

COMPENSATORY *M*MAGNETIC OSCILLATORS

ELECTROMAGNETIC BIOCOMPATIBILITY

Electromagnetic fields and living systems...

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INADEQUACY OF EXISTING MOBILE TELEPHONY SAFETY GUIDELINES NECESSITATES A NEW PRINCIPLE : BIOCOMPATIBILITY THROUGH ELECTROMAGNETIC COMPENSATION*

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* The opinions expressed herein are based entirely on my own independent research, and are neither endorsed nor rejected by the University of Warwick.

« CELLULAR TELEPHONES, IS THERE A HEALTH RISK ? »

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EMC STANDARD ELECTROMAGNETIC COMPATIBILITY (between machine and machine)

(93/31/ECC and 93/68/EEC), mandatory as of 1 January 1996, applies to any device, system, equipment, or electrical/electronic components likely to generate electromagnetic disturbances or the operation of which may be affected by these disturbances.

EUR - USA "This device complies with Part 15 of the FCC Rules. It may not cause harmful interference and must accept any interference received, including interference that may cause undesired operation"

In Europe and USA, on every computer screen, as well as on any electric device, since 1996, it is marked : emc

1. Electromagnetic Compatibility (EMC) between GSM Radiation and Electronic Devices

The importance of ensuring compatibility between electronic instrumentation of various kinds and the pulsed microwave radiation currently used in GSM mobile telephony is well recognised and accepted. Prohibition of the use of cellular phones on aircraft and in hospitals, on the grounds that their emissions might adversely interfere

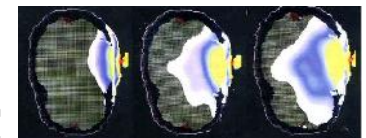
in a non-thermal way with sensitive electronic equipment, is familiar, and their possible deleterious effect on implanted heart pacemakers and hearing aids has been the subject of many published scientific studies in recent years.

More generally, current UK and European Community Electromagnetic Compatibility (EMC) legislation requires that all electronic goods offered for sale in the EU continue to operate satisfactorily up to an electric field exposure of 3V/m.

2. Thermal Effects as quantified by the SAR - Specific Absorption Rate (by tissues)

Unfortunately, however, the same concern does not currently extend to the alive human organism, which is generally considered immune from adverse influences of GSM radiation, on account of its intensity* being far too low to cause any deleterious degree of heating of body tissue (as quantified through the so-called specific absorption rate, or SAR); indeed for humans, contrary to case of electronic instrumentation, this heating is generally considered to be the only adverse effect possible. Furthermore, paradoxically some thermally based safety guidelines (such as those of ICNIRP or CENELEC) actually permit users to be exposed to electric fields over ten times stronger than the **EMC standard** of 3V/m (for electronic devices) !

*Intensity is expressed either as an electric (magnetic) field strength in V/m (Tesla), or as a power density, in units of Watts/cm², according as whether near or far field conditions obtain - the former being relevant to handset use, and the latter to public exposure in the vicinity of a Base-station.



S.A.R. obtained by simulation with a computerized modelling head



Instrumentation for measurement of the S.A.R.

3. Non-thermal Effects

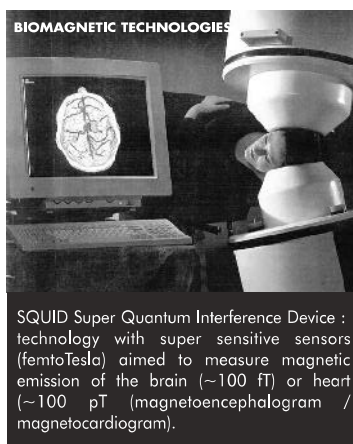
The belief that adverse health effects can be induced only by the heating effect of GSM radiation is, however, a fallacy. Firstly, this is empirically evident from the numerous and persistent reports of health problems by some people when exposed to this kind of radiation - be it from a mobile phone handset or from a Base-station - despite its intensity being **well below** existing safety limits based on SAR values.

Secondly, there is an extensive portfolio of evidence in the peer reviewed scientific literature, spanning some 30 years, which indicates that this radiation can affect an alive organism in various **non-thermal** ways, many of which are consistent with the nature of the health problems reported, such as headaches, sleep disruption, impairment of short-term memory and concentration, and, in the case of some epileptic children, a significant increase in the frequency of seizures. Finally, the ability of this kind of radiation to exert such non-thermal influences on an alive organism is a quite general prediction of modern biophysics.

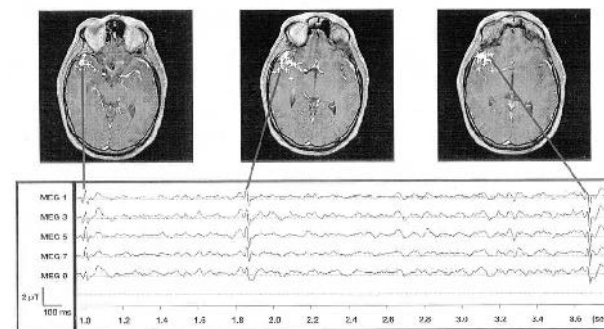
4. Alive Organisms are themselves sensitive Electromagnetic Instruments

Partly responsible for the reluctance to accept the reality of non-thermal effects is their rather counter-intuitive nature - as exemplified, for instance, by the fact that their magnitude is often found to increase as the strength of the irradiating field decreases - and the difficulties experienced in attempts to replicate them.

On the other hand, the equal reluctance to accept that they can provoke adverse health reactions in some people is due to a general lack of appreciation that electromagnetic fields are **not alien** to an alive organism, but actually play a rather fundamental and integral role in its organisation and control, from the cellular level upwards - i.e. that an alive organism is itself an electromagnetic instrument of great and exquisite sensitivity, and, as such, is just as vulnerable to being interfered with (non-thermally) by external electromagnetic fields as is an active piece of electronic equipment, although in the latter case the influence of a given field is always the same, unlike the situation with an alive organism!



A good example of the prevailing ignorance of this fact is provided by the recent development of TETRA (Terrestrial Enhanced Trunked Radio Access), in which the basic frame repetition rate is 17.6Hz. For this frequency (which lies in the range of beta brain-wave activity) is not only close to that at which a flashing visible light can provoke seizures in photosensitive epileptics, but also to the modulation frequency at which there is a maximum in the expression of calcium ions from cells when they are irradiated with low intensity microwaves!



Recording of magnetic induction peaks (~ 1000 femtoTesla = 1 pT) of an epileptic seizure by magnetoencephalography (MEG / SQUID)

5. Electromagnetic Sensitivity of Living Organisms

That the low intensity, pulsed microwave radiation currently used in GSM mobile telephony can exert subtle, non-thermal influences on the alive human organism arises, in the first place, because microwaves are, after all, waves, and, as such, have properties other than solely intensity. In particular, the radiation has certain rather well defined frequencies, which facilitate its discernment by the living organism, and via which it can, in turn, be affected. This is so because the alive human organism itself supports a variety of electrical biological activities of an oscillatory nature, each characterised by a particular frequency, **some of which happen to be close to those used in GSM**.

Existing Safety Guidelines, based on solely on consideration of the SAR, afford no protection against such effects, since they limit only the intensity of the microwave radiation sufficiently to ensure that tissue heating by absorption of energy from the microwaves is not in excess of what can be coped with by the body's thermoregulatory mechanism, so that homeostasis is not compromised. It must be appreciated that the aliveness of the organism here enters only in so far as it dictates the magnitude of the

temperature rise above which adverse health effects set in, the *heating itself* occurring irrespective of whether the organism is alive or dead!

By contrast, in order that the radiation can exert non-thermal influences it is essential that the organism be alive, for only then are excited the various oscillatory endogenous electrical activities, via which the radiation can access the system: the Dead have no ECG or EEG with which an external electromagnetic field can interfere!

Thus, just as a radio or another piece of electronic instrumentation has to be switched on (or energised) before it can respond or be interfered with by an extraneous incoming signal, so the organism has itself to be energised (i.e. alive) if it is to be non-thermally sensitive to radiation.

6. The inadequacy of Conventional Protective Strategies

Existing Safety Guidelines thus neglect the most discriminating feature of all, namely, the aliveness of the irradiated organism; they address only 'one side of the coin' - the thermal side - leaving the exposed person vulnerable to the possibility of adverse health effects provoked by the neglected non-thermal side.

The same indictment, of course, applies to any protection device that acts simply to reduce - either by screening or by an employing an ear-piece, for example - the intensity of the microwave radiation emitted by a mobile phone handset into the head of the user; for the user is still left vulnerable, particularly to the essentially unscreenable low frequency magnetic fields associated with the current surges from the battery of the handset, which are necessary to endow the emitted microwave signal with the pulse characteristics required for the TDMA (Time Division Multiple Access) system currently employed in GSM; evidence of the noxiousness of these fields has recently been obtained from experiments on chick embryos.

Clearly, non-thermal influences are connected more with the transfer of information from the irradiating field to the alive organism, through the latter's ability to 'recognise' certain frequency characteristics of the radiation, than with its ability to absorb energy from the field. In order, however, for the organism to be able to discern such weak radiation against the level of its own thermal emission at physiological temperatures, the radiation must have a certain minimum intensity. This minimum intensity is, however, far below (typically of the order of 10^{-15} Watts/cm²) that necessary to cause any heating (typically, 10^{-3} Watts/cm²), in consequence of the radiation's rather well-defined carrier frequency (or relatively high degree of coherence).

7. The Frequencies used in GSM are Bio-active

The particular frequencies utilised in GSM mobile telephony that must be anticipated to be especially 'bio-active' are those of the microwave carrier (900/1800 MHz) and those of certain pulsings that characterise the TDMA signal - specifically, the multiframe repetition rate of 8.34Hz, and the 2Hz periodicity associated with the discontinuous transmission (DTX) mode of the handset; this energy saving mode becomes active when the user is listening but not speaking.

For adequately metabolising systems themselves support highly organised, oscillatory electrical activities at the cellular level, whose frequencies generally lie in the microwave band, in terms of which the dramatic effects of ultra-low intensity microwaves on processes as fundamental as cell division and intercellular communication can be understood in a rather natural way; the two ELF's (at 8.34Hz and 2Hz), on the other hand, correspond to those found in the human EEG - specifically, in the ranges of the alpha and delta brain-waves, respectively.

This anticipation is amply borne out by the ways in which this kind of radiation has been found to affect a wide variety of brain functions - such as electrical activity (EEG), electrochemistry and the permeability of the blood/brain barrier- and to degrade the immune system. Furthermore, although the precise way in which these influences actually provoke adverse health reactions is at present unclear, there is an undeniable consistency between these non-thermal influences and the nature of many of the health problems reported.

Furthermore, it is clear that because both the occurrence of the initial provoking non-thermal effect and the severity of any associated adverse health effect depend on aliveness, they necessarily depend on the state of the organism when it is exposed to the radiation.

8. The Subjective Variability of (non-thermal) Biological Responses

This will, of course, vary from person to person, depending, for example, on the stability of their alpha rhythm against interference or entrainment by the radiation, their individual biological resistance to stress, and the robustness of their immune system.

Accordingly, identical exposure to exactly the same radiation can entail different (non-thermal) responses in different people (unlike the case of active electronic instruments), consistent both with the fact that not every exposed person is adversely affected, and with the difficulties encountered in some laboratory attempts to replicate non-thermal effects under in vivo conditions. Depending on a person's genetic

predisposition, and the fact that stress is cumulative, it is quite possible that exposure to an electromagnetic field simply supplies the final contribution that raises the person's level of stress above some critical value, thereby 'triggering' the manifestation of some particular pathology, which is already in a well advanced state.

A similar non-uniqueness, it should be noted, also characterises the consequences of microwave heating, where, for example, a temperature rise of 1°C can be either lethal or life-saving depending on the condition of the person at the time.

9. S.A.R. Reduction is Insufficient

To cover a reasonable range of conditions, a certain safety margin is incorporated into the permitted microwave exposure intensity; indeed, it is the lack of consensus as to the actual magnitude of this margin that is responsible for the variation in the exposure intensities recommended by different regulatory bodies.

It is to be stressed, however, that the heating itself always occurs, irrespective of the condition of the person, quite unlike the situation with non-thermal effects. It is, of course, this fact that underlies the possibility of using 'phantom' heads to determine SAR values; it should, however, be realised that the reliability of the values so obtained is contingent on the extent to which the dielectric properties of the synthetic brain fluids used actually approximate to those in the actual living organism. On the basis of what little information is available, the differences could prove to be significant.



Whilst in the case of non-thermal effects, reducing the intensity to below the non-thermal discernment threshold would, of course, enhance the immunity of the exposed person to adverse effects thereby provoked, it would, in effect, render the technology unusable, because of this threshold is so very low. Accordingly, in the quest for electromagnetic biocompatibility between the alive human organism and the kind of radiation currently used in GSM mobile telephony a quite different strategy must be adopted.

10. Non-thermal Electromagnetic Therapies

One that suggests itself is based on the established therapeutic efficacy of exposure to sub-thermal electromagnetic fields of various kinds under clinically controlled conditions, such as in connection with accelerating the healing of bone fractures, for example, or by increasing the efficacy of ionising radiation so that smaller doses can be used.

Perhaps even more remarkable is microwave resonance therapy, which can restore homeostasis in a wide range of pathologies by utilising ultra-low intensity radiation of a specific frequency.

11. Compensatory Magnetic Oscillation

The efficacy of this therapy in dealing with endogenous disorders not only again indicates that electromagnetic fields are not alien to the alive body, but suggests that it should be possible to mitigate dysfunctions that are provoked by 'informational' influences of external electromagnetic radiation - against which conventional strategies of protection are impotent.

The appropriate strategy would be to utilise some kind of 'compensating' emission to interface the alive human organism with the external electromagnetic pollution to ensure that biocompatibility is realised - essentially by providing an electromagnetic 'antidote' to an electromagnetic pollution - i.e. by treating an electromagnetic problem electromagnetically - or 'like with like'.

This is the philosophy underlying an ingenious technology developed by TecnoLab, in which the compensating emission is a hyper-weak, ELF magnetic field, the dominant frequency of which is close to 12Hz. This field is emitted by an autonomous oscillator, when exposed to a 'polluting' electromagnetic field. The efficacy of this technology has been empirically established in a variety of independent experiments on living organisms - both animal and human exposed to radiation from actual radiative devices, namely mobile phones and VDUs.

It should be emphasised that despite this efficacy, no difference in SAR would be detected if a measurement were made with the compensating emitter in place, again illustrating the inadequacy of this concept to properly address the problem of electromagnetic biocompatibility, and indicative that the fact that most noxious effects of the GSM radiation derive from its non-thermal influence on the alive organism.

12. Towards Electromagnetic Bio-Compatibility

An understanding of the actual way in which the compensating magnetic emission succeeds in maintaining homeostasis when an (alive) organism is exposed to electromagnetic pollution is currently the subject of much research at an international level, in which concepts at the frontiers of present day knowledge are being invoked.

Of crucial importance is the recognition that, at both the microscopic (cellular) and macroscopic levels, a living organism is a non-equilibrium quantum system. For this entails quite novel possibilities whereby the organism can sense hyper-weak electromagnetic fields, and in turn respond to them in an entirely non-thermal way.

Research to date strongly suggests that the compensating magnetic field targets ion-protein complexes, whose integrity it helps to maintain (quantum mechanically), when they are under the disruptive influence of an external electromagnetic pollution. For it is known that Ca, Mg, K and Na ions play a crucial role in the signal transduction processes that are essential to the orderly (and consequently healthy) functioning of an alive organism.

The magnetic compensative strategy developed by TecnoLab must thus be considered to be in the vanguard of a new generation of technology that achieves, in an ingenious and novel way, a much higher degree of electromagnetic biocompatibility than would otherwise be possible.



BIOCOMPATIBILITY

"Biocompatibility refers to any process, item, device, factor, which directly or indirectly does not adversely affect the health or the balance of a living organism, be it in the short, medium or long term. It respects the hippocratic principle : "Primum non nocere". A fortiori : Anything that maintains or improves health is deemed biocompatible"



Definition taken from a text of The World Health Organization