FCC 13-39

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies	)	ET Docket No. 13-84
	)	
Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields	)	ET Docket No. 03-137
	)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by: L. Lloyd Morgan
Environmental Health Trust, P.0. Box 58
Teton Village, WY 83025
Lloyd.L.Morgan@gmail.com
510 841-4362

November 18, 2013

Erroneous Comments Submitted to the FCC on Proposed Cellphone Radiation Standards and Testing by CTIA – The Wireless Association, September 3, 2013

Devra Lee Davis PhD MPH[1], Alvaro de Salles PhD[2], Susan Downs MD[3], Gunnar Heuser MD PhD[4], Anthony B. Miller MD[5], Lloyd Morgan BSEE[6], Yael Stein MD[7], Elihu D Richter MD MPH[8]

[1] Founder & President, Environmental Heath Trust; http://en.wikipedia.org/wiki/Devra_Davis (accessed 16 Nov. 2013).
[2] Professor Electrical Engineering from Escola de Engenharia, Universidade Federal do Rio Grande do Sul- UFRGS, Porto Alegre, Brazil,
[3] University of California—San Francisco, Dept. of Psychiatry.
[4] Former Assistant Clinical Professor, UCLA, Emeritus Staff member Cedar Sinai Medical Center, Fellow American College of Physicians.
[5] Professor Emeritus, Dalla Lana School of Public Health, University of Toronto, Canada.
[6] Sr. Research Fellow, Environmental Health Trust.

Executive Summary

We document numerous errors of fact and interpretation in the CTIA Comments:

- CHILDREN'S EXPOSURE: Contrary to CTIA's assertions that the current standard adequately protects children, pregnant women and other vulnerable groups, the exposure limits recommended in the past three decades have consistently singled out children's exposure as requiring special consideration and attention.
- "HARMONIZATION": The CTIA states the need to increase exposure under the rubric of international "harmonization" of the standard which would result in as much as a 3-fold increase in the maximum allowed absorption of microwave radiation.
- FIFTY-FOLD SAFETY FACTOR: The CTIA assertion that the current standard relies on a fifty-fold safety factor is incorrect. It is only 2.5 times higher than a potential irreversible effect.
- STATE OF THE SCIENCE: We counter the CTIA assertion that International Agency for Research on Cancer of the World Health Organization (IARC) declaration that cellphone and other wireless device radiation is a possible human carcinogen "does not change the state of the science."
- CERTIFICATION PROCESS: We disagree with the CTIA's assertion that there is only one FCC approved cellphone certification process. There are two FCC approved processes: Computer Simulation and SAM[9]. Computer simulation is far superior to SAM. Unfortunately the computer simulation process has never been used to certify that wireless devices meet the exposure limits although the FDA helped to develop it and currently relies on it to evaluate and approve medical devices.
- CONFLICTS-OF-INTERESTS: Documents that many of the organizations and individuals cited as authorities by the CTIA have direct ties to the telecommunications industry and are often funded by the industry.
- BRAIN CANCER RATES: We counter the CTIA assertion that brain cancer incidence rates are stable when in fact brain cancer incidence increased in 4 countries, and for 3 of these 4 countries glioblastoma has doubled, in the last decade or less.
- EXPOSURE: Shows how "normal operation positions" of wireless devices can result in exposures of more than 2 orders of magnitude higher than the

[7] Dept. of Anesthesiology and Critical Medical Care Medicine, Hebrew University-Hadassah Medical Center. Jerusalem, Israel.
[8] Professor Occupational and Environmental Medicine, Hebrew University-Hadassah School of Public Health and Community Medicine, Jerusalem, Israel.
[9] Specific Anthropomorphic Mannequin

exposure limits and bone marrow in children's skulls absorb 10-fold greater radiation than adult's marrow.

- ADVERSE HEALTH EFFECTS: The CTIA selectively reviews the science, more often than not, incorrectly, while myriad studies published after the adoption of the current FCC exposure limits which show adverse health effects, particularly cancers contradicting CTIA's assertions.
- ANIMAL STUDIES: CTIA assertions implying that evidence from animal studies is contradicted by listing of animal studies that found adverse effects and was used by IARC for its declaration of a "possible carcinogen."

Table of Contents

Introduction

Originally, CTIA was the Cellular Telecommunication Industry Association, and transformed itself into CTIA—The Wireless Association. The original name remains a correct appellation. Its members include 28 carrier companies, 109 "Sub-GM Members" (mostly suppliers and cellphone manufacturers), and 103 Associate Members.[10] As such the CTIA has a vested interest in portraying its information in a manner that would optimally benefit its members.

As will be cited throughout this response CTIA's Comments are often incorrect, and/or incomplete and/or misleading. They selectively review information that is compatible with their proposals to weaken current standards by allowing up to 3-fold increased microwave radiation, and they systematically ignore studies that show that current standards do not adequately protect public health or the environment.

The focus of this response, prepared by experts in public health, will be on children's substantially larger absorption of microwave radiation, the inability of the currently used wireless device certification process to account for specific tissue types (e.g., bone marrow) that absorb greater radiation than adults, and children's wearing of metal eyeglasses, jewelry and piercings, leading to the urgent requirement to adopt new exposure limits that recognizes this real-world realities.

The History of Exposure Standards

The CTIA Comments references standards by ANSI[11] (1982), NCRP[12] (1986), IEEE[13] (1991), ANSI/IEEE[14] (1992), FCC Bulletin 65 (1997) and its Supplement C (2001), ICNIRP[15] (1998), and IEEE (2005)[16]. Yet, the CTIA ignores statements contained within these documents that constitute the concerns, warnings, and specific details for protection of the most vulnerable member of our nation.

[10] http://www.ctia.org/membership/ctia_members/ (accessed 5 Nov. 2013).
[11] ANSI: American National Standards Institute
[12] NCRP: National Council of Radiation Protection
[13] IEEE: Institute of Electrical and Electronic Engineers. A professional organization of industry engineers and academics whose works supports industry
[14] This standard is identical to IEEE 1991.
[15] ICNIRP; International Commission on Non-Ionizing Radiation Protection
[16] CTIA refers to it variously as IEEE 2006 and IEEE 2005. IEEE 2005 is correct.

ANSI 1974

The chairman of the Subcommittee that created this document was Arthur W. (Bill) Guy. Other members were: John Osepchuk and Ron Peterson. For more information see **Credibility of Sources**, Individuals below.

This standard was very short, only two pages (title and authors excluded). It defined an exposure limit for power density[17] equal to 10 mW/cm^{2}averaged over 6 minutes.

It did report several factors of concern.

Concerns

1. The authors noted "People who suffer circulatory difficulties and certain other ailments are more vulnerable," adding, "Under conditions of moderate to severe heat stress the guide number should be appropriately reduced."
2. The last section, "Whole Body Irradiation and Partial Body Irradiation" states "These formulated recommendations pertain to both whole body and partial body irradiation. Partial body must be included since it has been shown that **some parts of the human body (for example the eyes and testicles may be harmed if exposed to incident radiation levels significantly in excess of the recommended levels** [**emphasis** added]."
3. It states, "It is the present consensus that thermal effects are considered to be the most harmful and the therefore have been used as the basis for establishing the levels in this standard. Sufficient information concerning modulation effects, peak power effects, field strength effects, or frequency dependencies and limits are not currently available to substantiate adjustments of the radiation protection guide to account for these effects."

The U.S. Occupational Safety and Health Administration (OSHA) adopted this and a previous 1966 standard.[18]

In fact, all subsequent standards no longer required that whole-body and partial body irradiation levels be the same. Indeed, the partial body irradiation was henceforth allowed to be 20-fold higher than is allowed for whole-body irradiation.

[17] Power density is the radiated power found within a cross-sectional area.
[18] Microwave News, May 1981, p. 4.

ANSI 1982

As with the ANSI 1974 the chairman of the subcommittee that produced the standard was Dr. Arthur W. (Bill) Guy.

This standard was based on the ANSI 1974 standard. The starting point to establish an exposure limit was what whole-body exposure level *hungry* rats previously trained to find food ceased trying to find food. The ANSI committee stated, "[R]eliable evidence of hazardous effects is associated with wholebody-averaged SARs above 4 W/kg." Yet they also stated "The assumption is that reversible disruption during an acute exposure *is tantamount to irreversible injury* during chronic exposure." (ANSI, 1982, p. 13) [*emphasis* added]. In other words, because these behavioral changes occur during a short (acute) exposure, they can be assumed to cause irreversible damage with a continuous (chronic) exposure.

ANSI then arbitrarily established a 10-fold safety factor, dividing the whole-body SAR which was "tantamount to irreversible injury"—resulting in SAR_{WB}[19]=0.4 W/kg ANSI, 1982, p. 13-14).

But, in fact, the level they used to calculate this "safety" factor was 4 times higher than the level at which rats ceased seeking food. A 1975 study, known but ignored by the ANSI Committee, found that the cessation of efforts to find food occurred at a whole-body SAR_{WB}=1 W/kg[20], *not at 4 W/kg*. As will be seen in the response to CTIA's assertion that there is a 50-fold safety factor, this study is important (see **Fifty-Fold Safety Limit Is Specious** below).

ANSI adopted a standard for whole body exposure of 0.4 W/kg averaged over 6 minutes, and a 20-fold greater spatial peak SAR[21] exposure over any 1 gram of tissue of 8 W/kg averaged over 6 minutes. This fundamental change allowed a 20-fold higher exposure into the brain than into the rest of the body.

There was no logical explanation why the brain should be allowed to absorbed 20-fold more radiation than the whole-body, but the Committee did supply an explanation:

[19] SAR_{WB}: Whole body SAR is applicable in the far-field where the whole body is absorbing the incident radiation.
[20] J. A. D'Andrea, O. P. Gandhi, R. P. Kesner. Behavioral effects of resonant electromagnetic power absorption in rats. Biological Effects of Electromagnetic Waves, Selected Papers of the USNC/URSI Annual Meeting, Boulder, Colorado, October 20–23, 1975.
[21] Spatial peak SAR is applicable in the "near-field" where the radiation is only absorbed by a portion of the body as when a cellphone is held to the ear. In contrast, whole body SAR is applicable in the "far-field" where the radiation impacts the whole body.

> "By implication and demonstration, peak SARs in a biological body can *range more than an order of magnitude above the average SAR over a* limited mass of the exposed tissue."

Rather than reducing whole-body SAR by a factor of 20 because "peak SARs can range more than an order of magnitude" higher, they chose to allow a 20-fold high peak SAR.

The most important change was the exclusion of any hand-held device transmitting less than 7 Watts of radiation.[22] The potential effect of this exclusion would be that no U.S. government agency such as the FDA or EPA could require pre-market safety testing of wireless devices. At this time (1981), Motorola, with millions of "walkie-talkies" that radiated less than 7 Watt in use, was protected. This exclusion was variously referred to as the "low power exclusion" or as the "Motorola exclusion."

"Dr. Quirino Balzano of Motorola … [was] pleased: 'The standard now recognizes that, in the near field, high electric field readings do not necessarily cause biological effects.'"[23] Nine years earlier, April 3, 1973, a senior executive at Motorola, Martin Cooper had placed the first cellphone call to its major competitor, AT&T.[24] In effect, this could have been a gift in the for the nascent cellphone industry, had the FCC not removed this exclusion when it adopted its 1996 exposure rules.

As the ANSI 1982 standard approached final approval the Environmental Protection Agency registered its disapproval. Dave Janes with the EPA stated, "My position has already been made clear, and it has not changed."[25]

The ANSI Committee expressed concern that important factors were not considered:

Concerns

1. "It was recognized that the specific absorption rate (SAR), which provides the basis for limiting power densities, does not contain all of the factors that could be of importance in establishing safe limits of exposure. First, other characteristics of an incident field such as *modulation frequency* and *peak intensity* may pose a risk to health [*emphasis* added]."

[22] ANSI 1982, p. 10.
[23] Microwave News, May 1981, p. 4.
[24] Devra Davis, Disconnect, p.41.
[25] Microwave News, October 1981, p. 7

2. There are clear warnings that within an averaged SAR for a smaller volume of tissue, there will inevitably be "hotspots" well above the averaged SAR over a larger volume. As ANSI noted, "[A] whole-body-averaged SAR is the mean of a distribution, the high side of which is an envelope of electrical hotspots." The discussion continues, "Because of the invariable presence of electrical hotspots in the irradiated body and the inherent correlation between magnitudes of whole-body and part-body SARs, a biological effect induced by a localized SAR that is well above the whole-body average will be reflected to some extent by that average [ANSI 1982, p. 14]."

   For more information see **FCC's Two Cellphone Certification Processes**, The Average Tissue Volume Is a Major Factor in Determination of SAR below.
3. The Committee noted, "In addition, **modulation-specific effects, such as efflux of calcium ions from brain materials were not considered adverse because of the inability of the subcommittee's members to relate them to human health**[26]. The narrow ranges of power density and the low and narrow range of modulation frequencies associated with field-induced efflux of calcium ions, and the authors' findings that the phenomenon is reversible, are factors that entered into the subcommittee's deliberations [ANSI 1982, p. 13, **emphasis** added]."

   This statement reflects the absence of biological expertise on the ANSI Subcommittee 32 years ago, regarding the now well-known critical importance of calcium homeostasis in cells and that electromagnetic radiation impacts calcium homeostasis (e.g., Blackman et al. 1991,[27] Anghileri et al. 2005,[28] Yan et al. 2008 and 2009,[29] Maskey et al. 2010,[30]

[26] The inability to relate the effect of calcium ion efflux from brain cells to human health speaks of the lack of biological knowledge on the Committee.

[27] Blackman CF, Benane SG, House DE (1991). The influence of temperature during electric- and magnetic field-induced alteration of calcium-ion release from in vitro brain tissue. Bioelectromagnetics, 12: 173–182.doi:10.1002/bem.2250120305 PMID:1854354.

[28] Anghileri LJ, Mayayo E, Domingo JL, Thouvenot P (2005). Radiofrequency-induced carcinogenesis: cellular calcium homeostasis changes as a triggering factor. Int J Radiat Biol, 81: 205–209. doi:10.1080/09553000500076957 PMID:16019929.

[29] Yan JG, Agresti M, Zhang LL et al. (2008). Upregulation of specific mRNA levels in rat brain after cell phone exposure. Electromagn Biol Med, 27: 147–154.PMID:18568932.

Yan JG, Agresti M, Zhang LL et al. (2009). Qualitative effect on mRNAs of injury-associated proteins by cell phone like radiation in rat facial nerves. Electromagn Biol Med, 28: 383–390. PMID:20017629

[30] Maskey D, Kim M, Aryal B et al. (2010). Effect of 835 MHz radiofrequency radiation exposure on calcium binding proteins in the hippocampus of the mouse brain. Brain Res, 1313: 232–241. PMID:19968972.

Donnellan et al. 1997,[31] Bawin et al. 1975 and 1978,[32] Blackman et al. 1980,[33] Dutta et al. 1984, and 1989,[34] and Schwartz et al. 1990[35]).

As calcium has been understood to be vitally important to the functioning of membranes and transport of energy, the assertion by the Committee in 1982 that this demonstrated impact of radiation on calcium efflux does not have health consequences was wrong at the time and is even more wrong at this point in scientific history.

Thus, contrary to CTIA's 19 assertions that that non-thermal effects do not exist, a number of studies reported non-thermal adverse biological effects from electromagnetic radiation several years ago.

NCRP 1986

The Report was published almost 3 decade ago. CTIA's first comment on NCRP involvement with the current FCC exposure limits states "The Commission revised its RF emission standards in 1996, adopting limits based on guidelines from the National Council on Radiation Protection and Measurements (NCRP) and the 1992 ANSI/IEEE C95.1 standard" [CTIA Comments p. 5] and has a further 10 comments concerning NCRP, particularly in stating that there was no evidence of non-thermal effects from exposure to electromagnetic radiation (EMR). As will be seen below, this is not true.

Non-thermal effects (no measurable temperature change)

The NCRP 1986 uses both the term "athermal," and the term "non-thermal" for results that have no measurable temperature change.

[31] Donnellan M, McKenzie DR, French PW (1997). Effects of exposure to electromagnetic radiation at 835 MHz on growth, morphology and secretory characteristics of a mast cell analogue, RBL-2H3. Cell Biol Int, 21: 427–439. doi:10.1006/cbir.1997.0162 PMID:9313343.

[32] Bawin SM, Kaczmarek LK, Adey WR (1975). Effects of modulated VHF fields on the central nervous system. Ann N Y Acad Sci, 247: 1 Biologic Effe74–81. doi:10.1111/j.1749-6632.1975.tb35984.x PMID:1054258.
Bawin SM, Sheppard A, Adey WR (1978). Possible mechanisms of weak electromagnetic field coupling in brain tissue. Bioelectrochem Bioenerg, 5: 67–76. doi:10.1016/0302-4598(87)87008-3.

[33] Blackman CF, Benane SG, Joines WT et al. (1980). Calcium-ion efflux from brain tissue: power-density versus internal field-intensity dependencies at 50 MHz RF radiation. Bioelectromagnetics, 1: 277–283. doi:10.1002/bem.2250010304 PMID:7284026.

[34] Dutta SK, Ghosh B, Blackman CF (1989). Radiofrequency radiation-induced calcium ion efflux enhancement from human and other neuroblastoma cells in culture. Bioelectromagnetics, 10: 197–202. doi:10.1002/ bem.2250100208 PMID:2540756.

[35] Schwartz JL, House DE, Mealing GA (1990). Exposure of frog hearts to CW or amplitude-modulated VHF fields: selective efflux of calcium ions at 16 Hz. Bioelectromagnetics, 11: 349–358. doi:10.1002/ bem.2250110409 PMID:2285418.

The NCRP Report states:

"[A]fter acute exposure to relatively very-low-intensity, sinusoidally modulated shortwave and microwave fields (cf., e.g., Bawin et al. 1975; Blackman et al., 1980, Adey, 1980) [are found]. In experiments in which isolated chicken brains were exposed to CW fields or to fields modulated at 3 to 30 Hz, an exodus of calcium ions (Ca2+) from brain materials was observed, but only to modulated fields within a narrow band of frequencies centered near 15 Hz-and only within a narrow range of power densities. Because the average amount of energy captured by brain materials was held constant across frequencies, thermal effects alone could not be responsible for the release of Ca2+. These intriguing experiments are discussed in detail in Section 11 [p. 5]."

In Section 11, contrary to the CTIA claim, the NCRP does not deny "athermal" effects. Rather the NCRP authors effectively describe all effects including those with no measureable temperature change as thermally induced effects. They explain this reasoning as follows:

"As an indicant of an effect that is associated with quantities of energy absorbed rather than with quantities of incident energy across a sizable span of species and carrier frequencies, behavioral incapacitation has served as a highly useful criterion and benchmark in the formulation of protective exposure limits. These virtues notwithstanding, the end point of incapacitation (or of any dependent variable based solely on behavior) has a weakness that lies in its empirical rationale-no distinction can be made between thermal effects and effects arising from athermal events, or from thermal-athermal complexing-and in the corollary matter of mechanisms (p. 185)."

Thus the NCRP authors engage in a semantic argument which obfuscates the issue. Basically they contend that if an effect occurs in the absence of a measured change in temperature a non-measurable temperature change exists. NCRP does not challenge the reality that adverse effects have been found over a wide-range of experiment where there is no measurable temperature change. The greater scientific community uses non-thermal effects to mean effects which are found where there is no measurable temperature difference. The CTIA Comments ignore this semantic difference and declare in multiple ways,

"The FCC's RF standards, which are based on the ANSI/IEEE and NCRP recommendations, account for non-thermal effects. In

promulgating their standards, both ANSI and NCRP considered non-thermal effects but determined the scientific data on this point was unreliable [CTIA Comments, p. 13-14]."

This interpretation by the CTIA is most emphatically a misreading of the NCRP Report, as these excepts indicate:

On page 7 of the NCRP Report the authors state, "As a point of departure in the discussion of mechanisms, it can be stated that **there is ample evidence that athermal interactions in biological materials are not only possible but have been demonstrated for fields both strong and weak**. It must also be stated that the biophysical mechanisms of these athermal events are but poorly understood [**emphasis** added]."

On page 24, "The weight of the evidence is that, with the exception of calcium efflux experiments, reported elsewhere in this report, athermal effects of microwave power on cellular function are difficult to demonstrate."

The NPCR Report provides a definition of "dose" in the context of radio frequency radiation (RFR). On page 275, "dose" is the Specific Absorption (SA), and the "dose-rate" is Specific Absorption Rate (SAR). Thus the "dose" is the time in seconds multiplied by the "dose-rate" (SAR), and the resultant units of dose are Joules per kilogram (J/kg) or per the Système Internationale d'Unités (SI), or International System of Units, the formal unit of measure is Gray (Gy), 1 j/kg=1 Gy. For the importance of these definitions see **Fifty-fold Safety Limit Is Specious**, Five-fold safety factor for general public does not exist, section below.

IEEE 1991

In 1987-1988, ANSI, concerned about its lack of medical expertise, "handed over the setting of exposure limits to the Institute of Electrical and Electronic Engineers (IEEE)"[36]. However, the IEEE also lacked medical expertise as well as public health expertise.

Many of the Subcommittee members who approved this standard were telecommunication industry employees.

Among these employees were:

Q. Balzano

[36] Gandhi OP, Morgan LL, de Salles AA, Han Y-Y, Herberman RB, Davis DL. Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children. Electromagnetic Biology and Medicine, 31(1): 34–51, 2012.

Arthur W (Bill) Guy
M. (Mays) L. Swicord
Ron Petersen
For details on these individuals see **Credibility of Sources**, Individuals below.

This exposure standard, adopted in part by the FCC in 1996, and based on the ANSI 1982 standard, made changes which *appeared to reduce* the maximum exposure dose for the general public in "uncontrolled environments" compared to an *apparently* higher exposure dose for electric workers in "controlled environments",[37] but in fact under the changed standard both groups are exposed to *the identical radiation dose*.

IEEE 1991 reduced the dose-rate (SAR) for the general public by a factor of 5, while leaving SAR for electrical worker unchanged. Thus, for the general public maximum SAR_{WB}=0.08 W/kg and for workers maximum SAR_{WB}=0.4 W/kg; equivalently, the spatial peak was SAR=1.6 W/kg and SAR=8 W/kg, respectively.

But contrary to any logic, the previous averaging time, which was 6 minutes was increased 5-fold to 30 minutes for the general public. Thus as stated above the radiation dose was the same for the general public and electrical workers (1.6W/kg*30 minutes=2.88 kJ/kg=2.88 Gy, and 8W/kg*6 minutes=2.88 kJ/kg=2.88 Gy). Put simply, for the general public the dose-rate was reduced 5-fold and the dose was increased 5-fold, resulting in no difference. For more information see **Fifty-fold Safety Limit Is Specious** below.

For electrical workers the exposure limits for extremities (e.g., hands, feet, wrists, ankles, and by a recent FCC declaration, to the ear as well) is 20 W/kg; for the general public it is 4 W/kg, each case averaged over any 10 grams of tissue. The eyes and testes are specifically excluded from this requirement.

Though extremities are not explicitly defined, this would include the arms and legs. No rationale is provided for this high exposure. The leg is never mentioned but for an arm it states, for "exposure of a triple layered (fat-muscle-bone) cylindrical arm model with the E field both perpendicular and parallel to the axis of the cylinder. (The results of the analyses where the E field is parallel

[37] IEEE 1991, p. 9, "Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment."

to the axis of the cylinder are valid only where the arm model is equal or greater than one half wavelength.) The overall results of these analyses support the recommended peak exposure values as worst-case levels [p.26]."

IEEE 1991 also expressed concern for "subgroups of greater sensitivity."

Concern

"To some, it would appear attractive and logical to apply a larger, or different, safety factor to arrive at the guide for the general public. Supportive arguments claim *subgroups of greater sensitivity (infants, the aged, the ill and disabled), potentially greater exposure durations (24-hr/day vs. 8-hr/day), adverse environmental conditions (excessive heat and/or humidity), voluntary vs. involuntary exposure*, and psychological/emotional factors that can range from anxiety to ignorance. Non-thermal effects, such as efflux of calcium ions from brain tissues, are also mentioned as potential health hazards [p. 14, *emphasis* added]."

The CTIA Comment denies the existence of non-thermal effects 13 times,[38] and yet it never mentions calcium efflux, which has been a well-established non-thermal effect for many decades.

ANSI/IEEE 1992

In November 1992 ANSI endorsed IEEE 1991. Other than title changes referring to ANSI, ANSI/IEEE 1992 is identical to IEEE 1991.

However in a Microwave News article titled "EPA Assails ANSI RF/MW Standards as Seriously Flawed," both the EPA and the FDA made strong objections to the FCC's exposure limit adoption.[39]

The EPA's objections included, "the standard has "serious flaws" and questioning whether it is 'sufficiently protective of public health and safety.' … in particular, the standard's different limits for 'controlled' and 'uncontrolled' environments and the failure to consider nonthermal effects."

The EPA recommended to the FCC that:

[38] Page 15—3 times, page 16—4 times, page 50—4 times, page. 51, and page. 53.
[39] Microwave News, January/February 1994, p. 10.

"The FCC should not adopt the 1992 ANSI/ IEEE standard. There are serious flaws in the standard that call into question whether the proposed use of 1992 ANSI/IEEE is sufficiently protective." It listed 4 concerns:

1. "1992 ANSI/IEEE allows a twofold increase in the [maximum permissible exposures] at high frequencies above that permitted by the current FCC guideline;"
2. "The two-level revised standard is not directly applicable to any population group but is applicable to exposure environments called controlled and uncontrolled environments that are not well defined and are discretionary. We disagree with this approach;"
3. "The 1992 ANSI/IEEE conclusion that there is no scientific data indicating that certain subgroups of the population are more at risk than others is not supported by NCRP and EPA reports;"
4. "The thesis that the 1992 ANSI/IEEE recommendations are protective of all mechanisms of interaction is unwarranted because the adverse effects level in the 1992 ANSI/IEEE standard is based on a thermal effect."

The FDA had a single objection, "[O]ne provision with which we must disagree.... The concept of limiting the SAR induced in the body appears to be disregarded... [by] a 'low-power exclusion clause' that exempts certain RF devices from the provisions of the standard only because they emit less than a specified amount of power. Recent data from technical publications and other sources indicate that certain lower-powered RF devices, such as hand-held, portable, two-way radios, cellular phones, and other personal communication devices can induce relatively high SARs in portions of the body of nearby persons. Indeed, some devices that meet the requirements of the low-power exclusion clause can induce SARs that exceed the local-SAR limits specified elsewhere in the same standard—making the standard appear self-contradictory...."[40]

The FDA also stated, "In addition, we recommend that the scientific literature be closely monitored for possible evidence that the exposure levels cited by the new standard may need to be reduced.... In our view, the adoption of the 1992 ANSI standard furthers, but does not end, our respective RF protection efforts."

There is little to no evidence that close monitoring of the scientific literature has occurred in the intervening years.

[40] Microwave News, January/February 1994, p. 10.

A 3-page Microwave News article, "Industry Urges FCC Adoption of ANSI/IEEE C95.1-1992" cites views from industry, one U.S. governmental agency and an organization of amateur (HAM) radio operators.[41]

The U.S. agency was the National Institute for Occupational Safety and Health (NIOSH) which was "concerned about the lack of participation by experts with a public health perspective." NIOSH also was concerned about the adequacy of workers "controlled environment" exposure and stated, "the conservative public health approach would be to adopt only the more restrictive 'uncontrolled environment' limits for all exposed workers and the general public."

The American Radio Relay League (HAM radio operators) stated, "There is in the ANSI/IEEE 1992 standard no stated justification for the standard for the 'uncontrolled' environment, or for the decision to utilize a safety factor of 50..."

Here are a few excerpts from some of industry's comments:
AT&T: "[B]ecause emissions from some Part 15 devices and hand-held terminals of various kinds may exceed the new limits, categorical exclusion of these types of equipment would not be appropriate"
CTIA: "It is not necessary or appropriate to require manufacturers to submit detailed data relative to this [exposure limit] measurement …"
FAA: "FAA will make no distinction between 'controlled' and 'uncontrolled' environments in the application of permissible exposure limits for [RF] protection."
Motorola: "It may be necessary in some cases, such as for cellular telephones, to routinely measure the [SAR] because the 2.5 cm spacing requirement for application of this exclusion is not met."

FCC Bulletin 65 1996 and its Supplement C 1997

As reported in Microwave News, on April 6, 1996 the new FCC regulations went into effect. The rules were based both on the NCRP and the ANSI/IEEE 1992 documents.[42] The FCC rejected the "low power exclusion," and required "[C]ompliance…be shown with laboratory measurements or by computer modeling," accepting the "occupational" and "general population" exposure differences.

[41] Microwave News, May/June 1994, p. 13-15.
[42] Microwave News, July/August 1996, "FCC RF/MW Rules Favor NCRIP Limit; Cell Phnes To Be Tested for Safety, p. 1.

Bulletin 65 "has been prepared to provide assistance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to radiofrequency (RF) fields adopted by the Federal Communications Commission (FCC). The bulletin offers guidelines and suggestions for evaluating compliance [p. 1]."

On the page following where the authors are listed, it states, Supplement C "is issued in connection with FCC's OET Bulletin 65, Version 97-01. The information in the supplement provides additional guidance for use by applicants for FCC equipment authorization in evaluating mobile and portable devices for compliance with the FCC's guidelines for human exposure to radiofrequency (RF) electromagnetic fields."

The CTIA Comments asserts "Since 2002, the Commission's sole pre-approved method for testing has been through the IEEE-recommended specific anthropomorphic mannequin (SAM) [p. 6]." This assertion is false. Supplement C in the section, SAR Computation Guidelines and Descriptions (p. 16-18) states,

> "Currently, the finite-difference time-domain algorithm is *the most widely accepted computational method for SAR modeling*. This method adopts very well to the tissue models which are usually derived from MRI or CT scans, such as those available from the *visible man project*. FDTD offers great flexibility in *modeling the inhomogeneous structures of anatomical tissues and organs*. The FDTD method has been used in many far-field electromagnetic applications during the *last three decades*. With recent advances computing technology, it has become possible to apply this method to near-field applications for evaluating handsets [p. 16, *emphasis* added for context provided in the **FCC's Two Certification Processes** section below]."

Supplement C was published in December 1997. *Three decades* previously this computer simulation process was in use (close to 5 decades from the present). Seventeen years ago this was *the most widely accepted computational method for SAR modeling*. Seventeen years previously, it offered great flexibility in *modeling inhomogeneous structures of anatomical tissues and organs*. The *visible man project* has morphed into the Virtual Family[43] and is in current use

[43] http://www.fda.gov/AboutFDA/CentersOffices/OfficeofMedicalProductsandTobacco/CDRH/CDRHOffices/ucm302074.htm (accessed 5 Nov. 2013).

by the Food and Drug Administration (FDA), and much of its development has been paid for by U.S. taxpayers.

"One of the advantages of using computational modeling is its ability to model the complex heterogeneous structures of anatomical tissues and to simulate the field scattering that occurs within tissues. The handset and the head or other tissue are digitized and represented by the respective properties, permittivity, and conductivity [page 17]."[44]

"Special FDTD techniques have been concurrently developed to provide accurate and efficient method for modeling handsets and antennas. It has been recently shown by researchers that the exact dimensions of an antenna and its location on the handset must be precisely modeled in order to obtain accurate results. Since the inner electronics of a handset are typically not modeled, it may be necessary to verify such handset models with antenna gain or field patter data that are generally available during product development [p. 18]."[45]

"The sinusoidal or pulsed signed used to excite the antenna of a handset typically consists of an arbitrary amplitude. The results should be normalized to the appropriate output power of the actual device. It is recommended that the results should be normalized to the maximum output power measured by the manufacturers using methods similar to those described in the measurement sections of this supplement. When technical data is requested the list of items given in Appendix B may be used for guidance as to the type of information that is appropriate for demonstrating compliance [p. 18]."

All of the above information is provided for applicants who want the FCC to certify that their product is in compliance. From above, the purpose of Supplement C states, "The information in the supplement provides additional guidance for use by applicants for FCC equipment authorization in evaluating mobile and portable devices for compliance with the FCC's guidelines for human exposure to radiofrequency (RF) electromagnetic fields."

Bulletin 65 published four months earlier than Supplement C used language very similar to Supplement C:

[44] Permittivity and conductivity parameters, different for different tissues and by age, determine the amount of cellphone microwave radiation that will be absorbed by a specific tissue given the person's age.

[45] My nearly 4 decade of experience in high-tech electronics confirms this statement, that the total modeling including all electronic components is available.

"With respect to evaluating portable devices, various publications are available that describe appropriate measurement techniques and methods for determining SAR for compliance purposes. The use of appropriate numerical and computational techniques, such as FDTD analysis, may be acceptable for demonstrating compliance with SAR values. Studies have indicated that such techniques can be used to determine energy absorption characteristics in exposed [p. 42]."

Bulletin 65 and Supplement C never refers to the SAM method cited extensively in the CTIA Comments, but it is mentioned indirectly as it expressed concerns about the SAM method.

1. "The permittivity and conductivity of simulated liquid tissues[46] prepared for SAR evaluation must be measured to ensure that they are appropriately for the operating frequencies of the device. These parameters are usually measured periodically or before each SAR evaluation to determine if it is necessary to add appropriate amounts of water[47] to restore the original dielectric properties as a result of evaporation [p. 12]."

2. "Most test facilities use separate head models for testing handsets on the left and right side of the head. While some models included ears and others do not, a few have also used a spacer to represent the ear [p. 12]."[48]

Given the above information, it is not a surprise that the CTIA Comments cites the SAM method 19 times! Many of these citations urge the Commission to embrace SAM as a "safe harbor" for compliance. What the "safe harbor" is and who it is for, is not explained. For additional details see discussion of **FCC's Two Certification Processes** below.

ICNIRP 1998

Shortly after the FCC adopted the IEEE 1991 standard's exposure limits in late 1996, the International Commission on Non-Ionizing Radiation Protection

[46] A single liquid is use to simulate the absorption of all adult tissues (the head has 40 tissues). Children's tissues are typically more absorbent than adult tissues. For additional information see **FCC's Two Certification Processes** below.

[47] Obviously this is important but is the liquid's dielectric properties at the time of the certification process required as part of the overall certification process?

[48] When this was written certification values would vary from one facility to the next.

published its exposure limits, which were dramatically higher than what the FCC adopted.

The CTIA Comments ask the FCC to "harmonize" its exposure limits to ICNIRP's 2W/kg, averaged over 10 grams exposure limit. There are 23 instances where the CTIA Comments refers to ICNIRP—usually in the context of harmonizing, and also with language that states there is no danger in moving to the ICNIRP limits. For example on page 15, "The available science indicates that the IEEE and ICNIRP standard adopted in Europe and elsewhere presents no known danger to human health and might have certain public interest benefits when compared with the more restrictive standard in the United States." As will be seen, this CTIA statement is not true.

ICNIRP is a non-governmental organization, accountable to no government, to no medical or public health body. It was founded by Michael Repacholi who served as its first chair. Its financial sources are not transparent, but there is evidence of industry funding through the Royal Adelaide Hospital where Repacholi was previously employed.[49] ICNIRP is a self-perpetuating organization, that is, existing Commissions choose new Commissioners. For additional information on Repacholi see **Credibility of Sources**, Individuals below.

Interestingly, ICNIRP also established two exposure limits, one for the general public and one for electrical workers, but with a fundamental difference. Rather than averaging the peak exposure over 1 gram of tissue, ICNIRP averages it over 10 grams of tissue. This results in a 2.3 - 3-fold increase in the allowed absorption of microwave radiation.[50] The importance of the amount of tissue used to determine SAR is discussed in the section **FCC's Two Cellphone Certification Processes**, The Averaged Tissue Volume Is a Major Factor in Determination of SAR below.

ICNRIP's exposure limits are:

> Occupational exposure: SAR_{WB}=0.4 W/kg, spatial peak SAR (head and trunk)=10 W/kg; Localized spatial peak SAR (limbs)=20 W/kg, averaged over 10 grams of tissue for 6 minutes.

[49] Microwave News, Nov. 17, 2006 http://microwavenews.com/docs/MWN.11%289%29-06.pdf (accessed 16 Oct. 2013.

[50] Gandhi, O. P., Kang, G. (2002). Some present problems and a proposed experimental phantom for SAR compliance testing of cellular telephones at 835 and 1900 MHz. Phys. Med. Biol. 47:1501–1508.

General public exposure: SAR_{WB}=0.08 W/kg, spatial peak SAR (head and trunk) =2 W/kg; Localized spatial peak SAR (limbs)=4 W/kg, averaged over 10 grams of tissue for 6 minutes.

The ICNRIP standard listed more concerns than any previous standard:

Concerns

1. SAR values depend on "the frequency, intensity, polarization, and source– object configuration (near- or far-field)" and on characteristic of the body, "its size and internal and external geometry, and the dielectric properties of the various tissues [p. 497]."
2. "Several studies with rodents and monkeys have also demonstrated a behavioral component of thermoregulatory responses. Decreased task performance by rats and monkeys has been observed at SAR values in the range 1–3 W/kg (Stern et al. 1979; Adair and Adams 1980; de Lorge and Ezell 1980; D'Andrea et al. 1986) [p 505]."
3. "Reports suggest that exposure of rodents to microwave fields at SAR levels of the order of 1 W/kg may produce strand breaks in the DNA of testis and brain tissues (Sarkar et al. 1994; Lai and Singh 1995, 1996) [p. 505]."
4. "Repacholi[51] et al. (1997) have reported that exposure of 100 female, Em-pim1 transgenic mice to 900-MHz fields, pulsed at 217 Hz with pulse widths of 0.6 ms for up to 18 mo, produced a doubling in lymphoma incidence compared with 101 controls. Because the mice were free to roam in their cages, the variation in SAR was wide (0.01– 4.2 W/kg) [p. 506]."
5. "[T]wo independent laboratories … produced a small, but statistically significant, release of Ca^{++} from the surfaces of chick brain cells (Bawin et al. 1975; Blackman et al. 1979) [p. 506]."
6. "[E]ffects of AM fields on Ca^{++} binding to cell surfaces have been observed with neuroblastoma cells, pancreatic cells, cardiac tissue, and cat brain cells, but not with cultured rat nerve cells, chick skeletal muscle, or rat brain cells (Postow and Swicord 1996). Amplitude-modulated fields have also been reported to alter brain electrical activity (Bawin et al. 1974), inhibit T-lymphocyte cytotoxic activity (Lyle et al. 1983), decrease the activities of non-cyclic-AMP dependent kinase in lymphocytes (Byus et al. 1984), and cause a transient increase in the

[51] "Repacholi" is Michael Repacholi, the founder of ICNIRP and its first chairman, and the founder and first leader of the International EMF Project.

cytoplasmic activity of ornithine decarboxylase, an essential enzyme for cell proliferation (Byus et al. 1988; Litovitz et al. 1992) [p. 506]."

7. "Of particular relevance to the potential carcinogenic effects of pulsed fields is the observation by Balcer-Kubiczek and Harrison(1991) that neoplastic transformation was accelerated in C3H/10T1/2 cells exposed to 2,450-MHz microwaves that were pulse-modulated at 120 Hz [p. 504]."

The above selected list of concerns expressed in ICNIRP 1998 is followed by a disclaimer beginning with "However, …," which then explains why these concern are wrong. Yet these authors have little or no knowledge of these fields because they are completely outside of their primary knowledge realm: engineering expertise. Also it is important to note that "absence of evidence is not evidence of absence."

The CTIA Comments fail to mention any of these concerns about acceleration of abnormal cell growth and other biological impacts and contends throughout there is no evidence. For example, "without any scientific evidence that the current rules pose any danger to human health, there is no need for additional regulation in the area of consumer 'disclosures' or encouraging consumers to limit their exposure to RF emissions [p. 15]." As we have seen and will continue to see below, there is copious scientific evidence of dangers to human health, contrary to the CTIA multitudinous assertions.

IEEE 2005[52]

Follows ICNIRP 1998

The exposure limit changes from IEEE 1991, thus from the FCC's exposure limits as well, are:

Occupational exposure: SAR_{WB}=0.4 W/kg, spatial peak SAR (head and trunk)=10 W/kg; Localized spatial peak SAR (limbs and pinnae[53])=20 W/kg, averaged over 10 grams of tissue for 6 minutes.

General public exposure: SAR_{WB}=0.08 W/kg, spatial peak SAR (head and trunk)=2 W/kg; Localized spatial peak SAR (limbs)=4 W/kg, averaged over 10 grams of tissue for 30 minutes (6 minutes for ICNIRP 1998).

Except for the longer averaging time difference for the general public, these limits are identical to ICNIRP's limits.

[52] CTIA refers to it variously as IEEE 2006 and IEEE 2005. IEEE 2005 is correct.

[53] Pinnae refers to what is commonly called "the ear" located on either side of the head

Industry and Military Participation

The number of industry and military members of the Subcommittee which created IEEE 2005 increased dramatically in comparison to IEEE 1991. For details see **Credibility of Sources**, Individuals section below.

Subcommittee Chair:

Chung-Kwang (C-K) Chou, a senior executive at Motorola's Florida Research Labs

Other Motorola Employees:

Quirino (Q) Balzano, Joe Elder, Joseph Morrissey and Mays Swicord.

Military Employees:

Eleanor Adair, Martin Meltz, Michael Murphy and Patrick Mason.

Industry consultants:

Ronald Peterson (Co-chair), Vitas Anderson, Tadeusz Babiji, William Bailey, David Black, Philip Chadwick, Linda Erdreich, Kenneth Foster, Arthur Guy, James Hatfield, Shiela Johnston, Niels Kuster, John Osepchuk, J. Patrick Reilley, Asher Sheppard, Richard Tell and Eric van Rongen

The IEEE 2005 Subcommittee had no one with medical expertise and/or public health expertise. It was a technical body, overwhelmingly representative of members who have an inherent conflict of interest. The IEEE 2005 document is a virtual clone of the ICNIRP 1998 document.

IEEE 2005 listed more than a dozen concerns:

Concerns:

1. "Studies of Latvian children living in proximity to a radar station reported a decrease in acoustical and visual reaction, neuromuscular function, memory, and attention (Lacal [R1032]) [p. 64]."
2. "Disruption of sleep has been reported in subjects exposed to RF energy either occupationally (Bielski [R267]) or living in the vicinity of RF broadcasting towers (Santini et al. [R859], [R989]), (Altpeter et al. [R977]). [p. 65]."
3. "Seven studies of correlations between headache and RF exposure derived data from subjects through questionnaires. Headache incidence and proximity to RF broadcast towers or use of mobile phones yielded a positive correlation (Hocking [R693]) (Oftedal et al. [R755]) (Sandstrom et al. [R777]) (Chia et al. [R849], [R919]) (Santini et al. [R859], [R989]). [p. 65]."

4. "The only report of a tumor increase due to long-term RF exposure at low levels was by Chou et al.[54] [R138]. A slight increase in overall tumor incidence was reported in rats exposed for 2 years to 2450 MHz at low SAR levels (0.15-0.4 W/kg). A possible increase in pheochromocytoma (based upon only 7 tumors in exposed vs. 1 in sham exposed animals) was observed. The authors did not interpret these observations as biologically significant … [p. 67]."

   Unstated but also true, the Chou et al. study found serious adverse effects to the immune system. Table 2 reported the "number of neoplastic lesions per organ system" (35 organs), non-malignant, malignant, or metastatic, among exposed and unexposed (sham) animals. Exposed animals had double the metastatic tumors compared to unexposed (36 vs. 18; 3.6-fold more malignant tumors (18 vs. 5), and 17% more non-malignant tumor (62 vs. 55). The total number of tumors in exposed animals was 116 compared to 76 unexposed animals (>50% more tumors in the exposed animals).

   C-K Chou, the chairman of the IEEE 2005 subcommittee that created this standard, was the lead author of the study and as such was responsible for the statement, "The authors did not interpret these observations as biologically significant …"!
5. "A study by Repacholi[55] et al. [R606] using transgenic Pim-1 mice did report an association between long-term RF exposure and mortality from a certain subtype of lymphoma (follicular), but did not report a statistically significant increase in lymphoblastoid lymphomas. The Pim-1 transgenic model was specifically reported to use appearance of the latter type of lymphoma to reveal carcinogens in a shorter time frame than used for the detection of the follicular lymphomas. A subsequent study, performed at multiple exposure levels with a more uniform and better characterized exposure field, was not able to confirm the initial Pim-1 findings (Utteridge et al. [R846]) [p 67-68]."
6. "An association … from a certain subtype of lymphoma" was a 2.4-fold statistically significant risk. "A subsequent study, performed at multiple exposure levels with a more uniform and better characterized exposure field, was not able to confirm the initial Pim-1 findings (Utteridge et al)," because the study was so badly done that animals continued to gain weight after they had died.

[54] The lead author of this study, C-KI Chou, is the Chairman of the IEEE Subcommittee that created IEEE 2005.
[55] Repacholi is Michael Repacholi. For details see **Credibility of Sources**, Individuals, section below.

7. "Studies by Lai and Singh [R275], [R617] have reported DNA breaks in the brain cells of rats exposed at 2450 MHz [p. 69]."
8. "Independent replications, albeit with modifications of the initial procedure (Malyapa et al. [R641]) failed to confirm the finding." The Malyapa "non-replication, replication"[56] study was funded by Motorola
9. The term micronuclei (MN) refers to fragmented pieces of a cell's nucleus. "There are reports of the induction of MN by exposure of mammalian cells in vitro to specific frequencies and modulations (d'Ambrosio et al. [R800], Tice et al. [R815]) [p. 70]."
10. "When the newly calculated WBA [Whole Body Averaged] SAR values for **small children** are examined (Dimbylow [R1085]), it becomes apparent that when exposed at the previous MPE, WBA SAR values, depending on the frequency, **could exceed 0.08 W/kg by approximately a factor of two** [p. 92, **emphasis** added]."
11. "A topic of extensive discussion during preparation of this revision was the data for children relating to WBA SARs in the 2–3 GHz range (Dimbylow [R1085]). **These data, based on computational modeling, indicate that the [Basis Restrictions] for children may be exceeded** [p. 126, **emphasis** added]. "
12. "The latter report ["Mobile phones and health 2004," Documents of the NRPB, vol. 15, no. 5, National Radiological Protection Board, Chilton, Didcot, Oxfordshire, UK, 2004] stated that: '… **children might be more vulnerable to any effects arising from the use of mobile phones because of their developing nervous system, the greater absorption of energy in the tissues of the head, and a longer lifetime of exposure**.' [p. 135, **emphasis** added]."
13. "The IEGMP[57] [Independent Expert Group on Mobile Phones], however, in making its risk assessment regarding the use of mobile phones by children, did not demonstrate that it gave appropriate weight to this relevant literature on the biological effects [birth defects from animal exposures during gestation, CNS structure and function including cognition, brain cancer] of RF exposure on developing laboratory animals, particularly those studies that tested mobile phone signals."

For more information see IEGMP in the **Credibility of Sources**, Organizations section below.

[56] The term "non-replication, replication" study is used because Malyapa did not use the identical protocol that Lai and Singh used, thus it was not a replication. This is a standard technique used by industry for "replication" studies.
[57] IEGMP members included: Michael Repacholi, Anthony Swerdlow (see Credibility of Sources below).

The above selected list of concerns expressed in IEEE 2005 is typically followed by a disclaimer beginning with "However, …" and then explains why these concerns are wrong. Yet these authors have little or no knowledge of these fields because they are completely outside their knowledge realm: engineering expertise. Also it is important to note, that "absence of evidence is not evidence of absence."

Interestingly, the CTIA Comments never cites studies discussed in these various exposure standards whether the studies did, or did not report, adverse biological effects.

IARC's Possible Carcinogen Finding

One section of the CTIA Comments (pages 23-26) is titled, "2. The IARC Monograph Confirms and Does Not Change the State of the Science." As will be seen, the IARC Monograph, without doubt, changed the state of the science.

In May 2011, IARC declared that exposure to radio frequency radiation (RFR)[58] is a "Class 2B possible carcinogen." Since RFR had not previously been declared a possible carcinogen, this was a major change to the state of the science. A study published after the IARC declaration, citing additional studies, concluded that cellphone and other wireless device radiation is a human carcinogen.[59]

CTIA's distortion of IARC's finding

The CTIA Comments attempt to minimize this declaration when they state "The 2B category itself includes 285 agents, including RF fields alongside other 'possibly carcinogenic' agents like coffee and picked [sic] vegetables [p. 25]."

By selecting coffee and pickled vegetables out of 285 agents that IARC has classified as possible human carcinogens, the CTIA is attempting to mock the classification altogether.

"Pickled vegetables" implies all pickled vegetables. There is only one pickling agent, polysulfate sodium, which led to this categorization and it is available in traditional areas of Asia. IARC Monograph 56 which made this categorization stated,

[58] Microwaves, a frequency range used by wireless devices, are within the frequency range of RFR.

[59] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology. 2013 Apr;20(2):123-9. doi: 10.1016/j.pathophys.2013.03.001. Epub 2013 May 7.

"A large case-control study of oesophageal cancer in Hong Kong showed a significant dose-response relationship between consumption of pickled vegetables and oesophageal cancer, after potential confounding factors were taken into account [p. 4]." "In a single study, extracts of pickled vegetables from northern China induced morphological transformation of Syrian hamster embryo cells in culture. Extracts of pickled vegetables from northern China and Japan are mutagenic to bacteria [p. 5]."

CTIA's dismissal of IARC's process for determination of Class 2B possible carcinogens

However, choosing 2 out of 285 agents to raise questions about the entire process that IARC uses in evaluating cancer hazards is merely a diversion. The question that the FCC must address in this context of the 285 agents is: What policies have governments taken with respect to these agents generally? Lead, engine exhaust, DDT, and other pesticides that are on the IARC Class 2B possible carcinogen list, are all subject to restrictions and controls by governments around the world. The question for the FCC to ask in this context is: Why should exposure to an agent identified as a cancer risk to humans be increased by up to a 3-fold? In calling for "harmonization" to the ICNIRP 1998 exposure limits, the CTIA is basically discrediting and dismissing IARC's evaluation altogether. For details see **ICNIRP "Harmonization"** below.

Below is a partial list of well-known agents. These possible carcinogenic agents include:

Bitumens, Carbon black, Carbon tetrachloride, Chlordane, Chlordecone (Kepone), Chloroform, Coffee (urinary bladder), DDT, Diesel fuel, Engine exhaust (gasoline), Gasoline, Heptachlor, Hexachlorobenzene, Lead, Magenta, Magnetic fields (extremely low-frequency), Nickel, Nitrobenzene, Pickled vegetables (traditional in Asia), Phenobarbital, Tetrafluoroethylene, Vinyl acetate, and Welding fumes. For the complete list see **Appendix, Possible Carcinogens**.

ICNIRP "Harmonization"

There are 32 instances in the CTIA Comments that refer to ICNIRP and 16 instances referring to harmonizing exposure standards to ICNIRP. As we have seen IEEE 2005 is a virtual clone of the ICNIRP 1998 standard.

Over and over again the CTIA Comments assert the need to "harmonize" the standards.

"Indeed, as the Government Accountability Office ("GAO") recently explained in its review of the latest research, the consensus view is that those standards are overly protective and should be harmonized with more recent international standards. [p. 1]." *The GAO report made no such statement*. It did note "Both [ICNIRP and IEEE] of these recommendations call for an exposure limit of 2.0 watts per kilogram averaged over 10 grams of tissue, which according to IEEE represents a scientific consensus on RF energy exposure limits [p. 17]."

As has been shown above and below, both ICNIRP and IEEE have fundamental conflicts of interests by calling for higher exposures to microwave radiation.

"IEEE's new recommended limit brought it into harmony with ICNIRP's 1998 recommendations, which have been adopted by more than 115 countries and territories in the European Union and elsewhere [p. 30]." The cited footnote (141) references a poster presented at the BIOEM2013 meeting[60] by J. Rowley, Director for Research and Sustainability at the GSM Association (an industry organization similar to the CTIA).[61] *The poster did not list more than 110 countries*. CTIA Comments' footnote 141 lists 16 countries.

Up to 3-Fold Increase in Exposure Limits

As early as 2002 a study reported, "A mobile phone compliant with the ICNIRP standard of 2.0 W/kg SAR in 10 g of tissue may lead to a 2.5 to 3 times excess above the FCC standard of 1.6 W/kg in 1 g of tissue."[62] Two years later, a study found, "ICNIRP guidelines and the newly proposed IEEE guidelines with a relaxed limit of 4.0 W/kg for any 10-g of tissue of the pinna[63] for maximum allowable powers for cellular telephones at 835 and 1900 MHz to show that the newly proposed relaxed IEEE limits will allow radiated powers that may be 8–16 times those permitted by the current IEEE Standard and up to two times higher than those permitted under ICNIRP guidelines used in over 30 countries."[64] Another paper stated, "The results suggest that the recommended ICNIRP reference levels need to be revised."[65]

---

[60] https://www.bems.org/node/6340 (accessed 15 Nov. 2013).
[61] https://www.bems.org/node/6340 (accessed 6 Nov. 2013).
[62] Gandhi, O. P., Kang, G. (2002). Some present problems and a proposed experimental phantom for SAR compliance testing of cellular telephones at 835 and 1900 MHz. Phys. Med. Biol. 47:1501–1508.
[63] The pinna's common name is the ear.
[64] Gandhi, O. P., Kang, G. (2002). Inaccuracies of a Plastic "Pinna" SAM for SAR Testing of Cellular Telephones Against IEEE and ICNIRP Safety Guidelines. IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, VOL. 52, NO. 8, AUGUST 2004.
[65] Bakker, J. F., Paulides, M. M., Christ, A., et al. (2010). Assessment of induced SAR in children exposed to electromagnetic plane waves between 10MHz and 5.6 GHz. Phys. Med. Biol 55(11):3115–3130.

Exposure Limit Change for Children and Fetuses

Contrary to the CTIA assertion, the *method used to certify that wireless devices meet the exposure limits should be changed* such that children's and fetuses' exposures are included along with the most vulnerable tissues (e.g., female breasts, testes, eyes, brain, parotid and thyroid glands.). The currently used certification process is not realistic and does not reflect the use of metal frame eye glasses, wearing of metal jewelry, dental braces and metal piercings. The GAO Report (published 7 Aug. 2012) on its opening page, captioned "**What GAO Recommends,**" stated, "FCC should formally reassess and, if appropriate, change its current RF energy exposure limit and mobile phone testing requirements related to likely usage configurations, particularly when phones are held against the body. FCC noted that a draft document currently under consideration by FCC has the potential to address GAO's recommendations." Fifteen months later, the draft document has yet to be released, and the problem of "phones held against the body" has yet to be addressed.

The certification process should include consideration of interaction of microwave radiation with commonly worn metal by persons (e.g., metal frame eye glasses, ear rings, metal necklaces, wire supported bras, body-piercing studs, orthodontic teeth braces, etc.) along with any metal (decorations or otherwise) placed on cellphones' cases. For details see **FCC's Two Certification Processes**, What the Science Has Found Since the Adoption of the FCC Limits in 1996, *Studies Showing Children's Exposure Is Higher than Adults* and Comparison of the SAM and FDTD Computer Simulation Processes below.

Fifty-fold Safety Limit Is Specious

The CITA Comments refers 18 times to a specious claim that there is a 50-fold safety factor to the current FCC exposure limits.[66]

CTIA's specious logic is there was a 10-fold safety factor established based on "reliable evidence of hazardous effects [hungry rats stop ceased searching for food] is associated with whole body-averaged SARs above 4 W /kg." Yet, "The assumption is that reversible disruption during an acute exposure is tantamount to irreversible injury during chronic exposure." This 10-fold "safety" factor was

[66] Pages 12 (twice), 28, 34, 34 (footnote 163), 40, 40 (footnote 183-twice), 40 (footnote 185), 43, 47, 49 (footnote 226), 56, 56 (footnote 252), 56 (footnote 253), 57, 57 (footnote 256), and 59.

increased by another factor of 5 for the general public. Thus, CTIA's logic claims there was a 50-fold safety factor.

Five-fold factor for general public is non-existent

As noted above, the alleged 5-fold safety factor between the general public and electrical workers *does not exist*. IEEE 1991 reduced the dose-rate (SAR) for the general public by a factor of 5 relative to electrical workers but increased the average exposure time by a factor of 5 (from 6 minutes to 30 minutes) relative to electrical workers. Put simply, for the general public the dose-rate was reduced 5-fold and the total dose allowed was increased 5-fold, resulting in **identical** doses for workers and the general public.

Ten-fold factor is a 2.5-fold factor from irreversible damage

The CTIA's alleged factor of 10, which can cause "irreversible injury," was based on a 4 W/kg whole-body exposure which caused hungry rats to cease searching for food. But seven years earlier, another study, known to the ANSI 1982 authors, found that hungry rats ceased searching for food when exposed to a whole-body radiation of 1 W/kg.[9] Thus, at most there is a 2.5-fold safety factor from what the authors stated was "tantamount to an irreversible" injury.

In public health policy, safety factors for food or drinking water contaminants are customarily set at 100-fold or more.[67]

FCC's Two Cellphone Certification Processes

As noted above (see FCC Bulletin 65 1996 and its Supplement C 1997 section) the FCC has approved, in contradiction of the CTIA Comments[68], two cellphone certification processes:

SAM Process

Using a large plastic head, called the Specific Anthropomorphic Mannequin (SAM), a liquid is poured inside that is alleged to have the radiation absorption properties of the 40 tissue types in the average adult human head. With a cellphone attached alternately to the right and left side of SAM where the ear[69] would be, a robotic arm with an electric field probed is manipulated inside the head as the probe measures the strength of the electric field. Using the electric

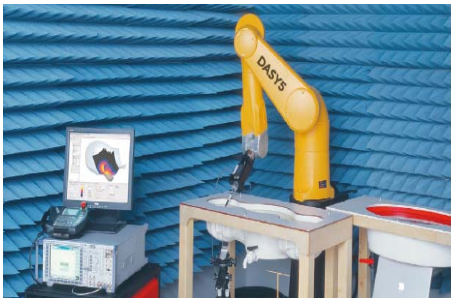
[67] http://www.foodsafetymagazine.com/magazine-archive1/december-2010january-2011/understanding-and-managing-food-safety-risks/ (accessed 15 Nov. 2013).

[68] "Since 2002, the Commission's sole pre-approved method for testing has been through the IEEE-recommended specific anthropomorphic mannequin (SAM) [p. 6]."

[69] It is not a plastic ear shaped like a real ear, but a plastic spacer.

field values the SAR is calculated at 3-dimensional coordinates and the maximum SAR value is reported to the FCC as *part* of the cellphone certification process.

SAM Phantom
Source: SPEAG Phantom Product Flyer



Robotic arm with electric field probe
Source: SPEAG DASY 52 Info Sheet

Organized by C-K Chou, and designed by industry, the SAM Process (commercially available from a single source) has been exclusively used to certify that cellphones meet the exposure limits.

Computer Simulation Process

Using a computer algorithm, finite-difference time-domain (FDTD), and the radiation absorption properties of individual tissues, along with the laws of physics that describes how radiation will bend as it penetrates though the 40 tissues types in the head, the computer calculates the SAR for any defined volume (or weight) of tissue.

As noted above, the FCC described FDTD computation as, "the most widely accepted computational method for SAR modeling. This method adopts very well to the tissue models which are usually derived from MRI or CT scans, such as those available from the visible man project. FDTD offers great flexibility in modeling the inhomogeneous structures of anatomical tissues and organs."

Details of SAM Cellphone Certification Process

Measurement accuracy: ±30%

Measurements made with the SAM process are accurate to ±30% of the measured value.

"With *proper preparation and execution* of a SAR measurement according to the protocols in this recommended practice, the target expanded measurement uncertainty for all uncertainty components in Table 5 and Table 6 *should be* less than ± 30% (+1.14 dB, –1.55 dB) for peak spatial-average SAR values in the range from 0.4–10 W/kg. *If uncertainty is higher*, the test lab should evaluate which measurement uncertainty component(s) need to be reduced to achieve the ± 30% target uncertainty, and then take actions to implement improvements. When the expanded uncertainty is greater than 30%, the measured results may need to take into account the percentage difference between the actual uncertainty and the 30% target value [emphasis indicates *conditional language*]".[70] Table 5 has 5 parameters (4 are for the liquid's absorption parameters) which contribute to the "Combined standard uncertainty." Table 6 has 13 parameters that contribute to the "Combined standard uncertainty. Each of the parameters in both Tables has 5 contributing factors.

Because the SAM Process has a ±30% measurement accuracy, no value above 1.12 W/kg (30% lower than the limit) should be accepted to insure that the 1.6 W/kg averaged over 1 gram of tissue exposure limit is not violated.

Sole-source Supplier

The system required to implement the SAM Process comes from a *sole-source* manufacturer, SPEAG (Schmid & Partner Engineering AG). SPEAG manufactures or supplies almost of the equipment required by the SAM Process:

Systems
Robot arm
Robot Controller
Robot Accessories
Mounting devices and adaptors
Fifteen various probes
Three versions of SAM (flat phantoms)
Four Flat Phantoms (used to measure SAR to body)

[70] IEEE Std 1528™-2003, p. 55-56.

Three Special Phantoms
Membrane Phantom
Flat Phantom
Modular Flat Phantom

Niels Kuster is Co-founder and President of the Board of Directors of SPEAG, and is the founding Director of the Foundation for Research on Information Technologies in Society (IT'IS), Switzerland, a Subcommittee member of the IEEE-2005 standard, a Member of the UK Mobile Telecommunications and Health Research (MTHR) organization, and held an invited professorship at the Electromagnetics Laboratory of Motorola, Inc., Florida.

The CTIA Comments cite "SAM" 29 times.[71] Five of these "SAM" citations refer to the SAM Process as a "safe harbor," although what is a "safe harbor," and who or what it harbors, is unexplained.

The multiple levels of financial conflicts of interest associated with the SAM Process, the extraordinarily large ±30% accuracy of SAR measurements, combined with the FCC's own language that the alternate process is

> "the most widely accepted computational method for SAR modeling. This method adopts very well to the tissue models which are usually derived from MRI or CT scans, such as those available from the visible man project. FDTD offers great flexibility in modeling the inhomogeneous structures of anatomical tissues and organs,"

implies it is nonsense to continue using the SAM Process to certify that cellphones meet the exposure limits.

Details of FDTD Computer Simulation Cellphone Certification Process

The Food and Drug Administration (FDA) is currently using this process in its Center for Devices and Radiological Health (CDRH), but only to evaluate and approve medical devices internal to the body. The FDA is a co-developer of the "Virtual Family" with the Swiss IT'IS Foundation[72]. The Virtual Family includes 6 models of children from 5-14 years of age and pregnant women 3, 6

[71] Pages: i (twice), 6, 6 (footnote 26), 16 (3-times), 28, 29 (4-times), 29 (footnote 136), 40 (footnote 186-twice), 52 (4-times), 53 (8-times), 53 (footnote 241), and 54.
[72] http://www.itis.ethz.ch/services/anatomical-models/overview/ (accessed 6 Nov. 2013).

and 9 months gestation.[73] Additional Virtual Family members are in development.

The Virtual Family models come from MRI scans and are based on the resultant human anatomy for each family member. The FDTD simulation incorporates frequency dependent and *age dependent* (typically children's tissues are more absorbent that adults') microwave absorption properties for various tissues.

Tissues' absorption properties vary widely with particular tissues and with age. Children's tissues are typically more absorbent than adults', and younger children's are more absorbent than older children's. See What the science has found since the adoption of the FCC limits in 1996, *Studies Show Children's Exposure Is Higher than Adults'* section below.

Yet the CTIA Comments states,

1. In regards "to whether existing … standard are … protective of children. The scientific consensus supports the Commission's existing … standards … No change in the state of the science warrants reconsidering them [p. 26]."
2. "The Commission's 1996 … federal safety standards … on the limits … determined that its … limits … protect all members of the public, including children. Research into this area has continued and has confirmed that existing standards are safe for children. [p. 27]."
3. "The conservative nature of the Commission's current emission standards and testing regime ensures that children are appropriately protected. The emission standard's fifty-fold safety factor 'accommodates a variety of variables such as different physical characteristics,' thereby accounting for adults and children alike. [p. 28]."
4. "[T]here are no science-based reasons to tighten either the emission standards for, or the testing methodology associated with, children [p.29]."

What the science has found since the adoption of the FCC limits in 1996

Studies Show Children's Exposure Is Higher than Adults'

1. A 2001 paper reported children's SAR is 50–100% higher than an adult's SAR. "The results show a general decrease of the dielectric properties [the lower the dielectric properties the higher the absorption of microwave radiation] with age. The trend is more apparent for brain, skull and skin

[73] The Virtual Family. IT'IS Foundation and FDA, p. 2. (http://www.itis.ethz.ch/assets/Downloads/VirtualPopulation/1302-virtual-population.pdf, accessed 23 Oct. 2013).

tissues and less noticeable for abdominal tissues. The variation in the dielectric properties with age is due to the changes in the water content and the organic composition of tissues."[74]

2. A 2004 paper found as the head size decreases, the percentage of energy absorbed in the brain increases; so higher SAR in children's brains can be expected.[75]
3. A 2002 study reported that SAR will be up to 7-times higher when the back of cellphone (where the antenna is located) is placed in a shirt pocket next to the skin.[76] This 2002 study easily explains why a 2013 case study reported multiple primary breast cancer in women who keep cellphones in their bras.[77]
4. A 2006 study found "that under similar conditions, the 1g-SAR calculated for the children is higher than that for the adults. When using the 10 years old child model, SAR values higher than 60% than those for adults were obtained."
5. A 2009 Report states "bone marrow exposure strongly varies with age and is significantly larger for children (~10x)." The author was Niels Kuster, the founder of SPEAG, the sole-source supplier of equipment required by the SAM cellphone certification process. Hippocampus and hypothalamus receive 1.6–3.1 higher SAR in children compared to adults'; children's bone marrow receive 10 times higher SAR than adults'; children receive higher SAR to the eyes than adults; children's cerebellum absorbs >2.5 times higher SAR than adults. Exposure to the eyes is higher in children than in adults.[78]
6. A 2008 paper by authors who were employed by France Telcom and TELCOM PartisTech found, "The comparisons have also shown that the maximum SAR in 1 g of peripheral brain tissues of child models aged between 8 and 15 is comparable to the maximum SAR in 1 g of peripheral brain tissues of adult models while it is about two times higher for child models aged between 5 and 8. This is certainly due to the smaller

[74] Peyman A, Rezazadeh AA, Gabriel C. Changes in the dielectric properties of rat tissue as a function of age at microwave frequencies. Phys. Med. Biol. 46 (2001) 1617–1629.
[75] Martinez-Burdalo, M., Martin, A., Anguiano, M., et al. (2004). Comparison of FDTD-calculated specific absorption rate in adults and children when using a mobile phone at 900 and 1800 MHz. Phys. Med. Biol 49(2):345–354.
[76] Gandhi, O. P., Kang, G. (2002). Some present problems and a proposed experimental phantom for SAR compliance testing of cellular telephones at 835 and 1900 MHz. Phys. Med. Biol. 47:1501–1508.
[77] West JG, Kapoor NS, Liao S-Y, Chen JW, Bailey L, Nagourney RA. Case Report Multifocal Breast Cancer in Young Women with Prolonged Contact between Their Breasts and Their Cellular Phones. Case Reports in Medicine Volume 2013, Article ID 354682. http://dx.doi.org/10.1155/2013/354682
[78] Christ, A., Gosselin, M-C, Christopoulou, M., et al. (2010). Age-dependent tissue-specific exposure of cell phone users. Phys. Med. Biol. 55:1767–1783.

thicknesses of pinna, skin and skull."[79] These results were based on "the same dielectric properties as the ones used for the adult models." Their "analysis confirms that the peripheral brain tissues of children seem to be higher exposed than the peripheral brain tissues of adults."

7. In 2010 Kuster et al. found averaged over 10 grams of tissue (it will be significantly larger averaged over 1 gram of tissue)[80]:

The above 7 studies is a partial listing of studies since the 1996 FCC exposure limits were adopted. The CTIA Comments ignores these studies and many others while glibly stating over and over again either that no change is necessary or the Commission should "harmonize" the standards to the much higher ICNIRP levels.

The Averaged Tissue Volume Is a Major Factor in Determination of SAR

The volume of tissue used is a very important parameter where the SAM or FDTD Computer Simulation Cellphone Certification Processes are used. It is clear that averaging the SAR over 1 gram of tissue results in a much higher SAR than averaging the SAR over 10 grams of tissue.

Using the FDTD computer simulation process the SAR values averaged over 10,000, 1,000, 100, 10 and 1 milligrams (mg) of tissue for children aged 1, 6, 8 and 10 year olds were presented at the joint annual meeting of the Bioelectromagnetics Society (BEMS) and European Bioelectromagnetics Association (EBEA) in Greece, June 2013.[81] The results are shown below in Figure 1.

As is seen in Figure 1, the smaller the weight (or volume) of tissue the higher the SAR. For a 6-year-old child, the SAR is almost 9-times higher when averaged over 1 milligram (mg) of tissue compared to the ICNIRP standard of 10 grams. Compared to the FCC standard of 1 gram, averaged over 1 mg, the 6-year old child's SAR is over 6-times higher.

[79] Wiart J, Hadjem A, Wong MF, Bloch I. Analysis of RF exposure in the head tissues of children and adults. Phys. Med. Biol. 53 (2008) 3681–3695.

[80] Niels Kuster et al. Age-dependent tissue-specific exposure of cell phone users. Phys. Med. Biol. 55 (2010) 1767–1783.

[81] Fernandez et al. Preliminary SAR simulation is highest for smallest volumes, youngest age groups, and highest dielectric constant. BIOEM2013, June 2013

One milligram (mg) of brain tissue is equivalent to 1 cubic millimeter (1 mm^3) of volume. The number of nerve cells (neuron) in 1 mm^3 is about 100 million.[82] There are many other cell types within this 1 mm^3 volume such as glial cells, which can form a cancer known as a glioma.

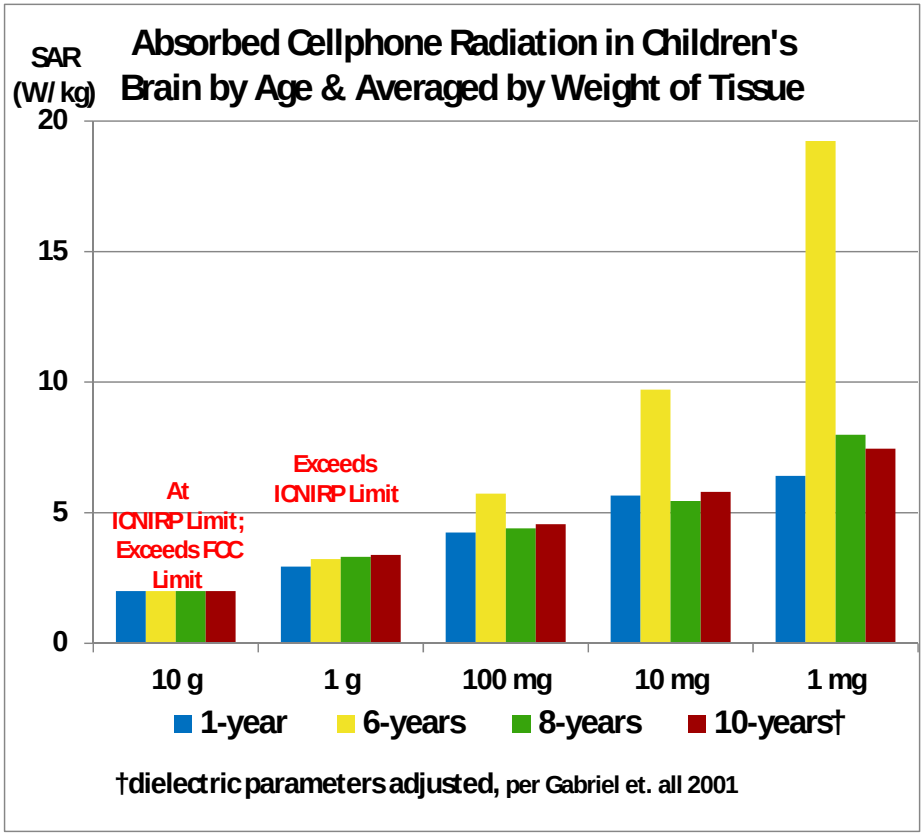


Figure 1. Specific Absorption Rates (SAR) from cellphone radiation averaged over various tissue weights for children of different ages.

Comparison of the SAM and FDTD Computer Simulation Processes

The CTIA Comments states, "One study conducted by an international task force of experts lead by Dr. Brian Beard of the FDA compared numerical computation of SAR using SAM- and MRI-based models of normal adults and found that 'SAM produced a higher SAR in the head than the anatomically correct head models. Also the larger (adult) head produced a statistically significant higher peak SAR . . . than did the smaller (child) head for all conditions of frequency and position' [p. 29]," but failed to mention that this *one study* was performed with the Mobile Manufacturers Forum (MMF), a European based industry organization similar to the CTIA.

[82] http://wiki.answers.com/Q/How_many_nerve_cells_are_in_a_cubic_centimeter_of_the_human_brain (accessed 24 Oct. 2013).

An August 2011 Korean paper reports that the SAM Process is *not conservative* as is claimed in regards to children.[83] Using a SAR averaged over 10 grams of tissue the authors reported,

> "For $Phone_{PIFA}$[84] exposure, in 50% and 70% of all cases considered, the SAM phantom provides an underestimation for pinna-excluded and pinna-included tissue conditions, respectively." They also report "for $Phone_{monopole}$[85] exposure at 1900 MHz, the SAM phantom shows underestimations of 40% (i.e., 8 of the total 20 cases) for pinna-excluded tissue and 80% for pinna included tissue."

When pinna tissue is compared to SAM at 835 MHz the SAR is increased by 105% and at 1900 MHz it is increased by 70%. The Conclusion section begins:

> "The SAM phantom based on IEEE Std 1528 and IEC 62209-1 is a standard head model that was designed to produce a conservative average in spatial peak mass for 1- and 10-g SARs in the human heads of a majority of phone users including children." Additionally they find that a cellphone held over the ear canal (EEC position) rather than as described in the IEEE std 1528 for the ERP position (15 mm from the top of the head), the SAR is higher when held over the ear canal as can be expected in most users. "However, the rationale for the 15-mm distance between the ERP and EEC is unclear, and is applied only to the SAM phantom."

Table 1 compares the two FCC approved cellphone certification processes' capabilities.[86]

As can be seen, for all 12 attributes in Table 1, the FDTD computer simulation process is superior. This process is already used by the FDA.

It is not possible for the SAM process to model the effects of body worn metal devices such as eye glasses, wire frame bras, ear rings, necklaces, dental braces and the multitude of metal piercings worn by adolescents and young adults. It

[83] Lee & Yun. A Comparison of Specific Absorption Rates in SAM Phantom and Child Head Models at 835 and 1900 MHz. IEEE TRANSACTIONS ON ELECTROMAGNETIC COMPATIBILITY, VOL. 53, NO. 3, AUGUST 2011.

[84] PIFA: "a mobile phone equipped with a planar inverted F antenna (PIFA) hidden within its housing and operating at 1900 MHz."

[85] Monopole: a monopole antenna.

[86] Gandhi OP, Morgan LL, de Salles AA, Han Y-Y, Herberman RB, Davis DL. Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children. Electromagnetic Biology and Medicine, 31(1): 34–51, 2012.

is virtually impossible for the SAM process to determine peak SAR values at resolution less than one cubic centimeter (1 cm^3), equivalent to 1 gram of tissue.

The SAM process says it can model the head and the body but must assume that the head and body have no tissue differences.

Attribute	SAM Process	FDTD Process	Comments
Children's exposure	No	Yes	Multiple ages
Pregnant women's exposure	No	Yes	1,3 & 9 months
Female exposure	No	Yes	
Specific tissue parameters	No	Yes	
3-D resolution	~ 1 cm^3	<1 mm^3	
Relative cost	Higher	Lower	
Medical implant modeling	No	Yes	
Testicle exposure	No	Yes	
Female breast exposure	No	Yes	With & without wire frame bra
Eye exposure	No	Yes	With & without wire frame eyeglasses
Thyroid gland exposure	No	Yes	With & without metal necklace
Parotid gland exposure	No	Yes	

Table 1. A comparison of the capabilities of the two FCC approved cellphone certification processes.

The SAM Process cannot possibly model the exposure to the eyes, testicles, parotid glands[87], thyroid gland, and penis, all of which are substantially exposed depending on the location of the cellphone.

The CTIA Comments ignore the exposure to other tissues and ignore the interaction of metal with the incident cellphone radiation. Yet, the CTIA Comments appear to be aware of these issues when it states, "Finally, absorption also varies from person to person based on the inevitable inhomogeneity of human anatomy and tissues [p. 28]." The CTIA admits that human beings are not homogenous, but the CTIA ignores the existence of the FCC approved computer simulation process which deals with the reality that human beings are inhomogeneous.

[87] A large salivary gland located in the cheeks.

Methodology Problems with the FCC Cellphone Certification Process

This section explains major problems that exist with the FCC cellphone certification process *even if the SAM Process was perfect*. It also shows that the data sent to the FCC clearly show an iPhone 5 cellphone model violated the certification criteria, and nevertheless it was certified that it met the limit and it could to be sold to customers.

Submission of Single Cellphone Model for Certification

A single cellphone is brought to an FCC certified testing facility (Telecommunications Certification Body or TCB). The FCC requires, "The performance and operating tolerances of a test device should be fully characterized to ensure that it is identical to the production units for meeting compliance [Supplement C, p. 45]," but provides no further information how this conditional sentence should be verified, and no proof is required that "it is identical to the production units."

There is no knowledge how this cellphone was chosen. Was it selected from a large number because its radiated power was smaller? Or was it randomly selected? Was it a prototype of the final product? Or was it from a mass-produced production line? The testing facility has no knowledge of where the single unit came from or how it was selected.

iPhone 5's SAR Data Submitted to the FCC Violated the Exposure Limit

One example of documentation sent to the FCC was the submission of Apple's iPhone 5 data to the FCC.[88]

In the documentation submitted to the FCC there were 21 specific tests, found in 11 tables where the unit exceeded the 1.6 W/kg exposure limit.

1. Table 17.1.1, p. 356 has 3 SAR values >1.6 W/kg.
2. Table "Sum of the SAR with Measured Values (Secondary Antenna)," page 360 has one SAR value >1.6 W/kg.
3. Table 17.1.2, page 262 has two values >1.6 W/kg.
4. Table 17.1.3, page 266 has one value >1.6 W/kg.
5. Table 17.1.4, page 369 has two values >1.6 W/kg.
6. Table 17.1.5, page 373 has two values >1.6 W/kg.
7. Table 18.1.1, page 388 has two values >1.6 W/kg.
8. Table 18.1.2, page 392 has two values >1.6 W/kg.

[88] SAR EVALUATION REPORT, For iPhone Model: A1428, A1429, FCC ID: BCG-E2599A, Report Number: 11U14136-7A1, Issue Date: 9/6/2012

9. Table 18.1.3, page 396 has two values >1.6 W/kg.
10. Table 18.1.4, page 400 has two values >1.6 W/kg.
11. Table 18.1.5, page 404 has two values >1.6 W/kg.

Every value >1.6 W/kg was easy to find as they were all in red font.

Page 355 introduces a new and bizarre *draft* rule. It reads in whole:

> 17. Simultaneous Transmission SAR Analysis (Model A1428)
>
> KDB 447498 D01 General RF Exposure Guidance v05 (Draft)[89], introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:
>
> $SPLSR = (SAR_1 + SAR_2)^{1.5}/Ri$
>
> Where:
>
> SAR_1 is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition
>
> SAR_2 is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first
>
> *Ri* is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of
>
> $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$
>
> A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:
>
> $(SAR_1 + SAR_2)^{1.5}/Ri < 0.04$
>
> FCC has authorized the use of the draft SPLSR formula for this application.

The result of this bizarre *draft* rule, authorized by the FCC, is it exempts 20 of the 21 violations of the exposure limit. When a unit analysis of the "SAR to Peak Location Ratio" (SPLSR) value is performed, it is even more bizarre. The units are $(W/kg)^{1.5}/cm^2$,[90] a value whose units make no sense whatsoever.

The logic for this exemption is not explained in KDB 447498 D01. This exclusion rule's sole purpose seems to be to allow violations of the exposure limit. For the iPhone 5 it excludes 20 of the 21 exposure limit violations, yet one violation of the exposure limit remains. Nevertheless the iPhone 5 was introduced for sale 6 business days later (Sept. 14, 2012) after the FCC received "Report Number: 11U14136-7A1, Issue Date: 9/6/2012" with

[89] https://apps.fcc.gov/kdb/GetAttachment.html?id=OkBNcs41tmuCWOtMVUf2tA%3D%3D (accessed 24 Oct. 2013).

[90] Centimeter is the assumed unit, but the rule does not define the units. It could be meters (m) or millimeters (mm).

between 1 and 21 violations of the exposure limit, depending on whether the *draft* exclusion rule is considered.

Post-Market Surveillance

According to the GAO Report, "FCC requires TCBs to carry out this post-market surveillance program, through which each TCB tests one percent of the mobile phones they have certified for RF energy exposure, to ensure that the phones continue to meet FCC's RF energy exposure limit [p. 24]."

With this post-market surveillance program the FCC has no way to monitor the millions to hundreds-of- millions of units produced annually as part of a post-market surveillance system.

It is unstated, but let's assume the post-market surveillance is once per year (as written it could be interpreted as one time only). A Silicon Valley TCB stated it has certified "close to a thousand cellphones."[91] If the average TCB has certified 100 cellphones then they would be required to test 1 cellphone model once a year (or once given the ambiguity of the sentence). With such a post-market surveillance system it would be virtually impossible to find if one percent of a particular cellphone model has exceeded the exposure limits even if millions of units were shipped per year.

Credibility Sources

In this section, individuals' and organizations' credibility are examined for inherent conflicts-of-interests because of their associations with the telecommunication and electrical utility industries. Organizations are also listed if they abdicate their role to an organization with conflicts-of-interests.

Organizations

AGNIR--Advisory Group on Non-ionising Radiation

See HPA below.

Exponent Inc.

Exponent Inc. has been described in David Michael's book *Doubt Is Their Product* as one of many "Product Protection Firms" hired to cast doubt that a product is harming workers and/or customers. Exponent is cited 11 times in the index of *Doubt Is Their Product*. Among its many employees are: Linda

[91] Cetecom, Inc.

Erdreich, Senior Managing Scientist and William H. Bailey, Principal Scientist. Both are members of the IEEE 2005 Subcommittee.

HPA—Health Protection Agency

The UK's Health Protection Agency (HPA) states on their web page, "There is no explicit UK legislation that limits people's exposure to electromagnetic fields, including the radio waves used in mobile telephony," then goes on to state, "The Recommendation incorporates the restrictions on exposure of the general public advised by ICNIRP in its 1998 guidelines."[92]

With no apparent internal expertise the HPA relies on the Advisory Group on Non-ionising Radiation (AGNIR. The CTIA Comments lauds AGNIR:

> "The UK Health Protection Agency Advisory Group on Non-Ionizing Radiation concluded in a comprehensive 2012 review and evaluation of the science that, 'although a substantial amount of research has been conducted in this area, there is no convincing evidence that RF field exposure below guideline levels causes health effects in . . . children' [p. 27]."

AGNIR is not an independent group and is not part of HPA per se.

Members of AGNIR with conflicts-of-interests are:

The AGNIR Chairman is Anthony Swerdlow, and Maria Feychting is an AGNIR Member.

IEEE—Institute of Electrical and Electronic Engineers

As noted above in The History of Exposure Standards section, this organization has inherent conflicts-of-interests because its members are part of the very industry which the FCC has the duty to regulate.

Its primary role is to provide services to the electricity and electronic industries. It has little to no medical or public health expertise.

IEGMP—Independent Expert Group on Mobile Phones (see IEEE 2005 section above)

Two of its members, Michael Repacholi and Anthony Swerdlow have documented conflicts-of-interest.

ICNIRP—International Commission on Non-Ionizing Radiation Protection

[92] Last revised 17 February 2010, accessed 29 Sept. 2011.

This organization is not accountable to any government, any public health agency, or any public health agency. Its sources of income are not transparent. It is a self-perpetuating organization whose existing Commissioners appoint new Commissioners.

The founder and first Chairman was Michael Repacholi.

Current Commissioners (italics indicate listed in Individuals below) are:
Rüdiger Matthes (Chairperson), *Maria Feychting* (Vice Chairperson), Rodney Croft, *Adèle Green*, Kari Jokela, James Lin, Carmela Marino, Agnette P. Peralta, Zenon Sienkiewicz, Per Söderberg, Bruce E. Stuck, Eric van Rongen, Soichi Watanabe, Gunde Ziegelberger (Scientific Secretary), and *Michael Repacholi* (Chairman Emeritus).

Two previous Commissioners were Anthony Swerdlow and Anders Allbom.

International EMF Project[93]

This organization is cited 13 times by the CTIA Comments, with 2 exceptions, it is *always* identified as the World Health Organization (WHO). While the International EMF Project is embedded within WHO, there is no evidence that it receives any funding from WHO, but it does receive funding from industry via the Royal Adelaide Hospital in Australia.[94] Michael Repacholi founded the International EMF Project and previously was employed by the Royal Adelaide Hospital. This indirect funding path from industry to the Royal Adelaide Hospital and back to the International EMF Project was not acknowledged until the media confirmed it and began to ask questions.

The 13 citations for the International EMF Project in the CTIA Comments are:
1. "Cell phones are not associated with increased health risks [p. 20]."
2. "See Power Point: Shaiela Kandel, ELF Policies Worldwide – Protection of General Public, at the WHO Workshop, "Developing and Implementing Protective Measures for ELF EMF" (Jun. 20-21, 2007) [footnote 141, p. 140]."
3. "[B]ecause many manufacturers' phones are sold in multiple countries, 'manufacturers have to develop and test phones based on different exposure limits, which can require additional resources and slow the time it takes to get new phones into the market.' [p. 32]."

[93] http://www.who.int/peh-emf/project/en/
[94] Microwave News, "Microwave News Responds to Mike Repacholi", Vol. XXVI No. 9 Nov. 17,. 2006. http://microwavenews.com/docs/MWN.11%289%29-06.pdf (accessed 25 Oct. 2013)/

4. "Moreover, bringing Commission limits into line with those of the majority of the world would reduce unwarranted fears and 'controversy connected with RF fields.' [p. 32]."
5. "[T]he WHO's International EMF Project advocates 'harmonization of … standards worldwide' because it is in large part the 'disparities in EMF standards' themselves that have caused 'increasing public anxiety….' [p. 32]."
6. "What is more, harmonization would facilitate global research efforts …[footnote 158, p. 33]."
7. "... and cooperation in the field [footnote 159, p. 33]."
8. "The International EMF Project's model legislation and regulations recommend adoption of the currently-applicable ICNIRP standards [p. 33]."
9. "[T]here is a clear consensus in the scientific community that 'exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health' [p. 33-34]."
10. "Like the current Commission standard, the ICNIRP-recommended emission standard for the general population is set at 50 times below the level at which biological impacts are observed, thus providing a significant safety margin [p. 34]."
11. "The conservative nature of the Commission's RF regime also obviates the need for consumer advisories [p. 40]."
12. "The Commission has rejected calls to regulate based on non-thermal effects, modulation effects and ELF fields, and the science has not changed [p. 47]."
13. "As the WHO, IARC and the IEEE have found, there is a lack of credible scientific evidence establishing health risks caused by non-thermal effects, ELF fields or modulation effects [p. 50]." In this quote, WHO refers to the International EMF Project, IARC refers to Monograph 97 (2008), and IEEE refers to IEEE 2005.

Given the clear connection of the International EMF Project to industry funding, including funds to an Australian Hospital, and forwarded back to International EMF Project, these 13 citations should be seen as invalid on their face.

International Epidemiology Institute (IEI)

IEI designed the Danish Cellphone Subscriber Cohort study. "According to Bloomberg Financial News (Mobile Phones Don't Cause Brain Cancer or Leukemia, Study Finds; 2/26/02), IEI completed a study that cost $373,000 and was funded in part by Denmark's largest phone company, Tele Danmark A/S, which is partially owned by SBC Communications, and the second-largest mobile phone service in Denmark, Sonofon A/S, owned by Telenor AS and BellSouth Corp."[95]

The Danish Cellphone Subscriber study has been strongly criticized for its methodology, not the least of which was the exclusion of 42% of its subscribers. Corporate users-arguably the heaviest cellphone user—were 28% of the subscribers.

The CTIA Comments states, "a large cohort study following cell phone users in Denmark from 2001 to 2011 has found no association between cell phone use and glioma, meningioma or acoustic neuroma [p. 21]."

In fact, the Danish Cellphone Subscriber Cohort study was recognized by the IARC Working group that produced Monograph 102 as affected by substantial misclassification, so that it was discounted in reaching the evaluation that radiofrequency fields were a possible human carcinogen, category 2B.

MTHR—Mobile Telecommunications and Health Research

MTHR is jointly funded by the UK Government and the mobile telecommunications industry.[96] Its current and former members include: Niels Kuster and Michael Repacholi.

SCENIHR—Scientific Committee on Emerging and Newly Identified Health Risks

In January 2009 SCENIR adopted an "opinion" on the "Health Effects of Exposure to EMF." For radio frequency fields, "It is concluded from three independent lines of evidence (epidemiological, animal and in vitro studies) that exposure to RF fields is unlikely to lead to an increase in cancer in humans. However, as the widespread duration of exposure of humans to RF fields from mobile phones is shorter than the induction time of some cancers, further studies are required to identify whether considerably longer-

[95] http://www.cspinet.org/integrity/nonprofits/international_epidemiology_institute.html (accessed 28 Oct. 2013).
[96] http://www1.itis.ethz.ch/mv/downloads/DAY3/3E-Challis-s.pdf (accessed 6 Nov. 2013).

term (well beyond ten years) human exposure to such phones might pose some cancer risk."[97]

Among the participants who created this "opinion" were Anders Ahlbom, Joachim Schüz and Eric van Rongen. For additional information on these participants, see Individuals section below.

SSI—Swedish Radiation Protection Authority[98] (now SSM-Swedish Radiation Safety Authority)

In 2002, SSI hired the International Epidemiology Institute (IEI) to evaluate epidemiological studies on brain tumor risks.

FSM—Swiss Research Foundation on Mobile Communications

Among many projects, FSM funded a childhood brain cancer study called CEFALO. "The Swiss Research Foundation on Mobile Communication (FSM) is a non-profit foundation approved by the Swiss Federal Supervisory Board of Foundations. … The FSM is sponsored by ETH Zurich, Orange, Sunrise and Swisscom."[99] Orange, Sunrise and Swisscom are each cellphone corporations.

Individuals

Dr. Eleanor Adair (deceased)

She was a member of the IEEE 2005 Subcommittee and was a long-time employee at the U.S. Brooks Air Force Base where the military researched effects of electromagnetic radiation (EMR) and develops EMR weaponry.

Professor Anders Ahlbom

Professor Ahlbom was removed from IARC's Expert Working Group to evaluate the potential carcinogenicity of radio frequency radiation the day before the meeting began, due to conflicts-of-interests. For some years, he had been a member of the Board of Directors of Gunnar Ahlbom AB, a lobby group headed by his brother Gunnar Ahlbom that had represented the interest of the leading Swedish mobile phone operator TeliaSonera, among others.

[97] http://ec.europa.eu/health/archive/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf (accessed 6 Nov. 2013).
[98] It has changed its name to Swedish Radiation Safety Authority, SSM.
[99] http://www.emf.ethz.ch/archive/english/portrait_e.htm (accessed 5 Nov. 2013).

Anders Ahlbom chaired the expert group Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), and has served as a chair of ICNIRP from 1998-2008 (see Organizations below). Maria Feychting, his protégé, replaced him at ICNIRP.

As a project manager for the cellphone industry funded COSMOS study "on Oct. 6, 2011 an [Anders Ahlbom] email directly to Ericsson: one eleven - page application with project and budget plan for 2012 to 2014. He writes in the email that the funding requires a firewall agreement 'preferably via Vinnova'."[100]

He was the lead author of ICNIRP's Epidemiologic Evidence on Mobile Phones and Tumor Risk, A Review by ICNIRP's Standing Committee on Epidemiology[101]: Anders Ahlbom, Maria Feychting, Adèle Green, Leeka Kheifets, David A. Savitz, Anthony J. Swerdlow.

Professor Vitas Anderson

He was a member of the IEEE 2005 Subcommittee and an industry consultant.

In a list of Awards and Grants, the list includes 2 from the Mobile Manufacturers Forum & GSMA Association, 2 from the Asian Office for Aerospace Research and Development (AOARD) of the United States Air Force Office of Scientific Research (AFOSR), 1 from the Mobile Manufacturers Forum, and 1 from the Australian Mobile Telecommunications Association & GSMA Association.[102] He is "a former Telstra employee who represented Telstra's interests on the former Standards Australia TE/7 standards committee."[103]

Professor Tadeusz Babiji

He was a member of the IEEE 2005 and is an industry consultant.

[100] Google Translation Swedish to English from http://www.nyteknik.se/nyheter/it_telekom/mobiltele/article3483861.ece
[101] CTIA Comments, footnote 108, page 23.
[102] http://www.swinburne.edu.au/lss/staff/view.php?who=vitasanderson (accessed 26 Oct. 2013).
[103] www.emfacts.com/download/A_Machiavellian_Spin_Sept_2010.pdf (accessed 16 Oct. 2013)

Dr. William H. Bailey

He was a member of the IEEE 2005 Subcommittee and a Principal Scientist with the "Product Protection Firm,"[104] Exponent Inc. "Before joining Exponent, Dr. Bailey was President of Bailey Research Associates, Inc."[105]

Dr. Quirino (Q) Balzano

Q was Corporate Vice President and Director Motorola, Inc. September 1974 – January 2001.

Dr. David Black

Black was a member of the IEEE 2005 Subcommittee and an ICNRIP Consulting Expert. He is a past President of the Bioelectromagnetics Society (BEMS). "He has been involved in the development of the New Zealand and Australian RF standards. His practice is now divided between clinical and academic Occupational and Environmental Medicine and electromagnetic safety."[106]

Philip Chadwick

He was a member of the IEEE 2005 Subcommittee and an industry consultant with Microwave Consultants Ltd., UK. He is a President-Elect of the Bioelectromagnetics Society (BEMS).

Kwok W. Chan

He was an author of FCC's Supplement C, which describes in copious detail how to implement the SAM Cellphone Certification Process. He is a scientist at the FCC and the brother-in-law of C-K Chou.

He is co-author with his brother-in-law on 13 science papers.[107]

In an interview with Zoominfo:

> "According to Mr. Chan, the FCC simply adopts the limits from different organizations and enforces the procedures for compliance with the limits and requirements. Mr. Chan explained that the limits are firmly established internationally and agreed upon by many experts so the FCC has 'really no choice but to adopt' these standards and enforce them. He

[104] A term used in David Michaels' (current head of the U.S. Occupational Health and Safety Agency—OSHA) book, *Doubt Is Their Product, How Industry's Assault on Science Threatens Your Health*.
[105] http://www.ct.gov/csc/lib/csc/pendingproceeds/docket_317/do317bailey.pdf (accessed 24 Oct. 2013).
[106] http://www.next-up.org/pdf/ICNIRP_CONSULTING_%20EXPERTS_01_2006.pdf (accessed 26 Oct. 2013).
[107] http://www.ncbi.nlm.nih.gov/pubmed/?term=Chan+KW+AND+Chou+C-K (accessed 7 Nov. 2013).

compared the FCC to an officer of the law who, unlike a judge, only enforces the law and is not meant to question it or change it. We are reaching out to the FCC because it is the last body in the chain of this process. By enforcing the standards, the FCC continues to support the established values without questioning the validity of them."[108]

Dr. Chung-Kwang (C-K) Chou

C-K Chou was chair of the Subcommittee that created the IEEE 2005 document. During this time he was a senior executive at Motorola's Florida Research Labs. In 2009 when Motorola closed down his group, he was the sole person Motorola did not layoff. He was given the title Chief EME (electromagnetic energy) Scientist for Motorola's Enterprise Mobility Solutions Division. Following Motorola's sale of this division to Google, he continued at Motorola Solutions. He is an Associate Member of the Motorola Science Advisory Board (2005-) and the Science Adviser of Mobile Manufacturers Forum (2001 -).[109] His brother-in-law, Kwok Chan, is an author of the FCC's Supplement C.

Dr. Joe A. Elder

He was employed by the Environmental Protection Agency (EPA) before joining Motorola. "Elder has changed his tune since joining Motorola a few years ago. He spent most of his professional career at the EPA where he worked on RF radiation and health. Back then, Elder had a radically different outlook. In the early 1980s, he was in charge of EPA's RF health review. His 268-page report, Biological Effects of Radiofrequency Radiation, issued in 1984 after a rigorous external peer review, concluded, '[B]iological effects occur at an SAR of about 1 W/Kg; some of them may be significant under certain environmental conditions.'"[110]

"Joe Elder is now self-employed as a radiofrequency bioeffects consultant. He was employed by Motorola (until 2009) and his wife holds stock in Motorola. His participation as an Observer in this IARC Monographs meeting is sponsored by the Mobile Manufacturers Forum representing manufacturers of mobile and wireless communication devices and the network infrastructure that supports them."[111]

---

[108] http://www.zoominfo.com/p/Kwok-Chan/72763339 (accessed 26 2013).
[109] http://www.radiologymalaysia.org/Content/2007/BioMedPhysics/RFSafety.html (accessed 15 Oct. 2013)
[110] http://microwavenews.com/news-center/industry-rules-rf-controlling-research-setting-standards-and-spinning-history (access 26 Oct. 2013).
[111] IARC Monograph 109, p. 7.

"When George [Carlo] had begun the [CTIA-funded] WTR project he set up a peer review board through the Harvard Center for Risk Analysis. Wheeler now asked that peer review board's membership be expanded to include Joe Elder, Peter Valberg and Asher Sheppard. Joe was at the EPA, but would later become a Motorola employee. Both Peter and Asher were receiving consulting contracts from Motorola. Motorola tried to rig the Peer Review Board with 'friendlies'."[112]

Dr. Linda Erdreich

She was a member of the IEEE 2005 Subcommittee and a long-term employee of the "Product Protection Firm,"[113] Exponent Inc. As an Exponent "expert" she testified for the CTIA at a Senate Hearing in September 2009.

In the early 1990s, prior to working with Exponent, she worked with Bailey Research Associates (later to merge with Exponent), which was hired by the CTIA to support the CTIA-funded Wireless Technology Research (WTR) program. Of particular interest was her involvement with Joshua Muscat lead author of a study which was eventually published in December 2000.[114]

The involvement with Muscat came about as the result of the CTIA's participation in a State the Science Colloquium held in June in connection with the annual meeting of Bioelectromagnetics Society (BEMS) where the CTIA-funded Muscat, post peer-review, study's results were presented.[115] The study showed a statistically significant risk of brain cancer from cellphone use (OR=2.6, 95% CI=1.2-5.4) with 34 cases and 34 controls.[116]

"The original peer-reviewed paper submitted by Muscat to the WTR in 1998, showed a statistically significant doubling in risk of rare neuroepithelial tumors. In the paper included in the book covering our State of the Science Colloquium in 1999, Wireless Phones and Health (Kluwer

[112] September 9, 2009: Excerpts of phone conversation notes with George Carlo (edited by George Carlo). Full document available upon request.
[113] A term used in David Michaels' (current head of the U.S. Occupational Health and Safety Agency—OSHA) book, Doubt Is Their Product, How Industry's Assault on Science Threatens Your Health.
[114] Muscat et al. Handheld Cellular Telephone Use and Risk of Brain Cancer, JAMA, December 20, 2000—Vol 284, No. 23.
[115] The above paragraph is a synopsis of George Carlo's book, *Cell Phones, Invisible Hazards in the Wireless Age, An Insider's Alarming Discoveries About Cancer and Genetic Damage*, pages 177-178 and 210-211, 2001. Dr. George Carlo was hired by Tom Wheeler to the head the WTR research program.
[116] Wireless Phones and Health, State of the Science, Kluwer Academic Publishers 2001.

Academic Press, 2001), also peer-reviewed, Muscat reported a statistically significant risk increase of neuroepithelial tumors. OR=2.6, 95% CI=1.2-5.4. Between 1999 and 2001, Muscat communicated frequently with Dr. Linda Erdreich, who had been hired by the CTIA to 'peer review' Muscat's paper. With Erdreich, Muscat became a consultant to the industry, participating in a number of industry sponsored scientific meetings across the globe during 2000."[117]

When the Muscat paper was finally published in the Journal of the American Medical Association (JAMA), the number of cases and controls for neuroepithelial brain cancer had 35 and 14 compared to the State of the Science Colloquium where it was 34 and 34 respectively. The risk of neuroepithelial brain cancer changed from a significant 2.6-fold risk to a borderline significant risk, OR=2.1, 95% CI=0.9-4.7, calculated p-value=0.073. No explanation was ever given for the changes that occurred between the State of the Science peer-reviewed presentation and the peer-review publication in JAMA.

On page one, the CTIA Comments state, "Since [CTIA's] formation in 1984, it has supported the industry's voluntary efforts to promote the safe, responsible use of wireless products and services [p. 1]." The Wireless Technology Research project is the only example of such "voluntary efforts."

Professor Maria Feychting[62]

Maria Feychting is Anders Ahlbom's protégé and he is her mentor. She is an ICNRIP Commissioner (replacing Ahlbom in 1998) and "participates" in the International EMF Project. She is an author of the ICNRIP review paper, "Epidemiologic Evidence on Mobile Phones and Tumor Risk." She receives 4% of her total income from Norwegian expert group on high frequency electromagnetic fields; 3% of her total income from the Swedish Safety Authority and additional income from AGNIR. As an Interphone study Principal Investigator (PI) she received money from the Mobile Manufacturers Forum and the GSM Association. As a COSMOS study PI she has received and will continue to receive funds from TaliaSonera, Ericsson AB, Telenor. As a co-investigator on a childhood leukemia study she received funding from the Electric Power Research Institute (EPRI).

[117] Email from George Carlo, 3 April 2008,

Dr. Arthur W (Bill) Guy

He was the chairman of the ANSI 1975 and 1982 standards, a member of the IEEE 2005 Subcommittee, an industry consultant and co-author with C-K Chou on 36 science papers.[118] His work was funded by Motorola where he stated in a Microwave News article, "For all practical purposes, there is very little difference in peak SARs for different-sized heads".[119]

In the 1990s he was with the "Scientific Advisory Group, Cellular Telecommunications Industry Association 1993 -- 1994; Chairman, Dosimetry Working Group, Wireless Technology Research [WTR], L.L.C. 1994-1997. IEEE Standards Coordinating Committee 28, Nonionizing Radiation, Vice Chairman 1989 - 1994, Subcommittee IV Human Safety Levels, Member 1989 – Present. Bioelectromagnetics Society President, 1983 - 1984; Member 1978 - Present"[120]

He was a co-author with C-K Chou on a study, "Long-Term, Low-Level Microwave Irradiation of Rats" (see C-K Chou, above) which reported adverse effects from microwave radiation.

George Carlo recruited Guy to join the Wireless Technology Research (WTR) program funded by the CTIA.[121] The CTIA funded the initial WTR Board which included Dr. Guy.[122]

Given that exposure standards are based on the premise that the only biological effects from exposure to microwave radiation is heating the following conversation between George Carlo and Bill Guy where Guy appears to say there are non-thermal biological effects from microwave radiation. "George asks, 'So the SAR is a measure of heating?' Guy replies, 'No, heat is a part of the formula to calculate it, but it measures the amount of energy passing through tissue during a time period. It's more than heating.' Carlo responds, 'But if it depends on heat, it has to be a measure of heating.' Guy replies, 'It could be, but not always.'"[123]

[118] http://www.ncbi.nlm.nih.gov/pubmed/?term=Chou+C-K+AND+Guy+AW (accessed 7 Nov. 2013).
[119] Microwave News May/June 2002 http://microwavenews.com/news/backissues/m-j02issue.pdf (Accessed 14 Oct. 2013).
[120] http://www.arrl.org/arthur-w-bill-guy-ph-d (accessed 27 Oct. 2013).
[121] George Carlo, *Cell Phones, Invisible Hazards in the Wireless Age*, p. 11.
[122] George Carlo, *Cell Phones, Invisible Hazards in the Wireless Age*, p. 133.
[123] George Carlo, *Cell Phones, Invisible Hazards in the Wireless Age*, p. 20.

Kenneth R. Foster[124]

He was a member of the IEEE 2005 Subcommittee and an industry consultant (Kenneth R. Foster & Associates, Electromagnetic Safety Consulting). In a consulting report he cited an Exponent Report, which cites the International EMF Project that no health problems exist.[125]

A book *Phantom Risk, Scientific Interference and the Law* edited by Foster, has a chapter which he authored, "Weak Magnetic Fields: A Cancer Connection?" In this chapter he cites a 1990 David Savitz study,[126] which failed to find a risk, but fails to cite another 1990 Savitz study which found extraordinary risks for brain cancer, "Men employed in any electrical occupation had age race adjusted odds ratios (ORs) of 1.4 (95% confidence interval (CI) 1.1-1.7) for brain cancer. Brain cancer odds ratios were larger for electrical engineers and technicians (OR 2.7, 95% CI 2.1-3.4), telephone workers (OR 1.6, 95% CI 1.1-2.4), electric power workers (OR 1.7, 95% CI 1.1-2.7), and electrical workers in manufacturing industries (OR 2.1, 95% CI 1.3-3.4)."[127]

James Hatfield

He was a member of the IEEE 2005 Subcommittee and an industry consultant.

Shiela Johnston

She was a member of the IEEE 2005 Subcommittee and an industry consultant.

Professor Leeka Kheifets

She was a member of the IEEE 2005 Subcommittee member, a long-term employee and on-going consultant for the Electric Power Institute (EPRI) and for various electrical utility corporations.

Shortly after founding the International EMF Project, Michael Repacholi recruited Kheifets to join him. After leaving the International EMF Project

[124] CTIA Comments, footnote 154 (citing International EMF Project), page 32.
[125] http://www.ripuc.org/efsb/SB%202008_02AdvisoryFoster_on_EMF_2_8_10.pdf (accessed 27 Oct. 2013).
[126] Savitz et al. Maternal employment and reproductive risk factors. Am J Epidemiol. 1990 Nov;132(5):933-45.
[127] Loomis & Savitz. Mortality from brain cancer and leukaemia among electrical workers. Br J Ind Med. 1990 Sep;47(9):633-8,

she became a "Professor-in-Residence" of Epidemiology at UCLA, though she continues to be funded by EPRI and by electrical utilities.

She is a member of the Independent Scientific Advisory Group to Swedish Radiation Safety Authority (SSM)[128] and a Member of ICNIRP's Standing Committee on Epidemiology. She was a member of IARC's Expert Workshop on ELF (Extremely Low Frequency) electromagnetic radiation which in 2001 declared such radiation to be a possible carcinogen. She voted in favor of this finding.

Her ICNIRP Declaration of Personal Interests outside income as a "Scientific expert, South Africa," and from EPRI.

Professor Niels Kuster

Professor Kuster was a member of the Subcommittee which created IEEE 2005. He was an invited professor at the Electromagnetics Laboratory of Motorola, Inc., Florida, and is the founder and President of the Board of the sole-source manufacturer of the equipment required to use the SAM Process for cellphone certification, SPEAG (Schmid & Partner Engineering AG)

He attended the IARC Expert Working Group as an "Invited Specialist" when it declared radio frequency radiation was a possible carcinogen.

Patrick Mason

He was a member of the IEEE 2005 Subcommittee and was a long time employee at the U.S. Brooks Air Force Base where the military researches effects of electromagnetic radiation (EMR) and develops EMR weaponry.

Dr. Martin Meltz

He was a member of the IEEE 2005 Subcommittee and was a long time employee at the U.S. Brooks Air Force Base where the military researches effects of electromagnetic radiation (EMR) and develops EMR weaponry. Meltz was hired by the CTIA in February 1999 as a consultant to the WTR research projects.[129] He is cited 9 times in the context of his work with WTR in the index of Carlo's book, *Cell Phones, Invisible Hazards in the Wireless Age*.

[128] Previously, SSI—Swedish Radiation Protection Authority
[129] George Carlo, *Cell Phone, Invisible Hazards in the Wireless Age*, p.161.

Joseph Morrissey (deceased)

He was a member of the IEEE 2005 Subcommittee and a Motorola employee. At the 2009 Bioelectromagnetics Meeting Morrissey was on the panel of the "Hot Topic Plenary: When Do We Know Enough To Stop Research on the Safety of Wireless Communications?" He took the position that it was time to stop all such research.

Dr. Michael Murphy

Murphy was a member of the IEEE 2005 Subcommittee and was a long time employee at the U.S. Brooks Air Force Base where the military researches effects of electromagnetic radiation (EMR) and develops EMR weaponry. He is a past President of the Bioelectromagnetics Society (BEMS).

Dr. John Osepchuk

He was a member of the IEEE 2005 subcommittee and an industry consultant and expert witness. He was employed by Raytheon Company in microwave R&D.

Dr. Ronald C. Peterson

He was Co-chairman of the IEEE 2005 Subcommittee and a paid industry consultant. He was employed by AT&T Bell Labs Lucent Technologies. He served as an expert witness for the CTIA testifying against San Francisco's Right-To-Know ordinance.

Professor Michael Repacholi

In a Telstra[130] funded study to expose mice to cellphone radiation, Repacholi was the lead author of this study. The study reported a 2.4-fold statistically significant risk of lymphoma (see IEEE 2005 above).

Repacholi is the founder and first chairman of ICNIRP. He also founded the International EMF Project embedded within WHO where "up to half of the funds raised for his EMF Project came from industry."[131] "Last year, sensing that the upcoming IARC assessment might undercut his legacy at both the WHO and ICNIRP, Mike Repacholi assembled a team to prepare its own assessment of the possible tumor risks from RF radiation:

[130] An Australian cellphone corporation.

[131] http://microwavenews.com/news-center/repacholi-half-who-emf-project-funding-came-industry (accessed 28 Oct. 2013).

That review,[132] "Systematic review of wireless phone use and brain cancer and other head tumors," has just been released by the journal *Bioelectromagnetics*."[133] This paper lists the following conflicts of interests: "PE [Paul Elliott] and AA [Anssi Auvinen] are Principal Investigators (PI) of the international COSMOS Study, which is a prospective cohort study investigating the possible long-term health effects of wireless phone use. PE receives funding from the UK Mobile Telecommunications and Health Research (MTHR) Programme (www.mthr.org.uk), an independent body set up to provide funding for research into the possible health effects of mobile telecommunications. MTHR is jointly funded by the UK Department of Health and the mobile telecommunications industry. PE's research is also supported by the Imperial College Healthcare NHS Trust Comprehensive Biomedical Research Centre, funded by the National Institute for Health Research (NIHR) and he is an NIHR Senior Investigator. AA receives research funding for the Finnish COSMOS component from the research programme of the National Technology Agency with contributions from network operators (TeliaSonera and Elisa) and Nokia. AA was the PI of the Finnish component of the Interphone consortium that was funded through the Fifth EU Framework programme, with partial funding from the Mobile Manufacturers Forum and the GSM Association (with UICC as the firewall). All other authors reported no conflicts of interest." Repacholi did not declare a conflict of interest.

J. Patrick Reilley

He was a member of the IEEE 2005 subcommittee and is an industry consultant.

Jack Rowley

Jack Rowley is employed by the GSM Association (GSMA) whose member companies use radiofrequency radiation to deliver communication services. GSMA, like the CTIA, has a large number of Full Members, Associate Members, and Rapporteur Members. Their memberships spans a greater reach than the CTIA, which is mostly based in the United States (GSMA has 55 full members in the USA—many overlapping with CTIA).

He has represented the GSM Association in government inquiries in North America and at workshops organized by the European Commission and

[132] Repacholi et al. Systematic review of wireless phone use and brain cancer and other head tumors. Bioelectromagnetics Volume 33, Issue 3, pages 187–206, April 2012

[133] http://microwavenews.com/short-takes-archive/repacholis-rf-review (accessed 28 Oct. 2013).

national authorities. His participation as an "Observer" in this IARC Monographs meeting is sponsored by the GSM Association.[134]

Dr. David A Savitz

A member of the IEEE 2005 Subcommittee, a well-paid "expert" witness for industry[135] and an ICNRIP advisory member.

Dr. Asher Sheppard

He was a member of the IEEE 2005 subcommittee and is an industry consultant. He was a consultant for Motorola. Motorola nominated him to serve as a peer reviewer for CTIA financed WTR science studies.[136]

Dr. Joachim Schüz

He has been a first or last author on 5 of the 6 studies of the industry-funded Danish Cellphone Subscriber Cohort Study.

Schüz spent many years at the Danish Cancer Registry but then moved to IARC.

He has been and/or continues to be funded by the Electric Power Research Institute (since 2006). As a project manager for the COSMOS Study he has received and will continue to receive funds from TaliaSonera, Ericsson AB, and Telenor. As the German Interphone study PI he received funds from MMF, and the GSMA.

He participated in the production of the SCENIR opinion published in January 2009.

Professor Anthony (Tony) Swerdlow

He is a former ICNRIP Commissioner and a current Chairman of AGNIR.

Professor Swerdlow's conflicts-of-interest with the cellphone industry were disclosed in an ICNIRP paper which stated "A.J.S. has been provided by a number of sources, including the European Fifth Framework Program; the International Union against Cancer, which receives funds from the Mobile Manufacturers' Forum and the GSM Association; the Mobile

[134] IARC Monograph 109, p. 8.
[135] Deposition of David Savitz, United States District Court, Portland, OR Plaintiffs v. Portland Public Schools CV No. 11-739-MO, p. 38-39, lines 6-9.
[136] George Carlo, Cell Phones, Invisible Hazards in the Wireless Age, p. 42.

Telecommunications Health and Research Programme; the Swedish Research Council; AFA Insurance; and VINNOVA (Swedish Governmental Agency for Innovation Systems). VINNOVA received funds from TeliaSonera, Ericsson, and Telenor … A.J.S. holds shares in the telecoms companies Cable and Wireless Worldwide and Cable and Wireless Communications. A.J.S.'s wife holds shares in the BT group, a global telecommunications services company."

Dr. M (Mays) L. Swicord

His PhD thesis reported microwave radiation effected DNA. He was chief of the Radiation Biology Branch at FDA's CDRH and left the FDA in 2003 for Motorola where he was the Director of Electromagnetic Energy Programs at Motorola's Florida Research Labs. In 2004, while at Motorola, he spoke on behalf of the Mobile Manufacturers Forum (MMF) at a seminar held in Brussels"[137] He was an "Observer" at IARC's Expert Workshop, sponsored by the CTIA, which declared radio frequency radiation is a possible carcinogen.

Richard Tell

He was member of the IEEE 2005 subcommittee and is an industry consultant.

Eric van Rongen

He was a member of the IEEE 2005 subcommittee and an industry consultant. He is an ICNRIP Commissioner.

The Stability of Brain Cancer Incidence Rates?

A paragraph on page 23 of the CTIA Comment stated:

"Perhaps most tellingly, while cell phone use has increased dramatically all over the world, there has not been any corresponding rise in the incidence of brain cancer. In fact, brain tumor rates have remained flat or even fallen slightly here in the United States.[138] Researchers comparing actual incidence with rates predicted by those who believe RF emissions cause brain cancer have found that actual incidence rates are at least 40 percent lower than such

[137] Microwave News 2004 http://microwavenews.com/news/mobile-phones-again-linked-tumor-risk (Accessed 14 Oct. 2013).

[138] Inskip et al. Brain Cancer Incidence Trends in Relation to Cellular Telephone Use in the United States, 12 Neuro-Oncology 1147 (2010). Actual footnote is an NCI statement referring to this paper.

predictions.[139] The same is true in European countries where cell phones were adopted relatively early in comparison to the United States. After studying brain cancer incidence in Sweden, Finland, Denmark and Norway from 1979-2008, IARC researchers and authorities in these countries found **incidence rates to be generally stable** over the entire period [**emphasis** added.]" [140]

Each of these studies had various methodological problems which tend to obscure the reality. This will be discussed below, but first we will examine the reality.

Four countries have reported a doubling of the worst brain cancer, glioblastoma multiforme (GBM). They are the Australia, Denmark, Norway and the United States.

A 2011 Australian study which examined brain cancer incidence rates for the years 2000-2008 reported "A significant increasing incidence in glioblastoma multiforme (GBM) was observed in the study period (annual percentage change [APC], 2.5; 95% confidence interval [CI], 0.4–4.6, n = 2275), particularly after 2006."[141]

The Danish Cancer Registry reported on 2 Nov. 2012, "The number of men who are diagnosed with the most malignant form of brain cancer (glioblastoma), has almost doubled over the past ten years.[142],,

In Norway, brain and central nervous system cancer, during the latest 10 years, increased annually at 2.8% per year in women and 1.8% per year in men.[143]

In the United States a study which examined brain cancer incidence rates for the years 1992-2006 reported, "Data from 3 major cancer registries demonstrate increased incidences of GBMs in the frontal lobe, temporal lobe, and cerebellum,

---

[139] Little et al. Mobile phone use and glioma risk: comparison of epidemiological results with incidence Little et al. Mobile phone use and glioma risk: comparison of epidemiological results with incidence

[140] Deltour et al. Mobile phone use and incidence of glioma in the Nordic countries 1979-2008: Consistency check. 23 Epidemiology 301 (2012).

[141] Dobes et al. Increasing incidence of glioblastoma mutileforme and meningioma, and decreasing incidence of Schwannoma (2000-2008): Findings of a multicenter Australian Study. Surg Neurol Int. 2011;2:176. doi: 10.4103/2152-7806.90696. Epub 2011 Dec 13.

[142] http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i+hjernesvulster.htm (Danish to English translation, accessed 31 Oct. 2012.

[143] http://www.saferphonezone.com/site/wp-content/uploads/2011/11/NorwegianBrainCancer.pdf (accessed 15 Nov. 2013).

despite decreased incidences in other brain regions.[144]" The frontal lobe, temporal lobe and cerebellum absorb 81% (900 MHz) and 86% (1800 MHz) of all the cellphone radiation absorbed by the brain[145].

It is curious that the CTIA did not cite these studies though each was published well before the CITA Comments were submitted.

Of the 3 studies the CTIA cited:

1. The first study[146] examined incidence for the years 1992-2006 and reported "[R]ates among whites, [w]ith the exception of the 20-29-year age group, the trends for 1992-2006 were downward or flat. Among those aged 20-29 years, there was a statistically significant increasing trend between 1992 and 2006 among females but not among males. The recent trend in 20-29-year-old women was driven by a rising incidence of frontal lobe cancers (the frontal lobe absorbs 19% (800 MHz) and 14% (1800 MHz) of the total cellphone radiation absorbed by the brain."
2. The second study[147] (with overlapping authors from the first study) examined brain cancer incidence 1997-2008 and reported "Age specific incidence rates of glioma remained generally constant in 1992-2008 … a period coinciding with a substantial increase in mobile phone use from close to 0% to almost 100% of the US population."

   In 1997, 25% of the U.S. population was using a cellphone. The average latency time for brain cancer is 30+ years. The paper stated the "*Minimum* latency periods of up to 10 years are *thought to apply* for mobile phone exposure" [*emphasis* added]. Therefore, according to the authors, the *minimum* time when an increase could possibly be detected was 2007, but the incidence data ended in 2008.
3. The third study[148] examined brain cancer incidence from 1979-2008. Its funding was from the "Danish part of the COSMOS study"[149] with

[144] Zada et al. Incidence Trends in the Anatomic Location of Primary Malignant Brain Tumors in the United States: 1992–2006. World Neurosurg. 2012 Mar-Apr;77(3-4):518-24. doi: 10.1016/j.wneu.2011.05.051. Epub 2011 Nov 7.
[145] Cardis et al. Distribution of RF energy emitted by mobile phones in anatomical structures of the brain. Phys. Med. Biol. 53 (2008) 2771–2783.
[146] Inskip et al. Brain Cancer Incidence Trends in Relation to Cellular Telephone Use in the United States, 12 Neuro-Oncology 1147 (2010). Actual footnote is an NCI statement referring to this paper.
[147] Little et al. Mobile phone use and glioma risk: comparison of epidemiological results with incidence Little et al. Mobile phone use and glioma risk: comparison of epidemiological results with incidence
[148] Deltour et al. Mobile phone use and incidence of glioma in the Nordic countries 1979-2008: Consistency check. 23 Epidemiology 301 (2012).
[149] http://www.thecosmosproject.org/funding.php (accessed 31 Oct. 2013).

additional funding from the GSM Association and Mobile Manufacturers Forum. It concludes, "Our data indicate that, so far, no risk associated with mobile phone use has manifested in adult glioma incidence trends, although the induction period, if any, is unknown." In 1979 there were no cellphone users in the world!

Normal Operating Positions

The FCC rules require that the exposure limits "For purposes of evaluating compliance with localized SAR guidelines, portable devices[150] should be tested or evaluated based on **normal operating positions** or conditions [Bulletin 65, p. 42 **emphasis** added]."

The GAO Report "Exposure and Testing Requirements for Mobile Phones Should Be Reassessed" in a sidebar on its opening page titled "**What GAO Recommends**" [emphasis in original] stated, "FCC should formally **reassess and, if appropriate, change** its current RF energy exposure limit and mobile phone **testing requirements related to likely usage configurations**, particularly when phones are held against the body [**emphasis** added]."

Clearly this is being ignored both by the FCC and by the cellphone companies who place warnings in the commonly unread cellphone manuals. Every cellphone manual has a warning that the cellphone model must be kept at certain distances away from the users' bodies or the exposure limits can be exceeded.

In the CTIA Comments, footnote 177 (page 38) refers the reader to an iPhone User Guide, but fails to direct the reader to "Go to Settings > General > About > Legal > RF Exposure" where warnings are found to maintain a 10 mm distance (~3/8 inch) from the body in order to not exceed the exposure limits. The screenshot is below.

In the above, Other Issues with the Current FCC Cellphone Certification Process section shows the iPhone 5 exceeds the exposure limits even at a 10 mm distance 21 times. Virtually all cellphone manuals have similar warnings. This is clearly a contradiction to the FCC's admonition "portable devices[151] should be tested or evaluated based on normal operating positions or conditions." The GAO Report is cited by the CTIA Comments 22 times, but fails to mention the most important item from the GAO Report.

[150] In the FCC's language "portable devices" are cellphones; laptops, tablets and similar devices are ""
[151] In the FCC's language "portable devices" are cellphones; laptops, tablets and similar devices are ""

Watts per Kilogram (over a volume containing a mass of 1 gram of tissue) in countries that follow the United States FCC limit and 2.0 W/Kg (averaged over 10 grams of tissue) in countries that follow the Council of the European Union limit. During testing, iPhone radios are set to their highest transmission levels and placed in positions that simulate use against the head, with no separation, and near the body, with 10 mm separation.

To reduce exposure to RF energy, use a hands-free option, such as the built-in speakerphone, the supplied headphones, or other similar accessories. Carry iPhone at least 10 mm away from your body to ensure exposure levels remain at or below the as-tested levels. Cases with metal parts may change the RF performance of the device, including its compliance with RF exposure guidelines, in a manner that has not been tested or certified.

SAR values for this device are available at:
www.apple.com/legal/rfexposure/iPhone4,1/en/

Although this device has been tested to determine SAR in each band of operation, not all bands are available in all areas. Bands are dependent on your service provider's wireless and roaming networks.

The most important item in the GAO Report is on the opening page, under the heading, "**What GAO Recommends**", states, "FCC should formally reassess and, if appropriate, change its current RF energy exposure limit and mobile phone testing requirements related to likely usage configurations, particularly when phones are held against the body."

The FCC has two nomenclatures for wireless devices: "Portable" devices for cellphones, and "Mobile" devices for laptop computers and tablets (e.g., iPads).

The exposure limit for the cellphones is a SAR=1.6 W/kg for "normal operating positions"; for the latter the FCC has very different language.

But for laptop computers and tablets there is a very different rule: "For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons [Bulletin 65, p. 40]."

Twenty centimeters (20 cm) is approximately 8 inches. The very name "laptop" means that it is not "used in such a manner that a separation distance of at least 20 cm is normally maintained. Indeed advertisements show usages far closer than 20 cm by children and adults.[152] At ½ inch the radiation from the laptop can exceed the exposure limit 256-fold!

Science Studies Reporting Adverse Health Effects

Epidemiology—Risk to Children

In regards to Children the CTIA Comments has a whole section titled "Current Emission Standards and Testing Procedures are Safe and Appropriate for Children," [p. 26-20] which asserts "The scientific consensus also supports the

[152] https://www.google.com/search?q=Children+%26+ipad&client=firefox-a&hs=75L&rls=org.mozilla:en-US:official&tbm=isch&tbo=u&source=univ&sa=X&ei=xAJ0UvTmG-O1iwLdh4HgAg&ved=0CEMQsAQ&biw=1246&bih=446&dpr=1.25 (access 1 Nov. 2013).

Commission's existing emission standards [are protective of children]. The Commission, as well as the expert agencies on which it relies for guidance, reached this conclusion when developing those standards. No change in the state of the science warrants reconsidering them."

The Commission reached its conclusion 18 years ago. In the intervening years there has been a host of science studies which have found that the existing standard **is not protective of children**. As noted above in the IEEE 2005, *Concerns* section above there are **5 studies which reported effects on children**. IEEE 2005 is the very standard with calls for increasing (AKA "harmonizing") the exposure limits which will increase allowed absorption of microwave radiation up to 3-times higher than the existing limit.

What follows are epidemiology studies which have reported significant risks to children after the existing limits were adopted 18 years ago:

1. In 2009 a study reported when cellphone or cordless phone use began as a teenager or younger, the statistically significant risk of brain cancer on the same side of the head where the cellphone was held was 8-fold. In comparison, adults had a statistically significant 2-fold risk.[153]

   In other words, **children's risk of brain cancer was 4-times higher than adults' risks**.
2. In 2011 an industry funded study (CEFALO) found for **children between the ages of 7-19 (median age 13)**, using Operator Data (billing records) a statistically significant greater than **doubled risk of brain cancer** with >2.8 years since first use. This finding was combined with a highly significant dose-response relationship (increased years of use, increased the risk for brain cancer, p=0.001).[154] CEFALO was funded by the Swiss Research Foundation on Mobile Communication (FSM) whose funding came from industry. For details see **Credibility of Sources**, Organizations above.

   It is well known that when exposed to any carcinogen, the risk is higher in children compared to adults. And the younger the child when exposed, the higher the risk. This well-known reality may be because

[153] Hardell & Carlberg. Mobile phones, cordless phones and the risk for brain tumours. INTERNATIONAL JOURNAL OF ONCOLOGY 35: 5-17, 2009.
[154] Aydin et al. Mobile Phone Use and Brain Tumors in Children and Adolescents: A Multicenter Case–Control Study. JNCI Vol. 103, Issue 16 | August 17, 2011

the younger the child the higher the rate of cell division in their bodies. Two examples of this phenomenon are shown below:

1. A 2005 study of young children (average age 7.1 years) exposed to ionizing radiation found for <5 years old a 356% increased risk/Gy for brain cancer; for 5-9 years old, a 224% increase and; for 10 or more years of age, a 47% increase.[155] That is, the younger the child, the higher the risk.
2. In 1993 at study showed the risk of lung cancer was higher when smoking began as a teenager or younger compared to adults; >12-fold compared to 6-fold.[156] When smoking begins as a child the risk is higher than when smoking begins as an adult.

Epidemiology Risk to Adults

Brain Cancer

1. The CTIA Comments (p. 21) asserts "In 2000, researchers conducting a hospital-based case-control study in the United States found no evidence of increased risk of brain cancer and cell phone use." This is not true this CTIA-funded study found a 2.6-fold borderline significant (93% confidence) risk of brain cancer from cellphone use. As noted above an earlier peer-reviewed publication reported a statistically significant risk of brain cancer, OR=2.6, 95% CI=1.2-5.4 (for details see Dr. Linda Erdreich above).
2. A 2007 Swedish study of brain cancer reported:
   Risk of high-grade brain cancer[157] for >10 years since first analog cellphone use, OR=2.7, 95% CI=1.8-4.2; similarly for cordless phone use, OR=2.2, 95% CI=1.3-3.9; and a *dose-response* relationship,[158]
   An increased risk of high-grade brain cancer per year since first digital cellphone use, OR=11%, 95% CI=6%-16%; for cordless phone use, OR=8%, 95% CI=5%-12%;
   Per every 100 cumulative hours of digital cellphone use, the increased risk of high-grade brain cancer was, OR=4%, 95% CI=2%-6%; cordless phone use, OR=2%, 95% CI=1%-3%.

[155] Sadetzki et al. Radiation Research. V 163 2005.
[156] Hegmann et al. 1993.
[157] Astrocytoma
[158] Mild et al. Pooled Analysis of Two Swedish Case–Control Studies on the Use of Mobile and Cordless Telephones and the Risk of Brain Tumours Diagnosed During 1997–2003. JOSE 2007, Vol. 13, No. 1, 63–71.

3. A 2013 study by the same Swedish team,[159] the only study to report risks beyond 10 years and up to more than 25 years of use, found statistically significant risks.
   The risks for brain cancer from wireless phone use (cell & cordless) for >15-20, OR=1.7, 95% CI=1.02-3.0; >20-25, OR=1.9, 95% CI=1.04-3.4, and >25 years, OR=3.0, 95% CI=1.5-6.0.

   Again, this study found dose-response relationships: For every 100 cumulative hours of wireless phone use the risk increased, OR=0.9%, CI=0.6%-1.2%, and for every year since first wireless phone the risk increased, OR=1.8%, 95% CI=0.1%-3.6%.

   The temporal lobe absorbs the larger proportion of cellphone radiation of any anatomical region of the brain. This study examined the risk temporal tumors combined with temporal lobe tumors which overlapped into the frontal, parietal and occipital lobes. The risk of brain cancers in these regions from wireless phone use reported was, for >15-20 years, OR=2.3, 95% CI=0.9-5.8; >20-25 years, OR=2.7, 95% CI=1.04-7.2; >25 years, OR=5.1, 95% CI=1.8-15).

4. In 2010 the industry and government funded Interphone study was published.[160]

   For regular use (at least once a week, for 6 months or more the risk of glioma (a subset of all brain cancers) found *statistically significant protection* from glioma[161], OR=0.81, 95% CI=0.70-0.94. This protective effect is the result of design flaws which underestimated the risk.[162] The authors of the study recognized the problem and noted "... bias may have led to a reduction in the ORs for regular use … [for] glioma (19%, 95% CI 30–6) [sic][163]."

[159] Hardell et al. Case-control study of the association between malignantbrain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use. Int J Oncol. 2013 Dec;43(6):1833-45.
[160] The INTERPHONE Study Group. Brain tumour risk in relation to mobiletelephone use: results of the INTERPHONE international case–control study. Int J Epidemiol. 2010 Jun;39(3):675-94. doi: 10.1093/ije/dyq079. Epub 2010 May 17.
[161] Glioma, is a cancer of glial cells in the brain.
[162] Morgan LL. Review, Estimating the risk of brain tumors from cellphone use: Published case–control studies. Pathophysiology 16 (2009) 137–147.
[163] Should be CI 6%-30%.

In spite of this underestimation of risk, they found after >10 years combined with ≥1,640 cumulative hours of cellphone use, a significant risk, OR=1.57, 95% CI=1.13-2.30, arguably the reported risk should be 1.86, which is 19% larger than the published risk of 1.57.

When the authors recognized this issue they decided to assess risk within users and use very low levels of exposure as the referent level rather than non-exposed subjects. When they performed this analysis they reported a doubled risk of brain cancer. For >10 years of cellphone use compared to 1-1.9 year of use, the risk more than doubled, OR=2.18, 95% CI=1.43-3.31; for ≥1,640 cumulative hours of use compared to <5 hours of use, the risk almost doubled, OR=1.82, 95% CI=1.15-2.89.

Acoustic Neuroma (a tumor of the hearing nerve)

The CTIA Comments claims,

> "A wide range of studies, conducted in a variety of scientific disciplines using data from a number of different countries, have reached the same conclusion: Cell phones are not associated with increased health risks. For example, as the WHO and the Commission have both noted, the 2010 Interphone study, which drew on data from 13 participating countries, found no overall increased risk of glioma, meningioma or acoustic neuroma with mobile phone use of more than 10 years.98 The Interphone study is the largest case-control study conducted to date. Similarly, a large cohort study following cell phone users in Denmark from 2001 to 2011 has found no association between cell phone use and glioma, meningioma or acoustic neuroma."

The above claim is far from the truth. The 2010 Interphone study was not a study of the risk of acoustic neuroma. It was a study of the risk of glioma and meningioma. As noted in preceding paragraphs the 2010 study found significantly increased risks of glioma.

What follows is a list of studies which have found significant risk of acoustic neuroma:

1. The first study to report a risk of acoustic neuroma from cellphone use was published in 2002.[164] For analogue cellphone use[165] they more than a tripled significant risk, OR=3.5, 95% CI=1.6-2.8.

[164] Hardell et al. Cellular and cordless telephones and the risk for brain tumours. European Journal of Cancer Prevention 2002, 11, 1-10.

2. Two years later, in 2004 the industry and government funded Swedish Interphone study reported an ipsilateral risk for >10 years since cellphone use began, they found an almost quadrupled risk, OR=3.9, 95% CI=1.6-9.5.[166] This result is *statistically identical* to the first study (this study's confidence interval spans the first study's confidence interval).
3. A year later, in 2005, a study[167] found the risk acoustic neuroma with >64 cumulative hours of digital phone use was, OR=1.5, 95% CI=0.99-2.3. With ipsilateral digital cellphone use, OR=1.7, 95% CI=1.1-2.6; for ipsilateral cordless phone use, OR=1.7, 95% CI=1.1-2.6).
4. In early 2010 a Japanese Study[168] found the heaviest cellphone users (>20 min/day) from both 1 and 5 years prior to diagnosis a quintupled relative risk, RR=5.0, 95% CI=1.4-24.8.
5. A year later, the 13-country, industry and government funded Interphone study published its 2011 study of acoustic neuroma.[169] With ≥1,640 cumulative hours of cellphone use, 5 years prior to the date of diagnosis they reported close to a triple risk, OR=2.79, 95% CI=1.51-5.16. With ipsilateral use, for ≥1,640 cumulative hours of cellphone use, 5 years prior to the date of diagnosis the risk more than tripled, OR=3.53, 95% CI=1.59-7.82. With >10 years of use combined with >1,640 cumulative hours the risk was even larger, OR=3.74, 95% CI=1.58-8.83.
6. In May 2013 a UK study reported a more than tripled significant risk of acoustic neuroma with 10 or more years of cellphone use, OR=3.11, 95% CI=1.08-8.95).[170]
7. A July 2013 paper reported wireless phone use for various ranges of time up to more than 25 years.[171] Also it is *the first study to show that the size of acoustic neuroma tumor increases with increasing microwave radiation exposure*. The following results were found:

---

[165] Analogue cellphone were the 1st generation cellphones. They only transmitted maximum power and they have consistently shown a higher risk than later generations of cellphones

[166] Lönn et al. Mobile Phone Use and the Risk of Acoustic Neuroma. Epidemiology • Volume 15, Number 6, November 2004.

[167] Hardell L, Carlberg M, Hansson Mild K. Pooled analysis of two case-control studies on the use of cellular and cordless telephones and the risk of benign brain tumours diagnosed during 1997-2003. Int J Oncol. Published online: June 13, 2005

[168] Sato et al. A Case-Case Study of Mobile Phone Use and Acoustic Neuroma Risk in Japan. Bioelectromagnetics, 2011 Feb;32(2):85-93. Epub 2010 Oct 28.

[169] The CTIA Comments stated (p. 21), "the 2010 Interphone study, which drew on data from 13 participating countries, found no overall increased risk of … acoustic neuroma with mobile phone use of more than 10 years."

[170] Benson et al. Mobile phone use and risk of brain neoplasms and other cancers: prospective study. Int J Epidemiol. 2013 Jun;42(3):792-802.

[171] Hardell et al. Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997-2003 and 2007-2009 and use of mobile and cordless phones. Int J Oncol. 2013 Oct;43(4):1036-44. doi: 10.3892/ijo.2013.2025. Epub 2013 Jul 22.

a. Increase in tumor volume per year since first analog[172] cellphone use, 7.4%, 95% CI=1.0%-14.2%, p=0.02; increase per 100 hours of cumulative analog cellphone use 10.3%, 95% CI=2.4%-8.7%, p=0.01;
b. Increase in tumor volume per years since first use of wireless phones (cell and cordless), 3.6%, 95% CI=-1.1%-8.6%, p=0.13; increase per 100 hours of cumulative wireless phones use, 1.0%, 95% CI=0.1%-2.2%, p=0.08;
c. Dose-response relationships: Increase risk per year since first wireless phone use, OR=5.6%,[173] 95% CI=2.9%-8.5%, and per 100 cumulative hours of wireless phone use, OR=0.8%, 95% CI=0.2%-1.4%.
d. With more than 20 years of wireless phone use, OR=4.4, 95% CI=2.2-9.0.

8. One month later (August 2013) a Korean Study also reported the acoustic neuroma tumor size increased with increased exposure.[174] The tumor volume in cubic centimeters (cm^3) was compared from long-term use versus short-term use. The results were:
   a. Duration of use, <10 years to >10 years: 5.57 cm^3 to 9.93 cm^3 (176% increase);
   b. Daily use, <20 min/day to >20 min/day: 4.88 cm^3 to 11.32 cm^3 (232% increase);
   c. Cumulative hours of use, <2,000 hours to >2,000 hours: 4.88 cm^3 to 13.31 cm^3 (273% increase).

It is hard to ignore 8 studies from 7 teams in 6 countries,[175] where with one exception (5 above), the CTIA Comments ignored these studies, and claimed (p. 20-21)

> "A wide range of studies, conducted in a variety of scientific disciplines using data from a number of different countries, have reached the same conclusion: Cell phones are not associated with increased health risks. For example, as the WHO and the Commission have both noted, the 2010 Interphone study, which drew on data from 13 participating countries, found no overall increased risk of … acoustic neuroma with mobile phone use of more than 10 years."

Parotid gland (a large salivary gland in the cheek) tumors

[172] Analog cellphone were the first generation cellphones. They radiated maximum power at all times.
[173] After 20 years of a 5.6% increase per year, the risk increases 2.97-fold
[174] Moon et al. Association between vestibular schwannomas and mobile phone use. Tumour Biol. 2013 Aug 27. [Epub ahead of print]
[175] 13-country Interphone studies counted as single country

The CTIA Comments fails to mention any risk of parotid gland tumors.
Four studies have reported risk of parotid gland tumors from cellphone use:

1. A 2006 joint Danish-Swedish industry and government funded Interphone study found for >10 years of ipsilateral cellphone use a borderline significant risk, OR=2.6, 95% CI=0.9-7.9, calculated p=0.078.[176]

   Several of the authors of this study are discussed above in the **Credibility of Sources**, Individuals section above. They are Anders Ahlbom, Joachim Schüz, and Maria Feychting.

   In 2006 the Israel Dental Association issued a warning which was reported in the Israeli newspaper, Haaretz. This article noted a disproportion number of these tumors in young people, "salivary gland cancer…was disproportionately common among young patients. One fifth of those patients were under 20. Oral cancers are associated with a high mortality rate in Israel, with patients living an average of five and a half years."[177]
2. A 2007 industry and government funded Israel Interphone study reported the risk to "Mainly rural or mixed rural/urban" cellphone users.[178] This subgroup was selected because cellphones radiate higher power in rural areas compared to urban areas as the base stations (cell towers) are typically farther away from users compared to urban users. The risk to rural or mixed rural urban cellphone users with cumulative number of calls ≥18,997 was OR=1.81, 95% CI=1.04-3.14; for cumulative call times >1,035 hours, OR=1.96, 95% CI=1.11-3.44.
3. In January 2011 an Israel study examined the risk of parotid gland tumor from 1970-2006.[179] This study showed a sharp rise in the number of parotid gland tumor relative to other salivary gland tumors beginning around 1990. This is illustrated by Figure 1 from the study.

[176] Lonn et al. Mobile Phone Use and Risk of Parotid Gland Tumor. Am J Epidemiol. 2006 Oct 1;164(7):637-43. Epub 2006 Jul 3.
[177] http://www.haaretz.com/print-edition/news/israeli-study-sees-link-between-oral-cancer-cell-phones-1.280073 (accessed 4 Nov. 2013).
[178] Sadetzki et al. Cellular Phone Use and Risk of Benign and Malignant Parotid Gland Tumors—A Nationwide Case-Control Study. Am J Epidemiol. 2008 Feb 15;167(4):457-67. Epub 2007 Dec 6
[179] Czerninski et al. Risk of Parotid Malignant Tumors in Israel (1970–2006). Epidemiology: January 2011 - Volume 22 - Issue 1 - pp 130-131.

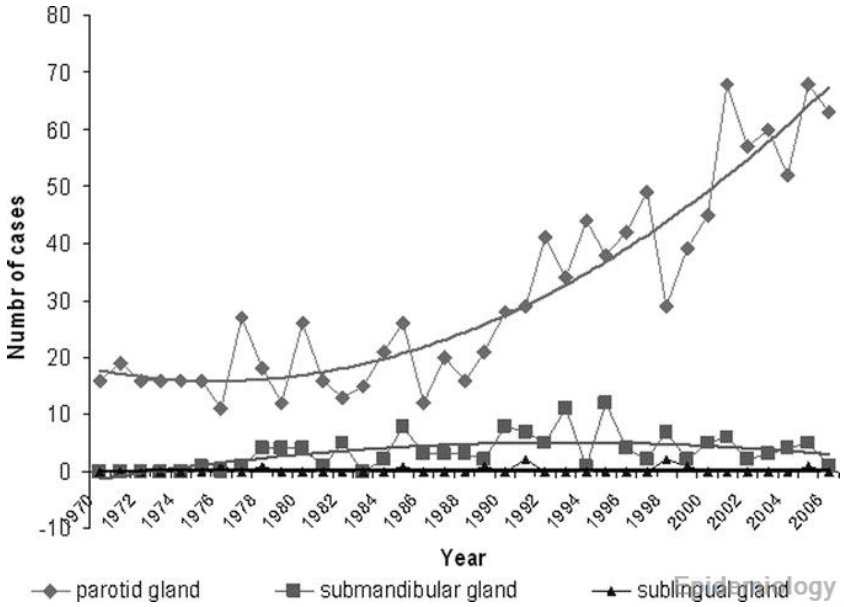


Figure 1. For trend analyses, we added regression lines and calculated R2 values. Parotid gland cancer: R2 = 0.83; Submandibular gland cancer: R2 = 0.36; Sublingual gland cancer: R2 = 0.02.

4. In April 2011 a Chinese study was published on the risk of parotid gland tumors.[180] This study found extraordinarily high risks (similar risk to what has been found with smoking and the risk of lung cancer):
   a. The risk of two parotid gland variants, epithelial parotid gland malignancies, and mucoepidermoid carcinoma, with >10 years since first use was, OR=10.63, 95% CI=5.31-21.3, and OR=20.73, 95% CI=9.38-45.8, respectively;
   b. With average daily use of >2.5 hour per day, OR=15.88, 95% CI=5.98-42.2, and OR=31.3, 95% CI=10.8-90.5, respectively.

Leukemia

The CTIA Comments ignored reported risks of leukemia from cellphone use. Two studies have reported risk of leukemia from cellphone use:

1. In 2009 a study in Thailand found, after adjusting for age, sex, income; use of cellphones; benzene and other solvent exposures; occupational and non-occupational pesticide exposures; pesticides used near the home; working with power lines, living near power lines, the risk from exclusive use of a 2nd generation GSM cellphone, OR=3.0, 95% CI=1.4-

[180] Duan et al. Correlation between cellular phone use and epithelial parotid gland malignancies. Int J Oral Maxillofac Surg. 2011 Sep;40(9):966-72. doi: 10.1016/j.ijom.2011.03.007. Epub 2011 Apr 6.

6.4. For any cellphone use, the high risk was for chronic myelogenous leukemia (CML), OR=2.3, 95% CI=1.0-5.5.[181]

2. An industry-funded[182] UK study published in 2010, found for ≥15 years since first cellphone use a borderline significant risk of leukemia, OR=1.87, 95% CI=0.96-3.63, calculated p=0.060 (94% confidence).[183] The team leader of this study was Anthony Swerdlow (see **Credibility of Sources**, Individuals above).

Breast Cancer

The CTIA Comments makes no mention of breast cancer from cellphones. There are women, particularly young women, who place their cellphones in their bras. Arguably, the female breast is the most absorbent tissue in the human body, with the brain, perhaps being the second most absorbent tissue.

A case series report was published in 2013 finding multi-focal (multiple-primary) breast cancers[184] that occurred in the center of their chests precisely where these women had kept their cell phones for periods of between "several hours per day to "eight hours a day or longer."

Current cellphone models have up to 6 transmitting antennae. For example the iPhone 5 has the 6 antennae: GSM 850 MHz, GSM 1900 MHz, WCDMA Band V, WCDMA Band II, LTE (VOIP) Band 4, and Wi-Fi 2.4 GHz. The women in this case series report have up to 6 primary breast cancers.

Studies of Risk to Male Fertility

There are multiple studies showing deleterious effects on sperm from exposure to cellphone, or laptop computers. In spite of these studies the CTIA Comments ignored the issue.

Human Studies

1. In 2007 a study at the Cleveland Clinic the abstract reported

[181] Kaufman et al. Risk factors for leukemia in Thailand. Ann Hematol. 2009 Nov;88(11):1079-88. doi: 10.1007/s00277-009-0731-9. Epub 2009 Mar 18.

[182] A grant from the Mobile Telecommunications and Health Research Programme, which is jointly funded by the UK government and the mobile telecommunication industry.

[183] Cooke R, Laing S, Swerdlow AJ. A case-control study of risk of leukaemia in relation to mobile phone use. Br J Cancer. 2010 Nov 23;103(11):1729-35.

[184] West et al. Case Report, Multifocal Breast Cancer in Young Women with Prolonged Contact between Their Breasts and Their Cellular Phones. Case Rep Med. 2013;2013:354682. doi: 10.1155/2013/354682. Epub 2013 Sep 18.

"Result(s): The comparisons of mean sperm count, motility, viability, and normal morphology among four different cell phone user groups were statistically significant. Mean sperm motility, viability, and normal morphology were significantly different in cell phone user groups within two sperm count groups. The laboratory values of the above four sperm parameters decreased in all four cell phone user groups as the duration of daily exposure to cell phones increased.

Conclusion(s): Use of cell phones decrease the semen quality in men by decreasing the sperm count, motility, viability, and normal morphology. The decrease in sperm parameters was dependent on the duration of daily exposure to cell phones and independent of the initial semen quality."[185]

2. A study show that temperature controlled donor sperm placed 3 cm below a laptop computer connected to Wi-Fi, or in a separate room without a laptop computer or the other electrical devices.[186] The study found
   a. "Sperm DNA fragmentation was increased after 4 hours of laptop exposure. In the test group, 8.6% ±6.6% of the cells were fragmented, whereas only 3.3% ±6.0% of the controls showed DNA fragmentation (*P<0.01)."
   b. "Progressive sperm motility (PG) was significantly reduced in the group incubated under the laptop compared with that of control group (68.7% ±8.8% to 80.9% ±7.5%, *P<0.01)."
3. A 2010 study examined the effect of cellphone radiation on sperm.[187] It found "Significant reduction in sperm head area (9.2 ± 0.7 μm² vs. 18.8 ± 1.4 μm²). The mean number of zona-bound sperm of the test hemizona and controls was 22.8 ± 12.4 and 31.8 ± 12.8 ($p < 0.05$), respectively. This study…had a significant effect on sperm morphometry. In addition, a significant decrease in sperm binding to the hemizona was observed. These results could indicate a significant effect of RF-EMF on sperm fertilization potential."
4. In 2005 a study reported: "Results: A total of 451 patients were examined during the 13 months of study period. Among the 221 men corresponded the criteria and completed the study, significant correlations were found between duration of standby position and sperm concentration (r=-0.161,

[185] Agarwal et al. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. Fertil Steril. 2008 Jan;89(1):124-8. Epub 2007 May 4.

[186] Avendaño et al. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. Fertil Steril. 2012 Jan;97(1):39-45.e2. doi: 10.1016/j.fertnstert.2011.10.012. Epub 2011 Nov 23.

[187] Falzone N, Huyser C, Becker P, Leszczynski D, Franken DR (2010) The effect of pulsed 900-MHz GSM mobile phone radiation on the acrosome reaction, head morphometry and zona binding of human spermatozoa. International Journal of Andrology 33:1-7.

p=0.04) length of daily transmission and rapid progressive or slow progressive motility (r=-0.191, p=0.005; r=0.323, p<0.001, respectively) and between the duration of standby position and rapid progressive motile sperm concentration (r=-0.218, p=0.005). Furthermore, difference was found between daylong standby and non-standby users in sperm concentration (59.11x106/ml vs 82.97x106/ml, p=0.021, N=51 vs 46) and between prolonged transmitters and non-transmitters in rapid progressive motility (36.31% vs 51.34%, p=0.007, N=16 vs 61).
Conclusions: The prolonged use of cell phones may have negative effect on spermatogenesis and male fertility that presumably deteriorates both concentration and motility."[188]

IARC Monograph 102

This 480 page monograph presented the studies and the reasoning which led to the categorization of radio frequency radiation as a possible carcinogen (Category 2B). In concluding there was "limited evidence" in experimental animals for the carcinogenicity of RF-EMF, the Working Group listed results from all of the animal studies.

The CTIA Comments refers to animal research 9 times emphasizing that the animal data was inadequate. Here we present the animal data reported in Monograph 102:

Animal Studies

1. "An increased incidence of total malignant tumours (all sites) was observed in rats exposed to RF radiation compared with sham-exposed controls (Chou et al., 1992) [p. 259]." The lead author was C-K Chou discussed in the **Credibility of Sources**, Individuals section above.
2. "The authors reported a twofold increase in the incidence of lymphoma in Eμ-Pim1 mice exposed to GSM RF radiation (P = 0.006 versus the sham exposed group) (Repacholi et al., 1997) [p. 265]." The author was Michael Repacholi discussed in the **Credibility of Sources**, Individuals section above.
3. "The incidences of tumours of the Harderian gland were significantly higher in male mice exposed to RF radiation than in controls, with a dose dependent trend (P = 0.0028, one-tailed test); this resulted in a significant positive trend in the overall incidence of benign tumours (P < 0.01). For females, no dose-related trends related to exposure to RF radiation were seen

[188] Fejes et al. Is there a relationship between cell phone use and semen quality? Arch Androl. 2005 Sep-Oct;51(5):385-93.

in the overall incidence of benign or malignant tumours, or of tumours regardless of type (Oberto et al., 2007) [p. 265]."

4. "A more rapid appearance of mammary-gland tumours and a statistically significant increase in the incidence of mammary-gland tumours in both groups of mice exposed to microwave radiation was reported, compared with controls (Szmigielskiet al., 1982) [p. 266]."
5. A study "(Anghileri et al., 2005) [c]ompared with controls, the exposure caused an earlier onset of general lymphocyte infiltration, formation of lymphoblastic ascites, and development of extranodal tumours of different histological types [p. 267]."
6. In the first of two experiments "the authors reported that mammary gland tumours developed more rapidly in rats exposed to signals at wbSAR 1.4 and 2.2 mW/g compared with controls … (Anane et al., 2003) [p. 277]."
7. "When compared with the sham-exposed control group the group at 4.0 mW/g demonstrated a statistically [s]ignificant increase in the number of rats with malignant mammary-gland tumours (mainly adenocarcinomas) and a significant decrease in the number of rats with benign mammary-gland tumours (Hruby et al., 2008) [p. 277]."
8. "In groups exposed to ENU, UMTS RF radiation increased the incidence of bronchioloalveolar carcinoma and hepatocellular adenoma (Tillmann et al., 2010) [p. 279]."
9. "Compared with the MX-treated sham-exposed control group [but not the cage control group], a statistically significant increase in the incidence of combined vascular tumours (haemangiomas, haemangiosarcomas and lymphangiomas combined) was observed in the mesenteric lymph nodes of the group treated with MX and RF radiation at a high intensity (wbSAR, 0.9 mW/g). Exposure to RF radiation had no significant effect on the incidence of tumours in any other tissue (Heikkinen et al., 2006) [p. 280]."
10. "Pre-exposure or simultaneous exposure to microwave radiation at either SAR value accelerated the development of benzo[a]pyrene-induced skin cancer. A comparable acceleration of skin tumorigenesis was reported in benzo[a]pyrenetreated mice undergoing confinement stress for 1 or 3 months (Szmigielski et al., 1982) [p. 280]."
11. "Two different schedules of exposure to microwave radiation at 2450 MHz were used. … Irradiation by either schedule resulted in an acceleration in the development of benzo[a]pyrene-induced skin carcinoma and decreased the lifespan of the animals (Szudziński et al., 1982) [p. 280 & 283]."

The above is a selection of studies which found an effect. There were many studies which did not find an effect. However a highly important concept in epidemiology is, "The absence of evidence is not evidence of absence"

Conclusions

The CTIA assertion that there is a 50-fold safety factor is not true. The current "safety" factor is 2.5-fold above a potentially irreversible effect. It would be difficult to understand any public health policy which would set such a "safety" factor so close to an *irreversible injury*, albeit in rats.

CTIA's assertion that there is a sole FCC approved cellphone certification process is not true. The computer simulation has far greater capability and the FCC should mandate its use in order to protect children, pregnant women and to deal with the reality that children, and women and to a lesser extent men have metal on their bodies, ears, necks, body piercings and dental braces which will all interact with cellphone radiation.

The existing cellphone certification process is fundamentally flawed. There is no confirmation that the single cellphone model provided for certification is representative of production units. The post-market surveillance system is ineffective. If the iPhone 5 dataset provided to the FCC is a typical example, the very credibility of the existing cellphone certification process is in question. An independent auditor should review every step of the cellphone certification process.

CTIA's asserts there are no non-thermal adverse biological effects from microwave radiation. This is not true. There is a long list of non-thermal effects, as reported in various exposure standards. Perhaps the most important is the repeated findings of radio frequency radiation disruption of calcium homeostatsis "which can have important consequences for health."[189]

CTIA asserts that "Current Emission Standards and Testing Procedures are Safe and Appropriate for Children [p. 26]." This is not true. There are studies showing children are at greater risk than adults from exposure to wireless devices, and studies showing children absorb more cellphone microwave radiation than adults.

[189] http://en.wikipedia.org/wiki/Calcium_metabolism (accessed 18 Nov. 2019).

CTIA asserts there are no studies showing risks. This too is not true. There are significant risks from cellphone use for tumors of the brain, the hearing nerve, the cheek's salivary gland, and female breast. There are also multiple studies both in humans and animals showing deleterious effects to sperm including DNA fragmentation.

Our government has a responsibility to protect its citizens and a responsibility to provide data that can help researchers and citizens better understand the health effects from wireless device use:

> Per an FCC call for comment [paragraph 215, Notice of Inquiry ET Docket 13-84] to other governmental agencies and institutes for additional information that could help support health research in the U.S., we believe that cellphone use data should be made available anonymously to researchers, and to any customer who requests their personal cellphone call data. Lack of accurate and complete usage data in the U.S. was reported during the House Oversight Committee hearing (Sept. 25, 2008) as one reason why little epidemiological research has been conducted in the U.S. on the potential health effects of exposure to radiofrequency energy from wireless phones. The availability of such anonymized data would also permit the U.S. to participate fully in global epidemiological studies, such as INTERPHONE. The FCC should, when revising its regulations, require that the telecommunications industry maintain such data and make it available in an anonymized form to researchers and to customers upon request.

The FCC's primary obligation is not to optimize profitability for the telecommunications industry. The Commission should enhance communications and protect the most vulnerable members of our society: "infants, the aged, the ill and disabled," [articulated in the IEEE 1991 exposure standard]. As the American Academy of Pediatrics has advised recently advised the Commission, young children should be added to this listed. Fetuses and men who wish to father healthy children should also be included in this "most vulnerable" list.

Throughout the CTIA Comments multiple organizations and individuals are cited to bolster the CTIA's assertion. Many of these organization and individuals have inherent conflicts-of-interests which we have documented above.

Finally, in light of his long history as a lobbyist for industry and as the first President of the Cellular Telecommunication Industry Association, the new Chairman of the FCC, Thomas Wheeler, should recuse himself from any matter

concerning revisions of the exposure limits. Thomas Wheeler's past positions create fundamental conflicts-of-interests.

Appendix, List of Possible Carcinogens

-alpha-C (2-Amino-9H-pyrido[2,3-b]indole)
Acetaldehyde
Acetamide
Acrylonitrile
AF-2 [2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide]
Aflatoxin M1
para-Aminoazobenzen
ortho-Aminoazotoluene
1-Amino-2,4-dibromoanthraquinone
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole
Amsacrine
ortho-Anisidine
Anthraquinone
Antimony trioxide
Aramite®
Auramine
Azaserine
Aziridine
(NB: Overall evaluation upgraded to Group 2B with supporting evidence from other relevant data)
Benz[j]aceanthrylene
(NB: Overall evaluation upgraded to Group 2B with supporting mechanistic and other relevant data)
Benz[a]anthracene
Benzo[b]fluoranthene
Benzo[j]fluoranthene
Benzo[k]fluoranthene
Benzofuran
Benzo[c]phenanthrene
(NB: Overall evaluation upgraded to Group 2B with supporting evidence from other relevant data)
Benzophenone
Benzyl violet 4B
2,2-Bis(bromomethyl)propane-1,3-diol
Bitumens, extracts of steam-refined and air-refined
Bleomycins
(NB: Overall evaluation upgraded to Group 2B with supporting evidence from other relevant data)

Bracken fern
Bromochloroacetic acid
Bromodichloromethane
Butylated hydroxyanisole (BHA)
beta-Butyrolactone
Caffeic acid
Carbon black
Carbon tetrachloride
Carpentry and joinery
Carrageenan, degraded (Poligeenan)
Catechol
Chlordane
Chlordecone (Kepone)
Chlorendic acid
Chlorinated paraffins of average carbon chain length C12 and average degree of chlorination approximately 60%
para-Chloroaniline
3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone
Chloroform
1-Chloro-2-methylpropene
Chlorophenoxy herbicides
4-Chloro-ortho-phenylenediamine
Chloroprene
Chlorothalonil
Chrysene
CI Acid Red 114
CI Basic Red 9
CI Direct Blue 15
Citrus Red No. 2
Cobalt and cobalt compounds
(NB: Evaluated as a group)
Cobalt metal without tungsten carbide
Cobalt sulfate and other soluble cobalt(II) salts
Coconut oil diethanolamine condensate
Coffee (urinary bladder)
(NB: There is some evidence of an inverse relationship between coffee drinking and cancer of the large bowel; coffee drinking could not be classified as to its carcinogenicity to other organs)
para-Cresidine

Cumene
Cycasin
Dacarbazine
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone)
Daunomycin
DDT (4,4'-Dichlorodiphenyltrichloroethane)
N,N'-Diacetylbenzidine
2,4-Diaminoanisole
4,4'-Diaminodiphenyl ether
2,4-Diaminotoluene
Dibenz[a,h]acridine
Dibenz[a,j]acridine
7H-Dibenzo[c,g]carbazole
Dibenzo[a,h]pyrene
Dibenzo[a,i]pyrene
Dibromoacetic acid
Dibromoacetonitrile
1,2-Dibromo-3-chloropropane
2,3-Dibromopropan-1-ol
Dichloroacetic acid
para-Dichlorobenzene
3,3'-Dichlorobenzidine
3,3'-Dichloro-4,4'-diaminodiphenyl ether
1,2-Dichloroethane
Dichloromethane (Methylene chloride)
1,3-Dichloro-2-propanol
1,3-Dichloropropene (technical-grade)
Dichlorvos
Diesel fuel, marine
(NB: Overall evaluation upgraded to Group 2B with
supporting evidence from other relevant data)
Diethanolamine
Di(2-ethylhexyl)phthalate
1,2-Diethylhydrazine
Diglycidyl resorcinol ether
Dihydrosafrole
Diisopropyl sulfate
3,3'-Dimethoxybenzidine (ortho-Dianisidine)
para-Dimethylaminoazobenzene
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)-vinyl]-1,3,4-

oxadiazole
2,6-Dimethylaniline (2,6-Xylidine)
Dimethylarsenic acid
3,3'-Dimethylbenzidine (ortho-Tolidine)
1,1-Dimethylhydrazine
3,7-Dinitrofluoranthene
3,9-Dinitrofluoranthene
1,6-Dinitropyrene
1,8-Dinitropyrene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,4-Dioxane
Disperse Blue 1
Dry cleaning (occupational exposures in)
Engine exhaust, gasoline
1,2-Epoxybutane
(NB: Overall evaluation upgraded to Group 2B with supporting evidence from other relevant data)
Ethyl acrylate
Ethylbenzene
Ethyl methanesulfonate
Firefighter (occupational exposure as a)
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole
Fuel oils, residual (heavy)
Fumonisin B1
Furan
Fusarium moniliforme, toxins derived from (fumonisin B1, fumonisin B2, and fusarin C)
Gasoline
(NB: Overall evaluation upgraded to Group 2B with supporting evidence from other relevant data)
Glu-P-1 (2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole)
Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)
Glycidaldehyde
Griseofulvin
HC Blue No. 1
Heptachlor
Hexachlorobenzene
Hexachlorocyclohexanes

Hexachloroethane
2,4-Hexadienal
Hexamethylphosphoramide
Human immunodeficiency virus type 2 (infection with)
Human papillomavirus types 5 and 8 (in patients with epidermodysplasia verruciformis)
Human papillomavirus types 26, 53, 66, 67, 70, 73, 82
Human papillomavirus types 30, 34, 69, 85, 97
(NB: Classified by phylogenetic analogy to the HPV genus alpha types classified in Group 1)
Hydrazine
1-Hydroxyanthraquinone
Indeno[1,2,3-cd]pyrene
Iron-dextran complex
Isoprene
Lasiocarpine
Lead
Magenta
Magnetic fields, extremely low-frequency
MeA-alpha-C (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)
Medroxyprogesterone acetate
MeIQ (2-Amino-3,4-dimethylimidazo[4,5-f]quinoline)
MeIQx (2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)
Merphalan
Methylarsonic acid
2-Methylaziridine (Propyleneimine)
Methylazoxymethanol acetate
5-Methylchrysene
4,4'-Methylene bis(2-methylaniline)
4,4'-Methylenedianiline
Methyleugenol
2-Methylimidazole
4-Methylimidazole
Methyl isobutyl ketone
Methylmercury compounds
(NB: Evaluated as a group)
2-Methyl-1-nitroanthraquinone (uncertain purity)
N-Methyl-N-nitrosourethane
Methylthiouracil
Metronidazole

Michler's base [4,4′-methylenebis(N,N-dimethyl)-benzenamine]
Michler's ketone [4,4′-Bis(dimethylamino)benzophenone]
Microcystin-LR
Mirex
Mitomycin C
Mitoxantrone
3-Monochloro-1,2-propanediol
Monocrotaline
5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone
Nafenopin
Naphthalene
Nickel, metallic and alloys
Niridazole
Nitrilotriacetic acid and its salts
(NB: Evaluated as a group)
5-Nitroacenaphthene
2-Nitroanisole
Nitrobenzene
6-Nitrochrysene
Nitrofen (technical-grade)
2-Nitrofluorene
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone
N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide
Nitrogen mustard N-oxide
Nitromethane
2-Nitropropane
1-Nitropyrene
4-Nitropyrene
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodi-n-propylamine
3-(N-Nitrosomethylamino)propionitrile
N-Nitrosomethylethylamine
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Ochratoxin A

Oil Orange SS
Oxazepam
Palygorskite (Attapulgite) (long fibres, > 5 micrometres)
Panfuran S (containing dihydroxymethylfuratrizine)
Pickled vegetables (traditional in Asia)
Phenazopyridine hydrochloride
Phenobarbital
Phenolphthalein
Phenoxybenzamine hydrochloride
Phenyl glycidyl ether
Phenytoin
PhIP (2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine)
Polybrominated biphenyls
Polychlorophenols and their sodium salts (mixed exposures)
Ponceau 3R
Ponceau MX
Potassium bromate
Printing processes (occupational exposures in)
Progestins
Progestogen-only contraceptives
1,3-Propane sultone
beta-Propiolactone
Propylene oxide
Propylthiouracil
Refractory ceramic fibres
Riddelliine
Safrole
Schistosoma japonicum (infection with)
Sodium ortho-phenylphenate
Special-purpose fibres such as E-glass and '475' glass fibres
Sterigmatocystin
Streptozotocin
Strontium-90 (see Fission products)
Sulfallate
Surgical implants and other foreign bodies:
- Polymeric implants prepared as thin smooth film (with the exception of poly(glycolic acid))
- Metallic implants prepared as thin smooth films
- Implanted foreign bodies of metallic cobalt, metallic nickel and an alloy powder containing 66-67% nickel,

13-16% chromium and 7% iron
Talc-based body powder (perineal use of)
Tetrafluoroethylene
Tetranitromethane
Textile manufacturing industry (work in)
Thioacetamide
4,4'-Thiodianiline
Thiouracil
Titanium dioxide
Toluene diisocyanates
Toxaphene (Polychlorinated camphenes)
Trichlormethine (Trimustine hydrochloride)
Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)
Trp-P-2 (3-Amino-1-methyl-5H-pyrido[4,3-b]indole)
Trypan blue
Uracil mustard
Vanadium pentoxide
Vinyl acetate
4-Vinylcyclohexene
4-Vinylcyclohexene diepoxide
Welding fumes
(NB: Volume 100D concluded that there is sufficient evidence for ocular melanoma in welders)
Zalcitabine
Zidovudine (AZT)