

# Biological Effects

In 2011, the International Agency for Research on Cancer (IARC) has classified EMFs as "possibly carcinogenic to human (group 2B)" based on positive association between glioma and acoustic neuroma and exposure to RF-EMFs from wireless telephones (Hardell et al., 2008; INTERPHONE study, 2010).

No kind of association was found for meningioma, parotid gland tumors, leukemia, lymphoma and other tumor types, allowing the IARC working group to conclude that there was "limited evidence in humans" for the carcinogenicity of RF-EMF.



## Can Long Term EMF Exposure Evoke Biological Effects?



### World Health Organization (WHO)

- more than 1500 peer-reviewed articles related to RF (3 kHz - 300 GHz) indicated that exposures below the recommended limits stated in the ICNIRP (1998) **do not produce any known adverse health effect.**



Studies on genetic material damage caused by both short-term and long-term exposure to cell phones on different animal tissues reported contradictory results.



Many different exposure conditions were reported such as wavelength, time of exposure, experimental models, biological endpoints, etc. And the results were often not reproducible (inconsistent findings despite repeated experiments).

## 4G LTE Emission & Health

Bioelectromagnetics is the study of the interaction between electromagnetic fields and biological system. Universiti Malaysia Perlis and Universiti Malaysia Kelantan collaborated on a research to determine any detrimental effect of long-term (chronic) exposure to 4G Long Term Evolution (LTE) mobile phones.

## UNDERSTANDING EMF

An electromagnetic field consists of waves of electric and magnetic energy moving together through space. Often the term "electromagnetic field" or EMF is used to indicate the presence of electromagnetic emission.

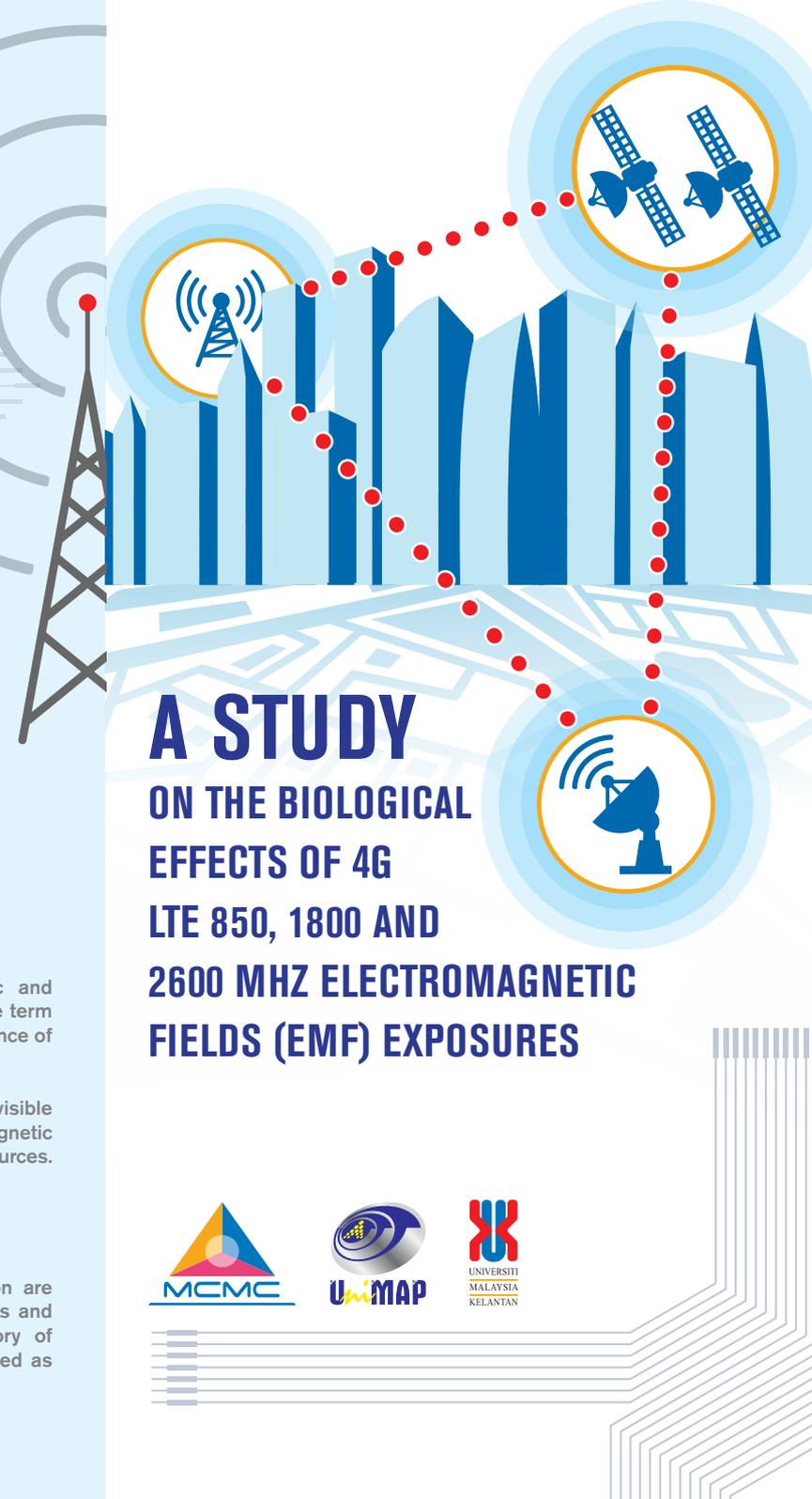
EMF are present everywhere in our environment but are invisible to the human eye. Besides natural sources the electromagnetic spectrum also includes fields generated by human-made sources. There are 2 types of EMF:

- Ionising
- Non-ionising

Examples of the much more dangerous ionising radiation are X-Rays and Gamma rays. EMF produced by mobile phones and other consumer electric equipment fall into the category of non-ionising, low-level radiation which is generally perceived as harmless to human.

For more information visit : [rfemf.mcmc.gov.my](http://rfemf.mcmc.gov.my)

## A STUDY ON THE BIOLOGICAL EFFECTS OF 4G LTE 850, 1800 AND 2600 MHZ ELECTROMAGNETIC FIELDS (EMF) EXPOSURES



## UBIQUITOUS

An estimated **6.9 billion** subscriptions globally.

## LOW POWER

Operating at frequencies between **450 and 2700 MHz** with peak powers in range of - 0.1 to 2 watts.

## OFF / ON

Only transmits power when it is turned **ON.**

## PROXIMITY

The power (hence RF exposure to user) declines rapidly as the distance from the handset increases.

Usage with a distance of **30-40 cm away**

from body eg. messaging, accessing Internet or calling using **“Hands Free”**

will pose lower exposure to radiofrequency fields compared to holding the handset against head.

## EXPOSURE REDUCTION

Exposure is also reduced by

**Limiting the Number and Length** of calls.

## RECEPTION

Using the phone in areas **With Good Reception**

also decreases exposure as this allows the phone to transmit at lower power.



# Mobile Phones & EMF

## Experiment

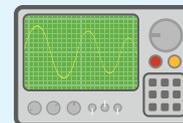
Rats were exposed to **4G LTE signal** with 3 different frequencies; **850, 1800 and 2600 MHz.**

### Impact Assessment

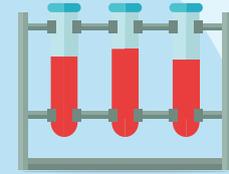
**Exposure for 2 hours/day at average SAR\* level (1.4 W/kg)** for four periods (2, 4, 6 & 8 weeks) was conducted on **80 Sprague-Dawley rats.**

## \*SPECIFIC ABSORPTION RATE (SAR)

is a measure of the amount of energy absorbed by the human body when exposed to a radio frequency (RF) EMF.

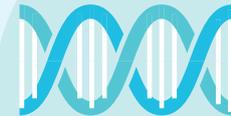


## Result Of Study



### BLOOD CELLS OUTCOME

4G LTE 850, 1800 and 2600 MHz exposure had no effect on red and white blood cells after 8 weeks of continuous exposure.



### CANCER OUTCOME

Under laboratory controlled conditions, long term exposure of experimental animals to different frequencies had no effect on deoxyribonucleic acid (DNA) damage and did not cause cancer.

## CONCLUSION

The findings found no strong evidence that chronic exposure to 4G LTE 850, 1800 and 2600 MHz had any effect on blood cells. The results also showed that chronic exposure to 4G LTE did not induce DNA damage and did not cause cancer.

