



EFFECTS OF 3G AND 4G MOBILE PHONE SPECIFIC ABSORPTION RATE (SAR) ON SKIN TISSUES

*Mushtaq Ahmed Bhat

Sr. Lecture in Physics Department of Education Jammu and Kashmir.

*Corresponding Author: Mushtaq Ahmed Bhat

Sr. Lecture in Physics Department of Education Jammu and Kashmir.

Article Received on 21/09/2017

Article Revised on 11/10/2017

Article Accepted on 31/10/2017

ABSTRACT

Mobile phone radiations are harmful for living being in world. In this work the effect of specific absorption rate (SAR) for skin tissues was done at 3G and 4G mobile phone frequencies. For this study the power of mobile phone handset is taken 1.5 W.

KEYWORDS: Electromagnetic waves, Mobile Phone Handset, Skin Tissues and SAR.

1 INTRODUCTION

The power absorbed by the tissue per unit mass is called SAR. It is measured in W/kg). SAR is usually averaged either over the whole body or over a body tissue. If we measure the specific absorption rate then handset should be near the head in a talk position.^[1] SAR is measured at the top position of amalgamation rate in the whole head, for which handset is often as close to their receiver as feasible.^[3] SAR decreases with the increase of relative permittivity and increase with the increase in conductivities of human body tissues. SAR explains the doable biological effects of radiofrequency fields. SAR can cause thermal effect. The increase in temperature of human body while using mobile phone is due to SAR.^[2] There is highest increase in temperature of human head while taking.

SAR values are dependent upon the size of the averaging volume. A number of countries have their own regulations of SAR for general public exposure to mobile phone radiations. Link between special measurements cannot be made exclusive of in order averaging volume used. There is misunderstanding and confusion regarding the SAR values for mobile phones and other wireless communication system. Specific Absorption Rate gives meaning for measuring the RF exposure of mobile phone radiations set by the FC Commission. The energy absorbed by the body can be measured by SAR.^[4] Actually SAR value is an important tool in checking the highest feasible disclosure to RF energy of mobile phone handset. Many people believe that using mobile phone handset with a higher value of SAR is dangerous than the handset having low SAR.^[5]

2. Calculations of SAR

By Poynting vector theorem SAR can be define as,

$$SAR = \frac{\sigma E_i^2}{\rho} \dots\dots\dots (1)$$

Where σ conductivity of the biological material and E_i is the field inside that material.

For 3G and 4G frequencies safe limit =0.4 W/kg.^[6]

3. RESULT AND DISCUSSION

SAR can be calculated for skin tissues at 3G (2100MHz) and 4G (2300MHz) by using above formula.

Table 1.

Distance from phone in cm	3G (2100MHz) Specific Absorption Rate for skin				
	0.1 mm	0.2 mm	0.3 mm	0.4 mm	0.5 mm
1	1031.951	1024.811	1017.721	1010.68	1003.688
2	257.9877	256.2029	254.4303	252.67	250.922
3	114.6129	113.82	113.0325	112.2505	111.4739
4	64.5078	64.0615	63.61829	63.17815	62.74106
5	41.27804	40.99246	40.70885	40.42721	40.14751
6	28.6641	28.46578	28.26884	28.07327	27.87904
7	21.05889	20.9132	20.76851	20.62482	20.48213
8	16.12423	16.01268	15.90189	15.79188	15.68262
9	12.73879	12.65066	12.56314	12.47622	12.3899
10	10.31951	10.24811	10.17721	10.1068	10.03688
11	8.527802	8.468802	8.410211	8.352026	8.294242
12	7.165119	7.115547	7.066319	7.01743	6.968881
13	6.105062	6.062824	6.020878	5.979223	5.937856
14	5.263947	5.227529	5.191362	5.155446	5.119778
15	4.585966	4.554238	4.52273	4.491439	4.460365

SAR inside the skin tissues of human body at f=2100 MHz (3G).

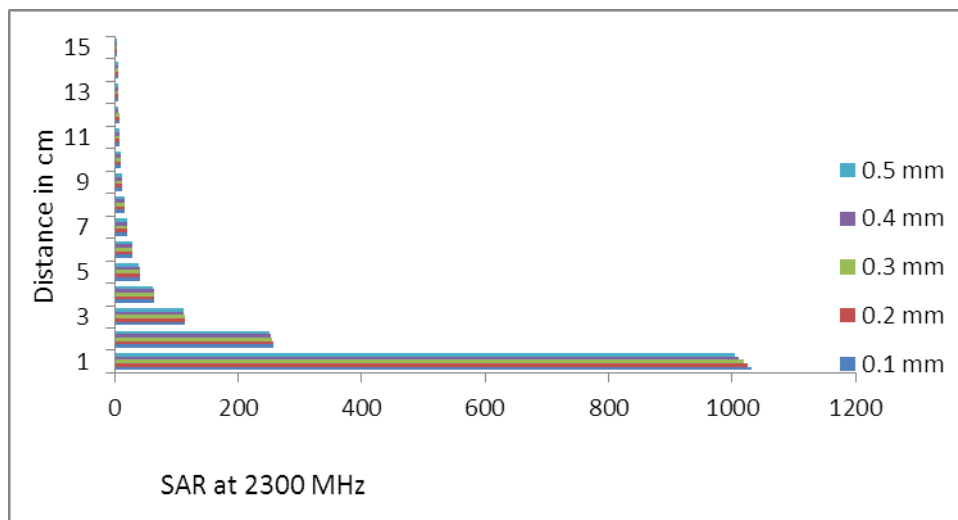


Fig. 1. The variation of SAR for skin at frequency 2100 MHz(3G).

Table 2.

Distance from phone in cm	4G (2300MHz) Specific Absorption Rate for skin				
	0.1 mm	0.2 mm	0.3 mm	0.4 mm	0.5 mm
1	1330.566	1318.54	1306.623	1294.814	1283.112
2	332.6414	329.635	326.6558	323.7036	320.778
3	147.7784	146.4428	145.1192	143.8077	142.508
4	83.17435	82.42264	81.67771	80.93952	80.208
5	53.22262	52.7416	52.26493	51.79257	51.32448
6	36.9586	36.62457	36.29356	35.96555	35.6405
7	27.15268	26.90728	26.6641	26.42311	26.1843
8	20.79009	20.60219	20.41599	20.23147	20.04862
9	16.42501	16.27656	16.12945	15.98368	15.83922
10	13.30566	13.1854	13.06623	12.94814	12.83112
11	10.99548	10.89611	10.79763	10.70004	10.60334
12	9.238483	9.154986	9.072245	8.990251	8.908999
13	7.871677	7.800534	7.730034	7.660171	7.59094
14	6.787171	6.725829	6.665042	6.604805	6.545111
15	5.913002	5.859561	5.806604	5.754124	5.702119

SAR inside the skin tissues of human body at frequency 2300 MHz (4G).

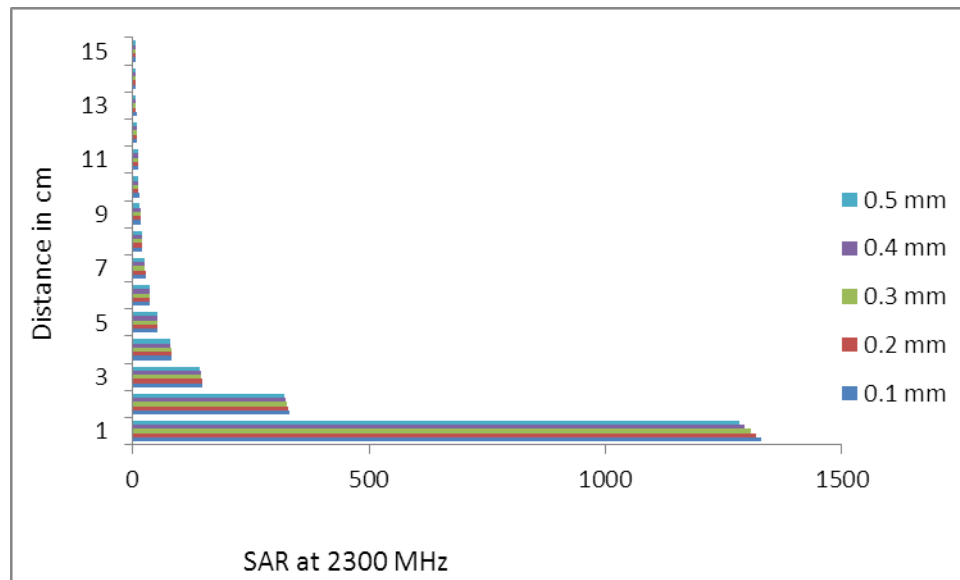


Fig. 2. The variation of SAR for skin at frequency 2300 MHz (4G).

4. CONCLUSIONS

According to World Health Organization and International Commission of Non-Ionizing Radiation Protection SAR becomes harmful after 0.4 W per kg of the body weight.

Table 1 and table 2 shows that SAR is harmful for 3G and 4G mobile phone communication network. Bold data in tables shows harmful effect. If a person having 75 kg weight than its safe limit of SAR is 119 W/kg. So always use mobile phone handset with low SAR value.

5. REFERENCES

1. C.L. James, (2003) "IEEE Antenas and Propagation Magazine," 45: 3.
2. P. Gajsek, W.D. Hurt, M.S. Zirix and P.A. Mason, (2001) "Parametric dependence of SAR on permittivity values in a man model," *IEEE Transactions on biomedical engineering*, 48(10): 1169-1177.
3. P. Gajsek, M. Zirix M., W.D. Hurt, J.T. Walters and P.A. Mason, (2001). "Predicted SAR in Sprague dawley rat as a function of permittivity values," *Bioelectromagnetics*, 22(10): 384-400.
4. J.J. Cleveland, D.M. Sylvar, J.L. Ulcek, (1997) "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", *OET BULLETIN*, 65.
5. A.Hoyto, J. Juutilainen, J. Naarala., "Ornithine decarboxylase activity is affected in primary astrocytes but not in secondary cell lines exposed to 872 MHz RF radiation," *Int Journaal of Radiat Biol*, 2007; 83: 367-374.
6. ICNIRP [www.icnirp.org / documents / emfdl.pdf](http://www.icnirp.org/documents/emfdl.pdf),(2010).