## Impact of Electromagnetic Wave on Brainwave

# 謝漢杰、高富建

E-mail: 381811@mail.dyu.edu.tw

#### **ABSTRACT**

Information and Communication Technology nowadays keeps on changing every day. Though it offers a more convenient life to people, the strong EM wave resulted from it endangers human health, that has already turned out to be the primary study for medical science. Furthermore, EM wave also attracts concern and panic of the inhabitants living in the surroundings which is filled with high-frequency and low-frequency EM wave. EM wave today comes from broadcast towers, the system of the wireless communication, GPS, TVs and defense satellites mostly. It is almost full of all over the world. Enjoying the convenience resulted from communication technology, people nowadays should also concern about whether EM wave would damage people 's health at the same time. As we can see, EM wave results in numerous sources. The study mainly focuses on how EM wave produced from WIFI affects people 's bodies in different physiological situations, including sleeping, taking a rest, and logical reasoning. The researcher observes different changing of brain wave when human beings expose in various strength of EM wave, and analyses the affection of EM wave toward people 's bodies in different physiological situations.

Keywords: Wireless Communications, EM wave, Physiological Situations, Brain wave

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### **REFERENCES**

- [1] World Health Organization(WHO) , What are electromagnetic fields? http://www.who.int/pehemf/about/WhatisEMF/en.
- [2] EEE TECHNOLOG NAVIGATOR, Radio frequency, http://technav.ieee.org/tag/8359/radio-frequency.
- [3] 培姬 班森著,楊素惠譯,"認識電腦傷害",武陵出版社,106-107頁,1997年。
- [4] 科技圖書出版,環境科學基本叢書,環境物理,環境醫學。
- [5] Trends in Neurosciences, Vol.32, Issue. 2, February. 2009, pp. 118-126.
- [6] http://www.who.int/peh-emf/meetings/archive/en/paper15morrissey.pdf.
- [7] 國立臺灣師範大學,科學教育研究所,科學教育月?,第271期,93年。
- [8] 成功大學物理系, http://www.phys.ncku.edu.tw/~astrolab/e\_book/telescopes/captions/em\_wave.html.
- [9] 林一平,交通大學資訊工程學系教授,"趣談電磁波",台灣電信產業發展協會(TTIDA)發表,http://www.ttida.org.tw/forum\_detial.php?b\_id=188.
- [10] 陳惠貞 , "第8章無線網路與行動通訊",新世代計算機概論第五版,學貫出版社。
- [11] MONASH University, Electromagnetic spectrum, http://www.monash.edu.au/ohs/topics/em-spectrum.html.
- [12] World Health Organization (WHO), http://www.who.int/peh-emf/project/EMF\_Project/en/index2.html.
- [13] http://ec.europa.eu/enterprise/sectors/electrical/files/lv/rec519\_en.pdf.
- [14] 本國非游離輻射管制說明,國民健康局。
- [15] 日本,環境省,保健 化學物質對策,放射線健康管理對策, http://www.env.go.jp/chemi/electric/material/minomawari.pdf.
- [16] 國際非電離輻射防護委員會(ICNIRP), http://www.icnirp.de/documents/emfgdl.pdf.
- [17] 英國健康和安全執行局, Health and Safety Exceutive(SHE), http://www.hse.gov.uk/radiation/nonionising/l184emf.pdf.
- [18] http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/North\_America/USA\_files/table\_us.htm.
- [19] http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Asia/China\_files/table\_ch.htm.
- [20] 王智弘, "The Program Design of EEG Analysis for e-Learning", 中華民國100年1月。

- [21] 益重科技,http://www.icci.com.tw/ch/CH2/2307/MD/MD0000002307001903.html.
- [22] 湯雅雯,『Design and Implementation of an EEG Measurement System and the Nonlinear Analysis of EEG Signal 』,國立成功大學論文,民國94年。
- [23] SCIENTIEIC AMERICAN科學人雜誌,『何謂腦波?』,科學Easy Learn,醫學2011年。
- [24] 王智弘," The Program Design of EEG Analysis for e-Learning",中華民國100年1月。