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Electromagnetic Pollution Emitted from Base Station

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Abstract: ***Mobile phones are an important part of daily life; thus, the rate of usage of mobile phones is increasing on a daily basis. Because they work in connection with base stations, number of base stations has to be boosted as long as the trend in the use of them continues. Because each base station runs by radiating electromagnetic waves, this is consideration source of distribution for many people from a medical point of view. In this work we explained the radiofrequency and microwave radiation out from some mobile telephones towers studies and Measurements were done in many countries in the world in Sudan capital Khartoum , Malaysia, Gaza and Turkish capital Ankara.***

Keyword: BS, MS, GSM, UTMS, WLAN

1. Introduction

Developments in technology and industry have facilitated human Life. However, environmental pollution has occurred as a result of these developments and is causing a threat to human and animal lives.

It should be expected that both play important roles in the functional activities of organisms. Before the 1990's radiofrequencies were mainly from a few radio and television transmitters, located in remote areas and very high places. Since the introduction of wireless telecommunication in th1990'stherollout of phone networks has caused a massive increase in electromagnetic pollution in cities and the countryside. Multiple sources of mobile communication result in chronic exposure of a significant part of the wildlife (and man) to microwaves at non-thermal levels [4].

In recent years, wildlife has been chronically exposed to microwaves and RFR (Radiofrequency radiation) signals from various sources, including GSM and UMTS/3G wireless phones and base stations, WLAN (Wireless Local Area Networks), WPAN (Wireless Personal Area Networks such as Bluetooth), and DECT (Digital Enhanced (former European) Cordless Telecommunications) that are erected indiscriminately without studies of environmental impact measuring long-term effects.
There are other sources such as radio stations and television, stations high-pressure, microwave ovens, all kinds of electronic devices and telephones. All of these sources are industrial but represented in the natural radiation emitted by earth quakes volcanic eruptions, explosions, such as gamma-ray And UV emitted by the sun.

1.1 Types of Electromagnetic Waves

1.1.1 Radio Waves

Radio waves are the lowest-frequency waves in the EM spectrum. Radio waves can be used to carry other signals to receivers that subsequently translate these signals into usable information. Many objects, both natural and man-made, emit radio waves. Anything that emits heat emits radiation across the entire spectrum, but in different amounts. Stars, planets and other cosmic bodies emit radio waves. Radio and television stations and cell phone companies all produce radio waves that carry signals to be received by the antennae in your television, radio or cell phone**.**

1.1.2 Microwaves

Microwaves are the second-lowest frequency waves in the EM spectrum. Whereas radio waves can be up to a mile in length, microwaves measure from a few centimeters up to a foot. Due to their higher frequency, microwaves can carry information through obstacles that interfere with radio waves such as clouds, smoke and rain. Microwaves are used for radar, landline phone calls and the transmission of computer data. Microwave remnants of the "Big Bang" radiate from all directions throughout the universe**.**

1.1.3 Infrared Waves

Infrared waves are in the lower-middle range of frequencies in the EM spectrum, between microwaves and visible light. The size of infrared waves ranges from a few millimeters down to microscopic lengths. The longer-wavelength infrared waves produce heat and include radiation emitted by fire, the sun and other heat-producing objects; shorter-wavelength infrared rays do not produce much heat and are used in remote controls and imaging technologies**.**

1.1.4 Visible Light Rays

Visible light waves are radiation that you can see with your naked eye. The different frequencies of visible light are experienced by people as the colors of the rainbow. The frequencies move from the lower wavelengths, detected as reds, up to the higher visible wavelengths, detected as violet hues. The most noticeable natural source of visible light is, of course, the sun. Objects are perceived as different colors based on which wavelengths of light an object absorbs and which it reflects.

1.1.5 Ultraviolet Waves

Ultraviolet waves have even shorter wavelengths than visible light. UV waves are the cause of sunburn and can cause cancer in living organisms. High-temperature processes emit UV rays; these can be detected throughout the universe from every star in the sky. Detecting UV waves assists astronomers, for example, in learning about the structure of galaxies.

1.1.6 X-ray Waves

X-rays are extremely high-energy waves with wavelengths between 0.03 and 3 nanometers -- not much longer than an atom. X-rays are emitted by sources producing very high temperatures like the sun's corona, which is much hotter than the surface of the sun. Natural sources of x-rays include enormously energetic cosmic phenomena such as pulsars, supernovae and black holes. X-rays are commonly used in imaging technology to view bone structures within the body.

1.1.7 Gamma Rays

Gamma waves are the highest-frequency EM waves, and are emitted by only the most energetic cosmic objects such pulsars, neutron stars, supernova and black holes. Terrestrial sources include lightning, nuclear explosions and radioactive decay. Gamma wave wavelengths are measured on the subatomic level and can actually pass through the empty space within an atom. Gamma rays can destroy living cells; fortunately, the Earth's atmosphere absorbs any gamma rays that reach the planet.

1.2 Types and Limitations of Electromagnetic Radiation

There are basically two types of electromagnetic radiation

1.2.1 Ionizing

This has sufficient energy to strip away electrons from atoms (creating two charged ions) or to break some chemical bonds such as X-ray, Gama ray, and Beta ray.

1.2.2 non-ionizing

Refers to any type of electromagnetic radiation that does not carry enough energy per quantum to ionize atoms or molecules that is, to completely remove an electron from an atom or molecule. As the frequency of the signal increases then the more energy it has, hence the wave may be in the non-ionizing or ionizing range as shown in Fig.1

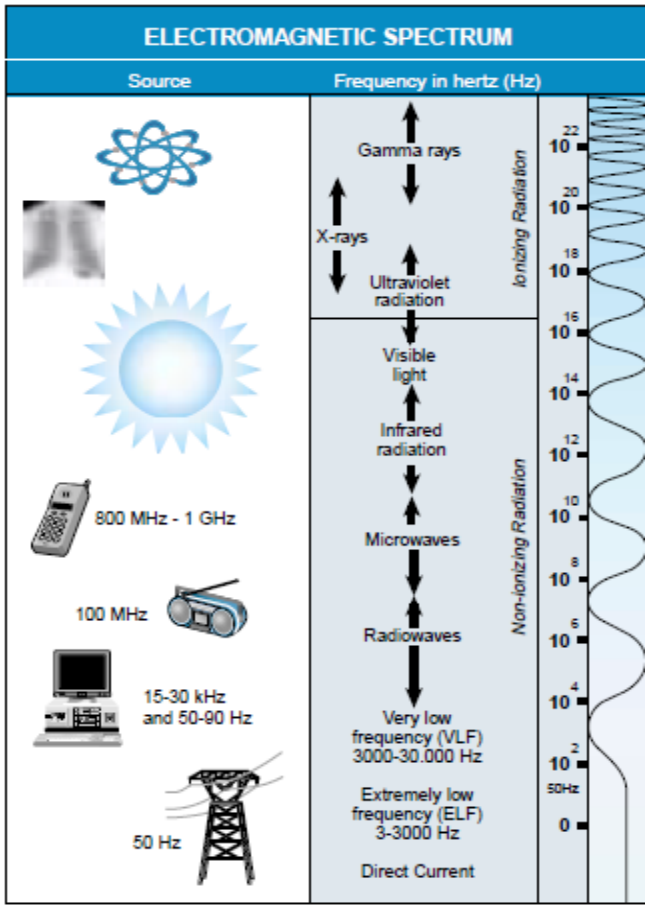


Figure 1: the electromagnetic spectrum showing the two types of electromagnetic radiation

1.3 Sources of Electromagnetic Pollution

Electromagnetic pollution is the result of electromagnetic excess of the environmental electromagnetic background that the electromagnetic waves radiated from many different technological products:

Power Lines

A noticeable source of extremely low frequency radiation is the high voltage electrical transmission lines, which in some instances produce such high losses that they bend the earth's ionosphere. Power lines are dangerous because they are constantly losing energy. Because you can't see electricity, and you don't have a detector, you can't see it oozing, but it is.

Satellite Dishes

Another case of electromagnetic pollution is satellite dishes. Main or secondary power lines in the vicinity may actually be amplified by the satellite dish. If antennas of satellite dishes are pointing at a certain angle, even partially towards a power transmission line, they will actually absorb and focus its frequency, and once it is captured, it will travel vertically above or below the dish.

Cellular Telephones

Portable and car telephone systems also amplify surrounding fields. Do not use these telephones unless you really have to. Some people have a tendency to put a whole day through on this device and can suffer detrimental effects such as loss of concentration and memory. So be very careful with them.

Radar Sites
Never stay near a radar site even when it is off. Radar sites augment all kinds of electromagnetic fields. Radar is a serious problem especially when the radar frequencies are changed, but are still in the same frequency range. That sudden change can be too much for the body and may trigger a whole series of problems.

Video Display Terminals
In a video display terminal, there are various sources of problems; however, the major problem is the fly back transformer. It can produce stronger fields than if you are near a substation. And that's a very intense field, 50,000 volts or more per meter. If you keep a distance of about 70 cm away from the modern types and if there are no other VDT's around, that should be o.k., but you should not be in the rear of a VDT. That is the worst place.

Pollution In The Average Home
In our homes and offices, all of our electrical appliances produce not only electrical but also magnetic fields, even when they are "off". For example, a television set will still produce quite strong fields even when it is off, as long as it is plugged into the electric supply. The same is true of lamps, typewriters, photocopiers, fluorescent light fixtures, video display systems, telephones, microwave ovens , extension cords and unused electric wires inside walls.

And strongest radiation comes from mobile phones, wireless phones, monitors, photocopiers, microwave ovens and hairdryers**.** We don't feel this electromagnetic radiation, but we may feel its effects. we should be aware, that prolonged exposure to electromagnetic radiation can cause: headaches ,stress and sexual health ,Sterility Lack of energy ,inability to concentrate ,Irritability Increased fatigue ,Immune system disorders**.**

1.4 Radio and Micro waves

Radio and Microwave wave radiation may be categorized as continuous waves (e.g., communications equipment), intermittent (microwave ovens, medical equipment, and radio frequency equipment), or pulsed mode (radar systems). It extends between few KHz to GHz in the electromagnetic radiation scheme.
There are many sources of RF/MW radiation and they are widely used in many applications, these are traffic radar devises, RF heaters and sealers, radio transmission Magnetic Resonance Imaging (MRI), computer monitors, medical diathermy and wireless communications including cellular phones and their base-stations.

2. Mobile Telephone System

Mobile telephony is based on two way radio communication between portable handset and nearest base-station. The mobile telephone base stations (MTBS) are normally installed on the rooftop of high-rise buildings in urban areas and often on towers for coverage in rural areas. The height of the stations above the ground varies according to locations. Generally they are installed at the height of 15 to 50 meters from the ground for the rooftop and 40 to 100 meters in the case of tower. Each MTBS has a Maximum capacity in term of number of users that it can handle at any one time and this can easily lead to call congestion in some parts of urban areas. A common approach adopted by service providers to overcome this problem is by providing more MTBS in the affected areas.

Such continuous increase in number of MTBSs erected has inevitably triggered concern among members of the public living around the stations on the possibility of health effect caused by the radiation produced by such facilities. The early mobile telephony systems such as NMT, Total Access Communication System (TACS), and Advance Mobile Phone System (AMPS), use analog telephony while newer systems such as GSM (global system for mobile communication) use digital technology.

3. Methodology

In this paper, the study shows a comparison between the number of published scientific papers that explain electromagnetic pollution from mobile stations in each of the city of Khartoum, Ankara, Malaysia and Gaza all of which illustrate the radiation output form GSM system operates in either the 900 MHz or 1800 MHz band.

In Khartoum city the results were taken from some towers were selected and some places around these towers were chosen, the power density was measured at many points at different distance. In Ankara city the measurement of EM Pollution study it is assumed that only far field conditions exist for the cellular (GSM900 and GSM1800), TV and radio transmitters since these installations are most of the time mounted on high towers or hills. In Malaysia country Safety assessments were made based on actual measurements carried out at the site of the mobile telephone base stations (MTBS) On-site measurements were done using special instruments suitable for the condition of the MTBS system being assessed. Measurement locations around the MTBS were identified during site visits based on situations that were foreseen as causing significant potential radiation exposure to the general public and workers. In Gaza city the paper discuss Electric field signals from mobile telephone base stations and all other significant signals from such sources as TV and FM radio were measured along the major roads in Gaza. The measurements were taken in three different days around noontime.

4. Results, Analysis And Discussion

In this part we present the results obtained during our study. for each paper for pervious mentions. In paper worked in Khartoum Power density measured for each base-station from different distances Data was also given as percent of the nominated standard (0.57 mW/cm2) although we believe that the national standards of China and Hungary (0.001 mW/cm2) are the best. Power density versus distance was presented for two base-stations only as examples (see Fig (2&3)) **.**

For each base-station the distance of measurements ranged between zero and 350m, although the accepted value for the distance range in literature is between 50 and 300m. The

recorded values of power density were in general measured in this range.

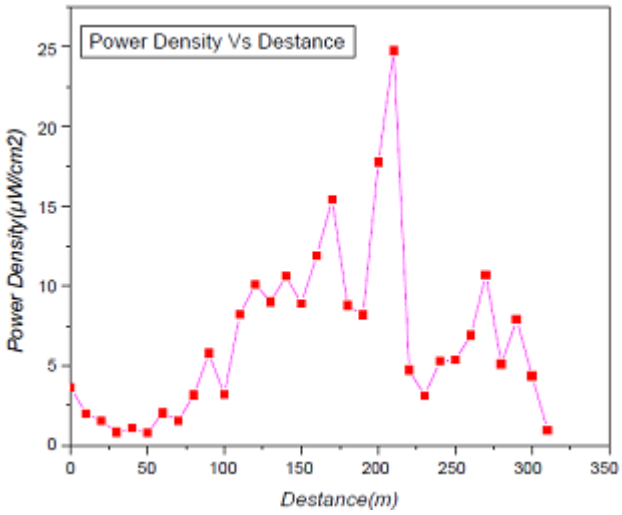
In paper worked in Gaza it was explained the RF EME exposure levels from a typical JAWAL tower The first experiment was to monitor closely a typical GSM tower The selected one was on the Door building rooftop which is close to the researcher's residence home. The measuring device was mounted at a distance one meter from one of the sector antennas1. The 24 hour measurements of the power density are illustrated in (Figure 4) The variation of the power density along the time is due to the variation of the number of active time slots**.**

And the second experiment The considerations in this subsection are restricted to the fields produced by GSM mobile phones. The maximum powers that 900 MHz GSM mobile phones are permitted to transmit by the present standards are 2W**.**

The level of radiation at call setup is much larger than that during conversation. During this phase the phone starts by checking all control channels in order to determine the substation with the strongest signal and hence will give the best connection. Then the phone sends the origination message which is a very short message (about 0.25 second). After the cellular service provider verifies that caller is valid, the base station sends a channel assignment message to the phone. This message informs the phone on which channel the conversation will take place. Consequently, the phone turns to the assigned channel and begins the call. At this step, the ring back signal or busy signal is heard. Both of these are transmitted by the base station as an audio signal just like the voice of the person on the destination.

An experiment is performed to highlight the variation of the radiation levels during the call progress. The electric field at a point 1 cm from a typical phone is measured. The result is shown in(Figure 5).in paper worked in malisya Explained the radiation emitted form MTBS These results are grouped according to locations of the MTBS i.e. on the rooftop and on tower. They are the averaged readings of the measurements made at all of the identified measurement locations around the MTBS. Measurement locations on the rooftop are basically within short distances to the MTBS. Since the radiation levels drop very significantly with distance, the radiation levels present here are, therefore, understandably higher than those on the ground because of shorter distances involved. The averaged radiation levels (broadband) present here were found to vary between 2.5 V/m and 18.8 V/m, which were 5.5% and 41% of the public limit respectively (see Figure 7). The actual levels varied from as low as 0.23 V/m to the highest of 61.3 V/m, which was taken way above the head at close distance to the center of the radiation beam.

The rooftop where the MTBS is located is normally a restricted area and accessible only to the employees and not the general public. Slightly higher radiation levels observed here are, therefore, not going to cause any problem to members of the public. These radiation levels are also acceptable to workers since they are allowed by Malaysian Communication and Multimedia Commission (MCMC) recommended exposure limits to receive higher levels of radiation than members of the public. The radiation levels inside the buildings are generally lower than outside because building materials have the capability to absorb a fraction of the radiation transmitted by MTBS (see Figure 6). The averaged radiation levels, which varied between 2.1 V/m and 4.7 V/m, were more or less the same as those observed outside the buildings. These radiation levels measured inside the buildings were suspected to have been interfered with radiation produced by other radiofrequency and microwave sources present in the buildings and backscattering of the incoming external radiofrequency and microwave radiation by walls, floor and ceiling of the rooms where measurements were made**.** Lower radiation levels recorded from measurements made on the ground around the MTBS on tower could also be due to less contribution from the background radiation present in the environment as most of these MTBS sites were located outside the city areas where the presence of other radiofrequency and microwave sources are insignificant. There were not many data managed to be gathered for the assessment of the radiation levels inside buildings around the MTBS on tower. The main reason was because towers are mainly located outside city areas where there are not many buildings present in immediate vicinity of their sites. As described earlier, the radiation levels are expected to be lower than outside because of absorption by building materials. However, this was not observed during the assessments due to similar reason given above(see Figure7) *.in paper worked in* Ankara the results taken from many source In this EM pollution measurement study; it is assumed that only far field conditions exist for the cellular (GSM900 and GSM1800), TV and radio transmitters since these installations are most of the time mounted on high towers or hills. It is essential to measure the combined field levels for all different signal sources in the environment**.** As shown in **Table 1**, total pollution value was re-corded average **3.658** V/m and its standard deviation was **0.538** according to the 68 measurement results taken from various locations in the city centre. GSM1800 av-erage pollution value was calculated **1.276** V/m while GSM900 average pollution value was **0.102** V/m.



Figrure 2: Power density versus distance at MTN tower at Mogran

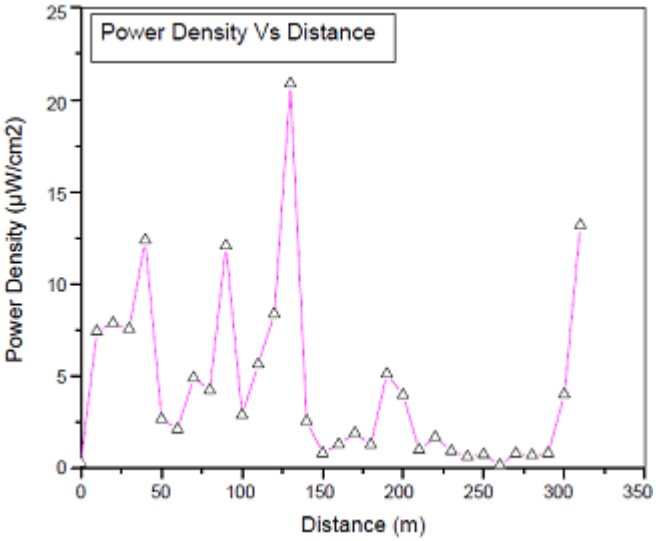


Figure 3: Power density versus distance at zain tower at Mogran

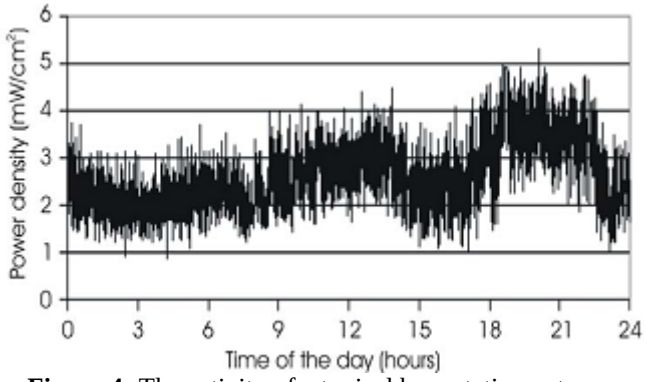


Figure 4: The activity of a typical base station antenna

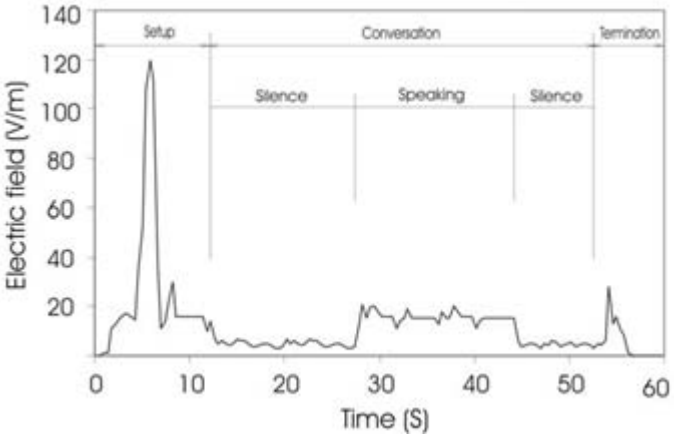


Figure 5: Electric field levels emitted from a typical GSM phone

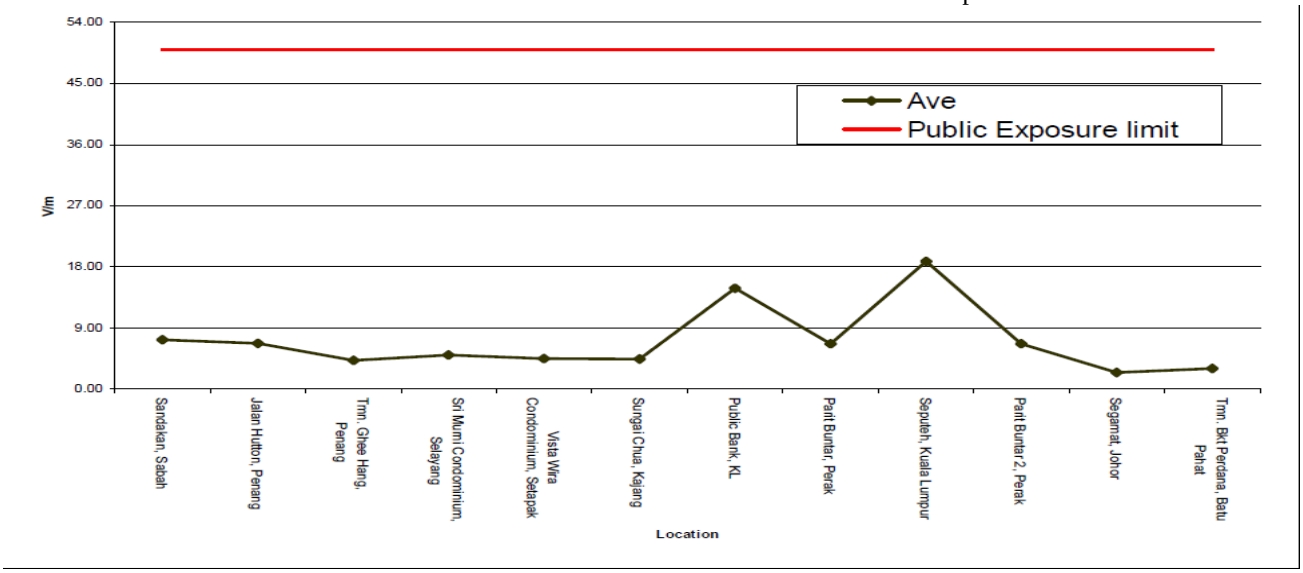


Figure 6: Plot of averaged radiation level on the rooftop against MTBS location for MTBS located on the roof top

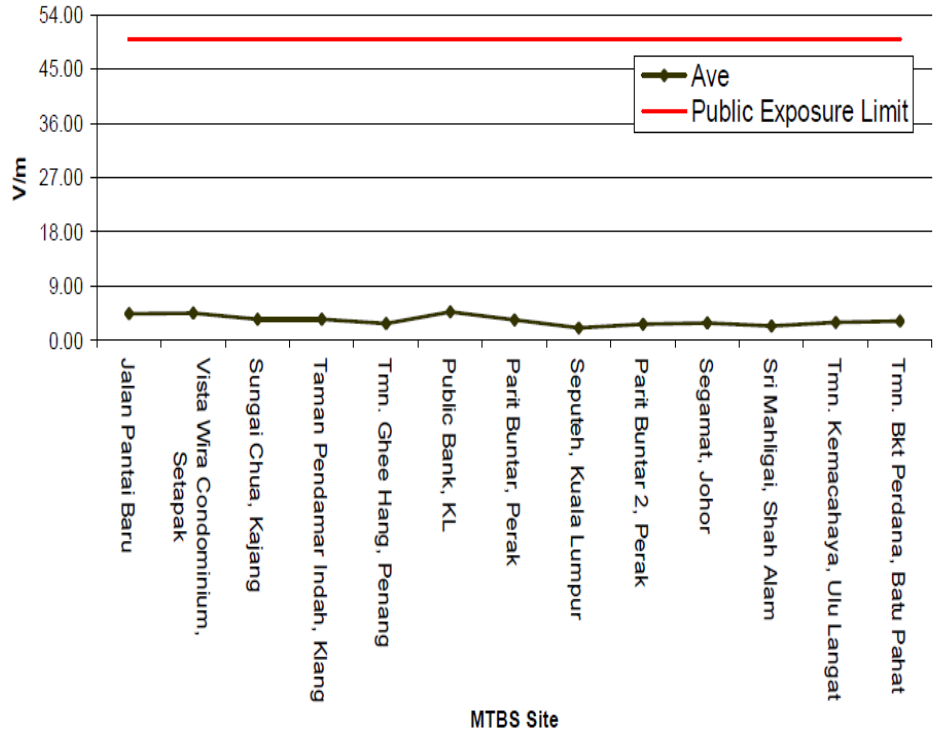


Figure 7: A plot of averaged radiation level inside buildings against MTBS location for MTBS located on the rooftop

Table 1: Descriptive statistics related to the variables

Series	Average E Value (V/m)	Standard Deviation
Total	**3.658**	**0.538**
UHF5	2.395	0.693
VHF4	1.514	0.303
UHF4	1.583	0.795
GSM900	**0.102**	**.0364**
GSM1800	**1.276**	**0.587**
Others	0.252	0.005

Table 2: show compression between for paper

Researcher Topic	*Title*	*The Most Important Things Obtain*	*The Most Important Weaknesses*	*Observations*
S.T. Kafi* and A.M.Ahmed, Ibrahim.E.A	Measurements of RF/MW Radiation Emitted from Selected Mobile-Phone Base-Stations in Sudan	Power density measured for each base-station from different distances Data was also given as percent of the nominated standard (0.57 mW/cm2) although we believe that the national standards of China and Hungary (0.001 mW/cm2) are the best. Power density versus distance was presented for two base-stations only	The lack of survey meters in sudan and to the expensive this devices The problem loop ration from some operating companies The foundation of building around the Tower, destroy our effort to measure the emittion of this towers correlated to distance.	Assessment of radiation emitted from base-stations was successfully done for the first time in Sudan. We recommended the removal of some base-stations from sensitive areas like schools, kindergardens, hostels, hospitals.
Mohd Yusof Mohd Ali, Rozaimah Abd Rahim, Mohd Anuar Abd Majid, Mohd Amirul Nizam	Radiofrequency and Microwave Radiation Safety Assessment of Mobile Telephone Base Stations	Explained the radiation emitted from MTBS These results are grouped according to locations of the MTBS i.e. on the rooftop and on tower . Since the radiation levels drop very significantly with distance, the radiation levels present here are, therefore, understandably	_____ _____ _____ _____ _____ _____ _____ _____	No Basic Principles to put communications towers in Malaysia, but there are organizations working in the field determine the radiation from mobile phone towers

	in Malaysia	higher than those on the ground because of shorter distances involved	_____ _____	
Muhammed Abdelati The Islamic University of Gaza Gaza, Palestine	ELECTROMAGNETIC RADIATION FROM MOBILE PHONE BASE STATIONS AT GAZA	*explained the* RF EME exposure levels from a typical JAWAL tower The first experiment was to monitor closely a typical GSM tower The selected one was on the Door building rooftop which is close to the researcher's residence home. The measuring device was mounted at a distance one meter from one of the sector antennas	The device used in this research has a cost around 8500$ and requires a time window of 0.2s for measuring and transmitting .the signal record	It is the first study to measure the intensity of electromagnetic radiation was successful in Gaza . Has by measuring the radiation in the open roads and proposed that the upcoming projects are separate each station Mobile
Özgür Genç, Mehmet Bayrak, Ercan Yaldiz	Analysis of the Electromagnetic Pollution for a Pilot Region in Turkey	Relied on statistical analysis theoretical intensity radiation using some of the theories and theoretical results were equal to the experimentally measured results.	It is difficult to determine the intensity of electromagnetic radiation accurately and because the radiation itself subjected to optical properties, absorption and reflection interference especially in Almzdhma areas	Electromagnetic radiation ratio is very high compared with international standards

5. Conclusion

Radiation emitted from cell phone towers are actually two types: microwave and radio waves which are non-ionizing radiation, but its effects in the long run. In this paper compares the four of scientific papers in four different countries dealt with all electromagnetic pollution emitted from cellular phone base stations. I worked all previous securities in the comparison between the percentage of electromagnetic pollution emitted in the surrounding areas communications towers and global standards for safety of electromagnetic pollutants. In Sudan, the proportion of high electromagnetic pollution compared to global standards for non-observance by the telecommunications companies of the global system and the paper concluded for some recommendations, including the removal of some base stations of the public areas and kindergartens. In Gaza have been working on the levels of electromagnetic radiation emitted by communications towers generally, but they focused on road traffic because they open areas and paper concluded that there are some rules you have to give attention and that of their proximity to residential buildings, which are on the road in traffic must be monitored alongtoday and for the most suitable proportion of radiation and thus control.

In Malaysia results were a comparison between the radiation emitted by the ground base stations and base stations on rooftops and the result was that the ground stations are less dangerous than the stations on rooftops as paper also concluded that the level of radioactive contamination Malaysia low below the safety line, and because MCMC Organization of the Malaysian authorities determine the level of security.

Turkey's study was to calculate the electromagnetic radiation in some areas in the Turkish capital Ankara and the study concluded that the levels of electromagnetic radiation higher than their safety and in accordance with international standards, where the average radiation obtained from the study 3.658 V/M while global standards 0.538 V/M and that of All electromagnetic effects. In the communications towers GSM 1800 average radiation was 1.276 V/M while basic criteria0 .58 V/M towers of the GSM 900 average radiation 0.102 V/M while basic criteria 0.03 V/M. We concluded from this study scientific papers prior to the communications towers all radiate microwave and other radio and are waves in nature have an impact on human health and therefore should all telecommunications companies into account international standards and governments must appoint organizations to work in the recruitment of calibrator required health.

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