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Determination and Classification of Coverage Areas of Terrestrial UHF Television Transmitters inOndo State, Nigeria.

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Abstract:*The electric field strength values of the transmitters of the Ondo State Radiovision Corporation (OSRC), Akure (CH 23, 487.25 MHz); OSRC, Oka Akoko, (CH 25, 503.25 MHz); and OSRC, Okitipupa, (CH 27, 519.25 MHz); were measured radially along several routes with the transmitting stations as references using a digital signal level meter. A hand held Global Positioning System (GPS) receiver was used for determining the geographic coordinates as well as the line of sight of the various data points from the base stations. Data were taken across the eighteen Local Government Areas of the State as far as road accessibility permits using a field vehicle with the receiving antenna attached. Data obtained were used to determine and classify the various grades of coverage as well as the towns and villages within the coverage zones. Surfer 8 software was used to generate the contour maps of the electric field strength of the signals over the Landmass. Coverage areas of 50.5%, 9.0% and 8.0% were determined for UHF Channels23, 25 and 27 respectively. The combined coverage areas for the three stations was 67.5% with 17.5% within the primary, 34.5% within the secondary and 15.5% within the fringe coverage areas, whereas 32.5% of the land mass was not serviced by any of the stations.The overall result of this research showed that the present configurations of the transmitters gave a significant coverage of the state. However, the stations need to upgrade their transmitting equipment to enhance optimum coverage and by extension the socio-economic activities of the people.*

Keywords:*Coverage Areas, Electric Field Strength, Transmitters and U.H.F.*

I. Introduction

The business of television broadcasting has been the exclusive rights of both the state and federal governments in Nigeria. However, in the last two decades the federal government of Nigeria opened the business to private investors and individuals [10]. Presently, there are about 250 terrestrial television stations in Nigeria, both private and government owned, with about 60% of them on the UHF band[7].In view of the importance of television broadcasting to the socio-economic development of the populace and the competition in the business in Nigeria, viewer's interest has grown from just watching anything on screen to qualitative, clean and sharp signals on television screen [5]. Based on this premise, researchers have continued to carryout work to determine the actual coverage areas of some broadcasting stations, their optimum signal level within the areas they are designed to cover [1], and the different grades of coverage servicing the people. Furthermore, much work had been done on the A.M radio signals in this regard [1] being the first generation radio stations in Nigeria [2]. Few works had also been done on the F.M Signal [3] and little work had been done on the television signals in Nigeria, [4, 5] thus the motivation for this work. The field strength of an antenna's radiation at a given point in space, is equal to the amount of voltage induced in a wire antenna 1m long located at that given point [9]. This field strength is affected by a number of conditions such as the time of day, atmospheric conditions, transmitter-receiver distance, transmitter power [9] and others like, terrain effect, transmitting and receiving antenna height, and the gain of the transmitting antenna [9].

Coverage Area for Broadcast Channels**;** This is the distance away from the transmitter in which the transmitted signal; voice(audio) and picture(video) for television and voice alone for radio can be received by the viewer or listener with the aid of a receiving antenna. All stations have their expected coverage areas and their signals should not constitute interference to others [10]. Coverage areas are classified into three [1] namely:

Primary Coverage Area: This is defined as a region about the transmitting station in which the electric field strength is strong enough to override ordinary interference at all times.The signal strength is dependable and could be received clearly with or without the use of an active antenna. This corresponds to the area where the signal strength is at least 40dBμV in this study.

Secondary Coverage Area: In this region about the transmitting station, the signal strength is often sufficient to be useful but not strong enough to override ordinary interference at all times. The use of an active receiving antenna may be needed for a clean reception [5]. This corresponds to the area where the signal

strength of at least 20dBµV but less than 40dBµV was recorded in this study. Fringe Coverage Area: In this region about the transmitting station, the signal strength is weak and not dependable; its service can neither be guaranteed nor be protected against interference [1].The use of an active receiving antenna may not bring about a clean reception at all times. This corresponds to the area where the signal strength is at least 15dBµV but less than 20dBµV.

Study Area;Ondo State is located in the South West geo-political zone of the Nigeria, with Akure as the State Capital. It was carved out of the old Western Nigeria on February 3, 1976. Though, the present Ekiti State, Nigeria, was carved out of the State on October 1st, 1996. The State has eighteen local government areas and lies between latitude $7^0$10'north and longitude 5^0,05' east with a landmass of 15,300km^2. It has a population of 3,440,000 (2006 Nigerian Census) and a population density of 220/km^2. The State is the largest producer of cocoa, and the fifth producer of crude oil in Nigeria. It has three major divisions- Ondo North, Ondo Central and Ondo South. Fig. 1 shows the location of Ondo State on the map of Nigeria.

Fig.1: Location of Ondo State on the map of Nigeria (Source: www.wikipedia.com)

II. Materials and Methods

Table 1, presents the characteristic of the experimental stations, while fig. 2 presents the digitized map of Ondo State showing the local government areas where electric field strength measurements were carried out.

Table 1: Characteristic of the Experimental Stations.

S/N	PARAMETER	OSRC, AKURE.	OSRC, OKA AKOKO.	OSRC, OKITIPUPA.
1	Base Station's Geographic Coordinate	Lat. 7.30^{0}N, Long. 5.16^{0}E	Lat. 7.45^{0}N, Long. 5.80^{0}E	Lat.6.55^{0}N, Long. 4.75^{0}E
2	Base Station Carrier Frequency /Channel	487.25 MHz/UHF 23	503.25MHz/UHF25	519.25 MHz /UHF 27
3	Base station Transmitting Power (W)	16,000	200	450
4	Transmitter	Harris 40kW UHF Sigma Diamond Drive	EMCEE TV 1000 F/A	EMCEE TV 1000 F/A
5	Height of Transmitting Mast (m)	333.00	121.90	134.10
6	Transmitting Antenna Gain (dB)	31.70	1.00	1.00
7	Height of Receiving Antenna (m)	1.83	1.83	1.83

2.1 Instrument and materials used.

The electric field strength meter used for measurement was the Dagatron TM 10 type with signal level range of 15-120 dBµV and frequency range of 5-852 MHz. The GPS receiver used for measuring the geographic coordinates and the monitoring of line of sight was the GARMIN Map-76 personal navigator type. Other instrument used were; a field car, connectors, coaxial cables, dual dipole receiving antenna and an administrative map of Ondo State for directions. Figures 3a and 3b present the digital field strength meter and the GPS receiver.

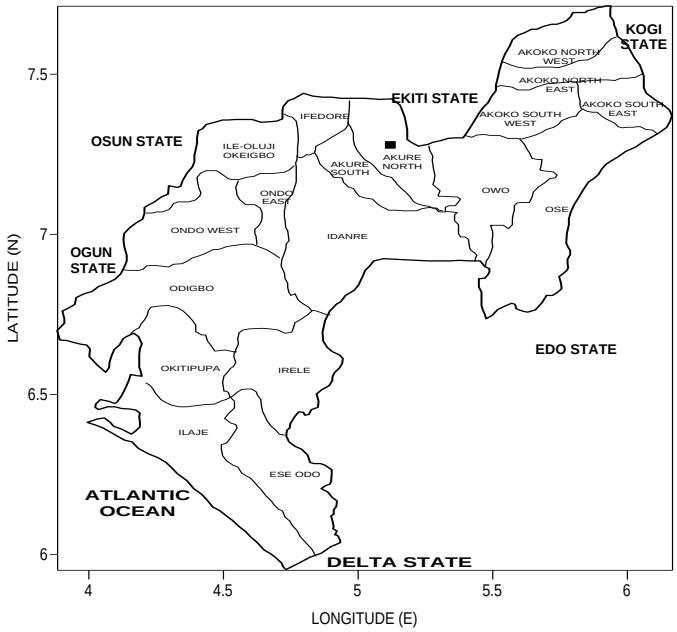

Figure 2:digitized map of ondo state showing the local government area

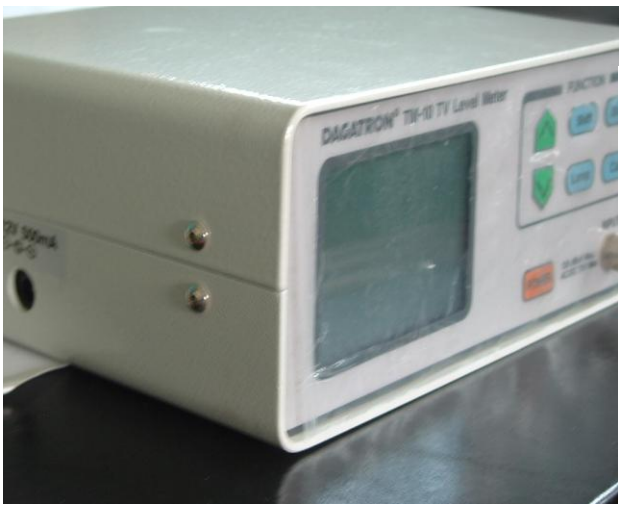

Fig 3a: The Dagatron T M10 Field Strength Meter.Fig.3b: Global Positioning System (GPS) Receiver GARMIN MAP 76 personal navigator

2.2 Electric Field Strength Measurement and Analysis

Measurement of electric field strength of Channels 23, 25 and 27 ultrahigh frequency (UHF) Television Stations in Ondo State was carried out radially from the base Stations along different routes in the State. Measurement and data collection were made at an interval of 10km from the main station in Akure, along the routes and 1kminterval from the booster stations in Oka Akoko and Okitipupa as reference points. The State was divided into three major routes classified as A, B and C and eight sub routes for easy data collation, observation and analysis for the main station, while two routes were considered for each of the booster stations. Detail of the routes and the local government areas is presented inTable 2. The main station (Transmitting Antenna) located at OritaObele, Akure, was marked and used as the reference point using the GPS receiver for all the routes. The

GPS receiver cursor was placed on the base station's location already marked as OSRC on the GPS waypoint memory. The line of sight from the base station was monitored during the drive. The GPS measures the location's Longitude, Latitude, and the elevation above sea level. The Dagatron TM10 field strength meterwith the receiving antenna connected to it via a coaxial cable of about 1.2m length using an I-connector was powered for the field strength to be measured. Meanwhile, the base station's frequency of 487.25MHz which had been stored in the meter's memory was recalled and the multiple values of the signal strength recorded. This procedure was repeated for subsequent measurements. Field strength readings were equally taken in all the towns on each of the routes and recorded. This method was used while taking the quantitative measurements of the electric field strength of the remaining channels 25 station, Oka Akoko and 27 stations, Okitipupa. Subsequently, the electric field strength of the transmitted television signal for different locations with their corresponding distances(LOS) from the base stations were measured and recorded. Generally, about 350 data sets were obtained along three major and twelve sub- major routes across the state. The data collectedwereused to determine and classify the coverage areas of the stations based on the following classification of the electric field strength values:

Primary Coverage Area (40dBμV≤/E/≤82dBμV)

i. Secondary Coverage Area (20dBμV≤/E/≤39dBμV)
ii. Tertiary (Fringe) Coverage Areas (15dBμV≤/E/≤19dBμV)
iii. Little or no Coverage Area (/E/<15dBμV)

The electric field strength values with the geographic coordinates were used to draw contour maps that were over laid on the digitized map of Ondo State for each of the stations. Using these maps, the percentage of coverage as a function of the state land mass was calculated. Areas of signal's intersection, where at least two of the signals can be received were shown and calculated. The various towns and villages that have access to various grades of coverage of the UHF television signals were also listed and categorized.

2.3 Calculation of Percentage of Coverage with respect to Land mass in this work.

This was calculated by inserting equal number of square boxes on the contour overlaid digitized map of Ondo State. The corresponding number of boxes within the primary, secondary, and fringe contours and as well as the areas not covered were now calculated as a percentage of the total number of boxes in the overlaid map to arrive at the grades of coverage.

Table 2: Routes categorization based on Local Government Areas

Route	Local Govt. Areas
A (Ondo North)	Owo, Akoko South West, Akoko South East, Akoko North East, Akoko North West and Ose.
B (Ondo Central)	Akure South, Akure North, Ifedore and Idanre
C (Ondo South)	Ondo East, Ondo West, Odigbo, Okitipupa, Ile Oluji/Okeigbo, Irele, Ese-Odo and Ilaje

III. Results and Discussions

3.1 Determined Coverage Areas of the OSRC Channel 23 Transmitting Station, Akure.

This study shows that the coverage areas of this channel asapercentage of the entire land mass of the State was50.5%; out of which 12.5%, 27.0% and 11.0% were possible for primary, secondary and tertiary coverage areas respectively. It also shows that 49.5% of the land mass of the state did not have access to any grades of service from the main station. Figure4presents the electric field strength contoursdepicting the spread of the coverage areas over the state land mass.Table 3lists the towns and villages that fell within the primary, secondary and fringe zones in all the local government areas under its coverage. Table 4 presents the areas that were poorly or not serviced by the main station, whereas table 5 shows the percentage of coverage in each of the local government areas.

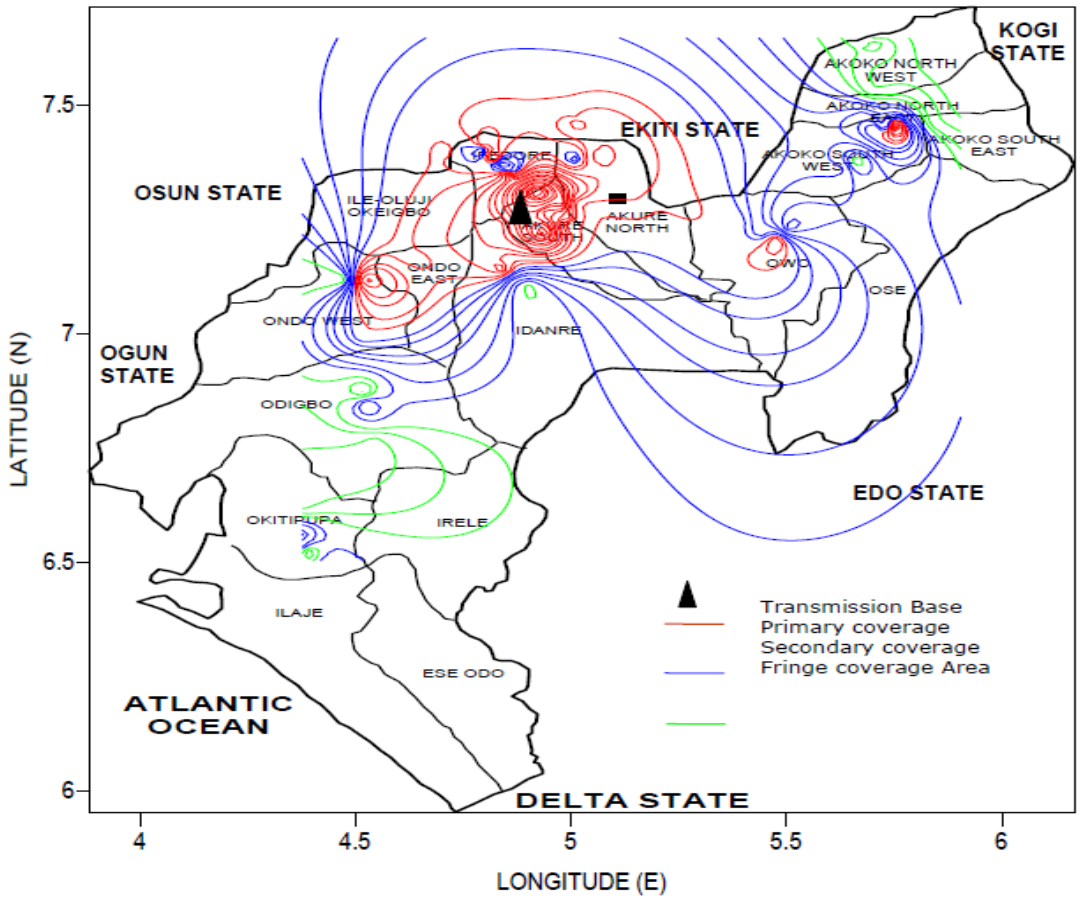

Figure 4: Contour map of the Electric field Strength of CH. 23 UHF, (OSRC Akure) over Ondo State land mass.

Table 3: Towns and villages within the Coverage areas of the CH.23 (487.25MHz) transmitter.

Type of Coverage	Towns And Villages Within The Coverage	Local Government Area
Primary (40dB𝜇V ≤E/ ≤ 82dB𝜇V)	Akure Metropolies, Alagbaka, Oke-Aro, Oba-Adesida, Oyemekun Road, Ala Quarters, Ijapo, Ijoka, OritaObeleAponmu, .ShagariVillage,Aule, FUTA, Oda	Akure South
	Oba Ile, Iju, Itaogbolu, Odudu, Igoba, Ogbese	Akure North
	Ijare, Ero, Ilara, Igbaraoke	Ifedore
	OwenaElesin, Bolorunduro,Oboto,Itanla	Ondo East
	Part Of Ile Oluji, EyinOwena	Ile Oluji/Okeigbo
	ItaOlorun, AladeIdanre, Part of Ododе- Idanre, Owena	Idanre
	Ago Itunu, Akinjagunla, Yaba, Itanla, Areas Of Ondo Town	Ondo West
	Uso, Oba's Palace Area Of Owo	Owo
	Iwaro, Iwonrin Quarters Of Oka	Akoko South West
Secondary (20dB𝜇V ≤E/ ≤ 39dB𝜇V)	Oreretu,Odojomu, Fagun, Sabo, Oka, Ayeyemi, Bagbe, Igbindo, Igunshin	Ondo West
	Fagbo, Tekuile, Asantan	Ondo East
	Oba Akoko, Akungba ,Oka Akoko	Akoko South West
	Ile Oluji, Bamikemo, Okeigbo	Ile Oluji/Okeigbo
	Omifon, Ajue, Asewele,	Odigbo
	Ododе, Atosin	Idanre
	Bolorunduro, Ifon, Afo,Ute	Ose
	Ibuji, Part Of Ilara	Ifedore
	Elejoka, Familugba	Akure North
	Farm Settlement Area	Okitipupa
	Epinmi, Isua	Akoko South East
	Ugbe, Ikare	Akoko North East
Fringe 15dB𝜇V ≤E/ ≤ 19dB𝜇V)	Arigidi, Eresu	Akoko North West
	Idoani, Idogun, Imeri	Ose
	Okitipupa, Ode Aye, Ayeka, Gbodigo	Okitipupa
	Ore, Odigbo	Odigbo
	Ajebamibo, Laje	Ondo West
	Part Of OdodeIdanre	Idanre

Table 4: Little or No Coverage Areas By the main station OSRC CH 23

Little or No Coverage /E/≤ 15dB⍰V)	Towns And Villages Within The Zone	Local Government Area
	Igbokoda, Mahin, Ugbonla, Ugbo, Ikorigho, Obe	Ilaje
	Igbekebo, Arogbo, Igbobini, Agadagba, Aleima	EseOdo
	Ilutuntun, Igbotako, Ijuodo, Omotoso	Okitipupa
	Kajola, Oniparaga, AraromiObu, Ayetinbo, Agbabu	Odigbo
	Oyin, Uro, Ajowa, Ikaramu	Akoko North West
	Part Of Ikare, Auga, Ise, Iboropa	Akoko North East
	Isua, Ikiran, Ayeteju, Ayekunle	Akoko South East
	Idogun, Imeri	Ose
	Iyansa, Akotogbo, Irele	Irele
	Part Of OdodeIdanre	Idanre

Table 5: Percentage of coverage areas by Channel 23 UHF with relative to the land mass of eachLocal Government Area in Ondo State.

S/N	LGA	Coverage in (%)	Description of grades of coverage		
			Primary in (%)	Secondary in (%)	Fringe in (%)
1	Akure South	100.0	80.0	20.0	-
2	Akure North	100.0	70.0	30.0	-
3	Ifedore	100.0	80.0	20.0	-
4	Idanre	70.0	15.0	50.0	5.0
5	Ondo East	100.0	60.0	40.0	10.0
6	IleOluji/Okeigbo	90.0	35.0	50.0	5.0
7	Ondo West	85.0	20.0	60.0	5.0
8	Owo	100.0	8.5	85.0	6.5
9	Ose	75.0	0.0	70.0	5.0
10	Akoko S/W	90.0	15.0	70.0	5.0
11	Akoko S/E	15.0	0.0	1.0	14.0
12	Akoko N/E	60.0	0.0	20.0	40.0
13	Akoko N/W	50.0	0.0	5.0	45.0
14	Odigbo	40.0	0.0	15.0	25.0
15	Okitipupa	25.0	0.0	5.0	20.0
16	Irele	30.0	0.0	0.0	30.0
17	Ilaje	5.0	0.0	0.0	5.0
18	Eseodo	10.0	0.0	5.0	5.0

3.2 Coverage Areas of the OSRC Channel 25 Booster Station, Oka Akoko.

The total coverage areas for this station in the state was 9.0% of the entire landmass with 3.0% of primary coverage, 4.0% of secondary coverage and 2.0% of fringe coverage. This station has an effective coverage in Akoko South West Local Government Area and limited coverage in threeother Local Government Areas in the northern parts of the state. Table 6 shows the coverage in the local government areas under it, while fig.5 shows the electric field strength contour maps. Table 7 also shows the coverage in terms of percentage in the local government areas under its coverage.

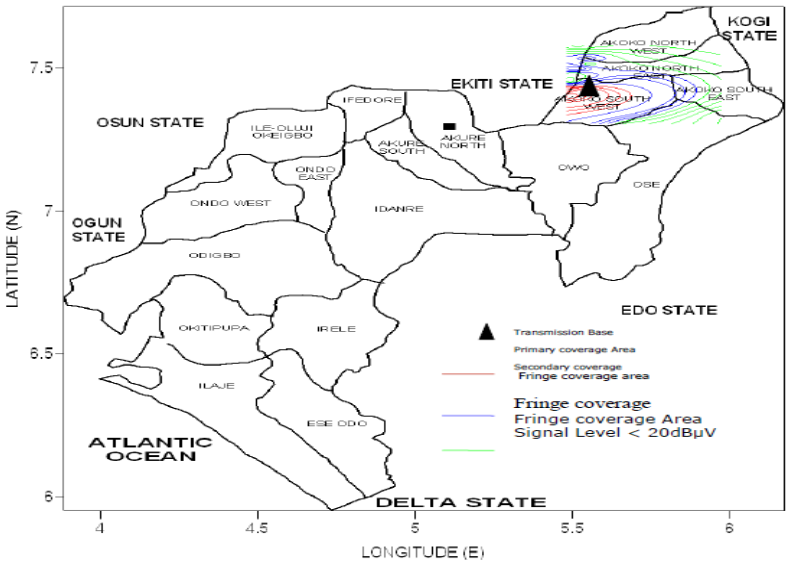

Figure 5: Electric Field Strength Contour for UHF CH. 25 Oka Akoko Booster Station over Ondo State landmass

Table 6: List of Towns and Villages within the Coverage Area of Channel 25, Oka Akoko.

Coverage Area	Towns and villages within the coverage	Local Government Area
Primary	Iwaro Oka, Iworin Quarter Oka and Oke Oka	Akoko South West
	Part of Isua.	Akoko South East
Secondary	AkungbaAkoko.	Akoko South East
Fringe	Ikare and Ugbe	Akoko North East

Table 7: Percentage Coverage Area of the Oka Akoko Booster Station in the local government areas under its coverage

S/N	LGA	Coverage in (%)	Description of grades of coverage		
			Primary in (%)	Secondary in (%)	Fringe in (%)
1	Akoko S/W	100.0	60.0	40.0	0.0
2	Akoko S/E	45.0	0.0	15.0	30.0
3	Akoko N/E	80.0	0.0	30.0	50.0
4	Akoko N/W	40.0	0.0	5.0	35.0

3.3 Coverage Areas of OSRC Channel 27 Booster Station, Okitipupa.

Thetotal coverage area for this station in the state as a percentage of its land mass was 8.0% with 2.0% of primary coverage, 3.5% of secondary coverage and 2.5% of fringe coverage. The station covers Okitipupa local government areas effectively with scanty presence in four other local government areas as shown in table 8 and the percentage of coverage is presented in table 9. The Fig. 6 shows the contour map of the electric field strength values over the coverage area.

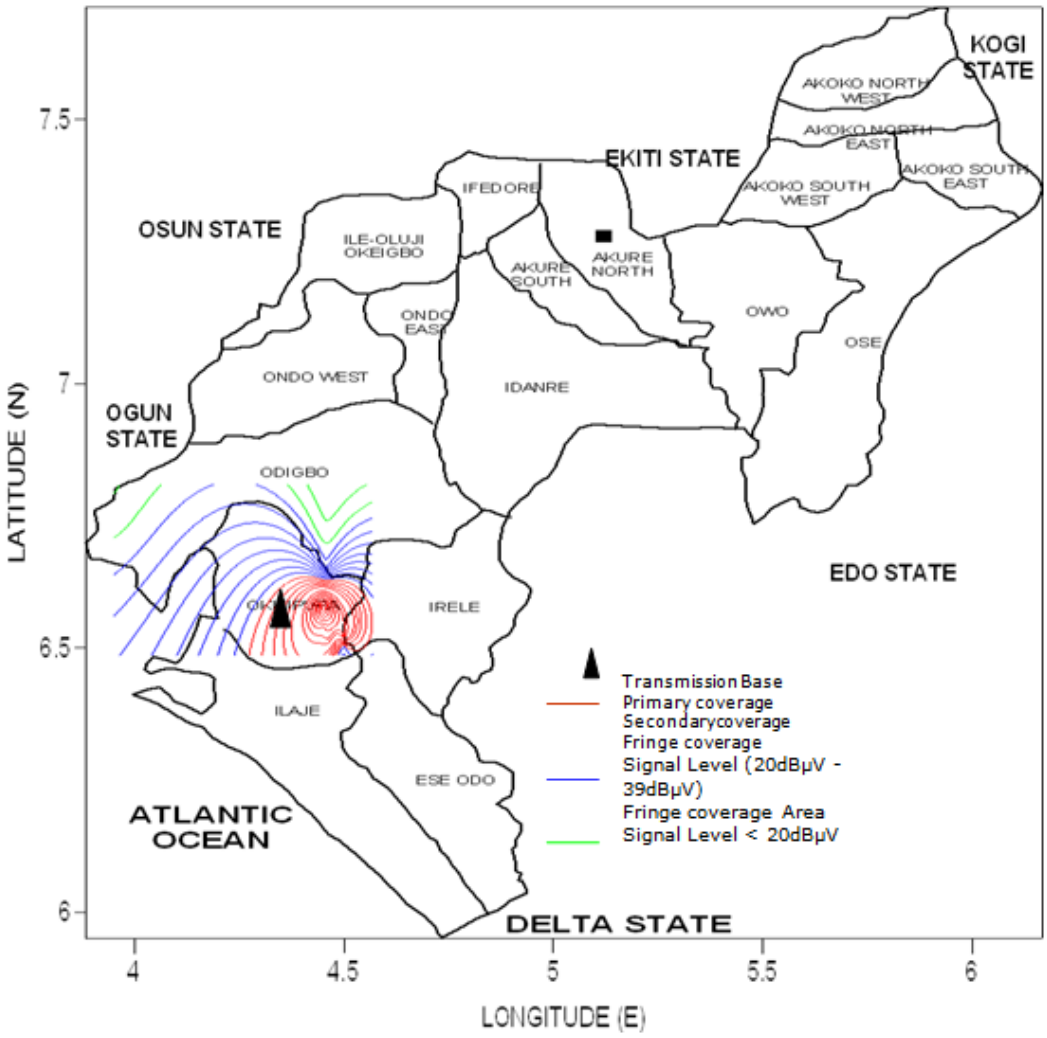

Figure. 6: Contour map of the Signal Strength of CH. 27 OSRC Okitipupa Booster Station over the coverage area

Table 8: List of Towns and Villages within the Coverage Area of Channel 27, Okitipupa.

Coverage Area	**Towns and villages within the coverage**	**Local Government Area**
Primary	Ode Aye, Okitipupa	Okitipupa
	Igbobini	**Ese- Odo**
Secondary	Ayeka, Gbodigo, Ijuodo	Okitipupa
Fringe	Part of Igbokoda	Igbokoda

Table 9: Percentage Coverage Area of the OkitipupaBooster Station in the local government areas under its coverage

S/N	LGA	Coverage in (%)	Description of grades of coverage		
			Primary in (%)	Secondary in (%)	Fringe in (%)
1	Okitipupa	100.0	50.0	30.0	20.0
2	Irele	12.0	3.0	5.0	4.0
3	Ilaje	5.0	0.0	2.0	3.0
4	EseOdo	5.0	0.0	2.0	3.0

3.4 Combined Coverage Areas of UHF Channels 23, 25 and 27 Television Stations in Ondo State and the areas not serviced by any of the stations.

The combined coverage areas of the three transmitting stations in Ondo State as a percentage of its landmass was 67.5% with 17.5% within the primary coverage, 34.5% within the secondary coverage and 15.5% within the fringe coverage. 32.5% of the state land mass was not serviced by any of the stations. These results were derived from calculations using the contour maps and the method of calculation explained earlier. Fig. 7 presents the combined electric field strength contour maps for the stations. The local government areas that were not serviced by any of the stations are mainly in Ilaje and Ese-Odo. Others are part of Irele, Akoko N/W, Akoko S/E, Akoko N/E, Ose and Idanre (because of its peculiar topography). Table10also gives the corresponding Local Government areas of the state enjoying the various grades of service.

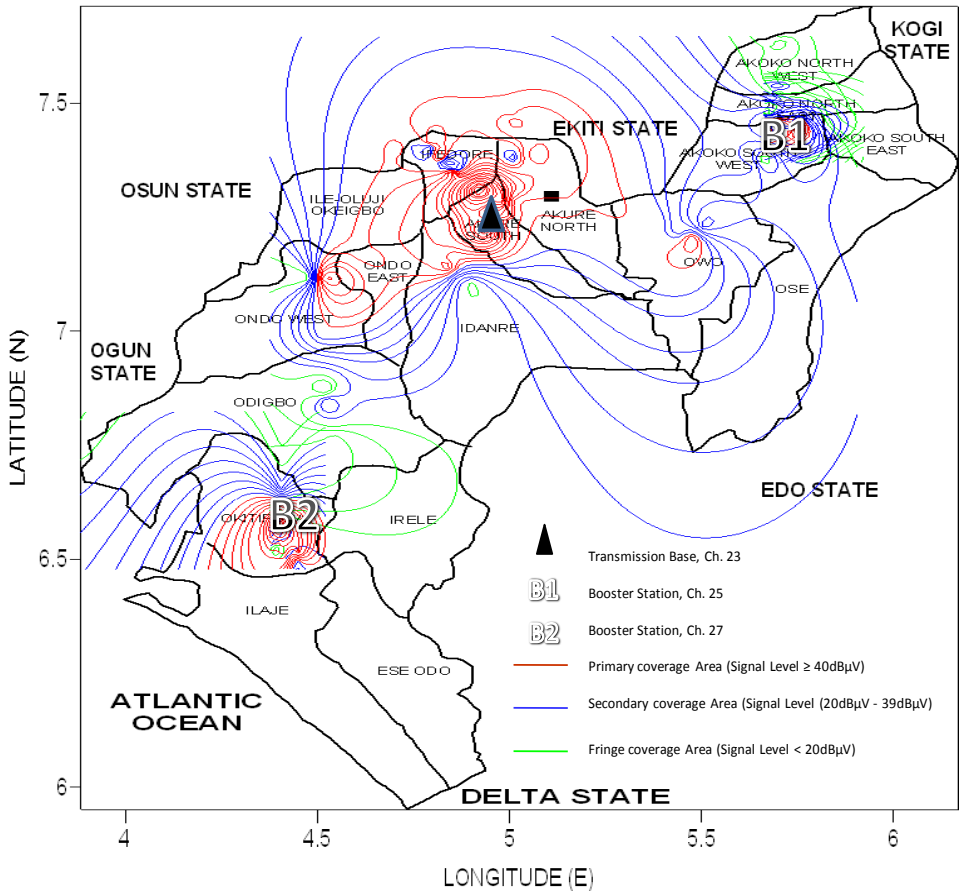

Fig.7: Combined electric field strength contour for the three stations under investigation.

Table 10: Percentage of Coverage by the Three OSRC UHF (CH23, CH25 and CH27) Signals for each Local Government Area in Ondo State

S/N	LGA	Coverage in (%)	Description of grades of coverage		
			Primary in (%)	Secondaryin(%)	Fringe in (%)
1	Akure South	100.0	80.0	20.0	-
2	Akure North	100.0	70.0	30.0	-
3	Ifedore	100.0	80.0	20.0	-
4	Idanre	70.0	15.0	50.0	5.0
5	Ondo East	100.0	60.0	40.0	-
6	IleOluji/ Okeigbo	90.0	35.0	45.0	10
7	Ondo West	85.0	25.0	58.0	2.0
8	Owo	100.0	8.3	91.7	
9	Ose	65.0	-	50.0	15.0
10	Akoko S/W	100.0	18.2	80.0	1.8
11	Akoko S/E	22.0	-	2.0	20.0
12	Akoko N/E	72.0	-	12.0	60.0
13	Akoko N/W	45.5	-	5.5	40.0
14	Odigbo	65.0	-	25.0	40.0
15	Okitipupa	100.0	40.0	55.0	5.0
16	Irele	40.0	-	-	40.0
17	Ilaje	5.0	-	2.0	3.0
18	Eseodo	5.0	-	2.0	3.0

3.5 Areas of Signal's Enhancement

Fig. 8 presents the areas where two of the signals can be received within the state. This was determinedas 4.94% of the entire landmass of the State.These areas are within the northern and southern parts of the State where the booster stations are located.There was no location in the central part of the state where any of the booster station's signal could be received.The towns and locations in these areas of signal's enhancement are presented in tables 11 and 12.

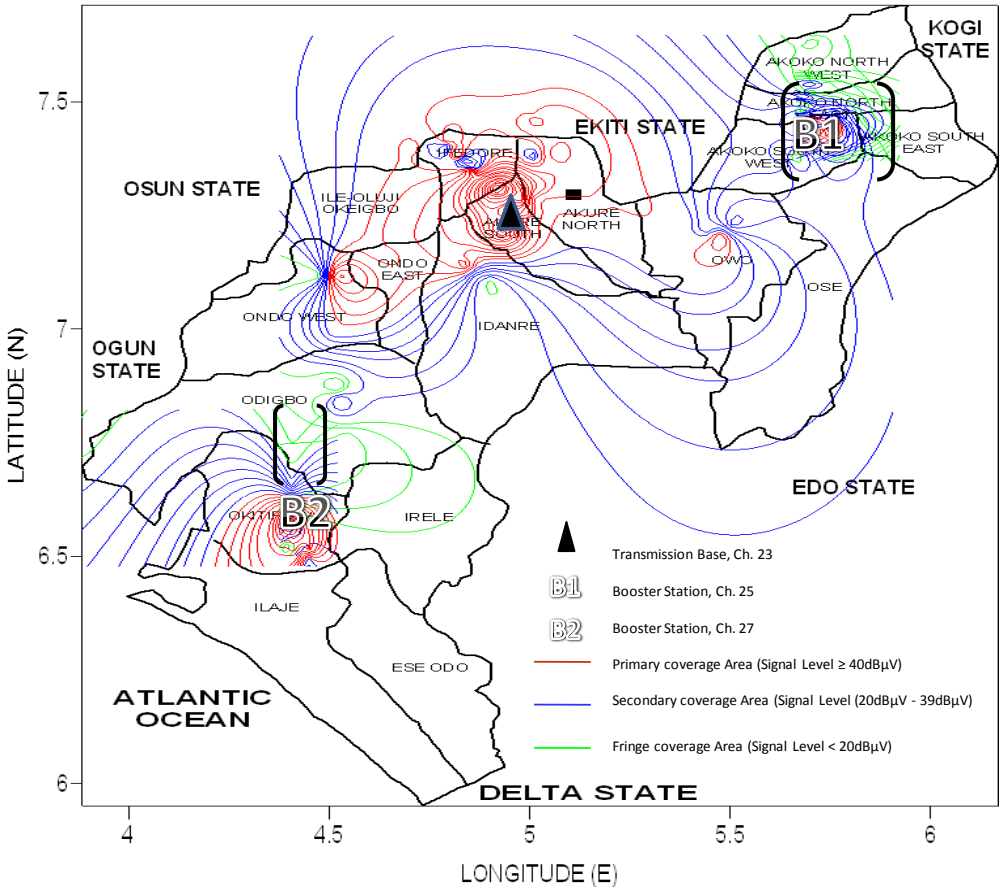

Fig. 8; Total Contours showing areas of signal's enhancement .

Table 11: Areas of signal's enhancement within the northern parts with channel 23 and channel 25

Towns within enhancement zone	Local Government Area
Iwaro Oka, Iworin Quarters of Oka Akoko,AkungbaAkoko	Akoko South West
Isua Ile	Akoko S/E
part of Ikare, ugbe, ilepa	Akoko N/E

These locations are majorly within the fringe coverage of the channel 23 signal and within the primary and secondary coverage of the channel 25 signal.Thus, making the signal of channel 25 preferable to viewers.

Table 12: Areas of Signal's enhancement within the southern parts with channel 23and channel 27.

Towns within enhancement zone	Local Government Area
Ode Aye, Agric farm settlement Okitipupa, part of Okitipupa town	Okitipupa LGA:

These locations are majorly within the fringe coverage of the channel 23 signal and within the primary and secondary coverage of the channel 27 signal, thus making the signal of channel 27 preferable to viewers in these towns.

IV. Conclusion

This study reveals the spatial coverage of the electric field strength of the three terrestrial UHF transmitters in Ondo State, Nigeria. The present configurations of the transmitters gave a significant coverage of the State with about 67.5% of her landmass enjoying various grades of coverage. 32.5% of the landmass had little or no access to the Television signals, meaning that about one third of the landmass of the state do not have access to the services of the stations.Coverage areas of 50.50%, 9.0% and 8.0% were recorded during the period under investigationfor the OSRC Akure Channel 23 UHF (487.25MHz), OSRC Oka Akoko channel 25(503.25MHz) andOSRC, Okitipupachannel 27(519.25MHz) respectively. 17.5% of the State land mass had access to the primary coverage (grade 'A' broadcast quality) of the stations, 34.5.0%of the State land mass had access to the secondary coverage of the stations (grade 'B' broadcast quality), while15.5.0% of the State land mass had access tothe tertiary/fringe coverage areas (grade 'C' broadcast quality) of the stations.Area of signal's overlap: 4.9% of the State land mass could receive any of the two UHF signals. 4.09% are in the northern part of the State where either the channel 23 or channel 25 signals can be received. 0.85% of the area are in the southern part of the State where either the channel 23or channel 27 television signals can be received.

The towns and villages of little or no coverage areas were majorly in the riverine local government areas of Ese Odo and Ilaje. Other areas are located in the Odigbo, Ondo West, Irele, Idanre, Akoko South East, Akoko North West, Akoko North East and Ose local government areas. Even though the three UHF transmitting stations gave a total coverage area of 67.5% of the entire landmasshowever, there isneed for the management of the stations to upgrade their equipment for better services because the fringe coverage area was 15.5.0%, leaving the optimum coverage areas of the stationsto52.0% (primary and secondary coverage). The implication of this is that 48.0% of the landmass had access to no or poor quality services of the stations. Other deductions from this work include:

A. the factors responsible for the enhancement of UHF signals (transmission and Reception) which are:

i. Output Power of the transmitter: This a key factor, the station with higher transmitted power like the main station (Channel 23) recorded higher coverage areas. Power transmitted is proportional to the signal received at any location away from the transmitter.

ii. The heights of the transmitting antenna above sea level: This is another key factor that enhances UHF transmission inthe state. A good example is the Oka Akoko station whose output power is only 200W but has a higher coverage than Okitipupa station with Output power of 450W (with the same antenna gain of 1 dB). The Oka Akoko mast is 121.9m and mounted on a location of 574m above sea level, giving total antenna height above sea level of 695.9m. The Okitipupa mast is 134.1m high and it is mounted on a location of 55m above sea level, giving a total antenna height of 189.9m above sea level. The coverage of OkaAkoko station was9% of the state while Okitipupa was about 8%.

iii. Elevation of Locations at the receiving end:the higher the values of this the higher the amount of signal received, because of the obvious good clearance from obstacles or diffracting structures along the signal path. A farther location with higher elevation than a nearer location with low elevation may recieve higher signal strenght. Different locations with the same line of sight but different altitudes, will receive differernt levels of signal all things being equal.

B. Factors Responsible for Loss of Signal

i. **Terrestial Factors:**Mountains, high buildings, and trees could be responsible for signal reduction in a number of ways; through reflection, refraction, difffaction, absoption and refractive effect.(Though not part of this study). A good example is Idanre town with 20km LOS distance from the main station where varying levels of low signals were received, there were locations without signal. Idanre has many mountains within and around it, this is the location of the famous Idanre hill.

ii. Low elevation at the receiving end:

since communication on the UHF band is on line of sight; receiving points with lowelevation may not receive the direct wave from source, only the weak signals through reflection or scattering could be received at these ends.

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