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Effect of Mobile Tower Radiation and Mobile Phone's Range Variation on Human Being

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Abstract: ***The mobile system consist of two parts mobile tower and mobile phone .The radiation of phone depends upon range of signal. In daily usage of mobile phones it is observed that there is variation in the network range bar. Using this range bar of networks we need to study its effect on variation of tissue temperature of human beings. If range is full, radiation is low and vica-verca.Tower transmit signal that is received by mobile phone, signal strength is inversely proportional to square of distance. Radiation effect is more near to the tower and less far away from the tower. It is observed that the received power is more as compared with calculated power of the tower. Radiation absorption is also proportional to time. If range of the network is more the electric field intensity is less and goes on increasing if range becomes less. As range decreases radiation increase, temperature of the tissue increases.***

Temperature variation is from 0.47°C to 4.1°C.In cancer treatment radiation therapy is used it is observed that as electric field intensity is increased penetration distance in the tissue will increase.

Keywords: Radiation, Field intensity, Radiation therapy.

I. INTRODUCTION

Mobile technology is increasing rapidly nowadays. Around 81 Crore cellphone users are present in India and 4.61 Lakhs mobile towers. long use of mobile phone can damage the health of individuals .it is associated with long illness such brain tumors, headaches ,low sperm count and mobility ,memory loss including demine which can result towards alzheimerli disease and concentration problems. With the help of radiation method we can measure radiation power ,electric field and magnetic field[1][2].Mobile phone generates a modulated version of radio frequency electromagnetic field which is form of non-ionizing radiation.it can induce electric field and current pass in a body which generates heat in the tissue[1][3].Here study is mobile have range bar when range bar is 5 we get signal proper magnitude -50dBm when range bar goes on reducing then signal strength reduce the range of signal -50dBm to -110dBm .when range is proper electrical field is 15V/m, as range decreases radiation increases electrical field increase it reaches up to 30V/m.

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Here we analyze for frequency 0.9Ghz and 1.8GHz, temperature variation for different range bar that is for variation in electric field, as radiation change it will change the temperature. Number of mobiles and number of mobile towers are increasing without considering its disadvantage. Thus the following parameters must be provided by mobile communication service providers.

1. Peak power and frequency from each antenna.
2. RF amplifier models and its specifications.
3. Type of antenna and its radiation pattern.
4. Land clearance required around the tower.
5. Electromagnetic radiation emerging from cell phone and towers.

A cell phone transmits power of 1 to 2 Watts. The frequency range is 824 to 849 MHz (CDMA), 890 to 915 MHz (GSM-900), 1710 to 1780 MHz (GSM-1800)[4][5], 1.8 to 2.5 GHz for 3G, for 4G its is 2 to 8 GHz and for 5G it is 24 to 80 GHz.The SAR limit for cellphone is 1.6 W/Kg and 6 minutes/day use[6][7]. If we use cellphone more than the SAR and time limits, it will create health hazards. If the usage of cellphone is more than time limit, it will effect on the ear lobes by heating, sleep disorder, lack of concentration, memory loss and even cancer.

Table 1.Exposure Range

Exposure range	Comments
<0.1 $\mu W/m^2$	No Concern
0.1 $\mu W/m^2$ to 10 $\mu W/m^2$	Slight Concern
10 $\mu W/m^2$ to 1000 $\mu W/m^2$	Severe Concern
>10000 $\mu W/m^2$	Extreme Concern

In the above table standard exposure ranges have been mentioned

II. THEORETICAL AND MEASURED POWER FROM TOWER

Here we measure power at the distance D, the transmitted power from tower is P_{tr} and the received power is P_{ri}. Here we consider gain of transmitting antenna G_{tr} and gain of receiving antenna to be G_{ri}. The received power at distance D is given by equation (1).

$$P_{ri} = P_{tr}.G_{tr}.G_{ri}.\left(\frac{\lambda}{4\pi D}\right)^2 \quad (1)$$

For transmitting power $P_{tr} = 20\ Watt$, transmitting antenna gain $G_{tr} = 17\ dB$, receiving antenna gain $G_{ri} = 2\ dB$, the received power at distance D = 50 meters.

At 887 MHz (tower transmitting frequency in CDMA), $P_{ri} = -3.2\, dBm$.

At 945 MHz (tower transmitting frequency in GSM-900), $P_{ri} = -3.8\, dBm$.
At 1872 MHz (tower transmitting frequency in GSM-1800), $P_{ri} = -9.7\, dBm$.
Power density for all these frequencies is 31,800 $\mu W/m^2$.

Table 2. Power Distribution

Sr. No.	Frequency in MHz	Distance (D) in m	Power Level (P_{ri}) in dBm	Cable Loss in dB	Radiation Density in $\mu W/m^2$
1	950	25	-28	3.78	159
2	951	20 (Outdoor)	-22	3.78	634
3	951	20 (Inside room)	-30	3.78	100
4	951	5 (Building Top Floor)	-30	3.78	100
5	951	8.5 (Ground Floor)	-18.6	3.78	1,387

Table 2 gives variation of power with respect to frequency and distance from the tower. Cellphone generates power within the range -50 dBm to -110 dBm. Full strength is at -50 dBm, as the range of the cellphone reduces, cellphone radiation power increases significantly. Here it is observed that the received power is more as compared with calculated power, at 25m distance the calculated power is 15.48 dBm and received power is 28 dBm. Many people living close to such cellphone towers have several health problems.

Table 3. Power Consumption

Sr. No.	Range	Power in dBm	Consumption per min.	Consumption per hour.	Consumption per day
1	IIIII	-50	405 W-sec	24.3 KW-sec	583.2 KW-sec
2	IIII	-65	3746W-sec	223.5 KW-sec	5365 KW-sec
3	III	-80	20250W-sec	1215 KW-sec	29150 KW-sec
4	II	-95	101250W-sec	6075 KW-sec	145750 KW-sec
5	I	-110	405000W-sec	24300 KW-sec	583200 KW-sec

Here we observed for different range bar radiation power is different, power consumption will be different for different range bar. As range bar reduce radiation power increase because of that power consumption will increase that increases tissue temperature.

Table 4. Electrical Field Distribution

Sr.No	Range Bar	Electric field intensity
1	IIIII	15v/m
2	IIII	18.5V/m
3	III	23.7V/m
4	II	27.3V/m
5	I	31V/m

When mobile phone is ON it works with the range bar I-V when range bar V it means full range power is -50dbm ,when range reduced mobile radiate more power. The electric field intensity is different for different range bar. Due to variation of range bar field intensity changes corresponding power change her we calculate x for different value of power for different range bar .
When tissue is exposed to electromagnetic field as per induction heating, heat induces in tissue because of blood circulation tissue heat transfer into blood and blood heat transfer into atmosphere here x is distance at which tissue temperature reaches to normal temperature after exposing to electromagnetic radiation[1][3].

$$x_{max} = \frac{1}{\sqrt{\lambda} - 1/L} . \{ Ln\left(L\sqrt{\lambda}\right) + Ln\left(1 + \left(\frac{\lambda - 1/L^2}{q_0}\right)(T_0 - T_e)\right) \} \quad (1)$$

Where,
X - distance from tissue surface to temp reached to normal
λ-wave length
L-microwave penetration depth in cm
$q_{0} = I_{0\tau/JLK}$
$I_{0\text{-wave}}$ intensity w/cm^2
τ-traction of energy transmitted into the tissue
J-mechanical equivalent of heat
K-coefficient of tissue heat conduction
T_0-temputure of arterial blood entering the tissue
T_e- tissue surface temperature
Here, power is calculated using high frequency heating equation.

$$P = 2\pi f \varepsilon_0 \varepsilon_r E^2 \quad (2)$$

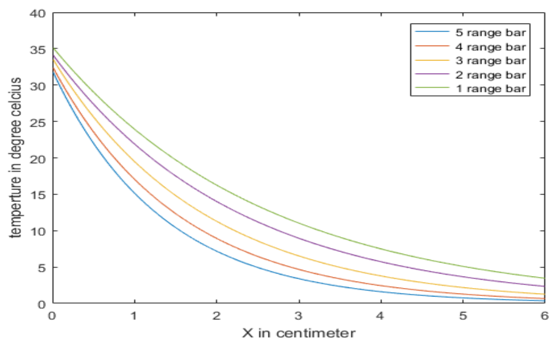

Fig.1. Mobile Range and Temperature Analysis

From above analysis it is observed that as signal range changes there is change in the electrical field intensity , when is range is full rise in temperature is 0.47°C and when range is lower electrical field intensity is more 30v/m ,rise in temperature is 4.1°C.

Table 5 Range Bar to Temperature Analysis

Sr.No	Range Bar	Rise in Temperature in °C
1	IIIII	0.47
2	IIII	1.2
3	III	2.6
4	II	3.2
5	I	4.1

Above analysis gives for full range that is IIIII bar temperature variation is less as range bar reduces temperature variation increases.

III. EFFECT OF ELECTRIC FIELD ON RADIATION THERAPY

Radiation therapy is a type of cancer treatment that uses beams of intense energy to kill cancer cells. Radiation therapy most often uses X-rays, but protons or other types of energy also can be used. The term "radiation therapy" most often refers to external beam radiation therapy. During this sort of radiation, the high-vitality shafts originate from a machine outside of your body that points the bars at an exact point on your body. During an alternate sort of radiation treatment called brachytherapy , radiation is put inside your body. Radiation treatment harms cells by wrecking the hereditary material that controls how cells develop and partition. While both sound and dangerous cells are harmed by radiation treatment, the objective of radiation treatment is to pulverize as couple of ordinary, solid cells as could be expected under the circumstances. Ordinary cells can frequently fix a great part of the harm brought about by radiation. Radiation treatment uses floods of radiation to treat diseases and tumors, just as different conditions. As a general term, radiation means floods of vitality, for example, light or warmth. The type of radiation utilized in malignancy treatment is a high-vitality type known as ionizing radiation. Exactly how radiation fills in as a treatment for cancer is intricate and as yet being inquired about, however on a basic level it separates the DNA of disease cells in a manner that upsets their development and division and can even murder them. Radiation therapy will sometimes be used on its own, and in some cases will be used alongside other cancer treatments, such as chemotherapy, if a cancer specialist decides that this will enhance the effect of the treatment. Most X-beams have a wavelength running from 0.01 to 10 nanometers, relating to frequencies in the range 30 petahertz to 30 exahertz (3×1016 Hz to 3×1019 Hz) and energies in the range 100 eV to 100 keV. X-beam wavelengths are shorter than those of UV rays and normally longer than those of gamma beams[6][7].

Superficial radiotherapy X-rays – 60 to 150 keV. Diagnostic X-rays – 20 to 150 keV (mammography to CT); this is the **range** of photon energies at which the photoelectric effect, which gives maximal soft-tissue contrast, predominates. Ortho voltage **X-rays** – 200 to 500 keV. Therapeutically helpful photon bars can likewise be gotten from a radioactive source, for example, iridium-192, caesium-137 or radium-226 (which is never again utilized clinically), or cobalt-60. Such photon bars, got from radioactive rot, are pretty much monochromatic and are appropriately named gamma beams. The standard vitality range is between 300 keV to 1.5 MeV, and is explicit to the isotope. Quite, photon pillars getting from radioisotopes are roughly mono energetic, as appeared differently in relation to the consistent bremsstrahlung range from a linac.

For healing cases, the normal portion for a strong epithelial tumor ranges from 60 to 80 Gy, while lymphomas are treated with 20 to 40 Gy. Preventive (adjuvant) portions are commonly around 45–60 Gy in 1.8–2 Gy fractions (for bosom, head, and neck malignancies.) Most examinations have recommended that the proficient temperature run for making HT-related antitumor impacts between 42 °C and 45 °C.45 However, the restorative utilization of fundamental HT 39–41 °C as an adjuvant to radiotherapy and chemotherapy is conceivable and produces beneficial helpful anticancer impacts.

$$\frac{\partial H}{\partial x} + \varepsilon \frac{\partial E}{\partial t} + \sigma E = 0$$

$$\frac{\partial E}{\partial x} + \mu_e \frac{\partial H}{\partial t} = 0$$

$$\rho c_p \frac{\partial T}{\partial t} = \frac{\partial}{\partial x}\left(K \frac{\partial T}{\partial x}\right) + \omega_b \rho_b c_b (T_b - T) + Q(T)\,|E|^2$$

$$\left.\begin{array}{lll} T(x,0) = \frac{T_c x}{L}, & T(L,t) = T_c, & T(0,t) = 0, \\ E(x,0) = \frac{E_0 x}{L}, & E(L,t) = E_0, & E(0,t) = 0, \\ H(x,0) = \frac{H_0 x}{L}, & H(L,t) = H_0, & H(0,t) = 0, \\ Q(T) = T^m & & \end{array}\right\}$$

$$\left.\begin{array}{l} t^* = \frac{tv}{L^2},\ x^* = \frac{x}{L},\ T^* = \frac{T}{T_b},\ c_1 = \frac{c_b}{c_p},\ \lambda = \frac{L^2 T_b^{m-1}|E_0^2|}{v \rho c_p} \\ E^* = \frac{E}{E_0},\ H^* = \frac{H}{H_0},\ \rho_1 = \frac{\rho_b}{\rho},\ \omega_1 = \frac{w_b L^2}{v},\ \lambda_1 = \frac{v \varepsilon E_0}{L H_0} \\ \lambda_2 = \frac{L \sigma E_0}{H_0},\ \lambda_3 = \frac{\mu_e H_0 v}{L E_0} \\ \frac{H_{i+1,j} - H_{i-1,j}}{2\Delta x} + \lambda_1 \frac{E_{i,j+1} - E_{i,j}}{\Delta t} + \lambda_2 E_{i,j} = 0 \end{array}\right\}$$

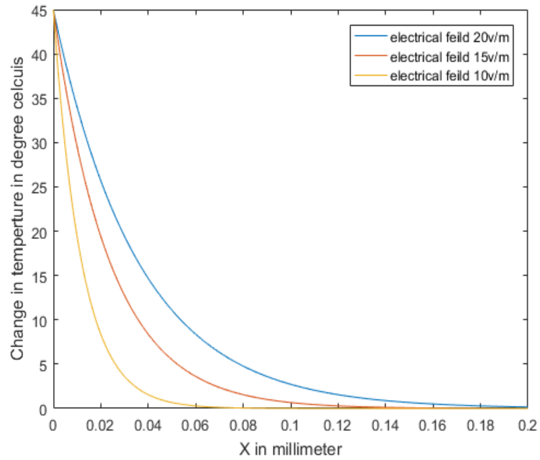

Fig.2 Temperature vs. Electric Field

In cancer treatment radiation therapy is used were there is rise in temperature from 113°F that is 45 °C It is observed that as electric field intensity increases from 10v/m to 20v/m penetration distance increases from 0.06mm to 0.18mm.

Table 6. Analysis of Electric field Intensity and Penetration Depth of Tissue

Sr.No	Electric Field Intensity (V/m)	Penetration depth in (mm)
1	10	0.08
2	15	0.14
3	20	0.18

For Cancer treatment rise in temperature is 45 °C.For 45 °C by changing electrical field intensity we can change penetration depth.

IV. CONCLUSION

It is observed that as network range varies from IIIII to I power variation is from -50DBM to – 110 DBM and electric field intensity variation is from 15 V/m to 30 V/m, corresponding analysis gives tissue temperature variation from 0.47 ℃ to 4.1 ℃.It is also observed that as electric field increases penetration distance also increases. From this we conclude that mobile phone should be operated with full range IIIII to avoid rise in temperature of the tissue.

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