



ELECTROMAGNETIC (EM) RADIATION FROM TELECOMMUNICATION TOWERS IN URBAN AREA: ERBIL CITY AS AN EXAMPLE

Student:

Waleed Abdelkarim Maiden

Govand Star Ahmed

Research Supervisor:

Dr.Nasih Hama Ghareeb



CONCEPT:

- Introduction.
- Biological Effects of cell tower Radiation
- materials and methods
- Limitations of electromagnetic pollution
- Results.
- **Discussion.**
- Image of graph
- References.



INTRODUCTION

IN TODAY'S WORLD, THE USE OF MOBILE COMMUNICATION AND INTERNET TECHNOLOGIES HAS BECOME INDISPENSABLE, AND THE CITY OF ERBIL IS NO EXCEPTION TO THIS TREND. THE ELECTROMAGNETIC SPECTRUM, WHICH IS THE BACKBONE OF THESE TECHNOLOGIES, IS REGULATED BY GOVERNMENT ORGANIZATIONS THROUGH INTERNATIONAL TREATIES, STANDARDS, AND AGREEMENTS. TELECOM TOWERS USE INSTALLATIONS THAT SUPPORT THE BACKBONE OF MOBILE COMMUNICATION IN ERBIL. HOWEVER, CONCERNS HAVE BEEN RAISED ABOUT THE POTENTIAL HEALTH HAZARDS ASSOCIATED WITH LONG-TERM EXPOSURE TO THE ELECTROMAGNETIC FIELD (EMF) EMITTED BY THESE TECHNOLOGIES. THE EMF HAS BOTH THERMAL AND NON-THERMAL EFFECTS ON LIVING ORGANISMS, AND VARIOUS MEDICAL PROFESSIONALS AND RESEARCHERS HAVE STUDIED THE INCREASING USE OF THESE TECHNOLOGIES AND REVEALED VARIOUS EYE-OPENING RESULTS. THIS ARTICLE AIMS TO PROVIDE AN OVERVIEW OF THE POTENTIAL HEALTH HAZARDS ASSOCIATED WITH EXPOSURE TO EMF AND TO DISCUSS THE CURRENT GUIDELINES AND REGULATIONS FOR SAFE EXPOSURE TO RADIATION IN ERBIL, A CITY THAT RELIES HEAVILY ON THESE TECHNOLOGIES FOR COMMUNICATION AND CONNECTIVITY.



BIOLOGICAL EFFECTS OF CELL TOWER RADIATION

- ❖ The Brain
- ❖ Risk to Children and Pregnant Women
- ❖ Effect on Skin
- ❖ Tinnitus and Ear Damage
- ❖ Effect on Eye/ Uveal Melanoma
- ❖ Increase in Cancer risk

MATERIALS AND METHODS:

- THE MATERIALS AND METHODS SECTION OF THE RESEARCH PAPER DESCRIBES THE PARAMETERS AND INSTRUMENTS USED TO MEASURE THE LEVELS OF EMR EXPOSURE AT SELECTED SITES IN ERBIL CITY. THE PD MEASUREMENTS WERE CONDUCTED USING A TENMARS TM 195 INSTRUMENT THAT DETECTS NIR IN THE FREQUENCY RANGES FROM 50 MHZ TO 3.5 GHZ. THE MEASUREMENTS WERE TAKEN AT DIFFERENT LOCATIONS AROUND THE LOCATION, AND THE AVERAGE READINGS WERE RECORDED. THE MEASUREMENTS WERE COMPARED WITH THE ICNIRP GUIDELINES, WHICH ARE WIDELY ACCEPTED AND ADOPTED BY MOST NATIONS WORLDWIDE. THE LOCAL SAR WAS ESTIMATED AT A POINT ON THE BRAIN AS THE ABSORBER AND TWO SPECIFICATIONS WERE USED TO COMPARE THE VALUES OF SAR, NAMELY ICNIRP, AND BL. TO COMPARE THE PD MEASUREMENTS, THE LOWEST ACCEPTABLE LEVEL OF EMR POLLUTION IN SALZBURG, AUSTRIA, WAS USED. IT IS ESSENTIAL TO NOTE THAT THERE ARE MANY OTHER INTERNATIONAL SPECIFICATIONS FOR EMR EXPOSURE, AND IN THE ABSENCE OF IRAQI SPECIFICATIONS, THE RESEARCHERS ADOPTED THE ICNIRP GUIDELINES.



LOCAL SAR HAS BEEN ESTIMATED AT A POINT ON THE BRAIN AS THE ABSORBER.
LOCAL SAR IS RELATED TO THE ELECTRIC FIELD THROUGH THE EQUATION

$$s = E \times H = \frac{E^2}{377}$$
$$SAR = \frac{\sigma |E^2|}{\rho b}$$

WHERE

$\sigma |E^2|$ = ABSORBED PD BY HUMAN BRAIN TISSUE

E = ELECTRIC FIELD STRENGTH (V/M).

H = MAGNETIC FIELD STRENGTH (A/M).

S = PD (MW/M²).

σ = CONDUCTIVITY OF THE HUMAN BRAIN TISSUE($\frac{1}{ohm \times m}$).

ρb = MASS DENSITY OF HUMAN BRAIN TISSUE (KG/M³).

The PD values measured by the Tenmars in mW/m² units were used to compute SAR Using Eq.(2). Table 1. shows the values of and constants according to the frequencies shown in it.

Table 1. Conductivity and mass density for the human brain tissue [46]

Frequency (GHz)	Conductivity($\frac{1}{ohm \times m}$)	3 Mass density (kg/m
0.9	0.7665	1030
1.8	1.1531	1030
2.1	1.310	1030

LIMITATIONS OF ELECTROMAGNETIC POLLUTION

TO COMPARE THE PD MEASUREMENTS IN THIS RESEARCH PAPER, THE ICNIRP GUIDELINES WERE ADOPTED IN PARTICULAR, FOR BEING WIDELY ACCEPTED AND ADOPTED BY THE MAJORITY OF NATIONS WORLDWIDE AFFLUENT NATIONS, INDIA FOR INSTANCE IS REGARDED BY INDIAN STANDARDS AS AN ASIAN COUNTRY, THE ICNIRP GUIDELINES WERE ADOPTED BY NATIONS BEFORE JANUARY 9, 2013, AFTER THE MENTIONED DATE ITS SPECIFICATIONS WERE UPDATED TO BE 10% OF THE PREVIOUS SPECIFICATIONS WERE LIKEWISE THE PD COMPARISONS BETWEEN THE MEASUREMENTS AND THE FACTORS IN SALZBURG, AUSTRIA WAS MADE LOWEST PERMISSIBLE LEVEL OF EMR POLLUTION WHICH GIVES A CLEAR INDICATION OF MINIMIZING THE HARMFUL EFFECT OF EMP ADOPTING THE MENTIONED INTERNATIONAL SPECIFICATIONS WAS DUE TO THE ABSENCE OF THE IRAQI SPECIFICATIONS RELATED TO THE PERMISSIBLE LIMITS OF NIR EMITTED FROM MOBILE PHONE TOWERS, THERE ARE MANY OTHER INTERNATIONAL SPECIFICATIONS AS WELL AS THE SPECIFICATIONS ADOPTED IN THIS PAPER. AS SHOWN IN TABLE 2.

Table 2. The maximum permissible exposure limit of PD
 (Where GSM is a Global system for mobile communication)

S. N	Specification	PD (mW/m ²) for GSM-2100	PD (mW/m ²) for GSM-1800	PD (mW/m ²) for GSM-900
1	ICNIRP	10500	9200	4500
2	India (from 1/9/2013)	1050	920	450
3	Poland, China, Italy	100	100	50
4	Austria, Salzburg City	1	1	0.5

TO COMPARE THE VALUES OF SAR, TWO SPECIFICATIONS WERE USED, THE FIRST ICNIRP BEING THE MOST RELIABLE SPECIFICATION IN MOST COUNTRIES OF THE WORLD. THE SECOND WAS BL, WHERE THE VALUES ABOVE IT ARE CONSIDERED THE BEGINNING OF HARMFUL CHANGES IN CELLS AND TISSUES, ESPECIALLY BRAIN TISSUE[44]. TABLE (3) SHOWS THE MAXIMUM PERMISSIBLE LEVEL FOR SAR, WHICH WAS ADOPTED IN THE CURRENT RESEARCH.

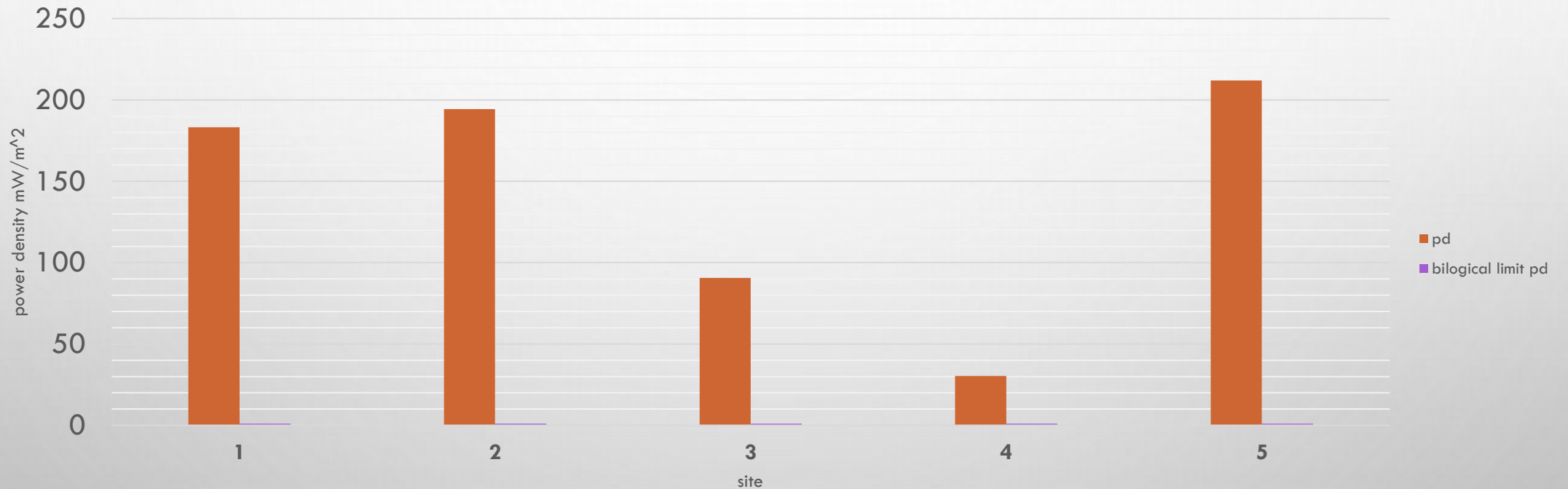
Table3: The maximum allowable limit of SAR [48]

S. N	Specification	PD (mW/kg) for GSM-2100	PD (mW/kg) for GSM-1800	PD (mW/kg) for GSM-900
1	ICNIRP	2	2	2
2	Biological limit	0.001	0.001	0.001

RESULTS:

IN THE PRESENT SURVEY, THE LEVEL OF RADIATION WAS OBSERVED TO BE ABOVE THE BIOLOGICALLY SAFE EXPOSURE LIMITS (LESS THAN 1 MW/M²) IN FIVE DIFFERENT PLACES IN ERBIL CITY. THE POWER DENSITY VALUES OF UNSAFE URBAN AREAS RANGED FROM 1 TO 212 MW/M². THE DATA ARE SHOWN IN FIG. 1 IN THE FORM OF A BAR DIAGRAM. THE DIFFERENT PLACES WHICH WERE HAVING HIGHER VALUES OF RADIATION WERE WITHIN 200M DISTANCE FROM THE TOWER. ALL OF THEM WERE FOUND TO HAVE RADIATION EXPOSURE LEVELS ABOVE THE BIOLOGICAL LIMIT. AN URBAN AREA NEAR THE SCHOOL IN THE CITY SHOWED RF RADIATION LEVELS AS HIGH AS 212 MW/M² (FIG. 1). AND ACCORDING TO THE HIGHT OF THE TOWER THE OTHER FINDINGS THE HIGHER TOWER HAS SAFER THAN THE EXPOSURE LIMITS BIOLOGICAL

Fig.1: compare between highest measurement power density and Salzburg, Austria (1 mW/m²) limit limits biological power density at mW/m² in the five placement which show that the high value is 212% than biological limits and the lower one 30.43% than biological limits.



DISCUSSION:

BASED ON THE RESEARCH CONDUCTED IN ERBIL CITY, THE RESULTS SHOWED THAT THE AVERAGE POWER DENSITY OF ELECTROMAGNETIC RADIATION EMITTED FROM TELECOMMUNICATION TOWERS IN VARIOUS LOCATIONS EXCEEDED THE BIOLOGICAL LIMITS SET BY THE AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY (ARPANSA) AND THE INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION (ICNIRP).

ACCORDING TO THE FINDINGS PRESENTED IN FIGURE 1, THE AVERAGE RANGE OF POWER DENSITY IN THE FIVE DATA POINTS WAS 212% MORE THAN THE BIOLOGICAL LIMITS, WITH THE LOWEST BEING 50%. MOREOVER, THE POWER DENSITY IN VARIOUS LOCATIONS WAS COMPARED TO BIOLOGICAL LIMITS SET BY ARPANSA AND ICNIRP, AS SHOWN IN TABLE 2. FOR INSTANCE, IN KREKARAN (NASEJ) NEAR CHINAR PREPARATORY SCHOOL FOR GIRLS, THE AVERAGE POWER DENSITY AT A DISTANCE OF 150 METERS WAS 183.24% MORE THAN THE BIOLOGICAL LIMITS (FIGURE 2). THIS CAN BE ATTRIBUTED TO THE PRESENCE OF ANOTHER TOWER NEAR THAT DISTANCE, WHILE THE SCHOOL IS 75 METERS AWAY FROM THE TOWER.

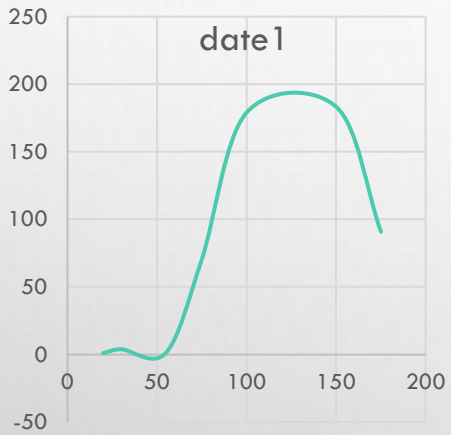
IN KURDISTAN NEAR ROSHNAY SCHOOL AND BECKHAL SCHOOL FOR GIRLS, THE POWER DENSITY WAS 194.39% MORE THAN THE BIOLOGICAL LIMITS AT A DISTANCE OF 100 METERS, AS SHOWN IN FIGURE 3. THE POWER DENSITY WAS CALCULATED AT THE SCHOOL'S AVERAGE RANGE OF DISTANCES.

IN ZANYARI NEAR PARK SHANIDAR, TWO TOWERS WERE PRESENT CLOSE TO EACH OTHER, CAUSING THE POWER DENSITY TO DEVIATE FROM NORMAL RANGES, AS SHOWN IN FIGURE 4. THE AVERAGE POWER DENSITY AT A DISTANCE OF 75 METERS WAS 90.65% MORE THAN THE BIOLOGICAL LIMITS.

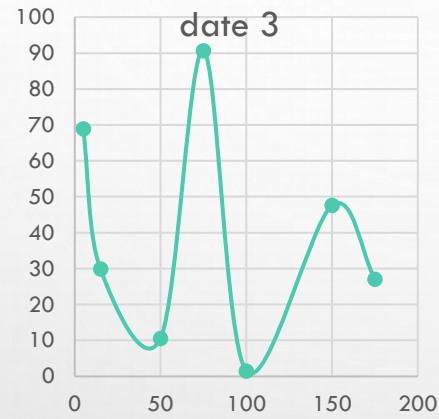
AT ZANKO TOWER 1, THE AVERAGE POWER DENSITY AT A DISTANCE OF 50 METERS WAS 30.43% MORE THAN THE BIOLOGICAL LIMITS (FIGURE 5). FINALLY, IN ZANKO TOWER 2, THE DATA WERE COLLECTED AT A HEIGHT OF 300 CENTIMETERS ABOVE THE GROUND, SHOWING THAT THE AVERAGE RANGE OF POWER DENSITY AT A DISTANCE OF 25 METERS WAS 212% MORE THAN THE BIOLOGICAL LIMITS. EVEN AT DIFFERENT DISTANCES, THE POWER DENSITY WAS NOT WITHIN THE SAFE RANGE, AS SHOWN IN FIGURES 2, 3, 4, AND 5 AT DISTANCES OF 20 TO 30 METERS, WITH PERCENTAGES RANGING FROM 1.441% TO 29.88%. OVERALL, THE RESULTS SUGGEST THAT ELECTROMAGNETIC RADIATION EMITTED FROM TELECOMMUNICATION TOWERS IN ERBIL CITY MAY EXCEED THE BIOLOGICAL LIMITS, AND APPROPRIATE MEASURES MUST BE TAKEN TO MINIMIZE THE EXPOSURE LEVELS.



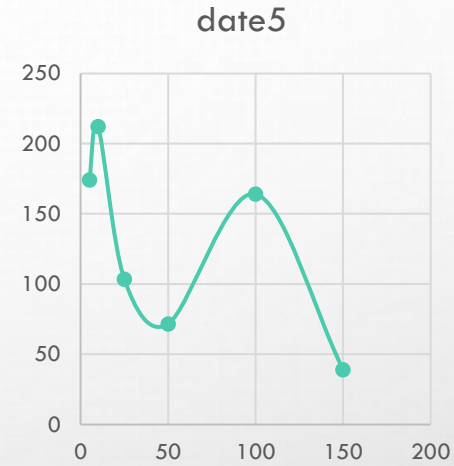
IMAGE OF GRAPH



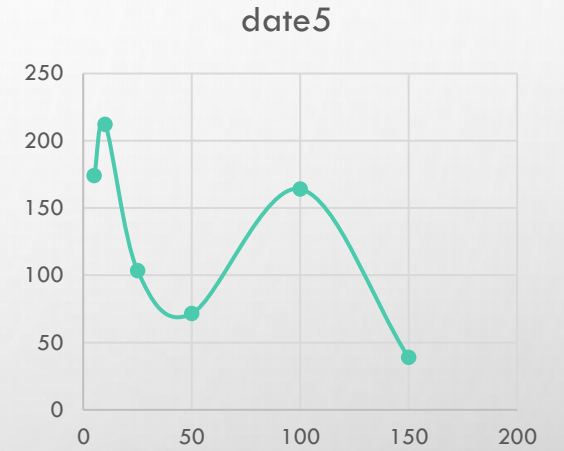
Krekaran(nasej)



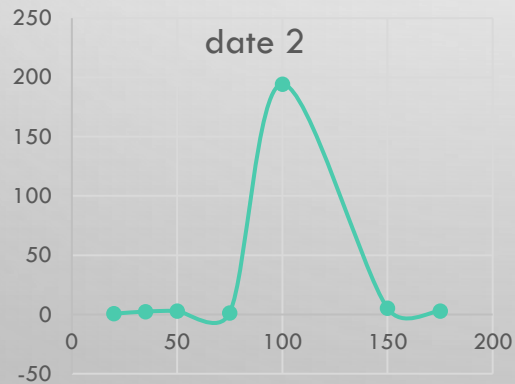
Zanyari



Zanko1



Kurdistan



Zanko2

CONCLUSION

THE STUDY INDICATES THAT THE ELECTROMAGNETIC RADIATION EMITTED FROM TELECOMMUNICATION TOWERS IN ERBIL CITY EXCEEDS THE RECOMMENDED BIOLOGICAL LIMITS SET BY INTERNATIONAL GUIDELINES. THE HIGHEST AVERAGE POWER DENSITY WAS FOUND NEAR A SCHOOL, WHICH MAY BE ATTRIBUTED TO THE PRESENCE OF MULTIPLE TOWERS. IT IS ESSENTIAL TO MONITOR AND REGULATE THE LEVELS OF ELECTROMAGNETIC RADIATION EMITTED TO ENSURE THE SAFETY OF INDIVIDUALS. FURTHER STUDIES ARE RECOMMENDED TO INVESTIGATE THE LONG-TERM EFFECTS OF EXPOSURE TO ELECTROMAGNETIC RADIATION



REFERENCES

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Thank you