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

COMMENTS OF ENVIRONMENTAL WORKING GROUP

Environmental Working Group respectfully submits its comments on the Commission's First Report And Order, Further Notice of Proposed Rule Making, and Notice Of Inquiry in the aforementioned dockets. EWG is a not-for-profit environmental and public health research and advocacy organization based in Washington D.C. that has raised concerns about the potential long-term health effects associated with exposure to radiofrequency energy (RF) emissions from cell phones.

In our comments, EWG urges the Federal Communications Commission to strengthen its cell phone radiation standards. Specifically, the agency's regulations must be revised so that they will adequately protect both children and adults, reflect actual current use patterns and provide meaningful consumer disclosure without preempting states from requiring additional disclosure.

Moreover, it is imperative that the FCC not weaken its existing standards by altering its testing guidelines to adopt average radiation exposure testing over a larger volume of tissue. This change, proposed by the FCC, would be a step backward, given the unanswered questions about the potential long-term effects of cell phone radiation exposure.

Because of the widespread use of wireless technology, a miscalculation could have potentially severe consequences.

I. INTRODUCTION AND BACKGROUND

The Commission's March 27, 2013, notice of inquiry (NOI) on wireless device safety was long overdue. In the 17 years since the FCC set its standards for radiofrequency energy emissions (RF) from cell phones, wireless technology been revolutionized. The 1996 standards were adopted at a time when cell phone use by children was rare, smart phones did not exist, cell phone cases were virtually unheard of and the FCC assumed that people would often carry the phones in holsters clipped to their belts.

Today, we live in a completely different world. In 2012 there were more than 326 million cell phone subscribers in the U.S. – 10 times as many as in 1997 (CTIA 2013). According to a recent survey, cell phone usage by children is common, and 78 percent of teenagers between the ages of 12 to 17 now own a cell phone (Pew 2013). Almost half of the phones being sold today are smartphones, and cases for these phones have become a multi-million dollar business (CNET 2013a). Wireless-only households now account for 35 percent of all households in the U.S. (CTIA 2013).

Unfortunately, the FCC's standards have not kept up with these changes in the marketplace. They do not account for the fact that children's brains absorb more RF energy than adult brains. They do not consider how phone cases may significantly alter the RF exposure profile of smartphones and other cell phones. They do not provide adequate protection for people who carry their phones next to their bodies rather than in a holster. They do not focus on protecting against potential long-term health effects. To make matters worse, the FCC's standards do not provide consumers who wish to minimize their exposure with sufficient information to make informed purchasing decisions.

These factors provide more than sufficient reason for the FCC to strengthen its standards. Considering the numerous scientific studies published in the last decade that point to potential adverse health effects from cell phone radiation – including childhood and adult cancer, reduced sperm count and reproductive/developmental effects – it becomes imperative for the FCC to act. This is not because there is definitive scientific evidence pointing to harm, but rather because the consequences of a miscalculation could be severe, given the ubiquitous use of wireless technology. It is against this backdrop that we urge the FCC to make the following improvements to its current cell phone standards.

II. FCC STANDARDS MUST BE STRENGTHENED TO PROVIDE ADEQUATE PROTECTION FOR CHILDREN

i. Cell phone use by children is common and increasing

Cell phone use is common and increasing among children and teens. A 2010 survey of 800 teenagers sponsored by the Pew Research Center found that 75 percent of young people ages 12-to-17 own cell phones, compared to 45 percent in 2004 (Lenhart 2010). Another 2010 consumer survey of 4,500 boys and girls reported that 20 percent of children ages 6-11 owned cell phones in 2009, up 68 percent from 2005 (MRI 2010). Cell phones and accessories are now aggressively marketed toward children, as is evident from the wide availability of Disney-themed phones and case covers, and large companies such as Sprint advertise child-friendly models. These trends highlight the need to ensure that children are not being exposed to cell phone radiation at levels that have potential to cause harm.

ii. FCC's standards must be revised to reflect the fact that children's brains absorb significantly more radiation than adult brains

Despite mounting scientific evidence that children are more vulnerable to potentially harmful RF emissions from cell phones, limits on specific absorption rates (SAR) are the same for children and adults. Given the unknowns about the potential long-term effects of exposing

developing brains to cell phone radiation and the increasing number of children and teenagers who own cell phones, it is critical that the FCC revise its standards to be more protective. This is especially important in light of the fact that children will be exposed to cell phone radiation for more years and therefore in greater total amounts than the current generation of adults (NRC 2008a).

Scientists from around the world agree that the head and brain of a child absorb significantly more radiation than those of an adult (de Salles 2006; Gandhi 1996; Kang 2002; Wang 2003). As noted by the International Agency for Research on Cancer, the average RF energy deposition is twice as high in certain regions of children's brains and up to 10 times higher in the bone marrow of children's skulls, compared to energy deposition in adult brains and skulls (IARC 2012; Christ 2010). Research from the wireless industry itself has reached similar conclusions, as evidenced by a 2008 study by France Telecom that found that the maximum SAR in models of children's brains at ages 5-to-8 was twice as high as in models of adult brains (Wiart 2008).

In general, as head size decreases, the percentage of energy absorbed by the brain increases (Martinez-Burdalo 2004). Moreover, children's tissues have higher water and ion content than adult tissues (Peyman 2009). Both factors increase radiation absorption, according to researchers from the U.S., the Finnish cell phone company Nokia, the Institute of Applied Physics in Spain and the U.K. Health Protection Agency (Gandhi 2002; Keshvari 2006; Martinez-Burdalo 2004; Peyman 2009). In addition, children have thinner skulls than adults.

U.S. cell phone emission levels and federal standards are based solely on radiation absorbed by adults and fail to account for children's higher exposures and potentially greater health risks. The FCC's 1.6 W/kg SAR standard is modeled on an adult head, not a child's smaller head with its thinner skull bone and different tissue composition. Assuming a conservative and likely overestimated departure point for health effects based on a SAR value of

4 W/kg, the FCC's 1.6 W/kg exposure standard for the head has only a 2.5-fold safety margin above the level that produced adverse behavioral effects in animals (EWG 2009a).

Furthermore, the FCC did not add any uncertainty (or "safety") factors to its calculations in developing a standard to account for the extra sensitivity of children. This is in stark contrast to the risk management approach practiced by the Environmental Protection Agency (EPA). According to EPA, protective reference values should be derived in a way that accounts for both the uncertainty and the variability in the available data (U.S. EPA 2008). In this framework, variability refers to heterogeneity or diversity in the human population, including differences in vulnerability to a particular physical, chemical or biological agent. Further uncertainty is typically due to a paucity of available information, the need to extrapolate from animal data to humans, assumptions about short-term exposure compared to chronic exposure, and the lack of data regarding all health endpoints that could be affected by exposure (NRC 2008b; U.S. EPA 2002).

To account for uncertainty and variability, default factors (typically tenfold) are used in EPA risk assessments for deriving the operational reference exposure values from experimental data (U.S. EPA 2009). The goal of applying uncertainty/variability factors (UFs) for developing general population exposure standards is to ensure that an adequate margin of safety exists to protect infants, young children and other vulnerable populations. The choice of specific UFs depends on the quality of the studies available and the extent of the research database. EPA has developed certain general principles that apply to most risk assessments (U.S. EPA 2002), to wit:

- The inter-species UF accounts for different sensitivity between humans and laboratory test species; it generally falls between a factor of 3 and 10, but factors higher than 10 may be applied;
- The intra-species UF accounts for variability in response between different individuals; this factor is generally set at 10 and must be higher in order to specifically protect children;

- The sub-chronic-to-chronic duration UF is typically set at a default value of 10 whenever the results of a short term exposure study are used to derive a long-term exposure standard;
- Finally, for certain exposures during vulnerable periods of development, as in the case of young children's exposure to pesticides, an additional safety factor of 10 is typically used (consideration of children's exposure is mandated under Food Quality Protection Act of 1996).

No such uncertainty factors were applied to the FCC standard to account for children's increased exposure to cell phone radiation.

All these data, taken together, suggest that when a child uses a cell phone that complies with the FCC standards, he or she could easily absorb an amount of radiation above the maximum allowed limits defined by the federal guidelines. FCC standards give adults only a slim margin of safety above emission levels that are known to harm animals. For children, the margin is much slimmer – if it exists at all. The FCC's standards must be updated to specifically address the special vulnerability of children and their higher levels of exposure.

iii. Children may face health risks from cell phone RF exposure

An adequately protective standard is particularly important in light of the emerging scientific evidence that children may face particular health risks from RF exposure. Much of the research to date has focused on an association between cell phone use and cancer, which was the subject of a large, multi-center epidemiological study undertaken in Europe, called INTERPHONE. The International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as "possibly carcinogenic to humans (Group 2B)," based on an increased risk of brain glioma observed by the INTERPHONE study (IARC 2012). There is also some evidence that RF may also contribute to acoustic neuroma and parotid malignancy, although the links to glioma are stronger (IARC 2012; Duan 2011; Hardell 2013; Sadetzki 2008; Shoemaker 2005).

Cell phone use by children has not been commonplace long enough for scientists to be able to definitively determine the long-term effects of ongoing exposure to the developing brain. There is also a relative scarcity of information on this question. In response to critical data gaps regarding the effects of RF on children, the World Health Organization Prospective has placed "cohort studies of children and adolescents with outcomes including behavioral and neurological disorders and cancer" on its list of high-priority research needs (WHO 2010).

A few epidemiological studies have been completed or are underway to address these data gaps. A 2012 case-control study that analyzed cancer incidence in Chinese children exposed to RF through mobile base stations found an increased risk of all neoplasms at above-median exposure to RF, and a positive but statistically insignificant association with brain neoplasms and leukemia (Li CY, 2012). Two international epidemiological case-control studies are examining the effects of cell phone radiation exposure in children. Results of the CEFALO study, which involved research centers in four countries, were published in 2011. While there were only weak, statistically insignificant associations between most cell phone use parameters and brain cancer risk, there was a significant association between increasing cancer risk and increasing time since first cell phone use in data provided by network operators (vs. self-reported data that is subject to recall bias) (Aydin 2011). This suggests that increases in brain cancer risk may correspond to duration of cell phone use. The authors also noted that their sample size may not have provided the statistical power to detect smaller increases in brain cancer risk. The second children's study, called Mobi-kids, involves research centers in 16 countries and is seeking to recruit thousands of participants. The FCC should take a precautionary approach and set stricter exposure limits while this important research is completed.

It is important to note that brain tumors have a long latency period of 10 to 15 years (ACS, 2012). Currently available studies may not be reflective of future trends in disease, particularly in those who began using cell phones as children. It is also notable these studies detected *any* increase in risk, given the relatively short time periods involved. The long latency

period of brain cancer creates yet another layer of uncertainty and yet another reason to implement a more stringent standard.

iv. Emerging evidence points to potential links between cell phone radiation and other health effects

Other research suggests that cell phone use could have other adverse effects on children. A Danish study of more than 50,000 children found that the likelihood of developing migraines and headache-related symptoms was higher in children who used cell phones versus those with no exposure (Sudan 2012). The researchers noted that while the study did not demonstrate a causal relationship, the potential health impact would be large if one exists. The same group also reported a weak association between cell phone use and hearing loss in children, but those results were not conclusive (Sudan 2013). Although definitive links between children's cell phone use and health effects have not yet been established, it is best to err on the side of caution.

Some research indicates that prenatal exposure to cell phone radiation may lead to effects later in life. Several studies using laboratory animals have suggested that cell phone radiation might be harmful to the developing fetus. A 2009 study in Turkey found that after pregnant rats were exposed to cell phone radiation for 15 minutes twice a day during the entire gestation period, the female pups had fewer ovarian follicles, indicating the potential for reproductive effects (Gul 2009). Prenatal exposure to cell phone radiation also reduced the number of nerve cells and affected brain structure in rats (Odaci 2008; Sonmez 2010).

A 2012 study by researchers at the Yale University School of Medicine found that mice exposed to cell phone radiation during gestation were hyperactive and had impaired memory (Aldad 2012). There have been similar findings in human studies. UCLA researchers reported that cell phone exposure during pregnancy and after birth was associated with behavioral problems in young children (Divan 2008; Divan 2012).

A proposed mechanism by which electromagnetic radiation may affect the brain is by increasing the permeability of the blood-brain barrier (BBB). The BBB protects the brain from

exposure to substances in circulating blood that could be toxic or disrupt the homeostasis of the brain microenvironment. Exposure to an electromagnetic pulse may increase the permeability of the BBB and perturb proteins that form the tight junctions that maintain its integrity (Ding 2010).

Some experiments using RF of the type emitted by cell phones, including exposures at non-thermal levels, have shown that it can affect BBB permeability in laboratory animals, (reviewed in Nittby 2008). Two studies in humans have reported increased transthyretin in blood, a biomarker of BBB permeability, although the authors made note of confounding factors (Soderquvist 2009a; Soderquvist 2009b).

Additional research has studied other potential health effects, such as childhood obesity, that may be related to prenatal electromagnetic field exposure. A prospective cohort study published in 2012 monitored maternal exposure to magnetic fields during pregnancy and the weight and body mass index (BMI) of 733 children for up for to 13 years. The study reported a relationship between prenatal exposure to magnetic fields and childhood obesity, with the highest exposures associated with the highest risk (Li DK, 2012).

Research on adverse affects associated with prenatal exposure to cell phone radiation is still emerging. A more comprehensive body of data is needed to determine if emissions from cell phones can affect the developing fetus or lead to behavioral or physical effects later in life. The uncertainties surrounding the possibility that children and the fetus may suffer adverse health effects from cell phone radiation strongly argue that the FCC should lower its current public exposure limits to ensure that such populations are protected.

II. FCC STANDARDS MUST BE MODERNIZED TO REFLECT ACTUAL PATTERNS OF CONSUMER USE

i. FCC standards and testing guidelines must assume that consumers will carry their cell phones directly against the body

In its Notice of Inquiry, the FCC acknowledges that there are "circumstances where test configurations may not reflect actual use" because current federal guidelines allow cell phone companies to use a spacer of up to 2.5 centimeters in "body-worn testing configurations." These

guidelines appear to stem from an FCC assumption in 1996 that consumers would be carrying their phones in holsters, rather than directly against the body. Whatever the reason for the agency's earlier decision, it is clear that the FCC must now update its testing guidelines to reflect the reality that many people commonly carry their phones directly against the body, often putting them phones in a pocket or and placing them on the lap – sometimes even placing them in their bras.

Notably, a 2012 Government Accountability Office (GAO) report concluded that consumers who hold a phone directly against the body could receive "*RF energy exposure higher than the FCC limit*" and recommended that the FCC "[r]eassess whether mobile phone testing requirements result in the identification of maximum RF energy exposure in likely usage configurations, particularly when mobile phones are held against the body, and update testing requirements as appropriate."

EWG strongly agrees with this recommendation. Given that holsters and belt clips are not commonly used today, it makes no logical sense to test RF exposure compliance of wireless devices at *any* distance from the body if the agency aims to simulate real-world usage. This is particularly important since at least some testing has indicated that RF exposure from an iPhone 4 would exceed FCC guidelines by a factor of three if tested right next to the body (Pong 2012). The difference is between allowing a 2.5 cm gap and zero spacing is not trivial.

ii. FCC testing guidelines and standards should account for the fact that cell phone cases affect the RF exposure profile of phones significantly

While cell phone holsters and belt clips are no longer common, in the 17 years since the FCC issued its RF standards for cell phones, form-fitting cases have become ubiquitous. Because these cases can alter the RF exposure profile of cell phones considerably, it is important that the FCC incorporate these accessories into its testing guidelines (Pong 2012). Otherwise the FCC standards will continue not to reflect actual consumer use patterns and therefore limit consumer confidence.

At a minimum, the FCC should require testing that indicates whether a cell phone case is likely to increase or decrease RF exposure so that consumers can make informed purchasing decisions. Currently, it is likely that few consumers are aware that using a case on a smartphone could increase (or in some cases decrease) exposure to cell phone radiation significantly.

III. FCC STANDARDS MUST BE REVISED TO PROVIDE MEANINGFUL CONSUMER DISCLOSURE, PROTECT THE PUBLIC'S RIGHT TO KNOW AND GIVE CONSUMERS THE POWER TO MAKE INFORMED DECISIONS WHEN CHOOSING PHONES, CASES AND WIRELESS NETWORKS

i. Consumers should be given sufficient information to be able to reduce their exposure to cell phone radiation

Public concern about RF exposure from cell phones has mounted in recent years as the technology has spread and more scientific evidence linking cell phone radiation to health effects has emerged. Many consumers are interested in reducing their exposure to this inadequately studied possible carcinogen. Exposure reduction could be accomplished via consumer behavior changes such as using a headset or choosing phones and networks that expose them to less RF energy over time.

However, the information currently provided to consumers is highly limited and problematic. It is important for the FCC to develop and mandate the disclosure of real-world SAR values for phones and networks. This information should be made readily accessible in multiple settings, including at the point of sale, and federal laws should not preempt states or municipalities from requiring additional disclosure.

ii. FCC itself has noted that SAR is not an accurate proxy for emissions, yet many consumers seek exposure information

On its website the FCC describes in detail why the maximum Specific Absorption Rate (SAR) – currently the *only* RF exposure metric tested by the FCC and made available to consumers – is not a good predictor of actual exposure to RF energy from cell phones (FCC 2013). The FCC notes, for instance, that "a single SAR value does not provide sufficient

information about the amount of RF exposure under typical usage conditions to reliably compare individual cell phone models" (FCC 2013).

Even with the lack of definitive information on the radiation emissions from particular phone models, consumers have shown high interest in phones that emit lower radiation. For example, for more than four years the technology website CNET has published a data table of cell phone radiation levels based on the maximum SAR value (CNET 2013b). In the 64 hours following the 2009 publication of a EWG database of cell phones SAR values and a science review, 442,000 people accessed these materials on the EWG website, collectively viewing 1.4 million online pages (EWG 2009b).

During those same three days, EWG's findings were reported in 100 news articles and in national and local broadcast news, including The New York Times, NBC Nightly News, WebMD and USA Today. This powerful response from the public and news media outlets reflects consumers' keen interest in the issue of cell phone safety. Consumer demand is also evident in the use of phone-based applications such as a program made by the tawkon company to track RF transmission power in real time, which gives users direct feedback on when the SAR exposure is highest (Tawkon 2013a). According to the Google app store Google play, this application has been installed between 100,000 and 500,000 times (Google 2013).

Clearly, people are eager to know whether cell phones are safe and how they can protect themselves and their families from potential adverse effects of excessive exposure to cell phone radiation.

iii. RF exposure varies by service provider, transmission technology, frequency bands, location and proximity to cell phone towers

Recent studies have indicated that a consumer's choice of wireless network, with its associated frequency bands and transmission encoding, may be a more important factor in cell phone RF exposure than the cell phone model. The technology used in transmitting and encoding cell phone signals has been changing every few years: from GSM to CDMA to WCDMA and

most recently to LTE. The changing antenna design, transmission frequency and encoding have large effects on average RF exposure levels (Shi 2012, Kelsh 2011).

For a given power output to the antenna, the newer 4th generation LTE antenna design produces a SAR value that is 2-to-60 times greater than the 2G and 3G designs (Shi 2012). Research has shown that there was a major reduction in consumer radiation exposure in the shift from 2G to 3G WCDMA transmission technologies. While 2G transmitted at 20-70 percent maximum SAR in average usage, 3G phones generally transmitted at levels below 1 percent of maximum SAR (Gati 2009; Vrijheid 2009). As the technology has evolved, concerns have been raised that LTE transmission technology with multiple-in/multiple-out antenna designs have transmission characteristics similar to 2G technology and that exposure will be a larger fraction of maximum SAR than 3G technology (Shi 2012; Anderson 2011).

Although studies have found marked differences in average SAR levels among cell phone networks, the FCC currently provides consumers with absolutely no information to assist them in choosing a cell phone provider that will expose them to lower cell phone RF energy. This not only inhibits consumer's ability to make informed purchasing decisions, it also deprives the public of its right to know. Because it is now clear that cell phone network technologies affect RF exposure as much as the phone design itself, the FCC-mandated exposure metrics should incorporate both parameters in an expected in-use SAR rating.

iv. Cell phone cases can significantly alter RF exposure profiles

Because cell phone cases can significantly alter the RF exposure profile, FCC testing for maximum SAR as well as expected in-use SAR should be done with and without cases, including non-metal cases. Studies have shown that even non-metal cases, which are used on the vast majority of smartphones sold today, can have a large effect on cell phone signal strength and the related maximum radiation emissions (Pong 2012). Depending on its design and the thickness and type of material used, a case exerts a large net effect on the SAR of a given phone (Cellsafe 2013; Pong 2012). Due to variations in phone design and antenna placement, moreover, the modulation

of the SAR value will be case- and phone-dependent. Currently, however, most consumers are unaware of this. The FCC provides zero information that consumers can use to guide their purchasing decisions.

v. FCC should develop an estimated in-use SAR metric

It is the responsibility of the FCC to develop a metric for phone/network combinations that is representative of the average RF exposure a user would experience. EWG recognizes that this is a complicated endeavor, given that cell phone radiation varies significantly based on location, proximity to towers, transmission frequency, transmission encoding and other factors. Nevertheless, this should not preclude the FCC from developing a metric that would provide real-world SAR value estimates or ranges that would allow reasonable comparison of phone/network combinations.

One option for developing such an in-use SAR metric would be to require phones to record the power output to the antenna and calibrate this to SAR measurements. This would allow real-time SAR reporting and provide much more detailed exposure information that could assist in epidemiological studies of cell phones usage and radiation exposure. The tawkon company provides an application for mobile phones that purports to accomplish this very task of measuring real-time radiation feedback for users and alerts the user when the phone is transmitting at higher power (Tawkon 2013b).

Other federal agencies have attempted to provide consumers with similar real-world metrics to guide purchasing decisions, and these metrics have proven to be highly valuable even when they are acknowledged to be imperfect. Two such metrics are the Department of Energy's and Environmental Protection Agency's Energy Star ratings for household appliances and the miles-per-gallon (MPG) fuel efficiency ratings for automobiles. MPG values are provided even though users may experience wide variability in performance in actual use: the agencies explain that fuel economy can be significantly affected by "driving behavior, driving conditions, vehicle maintenance, fuel characterizes, weather and other factors" (DOE 2013).

In-use SAR values could follow a model similar to the DOE and EPA MPG ratings for city and highway driving scenarios. In addition, the two agencies also maintain a website, www.fueleconomy.gov, where users can track and compare their vehicles fuel use with the government estimates.

vi. FCC risk communication should be updated to reflect current science

In addition to requiring cell phone companies to clearly disclose RF exposure information, the FCC should do a better job of publicly communicating the uncertainties surrounding cell phone use and health risks. The FCC makes the following statement on its website:

> "Some health and safety interest groups have interpreted certain reports to suggest that wireless device use may be linked to cancer and other illnesses, posing potentially greater risks for children than adults. While these assertions have gained increased public attention, currently no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses."

The tone of this statement implies that the concerns raised by public health organizations regarding radiation exposure from cell phone are baseless, when in fact the World Health Organization has determined that RF is a possible human carcinogen (WHO 2011).

While the scientific evidence surrounding cell phone use and health effects is not definitive, there is certainly sufficient research to warrant caution. In addition, there is data suggesting possible mechanisms of action, including oxidative stress and disturbances in the blood-brain barrier, as described here. The FCC should at least acknowledge that there is limited but suggestive scientific evidence that radiation from cell phones may be associated with adverse health effects, while recognizing that the current data is not compelling enough to establish a definitive link.

It is unclear what the next several decades will bring, but if RF exposure from cell phones does in fact cause cancer in even a small percentage of users, the world could be faced with millions of additional cancer cases. The likelihood of this scenario is yet unclear, but it

nevertheless provides a sobering backdrop for the FCC's upcoming decisions on wireless safety standards. We urge the agency to put public health protection and consumers' right to know front and center in its deliberations.

vi. FCC must take action that does not preempt state rights

It is critical that the FCC develop a more reliable exposure metric that is representative of average in-use RF exposure. The in-use exposure value should be comparable across phone/network combinations so that consumers can make informed choices. This exposure information should be disclosed to consumers in cell phone manuals and on Internet websites and be clearly displayed at the point of sale. Just as importantly, any actions by the FCC to enhance consumers' right-to-know must not preempt the right of states to adopt more stringent regulations with respect to exposure disclosure or cell phone RF education at the point of sale or in any other location or form.

IV. FCC MUST NOT WEAKEN ITS EXISTING STANDARDS BY BASING TESTING GUIDELINES ON AVERAGE RADIATION OVER A LARGER VOLUME OF TISSUE

It is imperative that the FCC not weaken its existing standards by altering its testing guidelines for radiation exposure by averaging over a larger volume of tissue.

The FCC currently calculates SAR values based on 1 gram of tissue, but the agency has indicated that it is now considering altering this long-standing method and may move to a system in which SAR values are calculated by averaging over 10 grams of tissue. It is important to note that calculations based on a greater volume of tissue will shrink SAR estimates compared to those based on a smaller tissue mass. Therefore if the FCC changes its calculation methodology and bases SAR values on 10g of tissue, it may underestimate mobile phone RF exposure. Calculations based on 10g of tissue will diffuse RF exposure over a large mass and may mask significantly higher exposures to small portions of the brain. There is also concern that calculating allowable exposure using 10g of tissue rather than 1g over a 6-minute period allows for greater heating in

small areas of the brain, and that such "hot spots" could have adverse effects on brain tissue (Blackman 2009). Research has shown that the SAR 1g calculation can be a better predictor of peak temperature increases and location than the 10g model (Bakker 2011).

A 2006 paper that calculated SAR values in adults and children using a 1g tissue model and a 10g tissue model found substantial differences. SAR values for adults and children using a 1850MHz planar antenna were 52 percent higher using a 1g SAR calculation than with a 10g SAR calculation (de Salles 2006). Calculations using a 850MHz planar antenna were 55 percent higher for adults and 70 percent higher for children using a 1g SAR average (de Salle 2006). This demonstrates that averaging over a larger (10g) tissue mass could significantly underestimate exposure to electromagnetic radiation. Other research shows a similar pattern in which exposure estimates using the 10g model consistently produce lower SAR values than the 1g model (Beard 2006).

Given the unanswered questions about the potential long-term effects of cell phone radiation exposure, increasing the tissue mass used to calculate SAR values, as proposed by the FCC, would be a step backward. Because of the widespread use of wireless technology, a miscalculation could have potentially severe consequences.

V. REFERENCES:

Aldad TS, Gan G, Gao XB, Taylor HS. 2012. Fetal radiofrequency radiation exposure from 800-1900 mhz-rated cellular telephones affects neurodevelopment and behavior in mice. Sci Rep 2: 312.

ACS. American Cancer Society. What are the risk factors for brain and spinal cord tumors? Last Medical Review: 10/09/2012. Available at: http://www.cancer.org/cancer/braincnstumorsinadults/detailedguide/brain-and-spinal-cord-tumors-in-adults-risk-factors

Anderson JB, Kuhn S, Krigslund R, Sorensen TB. 2011. Overview of new technologies. Presentation at 2011 International Conference on EMF and Health. Available: http://ec.europa.eu/health/electromagnetic_fields/events/ev_20111116_presentations_en.htm. Accessed: 9/2/2013.

Aydin D, Feychting M, Schüz J, Tynes T, Andersen TV, Schmidt LS, Poulsen AH, Johansen C, Prochazka M, Lannering B, Klæboe L, Eggen T, Jenni D, Grotzer M, Von der Weid N, Kuehni CE, Röösli M. 2011. Mobile phone use and brain tumors in children and adolescents: a multicenter case-control study. J Natl Cancer Inst. 103(16):1264-76.

Bakker JF, Paulides MM, Christ A, Kuster N, van Rhoon GC. 2010. Assessment of induced SAR in children exposed to electromagnetic plane waves between 10 MHz and 5.6 GHz. Phys Med Biol. 55(11):3115-30.

Beard BB, Kainz W, Onishi T. 2006. Comparisons of computed mobile phone induced SAR in the SAM phantom to that in anatomically correct models of the human head. IEEE Transaction on Electromagnetic Compatibility. 48(2):397–407.

Blackman C. Cell phone radiation: Evidence from ELF and RF studies supporting more inclusive risk identification and assessment. Pathophysiology. 2009 Aug;16(2-3):205-16.

Cellsafe. 2013. Cellsafe vs. Pong Test Results. Available: http://www.cellsafe.com.au/cellsafe-vs-pong-test-results. Accessed: 8/27/2013.

Christ A, Gosselin MC, Christopoulou M, Kühn S, Kuster N. 2010. Age-dependent tissue-specific exposure of cell phone users. Phys Med Biol 55(7):1767-83.

CNET. 2013a. Smartphones to outsell feature phones in 2013 for first time. Available: http://news.cnet.com/8301-1035_3-57572349-94/smartphones-to-outsell-feature-phones-in-2013-for-first-time/. Accessed: 9/2/2013.

CNET. 2013b. Cell Phone Radiation Levels. Available: http://reviews.cnet.com/cell-phone-radiation-levels/. Accessed: 8/5/2013.

CTIA. 2013. Wireless Quick Facts. http://www.ctia.org/advocacy/research/index.cfm/aid/10323. Accessed: 9/2/2013.

de Salles AA, Bulla G, Rodriguez CE. 2006. Electromagnetic absorption in the head of adults and children due to mobile phone operation close to the head. Electromagn Biol Med 25(4): 349-60.

Ding GR, Qiu LB, Wang XW, Li KC, Zhou YC, Zhou Y, Zhang J, Zhou JX, Li YR, Guo GZ. 2010. EMP-induced alterations of tight junction protein expression and disruption of the blood-brain barrier. Toxicol Lett 196(3): 154-60.

Divan HA, Kheifets L, Obel C, Olsen J. 2008. Prenatal and postnatal exposure to cell phone use and behavioral problems in children. Epidemiology 19(4): 523-9.

Divan HA, Kheifets L, Obel C, Olsen J. 2012. Cell phone use and behavioural problems in young children. J Epidemiol Community Health 66(6): 524-9.

DOE. 2013. The official U.S. government source for fuel economy information. Available: http://www.fueleconomy.gov/feg/info.shtml. Accessed: 8/23/2013.

Duan Y, Zhang HZ, Bu RF. 2011. Correlation between cellular phone use and epithelial parotid gland malignancies. Int J Oral Maxillofac Surg 40(9): 966-72.

EWG 2009a. Cell Phone Radiation: Science Review on Cancer Risks and Children's Health. Available: http://static.ewg.org/reports/2012/cellphones/2009-cellphoneradiation-fullreport.pdf

EWG. 2009b. Testimony of Olga V. Naidenko, Ph.D., EWG Senior Scientist. Before the Subcommittee on Labor, Health and Human Services, and Education, and Related Agencies Committee on Appropriations. United States Senate Hearing on The Health Effects of Cell Phone Use. Monday, September 14, 2009. Available: http://www.appropriations.senate.gov/ht-labor.cfm?method=hearings.download&id=b6e86769-8eba-476b-a7a7-fc48f1f15950. Accessed: 9/2/2013.

EWG. 2012. EWG's Guide to Safer Cell Phone Use: Where is EWG's Cellphone Database? Available: http://www.ewg.org/cellphoneradiation/where_database. Accessed: 8/27/2013.
FCC. 2013. Consumer Guide. SAR for Cell Phones: What It Means For You. Available: http://www.fcc.gov/cgb/consumerfacts/sar.pdf. Accessed: 8/27/2013.

Gandhi OP, Lazzi G, Furse CM. 1996. Electromagnetic absorption in the human head and neck for mobile telephones at 835 and 1900 MHz. IEEE Transactions on Microwave Theory and Techniques 44(10): 1884-97.

Gandhi OP, 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(9): 1501-18.

Gati A, Hadjem A, Wong MF, Wiart, J. 2009. Exposure induced by WCDMA mobiles phones in operating networks. IEEE Transactions on Wireless Communications. 8:12, 5723-5727.

Google Play. 2013. tawkon | track phone radiation. Available: https://play.google.com/store/apps/details?id=com.tawkon. Accessed: 8/27/2013.

Government Accountability Office. 2012. Exposure and Testing Requirements for Mobile Phones Should Be Reassessed, GAO-12-771. July 2012. Available: http://www.gao.gov/assets/600/592901.pdf. Accessed: 9/2/2013.

Gul A, Celebi H, Ugras S. 2009. The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280(5): 729-33.

Hardell L, Carlberg M, Hansson Mild K. 2013. Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 20(2): 85-110.

IARC. 2012. Non-ionizing radiation, part 2: radiofrequency electromagnetic fields. Volume 102. IARC monographs on the evaluation of carcinogenic risks to humans.

Kang G, Gandhi OP. 2002. SARs for pocket-mounted mobile telephones at 835 and 1900 MHz. Phys Med Biol 47(23): 4301-13.

Kelsh MA, Shum M, Sheppard AR, McNeely M, Kuster N, Lau E, et al. 2011. Measured radiofrequency exposure during various mobile-phone use scenarios. J Expo Sci Environ Epidemiol 21: 343-54.

Keshvari J, Keshvari R, Lang S. 2006. The effect of increase in dielectric values on specific absorption rate (SAR) in eye and head tissues following 900, 1800 and 2450 MHz radio frequency (RF) exposure. Phys Med Biol 51(6): 1463-77.

Lenhart A, Ling R, Campbell S, Purcell K. 2010. Teens and Mobile Phones: Text messaging explodes as teens embrace it as the centerpiece of their communication strategies with friends. Pew Research Center. April 20, 2010.

Li CY, Liu CC, Chang YH, Chou LP, Ko MC. 2012. A population-based case-control study of radiofrequency exposure in relation to childhood neoplasm. Sci Total Environ. 2012 Oct 1;435-436: 472-8.

Li DK, Ferber JR, Odouli R, Quesenberry CP Jr. 2012. A prospective study of in-utero exposure to magnetic fields and the risk of childhood obesity. Sci Rep 2:540.

Martinez-Burdalo M, Martin A, Anguiano M, Villar R. 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): 345-54.

MRI. 2010. Market Research Intelligence. Kids' Cell Phone Ownership Has Dramatically Increased in Past Five Years. American Kids Study data from 2005, 2007, and 2009. Available: http://www.gfkmri.com/PDF/MRIPR_010410_KidsAndCellPhones.pdf [accessed July 20 2013].

Nittby H, Grafström G, Eberhardt JL, Malmgren L, Brun A, Persson BR, Salford LG. 2008. Radiofrequency and extremely low-frequency electromagnetic field effects on the blood-brain barrier. Electromagn Biol Med 27(2):103-26.

NRC. 2008a. National Research Council. Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communication. Available: http://www.nap.edu/catalog.php?record_id=12036. Accessed: 9/2/2013.

NRC. 2008b. National Research Council report Science and Decisions: Advancing Risk Assessment Available: http://books.nap.edu/openbook.php?record_id=12209. Accessed: 9/2/2013.

Odaci E, Bas O, Kaplan S. 2008. Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological andhistopathological study. Brain Res. 1238:224-9.

Pew Research Center. 2013. Teens and Technology 2013. Available: http://www.pewinternet.org/Reports/2013/Teens-and-Tech.aspx. Accessed: 9/2/2013.

Peyman A, Gabriel C, Grant EH, Vermeeren G, Martens L. 2009. Variation of the dielectric properties of tissues with age: the effect on the values of SAR in children when exposed to walkie-talkie devices. Phys Med Biol 54(2): 227-41.

Pong. 2012. Pong submission to FCC Re: WT Docket 11-186. Available: http://apps.fcc.gov/ecfs/document/view?id=7021921006. Accessed: 8/27/2013.

Sadetzki S, Chetrit A, Jarus-Hakak A, Cardis E, Deutch Y, Duvdevani S, et al. 2008. Cellular phone use and risk of benign and malignant parotid gland tumors--a nationwide case-control study. Am J Epidemiol 167(4): 457-67.

Schoemaker MJ, Swerdlow AJ, Ahlbom A, Auvinen A, Blaasaas KG, Cardis E, et al. 2005. Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries. Br J Cancer 93(7): 842-8.

Shi D, Gao Y, Du X. 2012. The SAR value analysis of LTE terminals. 2012 International Symposium on Electromagnetic Compatibility (EMC EUROPE). Conference: 17-21 Sept. 2012.

Söderqvist F, Carlberg M, Hansson Mild K, Hardell L. 2009a. Exposure to an 890-MHz mobile phone-like signal and serum levels of S100B and transthyretin in volunteers. Toxicol Lett 189(1):63-6.

Söderqvist F, Carlberg M, Hardell L. 2009b. Mobile and cordless telephones, serum transthyretin and the blood-cerebrospinal fluid barrier: a cross-sectional study. Environ Health 8:19.

Sonmez OF, Odaci E, Bas O, Kaplan S. 2010. Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHzelectromagnetic field. Brain Res 14;1356: 95-101.

Sudan M, Kheifets L, Arah O, Olsen J, Zeltzer L. 2012. Prenatal and Postnatal Cell Phone Exposures and Headaches in Children. Open Pediatr Med Journal 6(2012):46-52.

Sudan M, Kheifets L, Arah OA, Olsen J. 2013. Cell phone exposures and hearing loss in children in the Danish National Birth Cohort. Paediatr Perinat Epidemiol 27(3):247-57.

Tawkon. 2013a. Tawkon, now keep talking. Available: www.tawkon.com. Accessed: 8/27/2013.

Tawkon. 2013b. How It Works. Available: http://tawkon.com/how-it-works. Accessed: 8/27/2013.

Vrijheid M, Mann S, Vecchia P, Wiart J, Taki M, Ardoino L, et al. 2009. Determinants of mobile phone output power in a multinational study - implications for exposure assessment. Occup Environ Med 66(10): 664-71.

U.S. EPA. 2002. A Review of the Reference Dose and Reference Concentration Processes prepared for the Risk Assessment Forum, U.S. Environmental Protection Agency EPA/630/P-02/002F. Available: www.epa.gov/raf/publications/pdfs/rfd-final.pdf. Accessed: 9/2/2013.

U.S. EPA. 2008. Integrated Risk Information System (IRIS) Guidance Documents. Available: http://www.epa.gov/IRIS/backgrd.htm. Accessed: 9/2/2013

U.S. EPA. 2009. Environmental Protection Agency. IRIS Glossary/Acronyms & Abbreviations. Available: http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=IRIS%20Glossary. Accessed: 9/2/2013

Wang J, Fujiwara O. 2003. Comparison and Evaluation of Electromagnetic Absorption Characteristics in Realistic Human Head Models of Adult and Children for 900-MHz Mobile Telephones IEEE Transactions on Microwave Theory and Techniques 51(3): 966-70.

WHO. World Health Organization. 2010. WHO research agenda for radiofrequency fields. Available: http://whqlibdoc.who.int/publications/2010/9789241599948_eng.pdf [accessed July 10 2013].

WHO. World Health Organization. 2011. IARC Classified Radiofrequency Electromagnetic Fields as Possibly Carcinogenic to Humans. Press Release # 208. 31 May 2011. Available: http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf. Accessed: 9/2/2013

Wiart J, Hadjem A, Wong MF, Bloch I. 2008. Analysis of RF exposure in the head tissues of children and adults. Phys Med Biol 53(13): 3681-95.