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Investigation of RF Exposure Levels from Different Mobile Telecommunication Base Stations in Ado-Ekiti, Nigeria

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Abstract

This study investigates the radiofrequency radiation levels at selected cellular base stations and evaluated the results against the internationally recommended and accepted levels as well as against the required limit for non-occupational exposure with respect to the International Commission on Non-Ionizing Radiation Protection (ICNIRP) standard for Radio Frequency (RF). The highest Radio Frequency (RF) levels at each base stations were computed as a percentage of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommendations in a given and selected environment in Ekiti State. Radio frequency radiation (RF) levels were measured at 15 selected cellular base stations of which 14 were Greenfields and only 1 was Hilltop base station in Ado-Ekiti, Ekiti State, Nigeria. The mobile cellular network operators considered for this investigation are MTN, GLO, AIRTEL, ETISALAT and any other combined network operators on a mast. Detailed measurements of power density of RF radiation were recorded over 2G, 3G and 4G cellular frequency bands at which the cellular network operators transmit in Ekiti State. Measurements were taken at intervals of 5 meters away from base stations up to 260 meters of the prominent populated areas taking into cognizance the direction of antenna used to generate the maximum radiation. At a distance of 5 meters, the highest case of maximum RF exposure at 900 MHz frequency band was 0.0117 W/m^2 which is 0.26% of the ICNIRP maximum public exposure (MPE) limits of the frequency band. At 1800 MHz

frequency band, the highest RF exposure recorded was 0.0046 W/m^2, which is 0.05% of the ICNIRP (MPE) limits of the frequency band. The highest RF exposure at 2100 MHz frequency band recorded was 0.0030 W/m^2, which is only 0.03% of ICNIRP (MPE) limit of the frequency band given the highest radiation levels by considering the base stations situated at Ekiti State University (EKSU), Ado-Ekiti, Nigeria. This study reveals that the radiation exposure levels in Ado-Ekiti, Ekiti State, Nigeria emitted by the four mobile cellular network operators are of orders of magnitude below the maximum permitted limits by the local and international regulatory commission and council.

Keywords: Electric field; electromagnetic radiation; frequency spectrum; power density; radio frequency

1. Introduction

The rapid development and incessant increase of mobile telecommunications infrastructure in most developing cities in Nigeria has raised concern amongst many localities over possible public health effects from exposure to radiofrequency electromagnetic radiation emanating from mobile telecommunication base station antennas. This study aimed at determining the radiofrequency radiation levels at some selected cellular base stations within Ado-Ekiti, Ekiti State, Nigeria. In most instances the sites were randomly selected, focusing on the population density, possible categories with concentration of the base stations and made to capture RF radiation levels from all the licensed cellular operators and evaluates the RF radiation levels against the maximum exposure limits set by International Commission on Non-Ionizing Radiation Protection[1].

Nigerian Communication Commission (NCC) conducted a program to measure RF power density in some state in the country in order to determine the worst case of exposure for the general public. In all the cases, the measured levels were found below the applicable exposure limits. The agency is charged with the responsibility of protecting the Nigerian people and environment from harmful effects of radiation. Fulfilling this function, NCC monitors RF Electromagnetic radiation levels in the community, undertakes research and examines the latest scientific literature on health effects from RF exposure. The relevant standard mandatory in Nigeria for mobile telecommunications frequencies on radiation protection standard for maximum exposure levels to radiofrequency fields is 3 KHz to 300 GHz [2, 3].

The frequency considered in this paper is 900 MHz to 2100 MHz, the exposure limits it specifies are identical to those of the 1998 Guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Measurement included each of the three technologies currently use in Nigeria which are Global System for Mobile Communication (GSM) 900, GSM 1800 and Universal Mobile Telephone Services (UMTS) 2100. The point levels of measurement were recorded and evaluated against the ICNIRP exposure guidelines, which specifies a maximum non-occupational exposure limit of $4.50\mathrm{W/m^2}$ at GSM 900 frequency band, $9.00\mathrm{W/m^2}$ at GSM 1800 frequency band and $10.00\mathrm{W/m^2}$ at UMTS 2100 frequency band[1].

Measurements were taken according to ICNIRP within all the sectors available, at various locations near the base station, by continuously scanning the frequency bands and logging the signal level for the cellular base station. More than one carrier frequencies were measured and measurements were taken at different interval away from the base station. The measurement sites were selected according to subjective criteria, such as levels of community health concern, most populated areas and ease of accessibility. Base stations owned by all the four mobile carriers' operators in Nigeria were represented in the chosen sites. Properties of each base station, such as number of antennas, their height, orientation and power density were considered during this research [4]. Electric field strength were recorded with the dipole antenna in three orientations: vertical (X), horizontal perpendicular (Y)

and horizontal aligned (Z) to the direction of the base station antenna at an approximate height of 1.5 meters above the ground level. The power density at each location was determined by combining these X, Y and Z polarization measurements. At each site, the orientation electric field measurements were combined to give the power density for each control or pilot channel frequency present. The power density were analysed to give a total value of maximum power density for the base stations.

World Health Organization (WHO), through its International EMF Project, has conducted a series of in-depth international reviews of the scientific literature on the Biological and Health effects of exposure to electromagnetic fields. Some of the reports are; Electromagnetic Fields and Non-Specific Health Symptoms [5]. Electromagnetic fields and public health "mobile telephones and their base station"[6]. Electromagnetic fields Hypersensitivity [7]. A study was carried out in [8] where measurements were based on compliance testing; a portable measurement system TS-EMF, spectrum analyzer was used for the measurements. The system was computer driven, while the (R&S) REFX software enables data acquisition and settings management. The power density level recorded from GSM 900 Base Station Antenna (BSA) in the far field was 0.75mW/m^2, which did not exceed the reference level when compared with ICNIRP standard level. A similar work was carried out in [10] where the electric field intensities and power densities were measured for the entire existing signal ranging from 80MHz to 2.5GHz. The result of their findings was compared with ICNIRP standard and shows that the radiation exposure level was about 34% lower than the reference level. Similar research was conducted in [10-11] in a bid to confirm compliance with acceptable radiation level.

However, none of these studies was conducted in Ado Ekiti Nigeria and the results from these locations cannot be generalised because the clustering of the base stations, the number of operating networks and technology deployed differs from one location to the other. Also there is the need for periodical measurement of radiofrequency radiation from the base station in developing cities as new base station are usually emerging due to the increase in demand for mobile communication services coupled with emerging new technologies with varying radiation level. Hence the need for this investigation with the aim of determining the compliance of the radiofrequency radiation level of the mobile network in Ado Ekiti, Ekiti State Nigeria.

2. Material and Methods

The RF radiation was measured based on the four mobile telecommunication operators which are MTN, AIRTEL, GLO and ETISALAT within the coverage areas in Ado-Ekiti, Ekiti State, Nigeria. Measurements were taken for frequencies within the three main cellular frequencies sub bands of 900MHz, 1800MHz and 2100MHz. The relevant spectrum analyzer data were recorded repeatedly and subsequently analyzed. In addition to the radiation levels measured, the location of each base station was taken using a Global Positioning System (GPS). The radiation levels in the spectral scans were recorded in dBm and MHz. Since the ICNIRP Maximum Public Exposure (MPE) limits are expressed in W/m^2, the power density were calculated and tabulated. The spectral scans for the two categories of base stations namely the Greenfield and Hilltop were recorded but only AIRTEL operator at Adebayo, Ado-Ekiti, a Greenfield base station, were presented with spectral scans in this report. Handheld spectrum analyzer model NA-773, 144/430MHz in fill mode was used.

The measurements taken by the spectrum analyzer were recorded with the spectral scans, the x-axis of the spectral scan represents the frequency range in the band (MHz) with the start and stop frequency indicated at the bottom of the scan, the spectral spans used was 300MHz while the y-axis represents the radiation strength in dBm (decibels). A fixed antenna (Probe) was mounted on the spectrum analyzer and automated mobile measurements were made, whilst walking around the GSM base station under survey. A 3-Axis RF Radiation Strength Meter TM-196, 9v Battery was also used to measure the detailed RF power density values in $\mu\text{W/m}^2$ and mW/m^2. Both signal data and position information of the base stations were also recorded. For each mobile telecommunication operators, measurements were made of all active frequencies at each particular mobile measurement sampled

location. The frequencies within the bands allocated for downlink and uplink frequencies of the three main cellular frequency sub bands used in Ekiti State, Nigeria is shown in Table 1.0.

These measurements were taken from 15 Base stations at 5 different Areas in Ado-Ekiti; Ekiti State University, Adebayo, Oke-Ila/Ijigbo, Ajilosun and Basiri. The description of the various base stations' location is tabulated in Table 1.1. All measurements were taken 1.5 meters above the ground at an interval of 5 meters up to 260 meters away from the base stations.

Table 1.0: Cellular Frequency Spectrum used in Ekiti State, Nigeria

Cellular sub bands	Uplink(MHz)	Downlink(MHz)
GSM 900	890 - 915	935 - 960
GSM 1800	1710 - 1785	1805 - 1880
UMTS 2100	1920 - 1960	- 2150

Table 1:1: Description of Study Site

Site I.D	Area	Location Description	BTS Operators	BTS Category	Site coordinates
001	EKSU	i. EKSU Campus Gate; ii. Inside EKSU Campus; iii. Inside EKSU Campus.	i. GLO ii. AIRTEL iii. MTN	Greenfield Greenfield Greenfield	(07º 42' 56" N, 05º 15' 37" E) (07º 42' 51" N, 05º 15' 13" E) (07º 42' 51" N, 05º 15' 12" E)
002	Adebayo	i. Opp. Mojere market; ii. Opopogboro behind GLO Office; iii. Behind seven days Adventist church.	i. GLO ii. AIRTEL iii. MTN	Greenfield Greenfield Greenfield	(07º 39' 16" N, 05º 13' 41" E) (07º 39' 02" N, 05º 13' 32" E) (07º 39' 10" N, 05º 13' 54" E)
003	Oke-Ila/Ijigbo	i. St. Andrew Anglican Church; ii. St. Patrick Catholic Cathedral; iii. Beside CAC Church Ogba-Alafia.	i. MTN ii. GLO iii. Combined Net. (MTN, GLO, AIRTEL, & ETISALAT)	Greenfield Greenfield Greenfield	(07º 37' 32" N, 05º 13' 27" E) (07º 37' 15" N, 05º 13' 20" E) (07º 37' 05" N, 05º 13' 20" E)
004	Ajilosun	i. Opposite Alafia bread Olujoda closed; ii. Behind AP Filling Station; iii. Opposite Holy Child Secondary School.	i. MTN ii. ETISALAT iii. AIRTEL	Greenfield Greenfield Greenfield	(07º 35' 27" N, 05º 13' 01" E) (07º 35' 10" N, 05º 13' 04" E) (07º 35' 37" N, 05º 13' 11" E)
005	Basiri	i. Ilamoji Oke-Ala Community; ii. Opposite Textile Basiri. iii. Ileri Oluwatedo Street along Nova road;	i. MTN ii. AIRTEL iii. ETISALAT	Greenfield Hilltop Greenfield	(07º 39' 08" N, 05º 12' 12" E) (07º 38' 16" N, 05º 12' 36" E) (07º 39' 20" N, 05º 03' 14" E)

3. Results and Discussion

Table 1.2 shows the radiation measurement for various networks at site 001 for the different mobile generations considered. At 900 MHz, it can be observed that the AIRTEL has the overall highest power density of 11.70 mW/m^2 and -40.00 dBm, at 1800 MHz, MTN has the highest power density of 1464.10 $\mu W/m^2$and -51.50 dBm, while at 2100 MHz, MTN has the highest power density of 3.00 mW/m^2 and -29.00 dBm. AIRTEL has the least radiation level of 282.00 $\mu W/m^2$ and -31.00 dBm at 2100 MHz. Table 1.3 shows the measurement at site 002, the findings shows that at 900 MHz, MTN has the highest radiation power density level of 2.39 mW/m^2 and -37.00 dBm, at 1800 MHz, MTN has the highest power density of 2.61 mW/m^2 and -41.00 dBm, while at 2100 MHz, MTN has the

highest power density of 2.26 mW/m^2 and -42.00 dBm. GLO has the least radiation level of 1001.30 $\mu W/m^2$ and -53.00 dBm at 1800 MHz.

Table 1.4 shows the results at site 003, the Combined Network has the highest power density of 1,079.30 $\mu W/m^2$ and -40.50 dBm at 900 MHz, also at 1800 MHz, it is noticeable that the Combined Network has highest power density of 671.00 $\mu W/m^2$ and -39.00 dBm, while at 2100 MHz, Combined Network still has the highest power density of 1,037.20 $\mu W/m^2$ and -38.00 dBm. MTN has the least radiation level of 101.70 $\mu W/m^2$ and -36.50 dBm at 1800 MHz. The result in Table 1.5 shows that ETISALAT has the highest power density of 1,672.00 $\mu W/m^2$ and -38.00 dBm at 900 MHz, at 1800 MHz, ETISALAT has the highest power density of 953.00 $\mu W/m^2$ and -34.00 dBm, while at 2100 MHz, ETISALAT still has the highest power density of 1,552.20 $\mu W/m^2$ and -38.00 dBm. MTN has the least radiation level of 145.50 $\mu W/m^2$ and -52.50 dBm at 1800 MHz. It can be observed from table 1.6 that at 900 MHz, AIRTEL has the highest power density of 1,446.50 $\mu W/m^2$ and -44.00 dBm, at 1800 MHz, AIRTEL has the highest power density of 1,301.20 $\mu W/m^2$ and -49.00 dBm, at 2100 MHz, AIRTEL also has the highest power density of 1,327.90 $\mu W/m^2$ and -40.50 dBm, while ETISALAT has the least radiation level of 187.50 $\mu W/m^2$ and -49.00 dBm at 1800 MHz, in all the three categories of cellular frequency bands.

Table 1.2: Measurements Results from Site 001

Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
953.57	AIRTEL	-40.00	11.70mW/m^2
942.85	AIRTEL	-35.50	4.50mW/m^2
953.57	MTN	-38.00	5.04mW/m^2
948.21	MTN	-36.00	4.70mW/m^2
782.14	GLO	-37.00	309.70$\mu W/m^2$
776.78	GLO	-37.50	287.90$\mu W/m^2$
1837.49	AIRTEL	-47.00	420.00$\mu W/m^2$
1853.57	AIRTEL	-50.00	500.50$\mu W/m^2$
1842.85	AIRTEL	-41.00	478.00$\mu W/m^2$
1837.49	MTN	-49.00	4.60mW/m^2
1500.00	MTN	-36.50	2.40mW/m^2
1832.14	GLO	-48.50	1666.30$\mu W/m^2$
1799.08	GLO	-31.50	1110.70$\mu W/m^2$
2116.07	AIRTEL	-35.00	411.00$\mu W/m^2$
2110.71	AIRTEL	-31.00	282.00$\mu W/m^2$
2116.07	MTN	-34.00	2.10mW/m^2
2110.71	MTN	-29.00	3.00mW/m^2
2217.85	GLO	-34.00	689.50$\mu W/m^2$
2116.07	GLO	-37.50	722.50$\mu W/m^2$
2110.71	GLO	-42.50	1436.70$\mu W/m^2$

Table 1.3: Measurements Results from Site 002

Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
950.89	MTN	-37.00	2.39mW/m^2
950.89	AIRTEL	-44.00	1941.30$\mu W/m^2$
954.91	AIRTEL	-43.00	1733.40$\mu W/m^2$
956.24	AIRTEL	-42.00	1600.30$\mu W/m^2$
945.53	GLO	-44.00	2.18mW/m^2
946.87	GLO	-45.00	2.08mW/m^2
949.55	GLO	-44.00	1771.00$\mu W/m^2$
950.89	GLO	-42.00	1719.70$\mu W/m^2$
956.24	GLO	-37.00	1612.20$\mu W/m^2$

Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
1837.49	MTN	-51.50	1464.10μW/m²
1845.53	MTN	-50.00	1333.40μW/m²
1848.21	MTN	-49.50	1206.20μW/m²
1820.08	AIRTEL	-47.00	1211.40μW/m²
1838.83	AIRTEL	-55.00	1205.60μW/m²
1846.87	AIRTEL	-59.00	1197.50μW/m²
1820.08	GLO	-53.50	1023.70μW/m²
1821.42	GLO	-53.00	1001.30μW/m²
2110.71	MTN	-42.00	2.26mW/m²
2113.39	MTN	-39.00	2.23mW/m²
2116.07	MTN	-35.50	1664.30μW/m²
2118.74	MTN	-43.50	1517.90μW/m²
2110.71	AIRTEL	-41.00	1577.40μW/m²
2112.05	AIRTEL	-39.00	1556.70μW/m²
2113.39	AIRTEL	-37.00	1309.50μW/m²
2116.07	AIRTEL	-37.50	1223.30μW/m²
2117.41	AIRTEL	-36.00	1212.40μW/m²
2110.71	GLO	-38.00	1565.50μW/m²
2112.05	GLO	-39.00	1558.60μW/m²
2113.39	GLO	-42.50	1531.70μW/m²
2116.07	GLO	-49.00	1297.50μW/m²
2117.41	GLO	-48.50	1238.70μW/m²
2121.42	GLO	-40.50	1190.50μW/m²
2122.71	GLO	-41.50	1151.90μW/m²
2124.10	GLO	-39.50	1150.00μW/m²
2128.12	GLO	-40.50	1136.80μW/m²

Table 1.4: Measurements Results from Site 003

Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
948.21	MTN	-35.00	444.70μW/m²
953.57	MTN	-40.00	336.50μW/m²
942.85	GLO	-32.00	381.40μW/m²
932.14	C. NET.	-40.50	1079.30μW/m²
1505.35	MTN	-36.50	101.70μW/m²
1832.14	MTN	-41.00	249.80μW/m²
1837.49	MTN	-43.00	281.30μW/m²
1842.85	MTN	-39.50	291.30μW/m²
1510.71	GLO	-39.50	208.90μW/m²
1816.07	GLO	-46.50	184.43μW/m²
1832.14	GLO	-48.50	174.30μW/m²
1521.42	C. NET.	-39.00	671.00μW/m²
1864.28	C. NET.	-42.50	543.00μW/m²
2110.71	MTN	-42.00	336.30μW/m²
2116.07	MTN	-41.00	362.20μW/m²
2341.02	MTN	-30.00	373.60μW/m²
2346.42	MTN	-32.00	513.00μW/m²
2121.42	GLO	-35.00	233.70μW/m²
2126.78	GLO	-37.00	219.60μW/m²
2110.71	C. NET.	-37.00	985.50μW/m²
2116.07	C. NET.	-38.00	1037.20μW/m²
2126.78	C. NET.	-36.00	952.80μW/m²
2132.14	C. NET.	-39.50	940.30μW/m²

Table 1.5: Measurements Results from Site 004

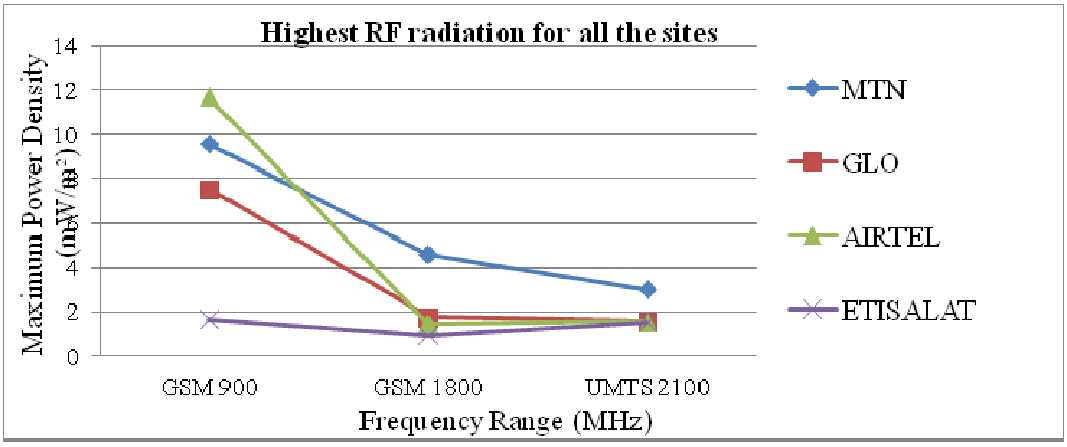
Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
932.14	MTN	-36.00	198.00μW/m²
953.57	MTN	-43.00	193.50μW/m²
958.92	MTN	-43.50	192.250μW/m²
942.85	ETISALAT	-38.00	1672.00μW/m²
948.21	ETISALAT	-36.50	1615.50μW/m²
953.57	AIRTEL	-33.00	731.70μW/m²
958.92	AIRTEL	-36.00	713.30μW/m²
1521.42	MTN	-40.00	175.40μW/m²
1858.92	MTN	-49.00	166.50μW/m²
1864.28	MTN	-52.50	145.50μW/m²
1505.35	ETISALAT	-34.00	953.00μW/m²
1821.42	ETISALAT	-40.00	713.80μW/m²
1500.00	AIRTEL	-35.00	644.20μW/m²
1832.14	AIRTEL	-44.50	627.30μW/m²
1853.57	AIRTEL	-39.00	532.80μW/m²
1858.92	AIRTEL	-41.50	448.20μW/m²
2110.71	MTN	-44.00	184.40μW/m²
2116.07	MTN	-48.50	180.30μW/m²
2137.49	MTN	-44.50	177.70μW/m²
2142.85	MTN	-42.00	175.50μW/m²
2110.71	ETISALAT	-38.00	1552.20μW/m²
2121.42	ETISALAT	-35.50	964.50μW/m²
2126.78	ETISALAT	-35.00	890.40μW/m²
2137.49	AIRTEL	-31.00	699.40μW/m²
2142.85	AIRTEL	-40.00	673.40μW/m²
2148.21	AIRTEL	-46.00	640.90μW/m²

Table 1.6: Measurements Results from Site 005

Peak freq. (MHz)	Mobile operator	Measured level (dBm)	Measured power density (W/m^2)
932.14	MTN	-36.00	505.60μW/m²
948.21	MTN	-38.50	419.30μW/m²
953.57	AIRTEL	-44.00	1446.50μW/m²
932.14	ETISALAT	-42.00	388.70μW/m²
937.49	ETISALAT	-44.00	325.40μW/m²
948.21	ETISALAT	-51.00	303.20μW/m²
1505.35	MTN	-34.50	420.20μW/m²
1521.42	MTN	-41.00	267.60μW/m²
1848.21	MTN	-48.50	229.90μW/m²
1864.28	MTN	-51.00	213.50μW/m²
1853.57	AIRTEL	-49.00	1301.20μW/m²
1848.21	AIRTEL	-50.00	1159.30μW/m²
1837.49	ETISALAT	-40.50	271.80μW/m²
1864.28	ETISALAT	-50.00	213.50μW/m²
1869.64	ETISALAT	-49.00	187.50μW/m²
2110.71	MTN	-47.50	414.50μW/m²
2116.07	MTN	-46.00	342.30μW/m²
2137.49	AIRTEL	-40.50	1327.90μW/m²
2142.85	AIRTEL	-42.50	1254.10μW/m²
2110.71	ETISALAT	-39.50	308.00μW/m²
2116.07	ETISALAT	-42.00	281.00μW/m²

The highest radiation measurement from all the sites at an interval of 5 meters away from the base stations is illustrated in Fig. 1.0, showing the highest RF radiation levels for GSM 900, GSM 1800 and UMTS 2100 downlink bands. It is obvious that at 900MHz, AIRTEL has the highest power density of 11.70mW/m^2, at 1800MHz, MTN has the highest power density of 4.60mW/m^2, at 2100MHz, MTN also has the highest power density of 3.00mW/m^2, while ETISALAT has the least RF radiation level of 0.953mW/m^2 at 1800MHz, in all the three categories of cellular frequency bands. It can also be observed that the radiation level is high at 900MHz but reduces with the generation of the mobile technology.

Figure 1.0: Measurements results of the highest RF radiation at 5m distance from the base station



The spectral scans recorded from the Adebayo base station, the site 002 is shown in Figs. 2 - 4. These indicated the spectral scans with the RF radiation levels for GSM 900, GSM 1800 and UMTS 2100 downlink bands recorded at 5meters away from the base stations. The highest RF radiation level at 900MHz is -37.00dBm at 950.89MHz with MTN operator, at 1800MHz, the highest RF radiation levels recorded is -47.00dBm at 1820.08MHz with AIRTEL operator, while at 2100MHz band, the RF radiation levels recorded is -48.50dBm at 2117.41MHz with GLO operator.

Figure 2: 900MHz Spectral scan

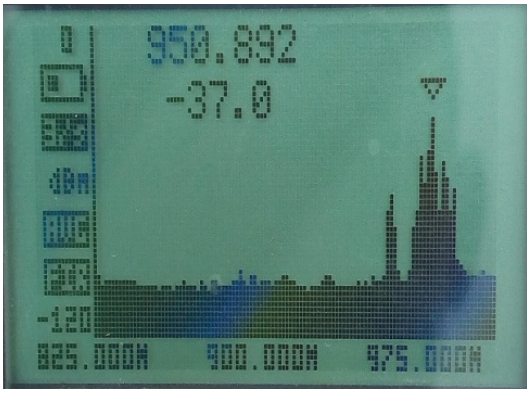


Figure 3: 1800 MHz Spectral scan

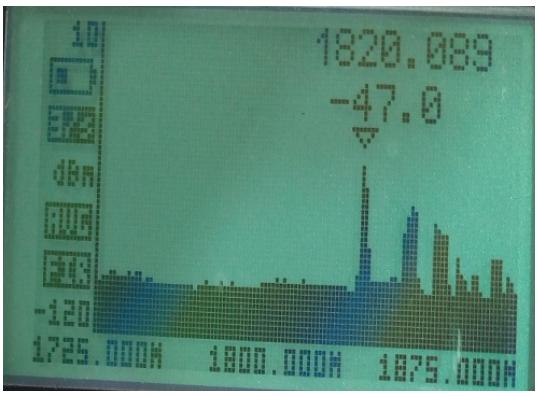
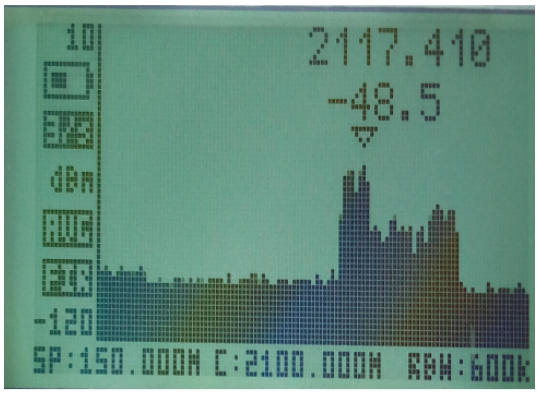


Figure 4: 2100 MHz Spectral scan



4. Conclusion

The study compares the radiations level from Mobile Network with the ones recommended by the International Commission on Non-ionizing Radiation Protection for exposure limitation. It is observed that the radiation measurements taken within Ado-Ekiti, Ekiti State, Nigeria are much lower than the ones recommended internationally. At 100 meters away from the GLO base station at Adebayo, Ado-Ekiti, it shows that the Network operator has the highest power density of 20.22mW/m^2 at -45.00dBm and 946.87MHz, converting the 20.22mW/m^2 gives a value of 0.0202W/m^2, which is 0.45%. It is followed by AIRTEL Network at Ekiti State University, Ado-Ekiti, having the highest power density of 11.70mW/m^2 at -40.00dBm and 953.57MHz at a distance of 5m away from the base station, converting the 11.70mW/m^2 gives a value of 0.0117W/m^2, which is 0.26%. Analyzing the results of this study logically, it is noticed that the radiation measurements taken from the entire base stations in Ado-Ekiti has RF radiations which are below 20.22mW/m^2 compared to the 4.5W/m^2 limits that is set by the

International Commission on Non-ionizing Radiation Protection (ICNIRP) as the maximum standard for public exposure. It is obvious that in every 100 meters, the RF radiation always increased to a peak and later decreased with further distance away from the mast. Similarly, the reduced value of dBm indicates the low level of RF radiation effects to the public health. This is an indication that the radiations considered to be the highest in Ado-Ekiti, Ekiti State, Nigeria are far much lower than the internationally recommended threshold, which implies that the exposures experienced within the base stations are still safe and far much less harmful to the public.

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