MEASUREMENT OF EMF AND RADIATION ON LIVING KIND IN RURAL AREA OF BANGLADESH

BY

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This Report Presented in Partial Fulfillment of the Requirements of the Degree of Bachelor of Science in Electronics and Telecommunication Engineering

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DHAKA-1207, BANGLADESH
JANUARY 2019

APPROVAL

This Thesis titled "**Measurement of emf and radiation on living kind in rural area of Bangladesh**" submitted by Emrul Kayes to the Department of Electronics and Telecommunication EngIneering(ETE), Daffodil International University, has been accepted as satisfactory for partial fulfillment of the requirement for the degree of Bachelor of Science in Electronics and Telecommunication Engineering and approved as to its style and contents. The Presentation was held on 22th January, 2019.

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I hereby declare that this project is my own work and effort under the supervision of Md. Taslim Arefin, Associate Professor and head, Department of Electronics and Telecommunication Engineering, Daffodil International University, Dhaka. It has not been submitted anywhere for any award. Where other source of information has been used, they have been acknowledged.

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ACKNOWLEDGMENTS

First I express my heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this Thesis successfully. It is a great pleasure for authors to express their unfettered gratification, sincere appreciation and profound respect to our respective supervisor, **Md. Taslim Arefin**, associate professor and head, department of ETE. For his constructive suggestion, scholastic guidance, constant inspiration, valuable advices and kind co-operation for the successful completion of work on "Electromagnetic field strength and Radiation on Living Kind of Rural Bangladesh". This could not be possible without his help.

Professor **Dr. Mohammad *Quamruzzaman,*** *Professor*,Department of Electronics and Telecommunication Engineering, Daffodil International University for **practical suggestion at the beggingwhen start for this thesis work.** Finally, I must acknowledge with due respect the constant support and patients of my parents.

Emrul Kayes

ABSTRACT

The goal of this work is to explore the electromagnetic field strength and radiation emitted by cell phone tower base station in residential areas of rural Bangladesh and its health effect on human body. The work is mainly divided into three main areas. The first area is an investigation of the magnetic fields in village environment. Second one is to measure the RF radiation. Electromagnetic field strength and RF radiation from mobile towers at a different selected locality in Barisal are measured. Frequency spectrum at different sites isalso measured. At the third phase measurement of different type health symptoms of RF exposure faced by the inhabitants from the tower are analyzed and compared.

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CHAPTER 1

Introduction

1.1 Introduction: There has been a significant growth in the international communication trade in recent years and it's resulted in a very dramatic increase in the range of wireless devices. [1] In recent data shows that the total number of mobile phone subscribers have reached147 million at the end of January, 2018 (source: BTRC). It has led to the mushrooming of supporting infrastructure within the form of cell towers and it has given the link to and from the mobile phone. And telephone companies have not followed any rules and regulation on the placement of the tower. They have placed haphazardly on top of the schools, mosques,hospitals, industrial buildings and terraces of highly populated residential areas. Government is not conscious about that. Electromagnetic radiation cannot be seen, felt or smelt and it is very hard to realize the evil part. Because one wouldn't notice their potential damage over long periods of exposure until they manifest within the variety of biological disorders. It has also become a new environmental threat and have the ill-effects of radio-frequency and electromagnetic field on bees, frogs, birds, fruit flies, and humans.

1.2 Motivation: The target of this venture is to represent the present situation of EMF and RF radiation in rural area of Bangladesh. People need to aware of the evil side RF radiation and Electromagnetic field. Motivation of this work was collect the evidence of Radiation and electromagnetic field effect. With the help of Cornet ED78S EMF

RF Meter we used to measure RF radiation and the Electromagnetic field in rural areas of Bangladesh. I measured the nearby area of base station within 50-100 meter and analyzed the data carefully.

1.3 The aims of this thesis were the following:

- To Measure the RF Radiation rate in the villager's residential areas of Barisal.
- ToMap the magnetic flux density in the villager's area of Barisal.
- To Investigate and calculate the RF effect on plants, long trees.
- To analyze and compare different type of health symptoms of RF exposure.

1.4 Report Formation: In recent year very dramatic increase in the range of wireless devices has created emergency situation in Bangladesh. In this thesis, at first I introduced the present situation of RF radiation, EMF in world and then described. In chapter three described the Biological Effect of Microwave Antenna. Materials and Methods is described in chapter four. Chapter five is the most important part of this thesis. Here we have analyzed the collected data and published the result. Power and density of RF radiation has measured from several towers of selected places in Barisal.

We have checked the medical history of those people who were living around 50 meter from the base station.

CHAPTER 2

2.1 RF Radiation: Cellular wireless telephones have become omnipresent. Wireless technology is based on widespread network of base stations. It connects users through RF signals. It is believed that mobile phones turn out RF energy of non-ionizing radiation that is simply too low to heat the body's tissues, and thence is unlikely to possess the same impact on human health as those made by ionized radiations. Notwithstanding, there is still a desire to see the amount of health risks caused by RF radiations.Human civilization are sinking with huge amounts of powerful wireless Radio Frequency (RF) signals. Cellular phone towers send high-frequency radio waves towards residential areas. several studies address the impact of mobile phone radiations on physical structure, solely a couple of contemplate the result of human exposure to base stations although such a control could also be bigger as a lot of body components will absorb RF energy. With the many increase in portable usage, doable health risks associated with RF exposure have become the topic of sizable attention. [1]

2.2 RF Radiation and Health Effects:

With the significant increase in mobile phone usage, possible health risks concerned to RF have increased day by day. The microwaves from microwave antenna of cell phone tower can trespass with human and natures body's own EMF. Health effect can be divided into two main categories: short term and long term effects. The short termeffect enhances brain electrical activity, sleep, heart rate cognitive function, and blood pressure.

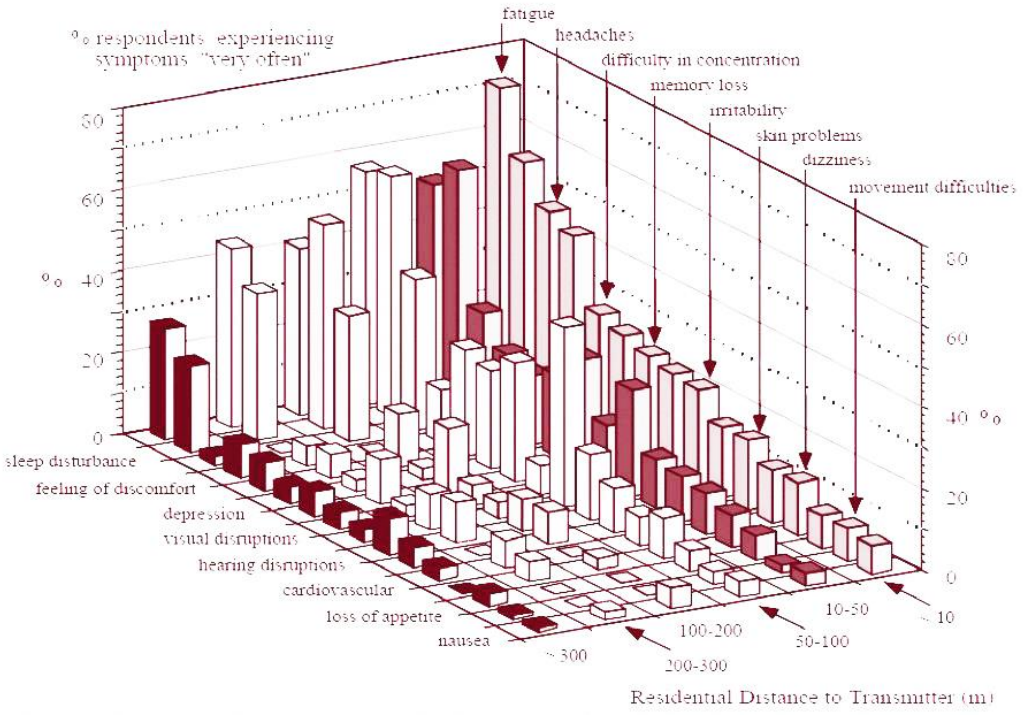

Fig 2.1: Response of residents living in the vicinity of a cellular phone base station.

Because of long term effect can launch cancers or brain tumors. The long term effects are tinnitus, headache, fatigue, memory loss and sleep disturbance, dysesthesia of the scalp, visual symptoms, sensations of warmth, muscle problem and epidemiological effects. [2].

2.3 Electromagnetic field:

The uses of Electromagnetic devices in our everyday life have increased a lot because of the invention during last hundred years. Over the last decade it has increased thousand time faster. It is a general concern in many countries because of the possibility of noxious health effects of Electromagnetic field strength. Biological body cell can be ionized through Electromagnetic field. The consequences of radiation have been inspected through an experiment preponderantly in cancer analysis. The theories for action mechanisms resulting in cell injury

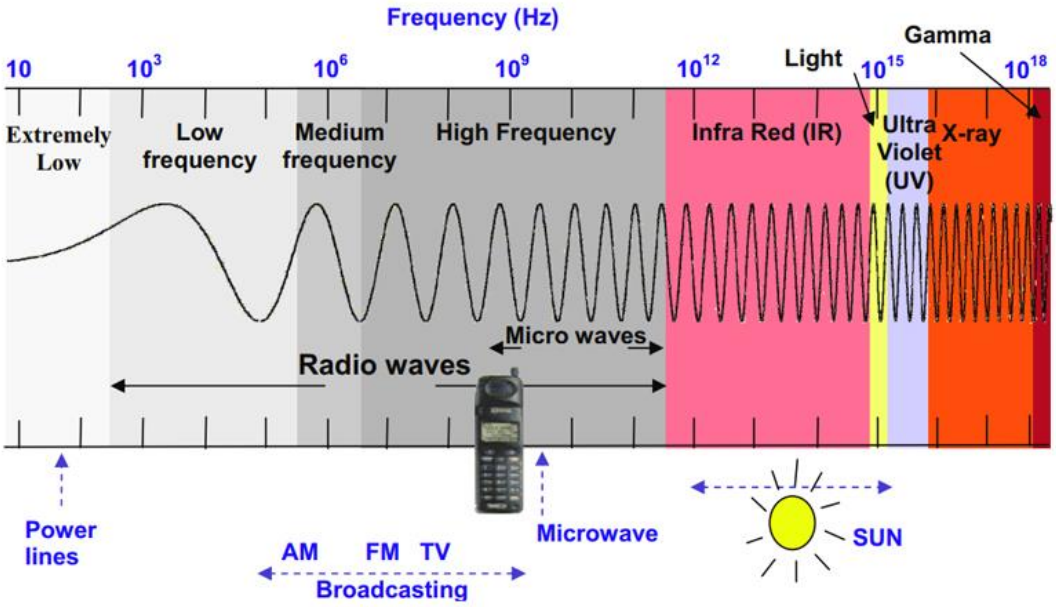

Fig. 2.2 The electromagnetic spectrum with different frequency band.

and to cancer square measure fairly well established [Hall 2000]. The radiation, with its higher energy compared to non-ionizing radiation, isn't the subject to bementioned within the gift thesis. However, it can sometimes be helpful to match the

characteristics and action of the 2 sorts of radiation and fields. In figure 1 the frequency and wavelength of EMFs shows in an exoteric form, and indicates the ranges where some EMF sources in our surroundings are located. It covers the frequency range 10 Hz to 10^{18} Hz. Here We have rehearsed only weak fields. presented in bold in Table number one.

TABLE ONE. A Range of relevant frequency bands (adapted from textbook by Brune et al. [2001]; page 115).

Turns Used for Frequency Band	Frequency Band	Wavelength (λ)
Static Field	0-3Hz	-100000 Km
Extremely Low Frequency	3-3000 Hz	100000- 100 Km
Very Low Frequency(VLF)	3-300 KHz	100- 1 Km
Radio Frequency (RF)	0.3-300 MHz	1000- 1m
Microwaves	0.3-300 GHz	1000- 1mm

Table2.1: In this thesis table, mobile phones frequencies from 900 MHz fields is pointed as RF-radiation.

It should again be marked that the term "EMF" is used as a common description for a long range of frequencies. Reactions get started in biological systems because of ionizing radiation, high frequency fields or low frequency magnetic fields are by no means equivalent.

2.4 Electromagnetic Field and Cancer Risk:

Human body is electrical at base level. [1] They reported that youngsters living in residential areas about to high power transmission lines (60 Hz) had a better incidence of childhood leukemia. [4]The reader is noted reviews of this field in ([Feychting et al. 2005] (general), [Naarala et al. 2004] (ELF cellular effects), [Crasson et al. 2003] (ELF effects on psychological feature functions). One amongst the challenges that of these studies share is to outline and specify the sort and magnitude of magnetic force fields to that subject's square measure exposed and that exposure levels might cause health effects.

First of all is these holes and our cell membranes and so that causes calcium leakage. In calcium it needs to be in a very narrow range in the body to do all of the things it does and so that it changed the calcium inside and outside the cell is no longer in balance because of these holes they are leaking out. infect they have done autopsies on autistic kids in their brains show all this calcium and balance throughout thei brain. These electromagnetic radiations are first of all causing those holes. and then they cause oxidation damage and that oxidation damage it just raises havoc at level of the cell it's breaking our DNA. It breaks both single and double standard DNA. So the difference between emf radiations in nuclear ionizing the nuclear an x-ray and all that is called ionizing and it breaks the DNA Human body is electrical at base level. One of the primary studies to point a causative relation between magnetic force fields and health effects was revealed by Wertheimer and Leeper in 1979. [1] what is more, the incidence decreased with the space from the facility lines. although the inflated risk was low, the study triggered more scientific studies in addition.

As public engagement in doable health effects by magnetic force fields, like cancer (leukemia, brain tumors and breast cancer), upset, and copy effects [see normally [Feychting et al. 2005]. The reader is noted reviews of this field in ([Feychting et al. 2005] (general), [Naarala et al. 2004] (ELF cellular effects), [Crasson et al. 2003]

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CHAPTER 3

Biological Effect of Microwave Antenna

Effect on Human:

3.1 Biological Effect of Microwave Antenna:

Human body observes radiation because it consists of 70% water. Cooking in microwave woven is very similar process where we heat the water in the water first. Microwave absorption impact is far a lot of significant by the body components that contain a lot of fluid (water, blood, etc.), just like the brain that consists of concerning ninety percent water. where the movement of the fluid is less the effect is more strong for example brain, heart, abdomen, eyes.Different type of health hazards attached with cellphone tower and cell phone. And described some of them in the sub section.

3.2 The Blood Brain Barrier:

The blood brain barrier (BBB) protects the brain by tight junctions surrounding cells of capillary walls which helps to keep toxic substances out. Experiments conducted on young laboratory rats found that RF from mobile phones will considerably open the blood brain barrier in animals and cause discharge of simple protein from blood vessels in inappropriate locations in the brain. The presence of albumen in brain tissue is a strong sign that blood vessels are damaged which the brain has lost a number of its protection. It is a long term process but it may lead to reduced brain reserve capability which may be disclosed by different later vegetative cell diseases and it is a matter of thinking that BBB and neurons are same in human and rates.

3.3 Children and Pregnant Women's Risk:

Children are most attackable to cell phone radiation as they.

- Absorb a lot of energy than adults from identical phone due to their smaller head and brain size, dilutant bone bones and skin, thinner, a lot of elastic ears, lower somatic cell volume, as well as larger physical phenomenon of nerve cells and therefore the energy penetrates a lot of deeply. Tumors in the middle brain area unit a lot of deadly than within the lobe.

- Reproduction of cell is quicker than man and it produce cancer more deadly.

- Life exposer time is longer than adult.

3.4 Irreversible infertility: In recent studies said that male fertility can utterly Affect. In 2006, the American Society for Reproductive Medicine declared that male cell phone users semen quality, sperm count, motility, viability decreased and normal morphology and is related to the time of cell phone use.

3.5 DNA damage: Cellular frequencies is also responsible for damaging DNA. Studies show that microwave exposure at levels below this fcc exposure commonplace, produces single and double strand breaks in DNA and membrane leakage due to calcium ions. Microwave radiation may interfere with the natural processes concerned in DNA replication and repair, by subtly sterilisation molecular conformation (architecture) and another damage is causing via free radical formation inside cells.

3.6 Interference with other gadgets: Navigational Cell phone signal interfere with navigational equipment and that's why it is banned in airborne flights. Electromagnetic interference(EMI) from mobile phones will cause malfunctioning of life-line electronic gadgets within the hospitals thereby probably endangering patients

and it's additionally suggested to limit mobile use in clinical areas like operative theatres and medical aid units.

3.7 Effect on Skin: Human skin get affected by cell phone radiation. More talkative people on cell phone have Higher concentration of the transtyretin protein than those who do not. Transtyretin is created in the liver; it helps transport vitamin within the body and plays an important role in nervous diseases like Alzheimers.

3.8 Effect on Eye: Human eye contains 98% water and contains 75% for cornea. Cell phone radiation can damage the visual system. and cause uveal melanoma. When Bovine eye lenses were exposed to microwave radiation, it caused gross injury and affected the optical operate of the lens.

3.9 Increase in Cancer risk: Cancer can cause for heavy uses of cell phone. It is very risky for the children under ten years and Can cause brain cancer of the glial cells that support the central nervous system and acoustic neuroma. It is prompt that kids ought to be discouraged from victimization mobile phones and prohibit use to emergency whereas adults ought to “keep calls short”.

Adverse effect on birds, animals and environment:

3.11 Effect on Honey Bees: Albert Einstein said, ‘‘If the bee disappears from the surface of the earth, man would have no more than four years to live.” By increasing electro pollution in the environment bees are facing a serious threat. In the US, Associate in Nursing abrupt disappearance of bees was discovered many years back and was related to the rising magnetism pollution. this is often called Colony Collapse Disorder (CCD) wherever bees cannot notice their manner back to the hive as a results of consistent magnetism back background that appears to disrupt intercellular communication inside individual bees.

3.2 Effect on Birds: When birds are exposed to weak electromagnetic fields, they disorient and begin to fly in all directions, which explain migratory birds undermining navigational abilities. A large number of birds like pigeons, sparrows, swans are getting lost due to interference from the new "unseen enemy", i.e. mobile phone masts. [1] Accidents happen mainly in the night, in fog, or bad weather, when birds might be using the earth's magnetic field for navigation, and could be seriously disoriented by the microwave radiation from telecommunication masts.

3.13 Effect on Plants: Electromagnetic radiation is also very harmful for plans, vegetables and crops. Studies show definitive clues that cell phone electrical phenomenon will choke seeds, inhibit germination and root growth, thereby moving the growth of agricultural crops and plants. a discount in wheat and corn yield within the fields close to high electromagnetic field lines has additionally been reportable.

CHAPTER 4

Materials and Methods

4.1 Materials:

In this part of this thesis contains the materials, equivalents, software used for the investigation and research. Here most important equivalent is Cornet ED78S EMF RF Meter ElectroMagnetic Detector “electrosmogmeter” and it was used to measure RF radiation and the Electromagnetic field. This equivalent can measure Electric, Magnetic Radio/microwave Detection All in One Package.

Fig 4.1: Electrosmogmeter with data during the survey.

4.2 Questionnaire:

To measure the RF radiation placed the electromog meter within 100 meter of cell phone tower. Measured RF radiation of a cell phone tower in villagers residential areas according to the cell position of the cell phone tower. And measured Electromagnetic field strength at that places. To study the health hazards and issues faced by the inhabitants living on the point of the bottom station (all living inside

100m), form survey was conducted on ten totally different symptoms on the southern part of Barisal (Swarupkhati, Banaripara, Barisal sodor).

Fig 4.2: Cell phone tower at Swarupkhati.

The survey was conducted on ten totally different places on forty people. The level of complaints for the studied symptoms was expressed by employing a scale of: zero = ne'er, 1= generally, 2 = often, three = fairly often. Health hazards faced by the inhabitants were analyzed and comparisons are created based on sex distance (less than 50m and over 50m).

3.3 Power density measurement:

Power density measuring was administrated on some chosen completely different homes and open places near cell phone tower in shut proximity to the base station. the most purpose of the measuring is to confirm that RF emission from every website doesn't exceed the general public limits and to seek out any correlation between the health complaints and also the power density.

$$Pd = nPtG / 4\pi D2$$

Here n = No of transmitters, Pt = Maximum power from each transmitter, G =Antenna gain (in decibel), D = Distance of the site from the transmitter. The power density was measured by Cornet ED78S EMF RF Meter Electromagnetic Detector “electrosmogmeter” manufactured by Cornet micro system.

Fig 4.3: Cell phone tower at Indurhat.

3.4 Frequency Spectrum:

Frequency Spectrum of the Radiation recorded at different open places and village houses. In here we also used Cornet ED78S EMF RF Meter Electromagnetic Detector “electrosmogmeter” manufactured by Cornet micro system to measure and analysis the frequency spectrum.

CHAPTER 5

Result and Discussion

6.1 Analysis of questionnaire

Electromagnetic field strength measurement of Barisal Sodor. We divided this place into three main sub places. They are Rupatoli bus Stand, Sagordi bazar and Notullabad Bus stand.

Table 6.1: Report between male (25) and female (20) living nearby the base station within 50m (all the figures are in percentage).

Sl No	Symptom	0		1		2		3	
		M	F	M	F	M	F	M	F
1	Fatigue	43	22	28	47	20	9	12	19
2	Nausea	39	37	40	38	12	14	4	9.5
3	Sleep Disruption	35	22	16	28	20	23	24	23
4	Feeling of Discomfort	55	41	20	37	6	19	12	0
5	Headache	35	13	48	57	12	9.5	0	19
6	Difficulty in concentration	28	27	40	52	16	19	12	0
7	Memory loss	31	22	40	47	16	23	8	4.7
8	Skin problem	31	32	32	23	12	14	20	4.7
9	Visual Disruption	51	65	20	23	4	9.5	16	4.7
10	Hearing Problem	59	65	20	22	4	9.5	12	0
11	Dizziness	63	32	24	42	24	19	24	4.7
12	Muscle Pain	54	42	14	16	16	17	12	21

Reference: 0 = never, 1= sometimes, 2 = often, 3 = very often

Table 6.2: Parallelism of complaints between male (10) and female (8) living near the base station outside 50m (all the figures are in percentage)

Sl No	Symptom	0		1		2		3	
		M	F	M	F	M	F	M	F
1	Fatigue	75	80	12	10	10	11	0	0
2	Nausea	74	79	12	9	9	0	11	0
3	Sleep Disruption	48	78	35	8	8	10	0	0
4	Feeling of Discomfort	50	88	35	0	10	12.5	0	0
5	Headache	60	68	23	18	8	10	0	0
6	Difficulty in concentration	62	70	25	20	10	12.5	0	0
7	Memory loss	48	78	48	18	0	0	0	0
8	Skin problem	35	100	48	0	0	10	0	0
9	Visual Disruption	35	78	35	20	0	23	0	0
10	Hearing Problem	48	100	35	0	11	24	0	0
11	Dizziness	63	32	24	42	24	19	24	4.7
12	Muscle Pain	62	55	20	16	8	13	6	11

Reference: 0 = never, 1= sometimes, 2 = often, 3 = very often

6.3 Power and Density Measurement:

Table 6.4: Power and density of RF radiation has measured from several towers of selected places. The highest measured value was 38.19mw/m2 at Rupatoli bus stand, Barisal. And the lowest measured value was 0.436mw/m2.

Places	EMF (μT)	RF (mw/m2)
Rupatoli Bus stand	0.88 μT	Min-24.65 Max- 38.19
Sagordi Bazar	μT	Min-0.2301 Max- 4.91
Notullabad Bus stand	0.4 μT	Min-22.45

		Max- 28.96

Table 6.5: Electromagnetic field strength measurement of Banaripara and it is a upazila of Barisal district. Here we divided the place into three sub places to measure accurately.

Places	EMF (μT)	RF (mw/m2)
Baisari	0.4 μT	Min-24.65 Max- 38.19
Zonata Bazar	0.2 μT	Min-0.2301 Max- 4.91
Banaripara Sodor	0.06 μT	Min-22.45 Max- 28.96

Table 6.6: Electromagnetic field strength measurement of Swarupkati, it is a upazila of Pirojpur district and in the division of Barisal. Here we divided the place into three sub places to measure perfectly as we can.

Place	Electromagnetic field strength (μT)
Swarupkhati Sodor	0.3 μT
Indurhat Sodor	0.4 μT
Banaripara Sodor	0.06 μT

Power density Measurement:

Table 6.7: Measured values of Power density at different houses.

SL No	Nature of House	Distance from the Tower	Exact Site of Measurement	Power Density (mw/m^2)	Power (dBm)	Main complaints of the House
1	Residence-1 / RCC	73	Living Room	1.5	-17	Muscle pain, Fatigue, sleep disorder, Nausea
			Balcony	21	-19	
2	Residence-2 / RCC	59	Living Room	1.95	-18	Muscle pain, Fatigue, sleep disorder, Nausea
			Kitchen	1.69	-19	
3	Residence-3 / RCC	100	Balcony	0.0018	-48	No complaints

Fig 5.1- 5.4: correspondence of complaints for the people (male and female) who are living around 50 meter from the base station. Here male is indicated with Red color and Female is indicated with blue color.

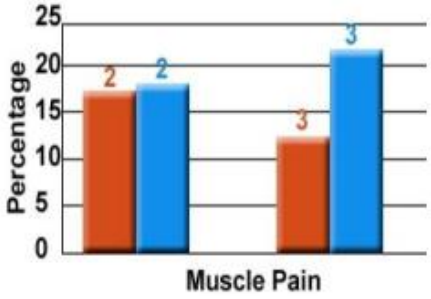

Fig-5.1

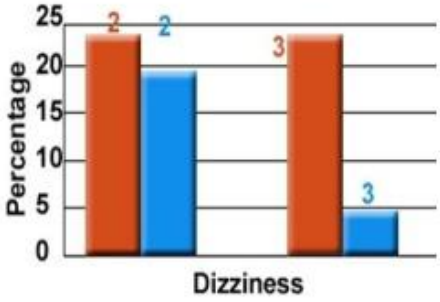

Fig-5.2

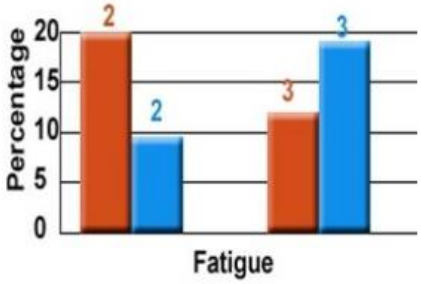

Fig-5.3

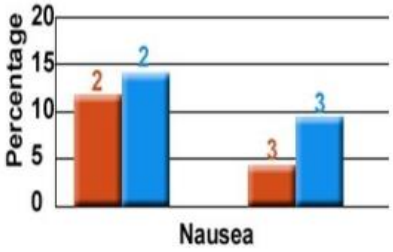

Fig-5.4

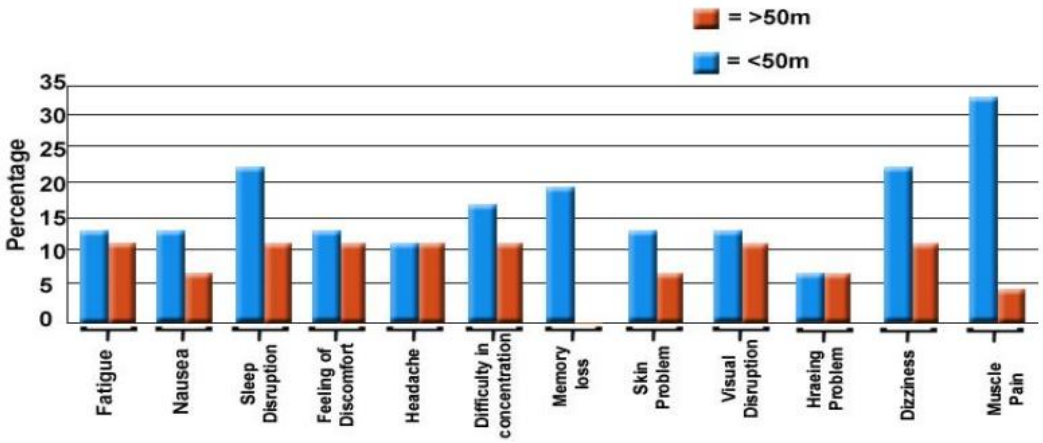

Fig-5.5: Comparison of complaints from all the individuals based on distance.

CHAPTER 6

Conclusion and future of Work

Conclusion: It has been audited that most of the measured value of power density at the sites are higher than that of the safety recommendation. Cell phone operator tries to tell that there is no health issue. But it is proved that it has become a serious health hazard due to radiation from cell phone tower. Cell phone business is turning into another tobacco business, that unbroken claiming that smoking isn't harmful and currently their square measure millions of folks round the world Health Organization have suffered from smoking. In truth cell phone tower radiation is the worst. Therefore, majority of individuals tend to possess familiarity towards personal protection.Unfortunately, mental object and non-awareness adds to the current misery and every one folks are interesting this slow poison inadvertently. notwithstanding folks are tuned in to the radiation hazard, they will not have the selection to maneuver off from it if the tower is put in close to their workplace or residential building.It may be ended that mobile tower mustn't be erected within the geographic region. it's recommended that human dwelling ought to be avoided inside 50m from the cell phone tower.

Future scope of Work: Future scope of the work is to measure the electromagnetic field strength and radiation all over Bangladesh and can divide the places into more sub places.

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APPENDEX

EMF- Electro Magnetic force

RF- Radio Frequency

EM- Electro Magnetic

GSM- Global System for Mobile Communication

ICNIRP- International Commission on Non-Ionizing Radiation

CDMA- Code Division Multiple Access

VAS- Visual Analog Scale

LM- Low Frequency