondary and fringe coverage areas.

Furthermore, contour maps were developed with the aid of ArcGIS 10.2 and overlaid on the map of Abuja to show the extent of signal coverage exhibited by the TV stations under investigation.

Conclusion

The results of this coverage assessment and analysis shows that the TV stations under investigation do not adequately cover Abuja. Hence, they may need antenna boosters. Therefore, coverage assessment and analysis are important as they provide governments, broadcasters, regulatory agencies, radio engineers and end users with information on Television coverage. This information will enable broadcasters to ascertain the portion of the population that have access to Television services.

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