

## Effect of Electromagnetic Radiations On Human Body

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**Abstract** - Mobile phones has become the integral part of human life in today’s world. The data shows that the total number of mobile phone users has been increased to 4.68 billion and is expected to reach 5 billion mark in 2019. Indians are second highest user 1,183,408,611 in numbers after China in may 2018. But every coin has two sides similarly here also one negative side of mobile phones is on human brain. Radiation of electromagnetic waves created a negative impact on human’s brain and their immune system. In recent years numerous ways such as (earphones, bluetooth, headset) has been investigated to reduce this harmful effect of EM wave .These frequencies are reducing human health exponentially. In this paper effect of EM waves with or without devices has been discussed.

**Keywords**- GSM, CDMA, Electroencephalogram, EM waves.

### I. INTRODUCTION

Electromagnetic spectrum consist of number of frequency ranging from below 1 HZ to  $10^{25}$  HZ. With the increasing need of fast and noise free communication every single frequency of the spectrum is being used optimally [1]. Hence this growing need of speedy communication has consequently created a disturbance in biological system. It is seen that children gets affected by EM waves more rapidly than adults .Absorption rate is higher in children [2]Waves coming out from cell phones can increase the amount of glucose in human body thereby damaging the oxygen radical and eventually working of the cell deteriorate. Electromagnetic radiation is of two types ionizing and non ionizing radiations. Ionizing radiations are able to break the bond between atom and electron and hence can severely damage body by causing diseases like cancer, memory loss, burning sensation and itching while on the other hand non ionizing waves does not have much energy to break the bond [3]. It just creates vibration in the molecules. Therefore a new area of research has emerged out .Now a days radiations are everywhere in the system starting from satellites mobile phones radar to microwave radiation caused at home via home appliances.

### II. EXPERIMENT

An experiment with the help of medical practitioners and university health centre by Aruna Tyagi and DR. Manoj Duhan (Chairman, ECE department, DCRUST) and Dinesh Bhatia (Biomedical department, DCRUST) was conducted in biomedical Engineering department of DCRUST University. In this experiment eighteen healthy people participated voluntary. Experiment was done on 10 men and 8 women aged between 18-30 years (number of electrodes used is 22) average weight and average height was 65 and 5.5’ respectively. In order to record the effect of radiations on humans, a PSG (32 channel) electroencephalogram system was used. Electroencephalogram is an electronic instrument to detect the signals taking place inside the brain [4] These Volunteers were tested in four conditions Initially volunteers were made to place in the no radiation environment, then they were tested under radiation caused due to a GSM mobile Subsequently on CDMA based mobile and then later on they were tested under vicinity of landline phones. The span of this process (talking time on cell phone) was 11 min. MOTO X, iPhone 6, BSNL landline phone were used in this experiment.

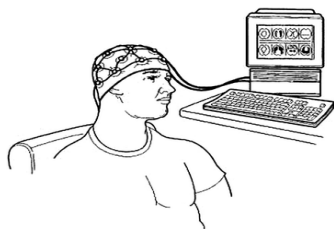


Fig.1.Implementation of EEG on a patient [8]

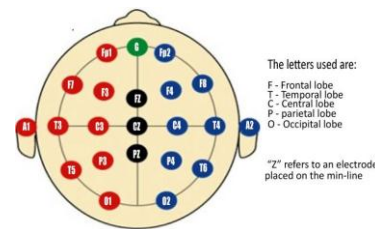


Fig2. Placement of electrodes on the brain [1]

	gsm	Cdma	Landline
FP1-F7	0.75	0.95	0.75
F7-T3	0.85	0.82	0.9
T3-T5	0.75	0.92	0.89
T5-01	0.69	0.78	0.9

Table1. Effect of GSM CDMA &Landline on human body

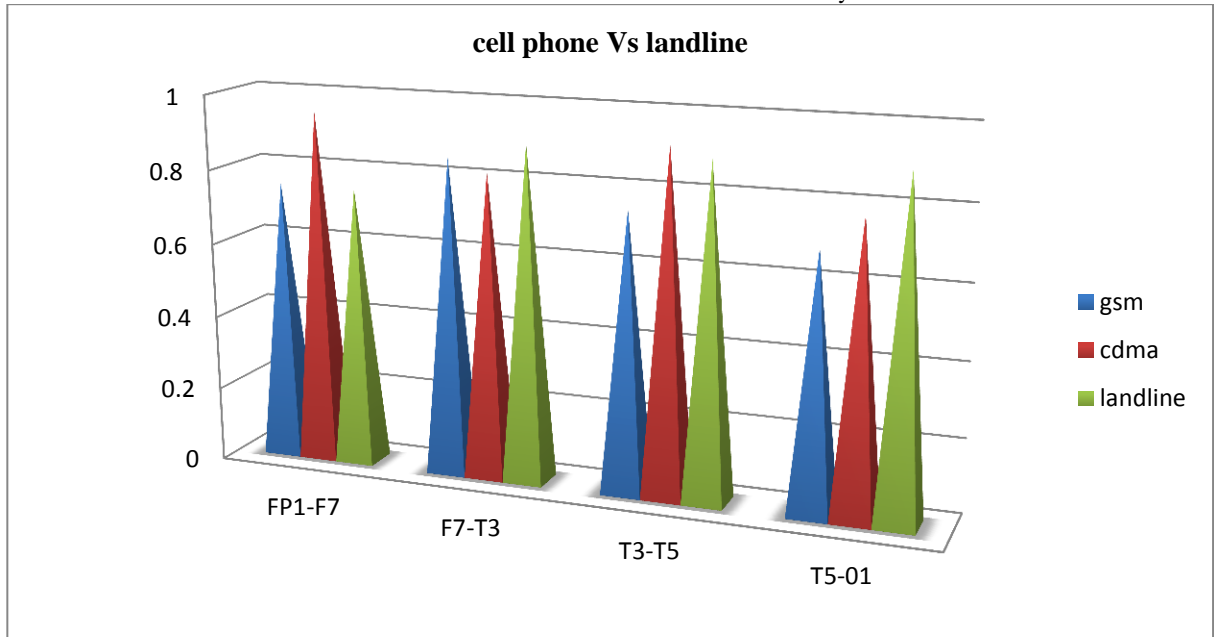


Fig.3.Effect of GSM CDMA and landline radiations on brain

### III. EXPERIMENT

To find out how effective headsets and earphones are in dampening the effect of electromagnetic radiations. Initially human volunteers were asked to talk on phone for 45 minutes. Internal images of their bodies were taken in every five minutes by thermal imaging technique. In the second phase of the experiment volunteers were asked to use the phone for the same time duration however this time using Bluetooth, headsets and earphones .Similar thermal images were taken in every five minutes. All the images were then collected and analyzed. Graphical analysis of thermal images is presented in the figure below .From the graph it can be seen that devices like earphone and headsets are quite effective in reducing the thermal radiations being emitted by mobile phone antennas.

Table 2. Radiation with no accessories Vs headset and earphones

Time (in min)	Headset	Earphones	No accessories
0	35	36	35.5
5	35	35	36
10	36	35	36
15	36	35	37
20	35	35	37.5
25	35	35	37.9
30	35	35	37.9
35	35.5	35	38
40	35	35	38
45	35	35	38

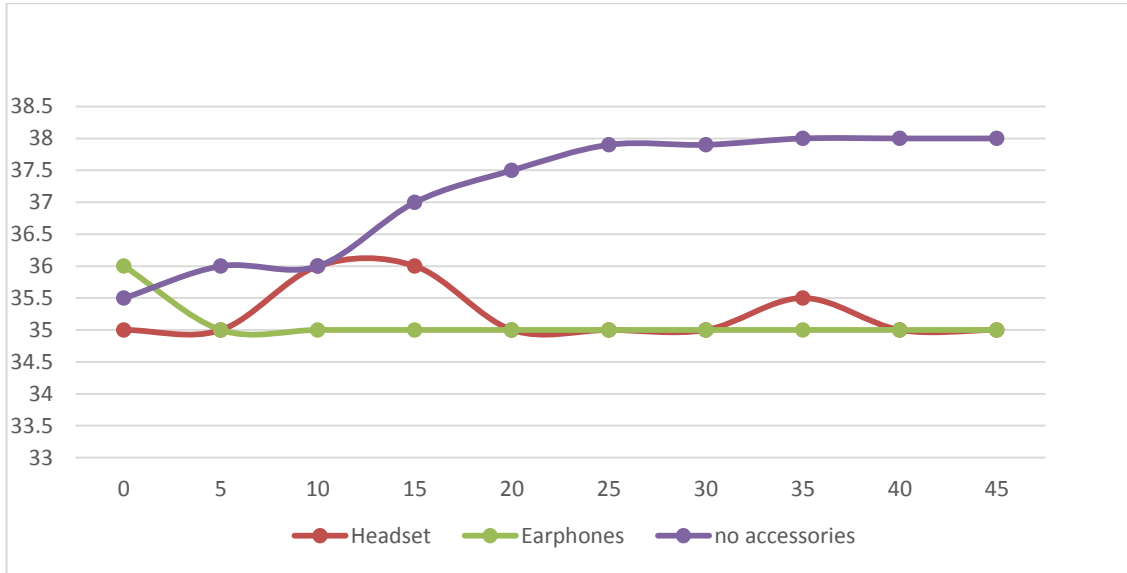


Fig 4. Comparison of radiation with no accessories headset and earphones

**IV. EXPERIMENT**

Under the surveillance and guidance of DR. Manoj Dhan (DCRUST, MURTHAL) an analysis is done to observe and measure the effect of radiations of electromagnetic waves from cellular gadgets on the humans. A track of human body response while using mobiles has been done through a machine named electroencephalogram. This experiment is done under different conditions. Initially examination was done when a volunteer uses a bluetooth device while talking on a call and later on same process is being repeated with another device called earphones. This observation has been recorded for the period of 11 minutes and the same examination is done on five inputs. Digital signal processing approaches have been practiced here.

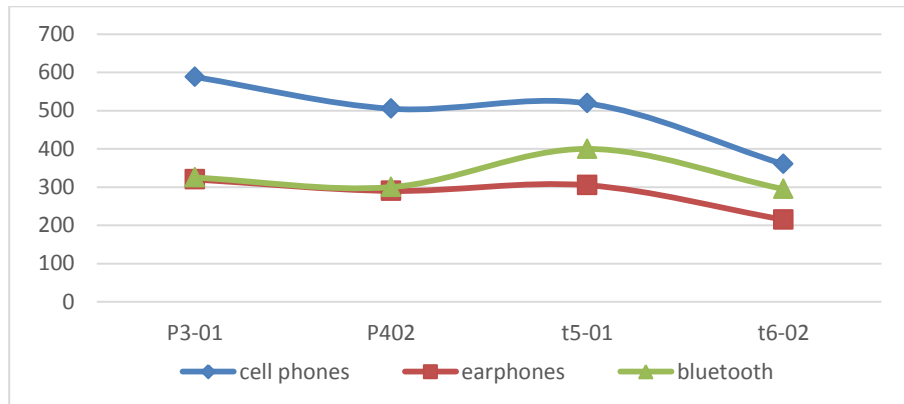


Fig.5. PLOT OF AVERAGE PSD VALUES OF FOUR CHANNELS OF MONTAGE

Table .3 PSD values of channels

	cell phones	earphones	bluetooth
P3-01	588	320	325
P402	505	290	300
t5-01	519	305	400
t6-02	360	215	295

## V. CONCLUSION

After performing the experiment, subsequently a conclusion is drawn that gsm operated mobile phones has more effect on humans compared to CDMA equipped mobiles. The adverse effect of electromagnetic radiation can be cut down by using devices like bluetooth, earphones, Headset. Peculiarly less damage is caused by earphones than bluetooth. It is advisable to use landline as it emits less radiation than cell phones.

## VI. FUTURE WORK

Mobiles phones has become an integral part of human's life. People keep on maintaining a continuous touch with the mobiles phones as they want to get connected with the world every time. So it's been difficult for people to maintain distance with the mobile phones and thus EM waves continue to harm human body and especially human brain. Hence a wide area of research is open to study the methods of eliminating harmful effects of EM waves by creating a perfect balance in nature and biological system [9] [10].

## PRECAUTIONS TO REDUCE THE EFFECT OF HARMFUL RADIATION OF EM WAVES THROUGH CELL PHONES

- Prior approval cell phones should go through testing process [5].
- Devices emitting harmful radiations should be banned.
- During a call one should use Bluetooth or handsfree[6]
- At home one should use landline phones as they emit less harmful radiation
- People can opt for messaging option instead of calling as continuous contact with mobile phone directly can deteriorate health.
- One should use mobile only at the time of high signal strength [7].

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