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Electric Field Strength Distribution of UHF Television Signal: A Case Study of Niger Delta Television Yenagoa, Bayelsa State Nigeria.

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***Abstract**: A very important factor in radio transmission design is ascertaining the level of signal strength variation with distance from the transmitter, this is key in determining the coverage area of a transmitter. Though much work on this has been done by researchers in recent times, majority of the works are on Frequency Modulated signals with little or no work on Ultra High Frequency television signals. This work determines the variation pattern of the electric field strength distribution of the Niger Delta Television, Channel 41 Yenagoa. The investigation involves the use of signal Strength meter in measuring the electric field strength of the signals along the various lines of propagation away from the transmitter. The data obtained was analyzed to determine the areas with minimum and optimal coverage. Distance was found not to be the only determining factor in the areas of minimal coverage, rather elevation and vegetation were found to be key factors affecting poor coverage.*

***Keywords:** Signal Strength, Transmission, Signal, Television Broadcast*

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I. Introduction

Television broadcasting in Nigeria has evolved over the years and has become an integral part of our social-economic life. The populace rely on television broadcast for weather update, political campaign, entertainment etc. These vested interest on television broadcast has made it very competitive as competing stations strive to air quality signals with minimum distortion. The Niger Delta Television is the electronic media outfit of the Bayelsa State Government Nigeria, which broadcast on the Ultra High Frequency band at channel 41 with carrier frequency of 532 MHz. Like every other form of telecommunication, poor reception is a big challenge and almost impossible to eliminate due to both natural and artificial factors [1]. Temperature for instance appears to have an appreciable undesirable effect on electric field strength generated by telecommunication transmitters. Other factors affecting the electric field strength of broadcasting stations include high relative humidity, noise, power of the transmitter, boosting etcetera [2,3].

Niger Delta Television (NDTV) has areas of weak electric field strength distribution, and some of those areas are not as a result of any technical deficit at the transmitter but rather due to geographical structures such as trees, mountains, mounds etcetera [4,5,6]. This work is aimed at investigating and analyzing the variation pattern of the electric field strength generated by the 11 KW UHF transmitter of the NDTV yenagoa by the use of a signal strength meter and TEMS application. The measurement was done using range intervals of 5km from the transmitter.

II. Study Location

Bayelsa state is one of the thirty six states in Nigeria situated at the Southern part of Nigeria. The state shares boundary with Rivers State, Delta State and the Atlantic Ocean. The land mass is about 10,773 square kilometers and lies between 4°55′29″N 6°15′51″E. [3,7,8].

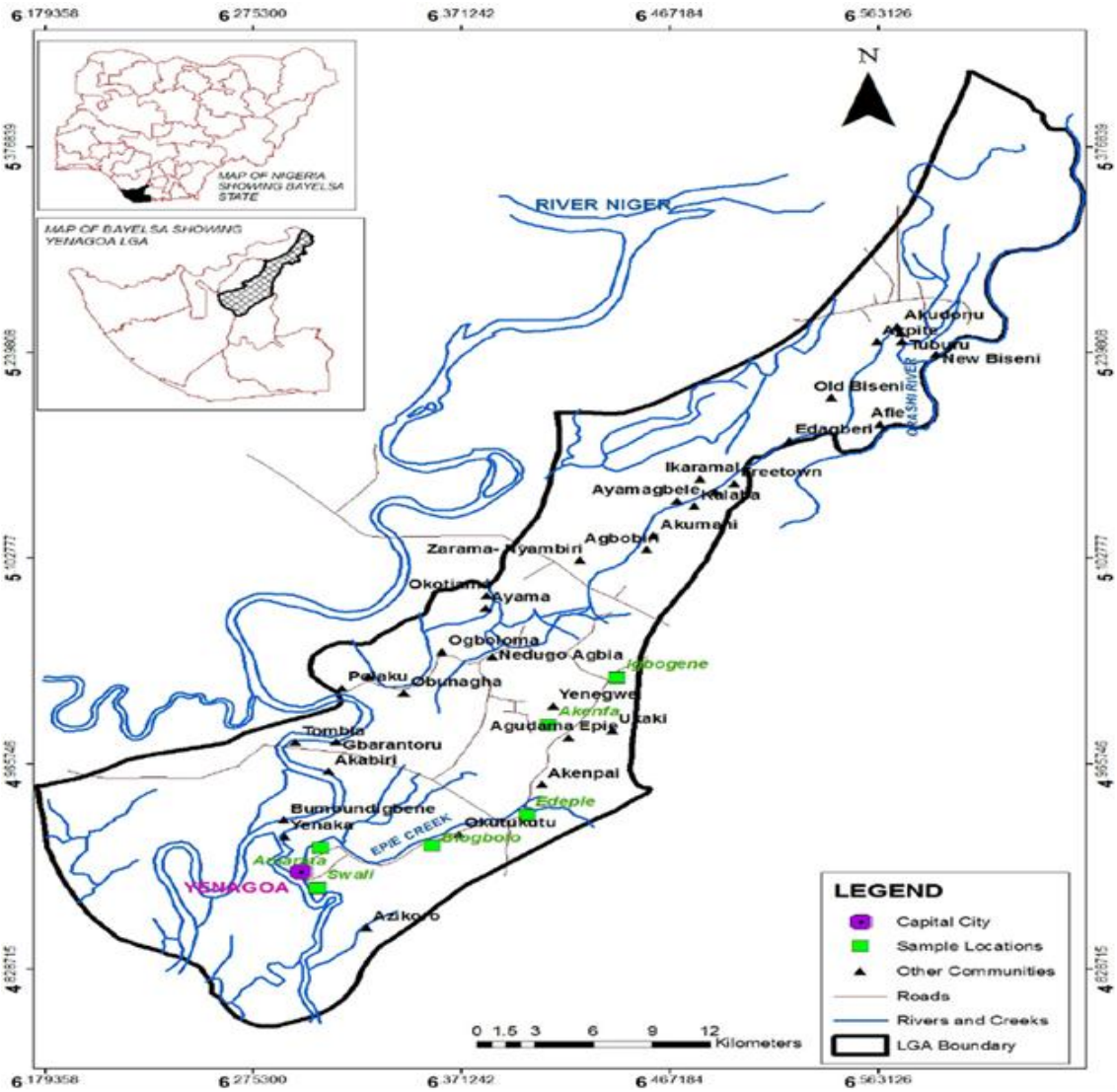

Figure 1: Map of Bayelsa State

III. Materials And Methods

Materials

Measuring instruments and related devices were employed in measuring the electric field strength distribution of the NDTV transmitter at various distances from the base station. The following are the instruments used

(1) A Dagatron T_m 10 Level meter

Frequency range: 5 – 862 MHz

Measurement range: 15 – 120 dBµV

Resolution: 0.1 dB

Accuracy: +/-3 dB

(2) A Germin Map 76 Personal Navigator

(3) TEMS 11.0 Software

(4) TV Receiving Antenna

(5) Movable Power Source

IV. Methodology

The measurements of electric field strength distribution were outwardly conducted on channel 41 UHF television signal of the NDTV along three major pathways from the base station by means of Dagatron T_m 10 Level meter. The point of reference using the Germin Map 76 Personal Navigator (a Global Position Receiver System) was the transmitter's aerial location along Amassoma Road Yenagoa. TEMS 11.0 Software (a travel distance application that uses GPRS) was used to measure the distance of the varying measurement points from the base station. The measurements were made at 5km intervals along the three pathways till total fading of the

signal was observed. At the measurement location a check was made to ascertain whether the strongest signal came from a direction other than from the transmitter. The receiving antenna was oriented in such a manner that the sector of its response with optimal gain was on the transmitter's direction.

Table 1: Transmission Parameters

S/N	Parameter	Value
1.	Base Station Transmitting Power	11 KW
2.	Base Station Carrier Frequency	532MHz
3.	Height of Transmitting mast	200m
4.	Height of Transmitting antenna	About 18m
5.	Transmitting Antenna gain	30dB
6.	Height of receiving antenna	1.9m

V. Result

The results obtained from the field were grouped according to the different pathways in which measurement was done. The electric field strength data collected were tabulated and plotted against distance from transmitting base station to produce a summary equivalent electric field strength distribution for each pathway. Table 2, 3 and 4 below shows the electric field strength variation with distance along Yenagoa-Ughelli, Yenagoa-Amassoma and Yenagoa-Nembe pathways respectively while figure 2,3 and 4 shows the plot of Electric Field Strength against Distance from Base Station for Yenagoa-Ughelli, Yenagoa-Amasoma and Yenagoa-Nembe pathways respectively.

Table 2: Electric Field Strength Variation with distance along Yenagoa-Ughelli Route

S/N	Distance from Base Station (KM)	Coordinate (Lat°N/Log°E)	Elevation (m)	Electric Field Strength (dBµV)	Average Electric Field Strength (dBµV)
1	0	10.29/4.92	11	81.56	81.73
				82.26	
				81.36	
2	5	10.32/4.94	13	78.16	79.06
				79.06	
				79.96	
3	10	10.36/4.94	14	78.36	78.79
				79.46	
				78.56	
4	15	10.39/5.01	14	76.16	75.76
				75.76	
				75.36	
5	20	10.40/5.05	13	77.96	77.10
				77.08	
				76.26	
6	25	10.40/5.08	15	72.46	71.99
				71.96	
				71.56	
7	30	10.34/5.12	13	77.16	77.48
				77.46	
				77.83	
8	35	10.28/5.12	13	73.76	73.59
				73.56	
				73.46	
9	40	10.25/5.16	14	46.96	44.96
				45.56	
				42.36	
10	45	10.20/5.19	17	56.36	59.19
				66.06	
				56.16	
11	50	10.21/5.23	16	56.16	56.33
				56.56	
				56.26	
12	55	10.19/5.36	16	53.06	52.69
				53.36	
				51.66	
13	60	10.13/5.28	14	66.16	66.79
				66.96	
				67.26	
14	65	10.17/5.19	15	53.56	54.23
				54.06	
				55.06	

15	70	10.15/5.10	15	46.76 46.96 46.66	46.79
16	75	10.15/5.04	17	49.86 40.16 40.79	43.33
17	80	10.13/5.09	17	47.26 57.66 57.16	53.36
18	85	10.08/5.41	17	47.16 57.46 57.26	53.29
19	90	10.07/5.43	16	51.06 51.56 52.06	51.56
20	95	10.12/5.46	15	45.66 54.56 53.84	50.67
21	100	10.11/5.48	18	46.96 35.16 47.56	42.56
22	105	10.09/5.50	17	40.06 40.56 41.76	40.79
23	110	10.06/5.53	19	46.16 45.96 46.16	46.09
24	115	10.06/5.58	18	40.55 40.56 40.57	40.56

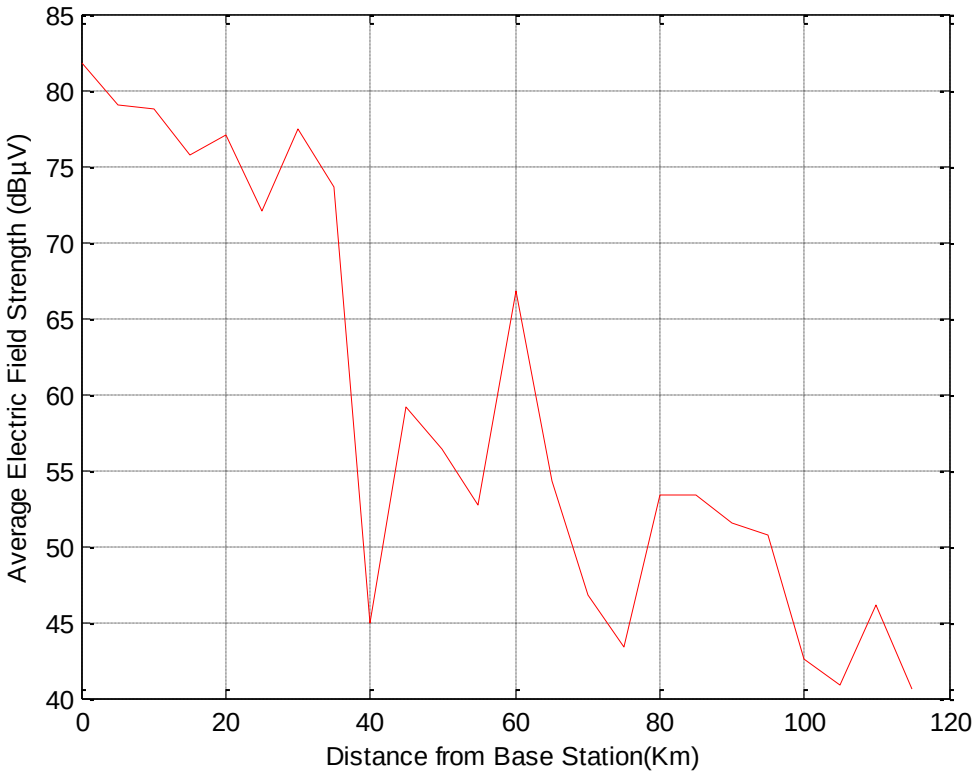

Figure 2: Signal Propagation Curve for Yenagoa-Ughelli Route

Table 3: Electric Field Strength Variation with distance along Yenagoa-Amassoma Route

S/N	Distance from Base Station (KM)	Coordinate (Lat°N/Log°E)	Elevation (m)	Electric Field Strength (dBµV)	Average Electric Field Strength (dBµV)
1	0	10.29/4.92	11	81.56	81.73
				82.26	
				81.36	
2	5	10.32/4.94	11	67.16	67.99
				68.86	
				67.96	
3	10	10.35/4.95	12	64.56	65.36
				65.96	
				65.56	
4	15	10.33/4.97	11	70.06	69.36
				67.76	
				70.26	
5	20	10.28/4.99	10	45.56	46.19
				46.86	
				46.16	
6	25	10.24/4.99	9	47.56	48.36
				48.56	
				48.96	
7	30	10.21/4.98	6	32.66	36.96
				38.66	
				39.56	
8	35	10.17/4.97	8	27.06	27.79
				28.56	
				27.76	
9	40	10.12/4.99	7	33.76	32.66
				31.66	
				32.56	
10	45	10.09/4.99	9	43.76	46.83
				50.16	
				46.56	
11	50	10.26/5.02	7	26.36	24.69
				23.76	
				23.96	
12	55	10.07/4.98	7	34.56	33.56
				32.56	
				33.56	
13	60	10.36/5.08	8	29.76	29.43
				29.56	
				28.96	
14	65	10.41/5.05	6	17.06	17.29
				17.46	
				17.36	
15	70	10.52/5.04	6	38.56	37.79
				37.26	
				37.56	
16	75	10.01/5.09	7	17.66	17.19
				16.96	
				17.16	
17	80	10.13/5.11	6	21.96	21.73
				21.56	
				21.66	
18	85	10.17/5.09	8	16.26	16.33
				16.16	
				16.56	
19	90	10.15/5.07	7	20.06	19.03
				17.46	
				19.56	
20	95	10.21/5.09	5	18.26	17.93
				17.96	
				17.56	
21	100	10.23/5.14	5	16.26	17.03
				17.96	
				16.86	
22	105	10.14/5.13	6	17.26	17.33
				17.56	
				17.16	

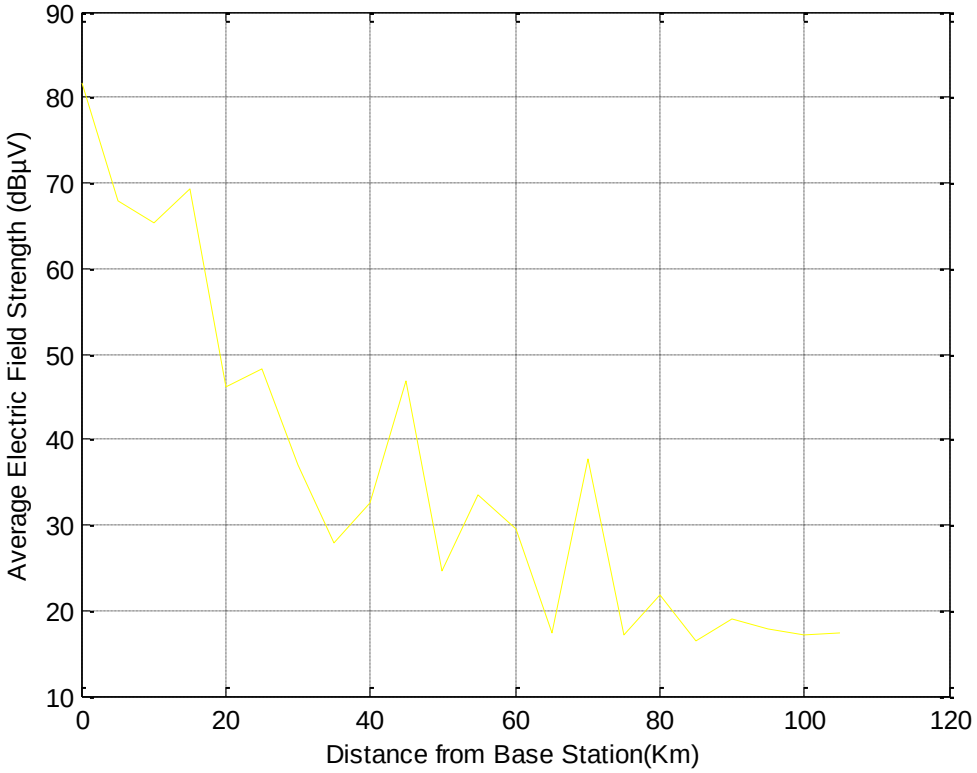

Figure 3: Signal Propagation Curve for Yenagoa-Amassoma Route

Table 4: Electric Field Strength Variation with distance along Yenagoa-Nembe Route

S/N	Distance from Base Station (KM)	Coordinate (Lat°N/Log°E)	Elevation (m)	Electric Field Strength (dBµV)	Average Electric Field Strength (dBµV)
1	0	10.29/4.92	11	79.02	79.29
				80.02	
				78.82	
2	5	10.28/4.88	10	64.62	65.45
				66.32	
				65.42	
3	10	10.27/4.84	10	62.47	62.97
				63.42	
				63.02	
4	15	10.26/4.80	9	67.52	67.55
				67.42	
				67.72	
5	20	10.28/4.79	6	43.02	43.65
				44.32	
				43.62	
6	25	10.31/4.79	9	45.02	45.82
				46.02	
				46.42	
7	30	10.33/4.81	9	30.12	34.42
				36.12	
				37.02	
8	35	10.37/4.81	8	24.52	25.25
				26.02	
				25.22	
9	40	10.37/4.77	9	31.22	30.12
				29.12	
				30.02	
10	45	10.39/4.74	7	41.22	44.29
				47.62	
				44.02	
11	50	10.38/4.73	7	23.82	22.15
				21.22	

				21.42	
12	55	10.36/4.70	9	32.02	31.02
				30.02	
				31.02	
13	60	10.36/4.71	6	79.02	79.19
				79.72	
				78.82	
14	65	10.32/4.68	6	14.62	14.52
				14.52	
				14.42	
15	70	10.33/4.70	8	26.82	28.25
				34.92	
				23.02	
16	75	10.30/4.67	7	23.62	23.22
				23.22	
				22.82	
17	80	10.37/4.68	9	25.42	24.56
				24.54	
				23.72	
18	85	10.37/4.66	9	29.92	29.45
				29.42	
				29.02	
19	90	10.40/4.67	7	14.62	14.94
				14.92	
				15.29	
20	95	10.41/4.65	8	21.22	21.05
				21.02	
				20.92	
21	100	10.43/4.63	6	24.42	22.42
				23.02	
				19.82	
22	105	10.45/4.61	6	13.82	13.65
				13.52	
				13.62	
23	110	10.44/4.62	5	13.62	13.79
				14.02	
				13.72	

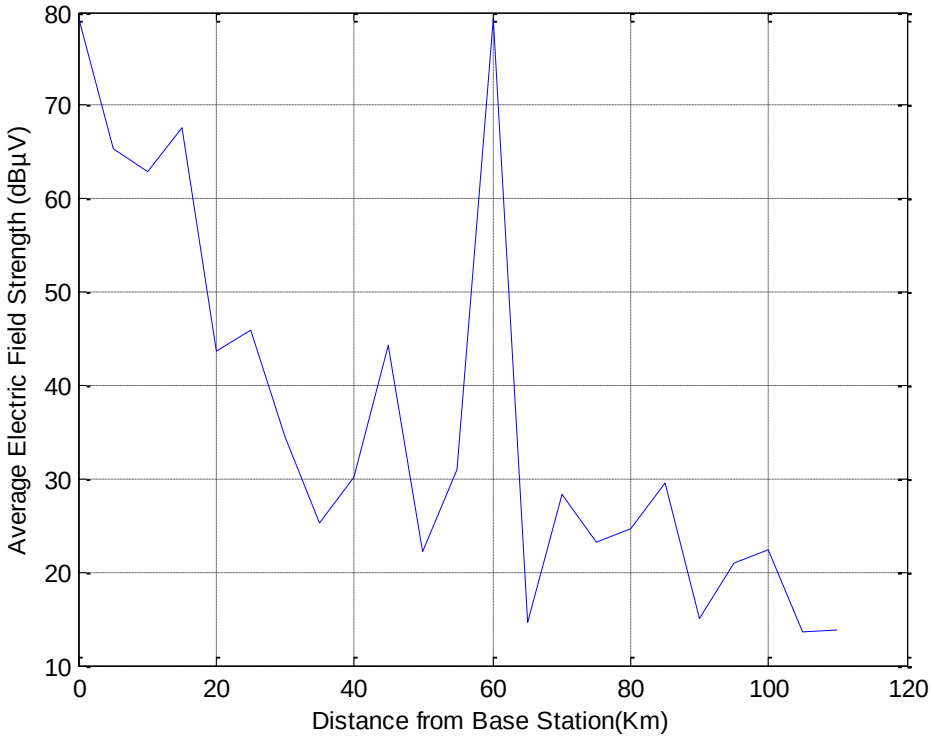

Figure 4: Signal Propagation Curve for Yenagoa-Nembe Route

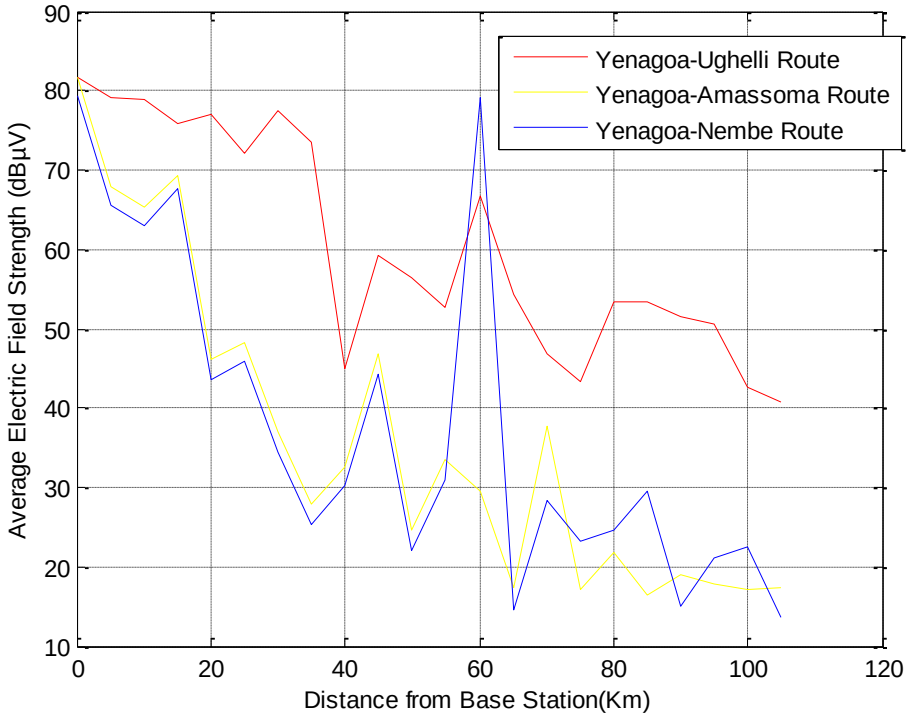

Figure 5: Signal Propagation Curve for the three Routes

VI. Conclusion

The broadcast of the Niger Delta Television covers approximately the entire state landmass. Though the of coverage varies from place to place, about 85% of the state as covered by this studies has an optimal coverage (a coverage of Electric Field Strength of 40dBµV and above) while about 10% of the state has secondary coverage (a coverage of Electric Field Strength of 20dBµV to 30dBµV) and about 5% of the state has only but a tertiary coverage (a coverage of Electric Field Strength of 15dBµV to 19dBµV). Along the Yenagoa-Ugheli Route, there is an optimum coverage from the base station to Delta State. There is a significant variation of the Electric Field Strength along the Yenagoa-Amasoma Route with a minimum value of 17.03dBµV and a maximum value of 81.73dBµV. This significant variation is attributed to the low elevation of the route. The Yenagoa-Nembe Route also has areas with tertiary coverage which implies that residents in those areas cannot enjoy the services of the Niger Delta Television using ordinary antenna. This route has a minimum Electric Field Strength value of 79.29 dBµV and maximum value of 13.79 dBµV.

References

[1]. P.C. Iwuji and C. Emeruwa (2018), *"Investigation of Signal Strength-Level Generated by Orient 94.4 FM Transmitter in Imo State Nigeria"*. International Journal of Science and Research, Volume 7, Issue 5, Pp 1089-1094.
[2]. O.O. Fagbohun (2014), *"Studies of Electric Field Strength Distribution of UHF Television Signal Propagation in Ekiti State Nigeria"*. IOSR Journal of Electronics and Communication Engineering, Volume 9, Issue 2, Pp 111-121.
[3]. G.O. Ajayi, and I.E. Owolabi (1975), *"Medium Wave Propagation Curves (for use in medium Wave transmission planning and design)"* Technical Report of the Radio Wave Propagation Research Group, Department of Electronic and Electrical Engineering, University of Ife, Nigeria.
[4]. L. Bothias, (1987), *Radio Wave Propagation*, McGraw-Hill Inc. New York St. Louis San Francisca Montreal Toronto, 144175.
[5]. Beasley and Miller (2010): *Modern Electronic Communication*, 8th edition, Prentice Hall of India pvt. Ltd.
[6]. G. Kennedy, and D. Bernand, (1992) *Electronic Communication Systems*, McGraw Hill/Macmillan, Singapore, 80-150
[7]. R.E Collin, (1985) *Antennas and Radiowave propagation*, McGraw Hill Inc. New Delhi, 40-409
[8]. M. Eiche (2010), *Measurement of the electric field strength to determine the Coverage Area of FM Radio Stations in Niger State, Nigeria*. Unpublished Thesis.

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