**Before the**
**FEDERAL COMMUNICATIONS COMMISSION Washington, D.C. 20554**

Federal Communications Commission FCC 13-39

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

# COMMENTS BY MOBILE MANUFACTURERS FORUM

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## I - INTRODUCTION AND SUMMARY

The Mobile Manufacturers Forum (MMF) submits these comments in response to the Federal Communications Commission's ("FCC") Further Notice of Proposed Rulemaking ("FNPRM") and Notice of Inquiry ("NOI") seeking comment on the FCC's regulations, rules, limits and related measures pertaining to the health and safety of radiofrequency ("RF") emissions from radio transmitters.[1] The MMF is an international association of telecommunications equipment manufacturers with an interest in mobile or wireless communications, including the manufacturers of mobile handsets and devices as well as the manufacturers of the network infrastructure. Established to support research into the health and safety of radio frequency electromagnetic fields, the MMF has worked with national and international health agencies to support identified research. Further information on the MMF can be found on our website at www.mmfai.org.

The MMF has indicated in this submission our support in-principle for the discontinuation of Supplement C and with the proposed replacement of that reference with a greater reliance on the Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB). The MMF has some concerns though and has indicated a number of principles that should govern KDB development and use. Most importantly, we urge the Commission to use the KDB process to embrace harmonization, consistent with the Commission's own

[1] See Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies; Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, First Report and Order, Further Notice of Proposed Rulemaking and Notice of Inquiry (rel. March 29, 2013) ("NPRM").

stated objectives as well as those that are required of it via the Office of Management and Budget (OMB) Circular A-119.

The MMF also supports the use of the proposed maximum time-averaged power or ERP evaluations for various transmitters. This approach has a number of practical benefits while still ensuring inherent product compliance. The MMF encourages the FCC to adopt IEC 62479-2010 as part of this process.

With regards to the FCC's exposure standards, the MMF submits that the scientific basis of these is now more than 20 years old and the rationale for continuing to maintain two separate standards in a world that has in the main adopted the guidelines set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is increasingly difficult to justify. On the contrary, there is very strong policy, practical and scientific grounds to justify an alignment with these international guidelines. The current FCC standards were based on early dosimetry considerations alone, whereas the ICNIRP 1998 or IEEE C95.1- 2005[2] standards 2.0 W/kg averaged over 10 g of tissue for general public exposure and 10 W/kg averaged over 10 g for occupational exposure are based on a significantly improved understanding of the RF and thermal dosimetry, and biological and health effects.

Both ICNIRP guidelines and IEEE C95.1- 2005 standard provide a very conservative framework for the protection of persons exposed to RF fields. From

[2] The American National Standard Institute (ANSI) adopted IEEE C95.1-2005 standard in 2006 as ANSI/IEEE C95.1-2006.

the substantial safety margin inherent in the standards themselves, through to the specificity of SAR measurement protocols and how the devices are tested compared to how they typically operate, the result is a very conservative framework suitable for widespread adoption. In fact, the World Health Organization (WHO) recommends that national governments should adopt the exposure guidelines developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998) or the Institute of Electrical and Electronics Engineers (IEEE C95.1- 2005), which are for the present purposes, essentially the same and collectively referred to as IEEE/ICNIRP or the "international standards".[3]

Currently, at least 115 countries, territories and regions use the ICNIRP guidelines as the basis of national safety standards for mobile devices and 105 for mobile phone networks. This is in contrast to only nine that follow the FCC for mobile networks and thirteen for mobile devices.

More importantly, the adoption of consistent science based standards increases consumer confidence and reduces community concerns: and as we show in the submission when countries have adopted arbitrary values in an attempt to pacify community concerns this has generally increased concern – the very opposite of what was desired. The MMF strongly urges the FCC to avoid such consequences by following science-based recommendations. The science-based approach not only will result in adoption of internationally harmonised exposure standards

[3] Both adopt a SAR compliance level of 2.0 W/kg averaged over 10 grams of tissue for general public exposure and 10 W/kg averaged over 10 grams of tissue for occupational exposure.

but, as will be shown below, will be consistent with a precautionary approach due to the ample safety margin in the current IEEE/ICNIRP standards.

Moreover, any arbitrary reduction in standards can have significant unintended consequences, which would make the operation of telecommunication networks difficult and in some cases impossible as we see in in some parts of Europe today. Thus, the MMF submits that the adoption of arbitrary values below those established by IEEE/ICNIRP and recommended by the WHO, represents a poor policy choice that actually threatens the proven safety, security and economic benefits that mobile communications provides to the community at large.

Members of the MMF remain sensitive to the concerns and questions raised with regards to RF emissions. We provide a range of consumer information including on company and industry websites and publications as well as in user manuals. If some members of the community remain concerned, the best way for them to reduce their exposure from cell phones is to follow the FCC's own advice that is consistent with the WHO's advice to use "hands-free" devices which keep cell phones away from the head and body during calls and to limit the number and length of calls.

Furthermore, the MMF supports the Commission's existing requirements to include information in device manuals to make consumers aware of the need to maintain the body-worn separation distance. While testing data for body-worn configurations would not be applicable to situations in which a consumer disregards this information on separation distance and maintains a device closer

to the body than the distance at which it is tested, we agree with the Commission's statements that this should not be viewed with any great concern for the reasons stated. As we discuss in detail in the course of this submission, both the international exposure standards and the compliance assessment framework are very conservative.

It should also be remembered that the telecommunications network is inherently precautionary. Studies of cell phones in everyday use show that when talking on a mobile phone while walking around a major city or inside city buildings, smartphones operate at less than one per cent of the phones maximum power output. This and other technical features such as discontinuous transmission, the existence of exposure standards, continuous research and on-going review as well as the availability of consumer information make the existing environment inherently precautionary.

Most importantly, international and national health authorities and expert bodies continue to maintain the consensus view that there are no established health effects below the levels recommended by ICNIRP and IEEE C95.1-2005.

These international standards are also recognised as providing ample protection for children and any other vulnerable groups in the community. The standards have taken concern such as lifetime exposure, increased absorption, and stages of childhood development into account and include significant added safety margins when setting safe exposure levels. The measurement standards have

been developed using worst-case scenarios to ensure children are adequately protected.

The MMF also submits that there is also strong congressional and executive support for the harmonisation of standards. The continued retention of the current FCC's standards, especially in the absence of scientific support from relevant standards committees, has resulted in a "government unique standard" ('GUS'), a position directly at odds with existing government policy and one which should be rectified by the adoption of IEEE C95.1-2005.

In addition, the adoption of harmonized international standards in the US would improve coverage with fewer dropped calls and better access to data services particularly in regional communities where services can sometimes be limited or patchy. Better coverage also results in better access to emergency services via the cellular network, which is a well-recognized public health benefit.

Likewise consumer expectations for mobile coverage are rapidly changing in the US like the rest of the world as more users adopt smartphones and tablets and are demanding reliable, fast and efficient mobile broadband connections. Adoption of the international standards would allow additional transmission power to be utilised in areas where the device is currently being required to operate at maximum power to connect to the network thereby effectively expanding coverage and resulting in a better mobile broadband experience.

With the extensive deployment of LTE, the United States currently enjoys a position of considerable technology leadership, but this technological lead can quickly be lost in this rapidly changing environment. Already manufacturers are finding the compliance framework established by the FCC for LTE devices exceptionally complicated and time consuming. The harmonization of standards would make the production of new devices much more efficient with only one global standard to design and comply with.

In relation to the evaluation of devices, the MMF submits that the FCC's current LTE testing requirements are unduly onerous, involving in some cases in excess of 100 SAR tests for head and body exposure in only two LTE frequency bands, equating to 4 – 6 weeks of testing for SAR type approval. Alternative approaches based on initial screening of conducted power are being used internationally and have been shown to be as effective as the current FCC specified approach. These alternative processes involve considerably less testing time – an important factor for products that often have a market life cycle of 12 months or so.

Finally, the MMF would also like to see a presumption of adoption operating where the FCC is actively involved in standards committees, rather than have all parties invest considerable time and resources into standards development only to see the FCC fail to adopt them or to mandate contradictory requirements. The MMF believes that this could be achieved through the KDB process and is consistent with the principles and requirements of OMB Circular A-119.

## II - FURTHER NOTICE OF PROPOSED RULEMAKING

### A - TECHNICAL EVALUATION REFERENCES IN RULES

The MMF notes the FCC's decision to "discontinue use of Supplement C as an informative reference for evaluation of mobile and portable devices" and, instead, to utilize "the Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB) to provide current guidance and policies on acceptable procedures for evaluating wireless devices."[4] KDBs, therefore, will constitute the sole repository of documented requirements for grant authorization testing. As such, KDB requirements will reflect, on a day-to-day basis, the extent of the FCC's commitment to harmonization with international standards and requirements.

In order for the KDB process to effectively supplant the more authoritative – but, concededly less flexible – guidance issued through an OET Bulletin and supplements, the MMF believes that KDBs must have the following qualities:

a. KDBs should be released in draft in order with an adequate notice period during which stakeholders can provide input;

[4] Id. at Paragraph 28.

b. KDBs issued in final should provide adequate time for an orderly transition of practices;[5]

c. KDBs must provide testing guidance that is consistent, as much as possible, both with current standards and international practices. (Where departure from international standards and practices are called for by a KDB, a rationale for such departure should be provided.)

d. KDBs should provide adequate flexibility to allow for innovation in both testing and technology.

In accordance with the above principles, the MMF urges the FCC to use this opportunity to embrace harmonized requirements through the KDB process. Such an approach will be in line with the FCC's statement that "we fully intend to continue to use the KDB to provide guidance on techniques and methodologies recommended by internationally and domestically accepted expert standards bodies, such as the Institute of Electrical and Electronics Engineers ("IEEE") and the International Electrotechnical Commission ("IEC"), to the extent that their standard procedures ensure compliance with our exposure limits."[6] As items covered by Supplement C are recast through the KDB process, the FCC should avoid developing unique U.S. requirements and work to keep the testing process aligned with international standard processes.

[5] The MMF members note that the FCC currently engages in such a practice, and MMF urges that this practice be continued.
[6] Id. at Paragraph 38.

By way of example, the MMF would note the ongoing issue of testing fluids for use with the SAM phantom. In 2001, the FCC initiated its ongoing requirement that simulants for head and body measurements each be unique such that two simulants are required for a complete suite of tests rather than the one simulant formula adopted in other countries, as provided for in IEC standard 62209-2 (2010). As a consequence, testing requirements are effectively doubled for products shipped to both the US and internationally since the approach outlined in the KDB must be followed for US product while product destined for the rest of the world will be tested according to IEC 62209-2 (2010).

The MMF notes that the above proposed KDB principles and our proposal for internationally recognized testing procedures are not only consistent with, but called for by the Office of Management and Budget ('OMB') Circular A-119, which directs Government agencies "to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical."[7]

[7] http://www.whitehouse.gov/omb/circulars_a119

## B - EXEMPTION OF FIXED, PORTABLE, AND MOBILE DEVICES

The MMF supports the inclusion of both MPE- and SAR-based exemptions for the various transmitters based on using the variable sliding scale as proposed in the discussion as referenced in R&O 03-137. The use of a sliding scale in regards to Maximum Permissible Exposure ("MPE") or SAR exclusion provides the industry with a more accurate tool to determine and test for compliance. Using the referenced formulas and table for SAR-based exemption, it will be possible for manufacturers of devices such as laptops with antennas built into back of the display, cordless phones, and tablets to demonstrate that maximum time-averaged power or ERP evaluations are adequate under some circumstances, thus reducing the costs of performing SAR engineering and compliance tests. Furthermore, the MMF supports the retention of the option for manufacturers to continue to do SAR testing should they wish to do so for a particular product or situation.

In reviewing Table 2 as proposed by the FCC for use with single transmitters, the MMF notes that the table does not specify the units of measurement for the power in the title to the table. The MMF therefore recommends that the actual units of measure are included as part of the table to avoid any uncertainty. The FCC should also include an explanation of which devices that the table applies to. The MMF queries whether this table will be part of the actual rulemaking or included in a KDB, since it is not clear what the FCC's intent is. For the sake of clarity, we recommend it be placed into a KDB.

For transmitters operating above 1GHz, the table has the same exclusion thresholds for 20cm as well as 40cm. While one would normally expect that the larger distance would be accompanied by an allowance for an increase in power output at higher frequencies and still be exempt, the FCC's explanation why this is not the case is an important element that should remain alongside the table in whatever form it is finally published in (i.e., KDB or Rulemaking).

Furthermore, we recommend that the FCC adopt IEC62479-2010[8] in order to provide a simple conformity assessment method for low-power equipment. IEC 62479 includes SAR-based test exemption criteria that would greatly reduce unnecessary testing for low-power devices.

[8] IEC 62479, Edition 1.0 (2010-06-16), Assessment of the compliance of low-power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz), International Electrotechnical Commission, Geneva, Switzerland.

## III - NOTICE OF INQUIRY

### A - EXPOSURE STANDARDS

The MMF notes that the FCC's existing RF exposure standards, adopted in 1996, are based on the standards extant at that time: the ANSI/IEEE C95.1-1992 Standard[9], and the NCRP's 1986 report on Biological Effects of RF Fields.[10] The scientific basis of the FCC's standard is therefore more than 20 years old and, as explained further below, has now been rejected by the majority of the world's scientists and regulatory bodies in favor of the current ICNIRP/IEEE standards. As expressly stated in the IEEE C95.1-2005 Standard:

> *Since publication of ANSI C95.1-1982 significant advances have been made in our knowledge of the biological effects of exposure to RF energy[11].*

As a result of reviews of the RF literature and the state of the science, the World Health Organization (WHO) provides the following advice to national governments with regards to RF exposure standards:

> ***Protection standards***
>
> *International exposure guidelines have been developed to provide protection against established effects from RF fields by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998) and the Institute of Electrical and Electronics Engineers (IEEE, 2005).*

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[9] The IEEE C95.1-1991 standard was adopted by ANSI in 1992 to become ANSI/IEEE C95.1-1992.
[10] 47 CFR 2.1093 (d), "The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814."
[11] IEEE C95.1-2005, page 35.

> *National authorities should adopt international standards to protect their citizens against adverse levels of RF fields. They should restrict access to areas where exposure limits may be exceeded.*[12]

The WHO advice has been widely followed. A recent paper[13] presented at the Joint Meeting of the Bioelectromagnetics Society and the European BioElectromagnetics Association in June 2013 found there are currently 115 countries, territories, dependencies and sub-national regions using the ICNIRP guidelines as the basis of national exposure standards for mobile devices and 105 for mobile phone networks. This is in contrast to only nine countries that follow the FCC standard for mobile networks and thirteen for mobile devices.

It is interesting to note that China adopted the ICNIRP guidelines in 2007 for devices[14] and several countries, including Australia[15] and Taiwan[16] that previously followed the FCC have now adopted national standards based on ICNIRP guidelines. The change in the international landscape towards greater harmonization of RF exposure standards based on IEEE C95.1-2005/ICNIRP was recognized in the recent Government Accounting Office (GAO) report:[17]

> *These international organizations have updated their exposure limit recommendation in recent years, based on new research, and this new limit has been widely adopted by other countries, including countries in the European Union.*

For the foregoing reasons, it is evident that the overwhelming view of the

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[12] http://www.who.int/mediacentre/factsheets/fs304/en/index.html accessed on 04 March 2013
[13] Rowley J., Joyner K., Zollman P. & Larsson LE. Radiofrequency Exposure Policies Relevant to Mobile Communication Devices and Antenna Sites. BioEM 2013, 10-14 June Thessaloniki Greece
[14] GB 21288-2007: *Limits for Human Local Exposure to Electromagnetic Fields Emitted by Mobile Phones*
[15] *Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz* available at http://www.arpansa.gov.au/pubs/rps/rps3.pdf
[16] CNS 14959 (2005): Limits for exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)
[17] http://www.gao.gov/products/GAO-12-771

scientific community, national experts and the international health agency actively overseeing this field, is that the current science supports the harmonized 2W/kg with 10g averaging for general public exposure and 10W/kg with 10g averaging for occupational exposure standard rather than the scientifically outdated standards still followed by the FCC.

In developing these more recent standards, the experts and scientists followed the example of the earlier standards body and built in substantial safety margins.[18] Consequently, there is no basis for continued use of the outdated standard that is no longer supported by the IEEE: it cannot be said to be either safer or more useful than the later standard. More specifically, given that both the 1.6W/kg averaged over 1 g tissue and the 2.W/kg averaged over 10 g of tissue – as well as the MPE values - are well below the threshold for adverse health effects with large safety margins[19], both values must be regarded as being equally safe for consumers.

In a world that is harmonizing around the science based international standards, any rationale for continuing to maintain a separate national standard would need to be based on strong public policy considerations. The contrary holds true, however: as detailed below there are very strong policy, as well as practical and scientific grounds to justify an alignment with international standards.

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[18] See IEEE C95.1-2005, Annex C.6 Safety factors and uncertainty factors

[19] See ICNIRP's 2009 Statement On The "Guidelines For Limiting Exposure To Time-Varying Electric, Magnetic, And Electromagnetic Fields (Up To 300 GHz) at http://www.icnirp.de/documents/StatementEMF.pdf

## B- RATIONALE FOR HARMONIZATION OF FCC'S STANDARDS

In addition to the fact that the scientific basis of the FCC's standards has become outdated with the original IEEE C95.1-1991 standard having been superseded twice in the intervening years (firstly by C95.1-1999 then by C95.1-2005), and that the WHO recommends adoption of either the IEEE C95.1-2005 standard or ICNIRP guidelines, there are significant policy grounds to justify the update and harmonization of the FCC's standards.

### 1 – CLEAR SCIENTIFIC SUPPORT FOR HARMONIZED STANDARDS

While the FCC has made the perfectly correct point that the "[c]ontinued use of present exposure limits is currently supported by statements from significant qualified expert organizations and governmental entities", it is important that the statement be understood as recognition that there is no public health risk from continued use of the standard and not as an endorsement of the thresholds of the standard. Therefore, such a statement should not be construed as support for continuing to use the outdated present standard rather than the updated one. In fact, there is strong support from international health and government expert agencies for the 2W/kg ICNIRP/IEEE standard. Key statements of such support include those made by:

The United Kingdom's Advisory Group on Non-Ionising Radiation:

*In summary, 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 adults or children.*[20]

The Swedish Council of Working Life and Social Research:

*Extensive research for more than a decade has not detected anything new regarding interaction mechanisms between radiofrequency fields and the human body and has found no evidence for health risks below current exposure guidelines. While absolute certainty can never be achieved, nothing has appeared to suggest that the since long established interaction mechanism of heating would not suffice as basis for health protection.*[21]

The German Radiation Protection Commission:

*(Unofficial Translation): … In line with other international bodies (ICNIRP 2009, WHO 2011) it can be determined that the underlying concepts of the existing protection limits are not in question.*[22]

The Norwegian Institute of Public Health:

*The current regulations are based on the ICNIRP reference values for maximum exposure. The Expert Committee does not recommend special measures to reduce exposure, e.g., by changing the threshold limit values.*[23]

These representative and recent statements, demonstrate that health agencies and expert bodies do not consider that there are any established health effects below the levels recommended by ICNIRP and IEEE C95.1-2005[24]. Taken in conjunction with the recommendation of the World Health Organization, the FCC

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[20] *Health Effects from Radiofrequency Electromagnetic Fields* – RCE 20, Advisory Group on Non-ionising Radiation (AGNIR), Health Protection Agency, April 2012. http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368

[21] *Radiofrequency electromagnetic fields and risk of disease and ill health: Research during the last ten years*, Swedish Council of Working Life and Social Research (FAS), 2012. http://www.fas.se/

[22] http://www.ssk.de/de/werke/2011/kurzinfo/ssk1109.htm

[23] "Svake høyfrekvente elektromagnetiske felt – en vurdering av helserisiko og forvaltningspraksis. FHI-rapport 2012:3" *(In English: Low-level radiofrequency electromagnetic fields – an assessment of health risks and evaluation of regulatory practice. NIPH report 2012:3).* http://www.fhi.no/dokumenter/6563fe9a33.pdf, *page 43.*

[24] Additional statements by expert bodies and health agencies are provided in Annex A.

therefore has strong scientific support for harmonizing its own standard.

## 2 – INTERNATIONALLY HARMOIZED STANDARDS PROVIDE A HIGH LEVEL OF PROTECTION FOR ALL, INCLUDING CHILDREN

The FCC has asked whether its current standards are appropriate as they relate to the use of devices by children.[25] MMF notes that the U.S. Food and Drug Administration (FDA) currently states on its website that "scientific evidence does not show a danger to users of wireless phones, including children and teenagers."[26] This position of the FDA is consistent with that of the WHO, as outlined in Fact Sheet 193: "Present scientific evidence does not indicate the need for any special precautions for the use of mobile phones. If individuals are concerned, they might choose to limit their own or their children's RF exposure by limiting the length of calls, or by using "hands-free" devices to keep mobile phones away from the head and body."[27]

Scientific reviews have specifically addressed the area of children's RF exposure. For example, in a 2009 survey of relevant research conducted by seven internationally recognised experts, the researchers determined:

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[25] Id. at Paragraph 6
[26] http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116331.htm (accessed on 21 May 2013)
[27] http://www.who.int/mediacentre/factsheets/fs193/en/index.html

> *Overall, the review of the existing scientific literature does not support the assumption that children's health is affected by RF EMF exposure from mobile phones or base stations.*[28]

Similarly a 2007 review by the Irish Government Expert Group[29], which conducted an in-depth scientific review of all the science on mobile phones and children, found:

> *There is no data available to suggest that the use of mobile phones by children is a health hazard.*

Likewise a 2011 review by the Health Council of the Netherlands[30] concluded:

> *There is no scientific evidence for a negative influence of exposure to electromagnetic field of mobile telephones, base station antennas or Wi-Fi equipment on the development and functioning of the brain and on health in children. This is the main conclusion of an advisory report the Health Council presented today to the State Secretary of Infrastructure and the Environment.*

Also, a comprehensive review of all the scientific evidence by the UK Health Protection Agency's independent Advisory Group on Non-ionising Radiation (AGNIR)[31] in April 2012 concluded:

> *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 effects in adults or children.*

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[28] "Children's health and RF EMF exposure" was issued by the Mensch Umwelt Technik (MUT) of the Julich Research Institute, Germany.

[29] http://www.dcenr.gov.ie/NR/rdonlyres/9857119F-CE1A-443F-9F17-44BB299D6FE6/0/ReportoftheExpertGroupontheHealthEffectsofElectromagneticFields2006.pdf

[30] Health Council of the Netherlands, 2011, *Influence of radiofrequency telecommunication signals on children's brains*. The Hague: Health Council of the Netherlands, 2011; publication no. 2011/20E. ISBN 978-90-5549-859-8

[31] http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368

Thereafter a review[32] by the Norwegian Institute of Public Health in September 2012 also found there was no scientific evidence for an association between mobile phone use and fast or slow growing brain tumours for people who had used mobile phones for up to 20 years. The research Committee considered the implications of long-term phone use for young people and the likelihood of health hazards occurring in the future and found they were unlikely:

> *There is always an element of uncertainty in all risk assessments. In this case, the Committee considers the uncertainty to be small... It is unlikely that long-term use of mobile phones will cause health risks that are unknown today.*

An Austrian study[33], published in January 2008 investigated previous health risk assessments and established physiological knowledge regarding mobile phone use, particularly with reference to children's health. The report stated:

> *Based on the assessments of the international committee and established knowledge on children's development it can be concluded that existing exposure limits do in fact provide reasonable safety.*

Furthermore, the report concluded:

> *There are no sufficient grounds to generally condemn mobile phone use by children, in particular, nor is there an established basis for pinpointing a specific age limit (above 3 years) as has been done by some overreacting committees.*

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[32] Low-level radiofrequency electromagnetic fields – an assessment of health risks and evaluation of regulatory practice. NIPH report 2012:3, 978-82-8082-510-0 English Summary, viewed 24 July 2013 http://www.fhi.no/dokumenter/c5ab86c32b.pdf

[33]Norbert Leitgeb, 2008, *Mobile phones: are children at higher risk?* Institute of Clinical Engineering, Graz University of Technology, Infeldgasse 18, Graz, Austria. Wiener Medizinische Wochenschrift 02/2008; 158(1-2):36-41. DOI:10.1007/s10354-007-0447-1

A study[34] conducted at the German Academy of Pediatrics and Adolescent Medicine published in October 2007, said there is no indication that children are particularly vulnerable to electromagnetic fields:

> *There are presently no scientific data supporting the concept of a special vulnerability of children and adolescents to high-frequency EMF, even if the usual caveats (developing organisms and structures may be more vulnerable, decades of life to come) are considered.*

International safety standards have taken these concerns and potential risks into account when setting their recommendations. The guidelines have been developed using worst-case scenarios and include added safety margins to ensure children are protected. For example, then Chairman of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), Dr. P. Vecchia stated[35]:

> *The protection system using basic restrictions and reference levels makes the ICNIRP guidelines flexible and applicable to virtually any exposure condition, and any group of population. Therefore, there is no need, or justification, for a special approach to the protection of children.*

Research has also been undertaken to assess whether there are differences between the absorption of RF in adults or children. Papers by Schönborn et al.[36], Kuster and Balzano[37], Hornbach et al.[38] and Meir et al.[39] have found that there

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[34]Otto M, von Mühlendahl, KE, 2007, *Electromagnetic fields (EMF): do they play a role in children's environmental health (CEH)?* Int J Hyg Environ Health. 2007 Oct;210(5):635-44. Epub 2007 Aug 31.

[35] Dr P. Vecchia, Chair ICNIRP, WHO meeting, Electromagnetic Fields and Children, Istanbul, 9-10 June 2004.

[36] Schonborn F., Burkhardt M., Kuster N. Differences In Energy Absorption Between Heads Of Adults And Children in the Near Field Of Sources. Health Physics, Vol. 74, Pg. 160 - 168, 1998

[37] Kuster N And Balzano Q. , Energy Absorption Mechanism by Biological Bodies in The Near Field Of Dipole Antennas Above 300 MHz. IEEE Transactions On Vehicular Technology, Vol. 41, No. 1, February 1992

[38] Hombach V., Meier K., Burkhardt M., Kuhn E., And Kuster N., The Dependence of EM Energy Absorption upon Human Head Modeling at 900 MHz. IEEE Transactions On Microwave Theory

are no significant differences between the absorption of RF in adults or children. Gandhi and Kang[40] and Bit-Babik et al.[41] have reported similar SAR patterns in adult and children head, in contrast to the results shown in Gandhi et al.[42] which were due to improper scaling of the size and color.

The results of these studies into children's absorption of RF have been considered by several expert and health agency reviews. In 2004, the Health Council of the Netherlands considered the available research on mobile phones and children and concluded:

> *There is no scientific data to assume a difference in the absorption levels of electromagnetic energy in heads of children and adults, nor is it likely that the electromagnetic sensitivity of children's heads changes significantly after the second year of life. Because of this, the Health Council of the Netherlands sees no reason for recommending limiting the use of mobile phones by children.*

The Health Council of the Netherlands[43] also specifically addressed the question of whether or not there needed to be different exposure limits for children or other vulnerable groups in the community and concluded:

> *The answer to this question is: no, because the potential additional*

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and Techniques, Vol. 44, No. I0, October 1996

[39] Meier K., Hombach V., K¨Astle R.Tay R., Kuster N., The Dependence Of Electromagnetic Energy Absorption Upon Human-Head Modeling At 1800 MHz. IEEE Transactions on Microwave Theory and Techniques, Vol. 45, No. 11, November 1997

[40] Gandhi O And Kang G. 2002. Some Present Problems And A Proposed Experimental Phantom For SAR Compliance Testing For Cellular Telephones At 835 And 1900 MHz *Phys. Med. Biol.* 47: 1501–18.

[41] Bit-Babik G, Guy A W, Chou C K, Faraone A, Kanda M, Gessner A, Wang J And Fujiwara O. 2005. Simulation of Exposure and SAR Estimation for Adult and Child Heads Exposed to Radiofrequency Energy from Portable Communication Devices *Radiat. Res.* 163: 580–90.

[42] Gandhi O P, Lazzi G, and Furse C. 1996. Electromagnetic Absorption in the Human Head and Neck for Mobile Telephones at 835 And 1900 MHz *IEEE Trans. Microw. Theory Tech.* 44**:** 1884–97.

[43] Health Council of the Netherlands, 2011, *Influence of radiofrequency telecommunication signals on children's brains*. The Hague: Health Council of the Netherlands, 2011; publication no. 2011/20E. ISBN 978-90-5549-859-8

*sensitivity of children and other vulnerable groups was explicitly accounted for in setting the exposure limits.*

*It is one of the reasons why the exposure limits for the general population include an ample uncertainty margin of a factor of 50. Based on the data presented in this report, the Committee sees no reason to recommend different exposure limits for children than for adults.*

Furthermore the Health Council of the Netherlands also undertook a further report in 2011[44] on the issue and reached the following conclusion:

*In summary, the Committee concludes that there is no cause for concern based on the knowledge about short-term effects outlined in this advisory report. Available data do not indicate that exposure to radiofrequency electromagnetic fields affect brain development or health in children.*

It is also instructive to note that when the Australian Radiation and Protection and Nuclear Safety Agency moved away from the FCC's standard to adopt the ICNIRP guidelines in their new standard, it stated on the issue of children and mobile phones[45]:

*In respect to the ongoing debate about possible health effects arising from use of mobile phone handsets, it has been suggested that children may be more vulnerable than adults because of their developing nervous system and greater absorption of energy in the tissues of the head (IEGMP 2000). However, there is insufficient evidence to substantiate this hypothesis. For mobile phone handsets, the basic restriction is spatial peak SAR applicable to all individuals of different sizes including children. Schönborn, Burkhardt and Kuster (1998) have shown that, at mobile phone frequencies, there is no substantive difference in the absorption of RF energy between an adult head and the heads of children aged 3 and 7 years. Notwithstanding this, the basic restrictions given in this Standard account for different sizes and tissue properties of all individuals including children.*

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[44] Influence of radiofrequency telecommunication signals on children's brains. The Hague: Health Council of the Netherlands, 2011; publication no. 2011/20E: http://www.gezondheidsraad.nl/sites/default/files/201120E.pdf

[45] Radiation protection Standard for Maximum Exposure to Radiofrequency Fields - 3kHz to 300GHz (2002) published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2002

While the policy and scientific discussions continue, it is clear that parents are deciding for themselves whether their children should use a mobile phone or not. By and large, parents appear to be allowing their use because of the perceived benefits in terms of safety and security that mobile phones provide for both children and parents alike.

Therefore the weight of scientific evidence, as reviewed by the experts in several independent fora, supports the position that the international standards provide ample protection for children and continue to be sufficient without additional measures being needed.

## 3 – INTERNATIONAL STANDARDS PROVIDE A BIOLOGICAL BASIS BETTER SUITED TO A HEALTH PROTECTION STANDARD

On the issue of the differences between the averaging of exposures,[46] the MMF notes that the FCC's peak spatial-average SAR for localized exposure of the general public (1.6 W/kg averaged over 1 g of tissue) and workers (8 W/kg averaged over 1 g of tissue) are based on the C95.1-1991 standard (and NCRP Report 86) which differ from the 2 W/kg and 10 W/kg averaged over 10 g of tissue SAR recommendation found in the ICNIRP guidelines and the IEEE C95.1-2005 standard.

In the revised IEEE C95.1-2005 standard, the recommended peak spatial-

[46] Id. at Paragraph 220

average SAR values for the controlled environment and the general public (if no RF safety program is implemented) have been changed and are now harmonized with the ICNIRP SAR guidelines, i.e., 10 and 2.0 W/kg averaged over 10 g of tissue, respectively. The rationale for the change is explained in Appendix C, Section C.2.2.2.1 of C95.1-2005. Whereas the 1991 SAR values were based on early dosimetry considerations alone, those in the 2005 standard are based on a significantly improved understanding of RF and thermal dosimetry and biological/health effects considerations as explained in the standard itself:

> The peak spatial-average SAR limits in IEEE Std C95.1, 1991 were based on dosimetry considerations. The 8 W/kg and 1.6 W/kg limits were determined from the 20:1 ratio between the peak spatial-average SAR and whole body average (WBA) SAR in experimental data available in the late 1970's. The 1 g averaging mass was consistent with data limited by the resolution of thermographic measurements at the time. Recent advances in numerical calculations have shown that the ratio of peak spatial-average SAR to WBA SAR for a 1 g averaging mass can be much higher, with reported values of more than 100:1.
>
> The committee, however, considered it inappropriate to relax the peak spatial-average SAR limits to 40 W/kg and 8 W/kg for the revision and instead discussed alternatives, one of which was to examine the basis of the ICNIRP peak spatial-average SAR limit. In an ICNIRP statement, a 10 gram averaging mass was recommended, "because of the very inhomogeneous spatial distribution of energy absorbed inside the head, together with concerns about possible localized heating of the eye and other parts of the head with equivalent mass." The committee agrees that the biologically based ICNIRP rationale is more appropriate than the purely dosimetry based rationale in IEEE Std C95.1-1991.
>
> Furthermore, the limit of 10 W/kg averaged over 10 g is supported by results from animal experiments showing that this limit is 10 times below the SAR threshold for cataracts in humans, which is estimated to be 100 W/kg deposited in the eyeball, a mass of about 10 g.[47]

[47] Paraphrased, Appendix C, Section C.2.2.2.1 IEEE C95.1-2005

The scientific judgment of IEEE, as expressed above, is very much in line with the views of other independent expert groups around the world. For example, McIntosh and Anderson indicated in their paper[48]:

> *Similarly for SAR, the averaging mass of 10 g appears superior (when compared to 1, 3, 5, and 7 g). This superiority disappears at 6 GHz where none of the averaging volumes/masses perform well. That is, the analyses suggest that as the frequency of exposure increases to 6 GHz, the ability of SAR and VAR appears to diminish as a reliable correlate to DT, in line with previous findings by Hirata and Fujiwara [2009] and McIntosh and Anderson [2010a], and the incident power flux density should be considered as a more suitable exposure metric for RF safety limits.*
>
> *Both the cube and the sphere appear to be equally suitable averaging shapes with minimal differences found between the two in the analyses performed in this article. Therefore, for safety standards and guidelines, it is recommended to specify the averaging shape that is easier to assess.*

The above comments indicate that there is a strong justification for the IEEE C95.1-2005 recommendation for SAR values to be averaged over a 10 g cube and applicable up to 6 GHz.

Likewise in relation to the comments and questions with regards to possibility of a 30-minute source-based averaging time[49], the MMF notes that this is also derived from the IEEE C95.1-2005 Standard. This averaging time can be source-related, e.g., the source repetition method, or use-related, i.e., designed to ensure that devices that have a particular functionality or usage condition will comply with the limit when measured over the time period in question[50]. If consumer demand is for devices with particular features (for example a device that has a

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[48] McIntosh RL., and Anderson V. SAR Versus VAR, and the Size and Shape That Provide the Most Appropriate RF Exposure Metric in the Range of 0.5-6 GHz, *Bioelectromagnetics* 32(4): 312-321, 2011

[49] Id. at Paragraph 222

[50] Further comment on time averaging is provided in Annex B.

"super burst" mode that could be activated in emergencies to boost TX power when a signal may not be available or reception is very poor) and it is tested according to the standard, then that should be permitted. In such a case, the phone would be designed to still be compliant with the standard using the permitted time-averaging period. Ensuring compliance with the standard over a time period that reflects the technology or reflects the intended use, still ensures that the overall objective is achieved.

Therefore considering the intent of the standard (and the FCC's objective) is to provide adequate protection for human exposure to RF energy, then it makes sense for the FCC to adopt a standard that is both biologically based and one that also takes into account the variety of ways that products can use RF energy.

## 4 – INTERNATIONAL STANDARDS ARE CONSERVATIVE

The MMF notes that both ICNIRP and IEEE C95.1-2005 provide a very conservative framework for the protection of persons exposed to RF fields. From the substantial safety margin inherent in the standards themselves, through to the specificity of SAR measurement protocols and how the devices are tested compared to how they typically operate, the result is a very conservative framework suitable for widespread adoption.

The following provides details on how conservativeness is built in to various components of the standards:

### a) The safety margin built into the standards

As the IEEE C95.1-2005 standard details:

*The safety factor for whole-body exposure durations greater than the averaging time has been estimated to be in the range of 10 to 50 in power (10 to 17 dB) for the upper tier BRs or MPEs. The corresponding BRs and MPEs of the lower tier incorporate an additional safety factor of 5 relative to the upper tier, i.e., an additional 7dB. The safety factors for special exposure measures, such as peak (short pulse) limits and contact and induced currents in the limbs, are often related to the safety factors incorporated in the BRs or MPEs for fields. This factor is generally of the order of at least 10dB.*

**b) SAM phantom**

The combination of higher tissue conductivities, a large head size, a thin ear and the exclusion of a hand holding the handset were all chosen to provide a conservative estimate of the peak spatial-average SAR associated for the operating configurations expected by typical wireless handset users.

The collective impact of the above parameters is to produce a margin such that the SAR values assessed using the test procedures of this standard are expected to be higher than during actual use conditions of a handset.

i. **Head size:** A head geometry that results in overall smaller distances between the handset and the tissue boundary will provide more conservative results because the separation between the equivalent current densities on the device under test and the tissue equivalent liquid will be less. Thus, a larger anthropomorphic head model, with larger local radii of curvature, will satisfy the criterion for minimal distances.

ii. **Phantom shape:** The dimensions and shape of Specific Anthropomorphic Mannequin (SAM), except for the ear protrusions discussed later, were derived from a subset of the 90$^{th}$ percentile dimensions from the survey of the US Army males.

iii. **Head tissue-equivalent liquid:** To fulfil the conservative criteria in SAR assessment, the homogenous liquid parameters must be carefully selected taking into account the energy coupling enhancement due to standing waves that occurs in tissue layers of the human head. The tissue-equivalent liquids are based on a study of the anatomical variations in the head region behind and above the ear for a cross section of a representative user population. At each frequency, the possible ranges of layered-structure thickness and conductivity of the tissue-equivalent liquid that resulted in the highest peak spatial-average SAR values (1 g and 10 g average) were evaluated. Dielectric properties for homogeneous head tissue-equivalent liquids were determined to produce the same (or slightly higher) peak spatial-average SAR values compared to the highest values occurring in the heterogeneous cases.

iv. **Pinna shape, orientation, and thickness:** In the selection of any phantom for handset SAR testing, a properly designed and positioned pinna (external ear) is necessary in order to achieve correct and repeatable geometrical relationships between the handset and the tissue boundary. For SAM, the pinna orientation and shape were selected to maximize the inductive coupling from a handset. The relevant IEEE standards committee decided to

simulate the pinna using a stable, simplified loss-less spacer with a thickness of 6 mm (inclusive of the 2 mm phantom shell thickness). This spacer thickness is considerably less than the typical 19–28 mm spacing between the rear edge of the pinna (when not compressed) and the head shown in the anthropometric data, thereby contributing to the conservative conditions of SAM for SAR assessments.

The conservativeness of SAM has been repeatedly shown in numerous computational studies using anatomical correct models from MRI scans. The spatial peak SARs in the SAM head model used for compliance evaluation have been shown to be conservative for both adults and children (by the teams of Beard et al[51]., Chris et al.[52] and Hadjem et al.[53]). Their conclusions are summarized in the following statements taken from the abstracts of their papers:

*The results show that when the pinna SAR is calculated separately from the head SAR, 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 for both the 1- and 10-g averages than did the smaller (child) head for all conditions of frequency and position. [Beard et al.]*

*The peak spatial specific absorption rate (SAR) assessed with the standardized specific anthropometric mannequin head phantom has been*

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[51] Beard BB, Kainz W, Onishi T, Iyama T, Watanabe S, Fujiwara O, et al., "Comparisons of computed mobile phone induced SAR in the SAM phantom to that in anatomically correct models of the human head," *IEEE Trans. Electromagn. Compat*., vol. 48, no. 2, pp. 397–407, May 2006.

[52] Christ A, Gosselin MC, Christopoulou M, Kuhn S, Kuster N, "Age-dependent tissue-specific exposure of cell phone users," *Phys. Med. Biol.*, vol. 55, pp. 1767–1783, Mar. 2010.

[53] Hadjem A, Conil E, Gati A, Wong MF and Wiart J, "Analysis of power absorbed by children's head as a result of new usages of mobile phones," *IEEE Trans. Electromagn. Compat*., vol. 52, no. 4, pp. 812–819, Nov. 2010.

*shown to yield a conservative exposure estimate for both adults and children using mobile phones. [Chris et al.]*

*The specific anthropomorphic mannequin (SAM) homogeneous head model has been also used to compare all the results and to confirm that the SAM model always overestimates adult and child head exposure… It was also pointed out that the value of the maximum local peak SAR in the SAM was always higher than in the adult and children models. [Hadjem et al.]*

The MMF notes that IEEE 1528-2003 provides additional information about the SAM phantom in Section 5 of the standard.

### c) Testing at Maximum Power

During SAR testing, the devices are tested using maximum power. In reality this is rarely experienced by users due to the existence of adaptive power control in the network. Power control is undertaken at the cell site level and serves to adjust the output power only to that level needed to make and maintain a quality connection. Discontinuous transmission is another network efficiency feature by which transmissions are minimised when the user is not talking, but rather listening[54].

Studies that have been undertaken on devices in real network conditions have shown that devices operate at average power levels of between 1% to 35% of their maximum as a result of power control and discontinuous transmission[55]. A more detailed discussion and their impact can be found in section D2 of this document, however the result is that by testing the devices at maximum power and without taking into account the impact of

[54] Further information about power control and discontinuous transmission is contained in Annex C
[55] Study details are provided in Annex C

power control and discontinuous transmission results in a very conservative SAR result.

The combination of all of these factors undoubtedly results in a very conservative compliance framework, such that even if one or more elements is shown at a later date to require modification, or the users fails to use the device as intended, the end result in terms of fundamental safety is not in question. As the FCC itself points out in relation to the issue of body-worn usage where a consumer disregards the information contained in product documentation about the correct distance to use the device, "a use that possibly results in non-compliance with the SAR limit should not be viewed with significantly greater concern than compliant use" as there is "no evidence that this poses any significant health risk"[56]. Therefore, in relation to the issue of separation distance, the MMF submits that there is no need to change existing requirements.

What can be established though from the above discussion is that both ICNIRP and IEEE C95.1-2005 provide a conservative exposure standard, and along with the relevant testing requirements, provide for a conservative compliance assessment framework.

## 5 – CONGRESSIONAL AND EXECUTIVE SUPPORT FOR HARMONIZATION

With the passage of section 12(d)(1) of the National Technology Transfer and

[56] Id. at Paragraph 251

Advancement Act (NTTAA)[57], Congress gave a clear direction to all federal agencies to use standards developed by voluntary consensus organizations as a means to carry out policy objectives or activities. The only exceptions to this mandate were if the use of these standards were inconsistent with applicable law or otherwise impractical (12(d)(3)).

This was further elaborated upon by the Office of Management and Budget ('OMB') Circular A-119[58], whereby Government agencies are "*direct(ed) to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical.*"

The FCC has previously acknowledged[59] that ANSI/IEEE C95.1-1992, was a voluntary consensus standard for the purposes of the Act. At that time, the FCC drew upon two lines of reasoning to suggest that adoption of the standard 'in its entirety' was "impractical". The first was that that ANSI/IEEE C95.1-1992 was not an internationally accepted consensus standard since it differed in key aspects from the recently released ICNIRP recommendations and secondly, that comments were filed by Federal health and safety agencies in that proceeding indicating that they were concerned about the safety ramifications of adopting certain aspects of the ANSI/IEEE C95.1-1992 standard. Therefore, based on these comments, the FCC concluded that adoption of ANSI/IEEE C95.1-1992 in its entirety would be problematic, and, therefore, would constitute an "impractical" action under the above-noted provision of the NTTAA, since it

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[57] 15 U.S.C. §3701 et seq. (1996)
[58] http://www.whitehouse.gov/omb/circulars_a119
[59] Second Memorandum Opinion and Order and Notice of Proposed Rulemaking, 12 FCC Rcd 13494 (1997) at Paragraph 36

would not satisfy public safety concerns raised by these expert federal safety and health agencies.

In relation to the first argument, the passage of time has now resulted in a harmonized "internationally accepted consensus standard", since both ICNIRP and IEEE C95.1-2005 are harmonised in relation to the partial body exposure limits of 2W/kg over 10gm averaging mass. While C95-1 MPE values for general public exposure are identical to the ICNIRP reference levels for 30 MHz to 100 GHz, the differences at lower frequencies that do exist seem hardly sufficient to claim that it is not an internationally accepted consensus standard. The World Health Organization itself recommends adoption of either IEEE C95.1-2005 or ICNIRP and recognises them from a health protection standpoint as being equal. The recommendation of the World Health Organization should also go in no small part to addressing the second of the concerns raised in the 1997 proceeding, at least with respect to the adequacy of the standard. While the WHO is not a US health agency, its recommendations and advice are carefully considerable by US agencies in other policy areas.[60]

In view of the Congressional and Executive mandate for agencies to adopt consensus standards, the existence of a harmonized internationally accepted consensus standard, the FCC's prior acceptance of the IEEE C95.1 standard as fulfilling the necessary criteria in principle and that health agencies such as the World Health Organization recommend its adoption, the MMF would submit that there is very strong support for the adoption of IEEE C95.1-2005.

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[60] For example the US Environmental Protection Agency adoption of WHO Dioxin Toxicity Equivalence Factors for Human Health Risk Assessments – see http://www.epa.gov/raf/hhtefguidance/

In light of the above, and noting that the FCC has stated that it is "confident in its own ability to remain abreast of scientific developments and research…as is necessary to make an independent determination of its exposure limits in the absence of affirmative input from agencies with more health and safety expertise"[61], the MMF submits that in the absence of inputs from other health agencies to the contrary, that the FCC moves to align its standards with those of IEEE C95.1-2005, being as it is a voluntary consensus standard and one that is accepted internationally.

While the existing standards are partly based on ANSI/IEEE C95.1-1992 and that in the 1997 proceeding the FCC decided at that time that it was "impractical" to adopt the standards in their entirety,[62] the language and logic in that Order led to the unavoidable conclusion that the FCC was knowingly mandating a government unique standard ('GUS').[63] We are now in substantially changed circumstances from those conditions and there is no need to continue to maintain the current standard, either formally or informally, as a GUS. The FCC in the current proceeding does not present any reasons why the 2005 version of the C95.1 standard would or could be considered "inconsistent with law or otherwise impractical" for adoption.

In view of the overwhelming international support for a harmonized exposure standard, together with the very clear Congressional and Administration direction for agencies to adopt voluntary consensus standards, the MMF submits

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[61] Id. Paragraph 215
[62] Second Memorandum Opinion And Order And Notice Of Proposed Rulemaking FCC 97-303 at Paragraph 36
[63] The fact speaks for itself, notwithstanding that the Commission did not list the RF exposure limits as a GUS in its 2012 report on NTTAA compliance.

that the FCC should align its standards with those of IEEE C95.1-2005.

## 6 – BENEFITS TO CONSUMERS IN RURAL AND REGIONAL AREAS

Harmonization between the current FCC standard and the international standard would provide both coverage and quality of service benefits for consumers living in rural and regional areas as well as those in areas of limited coverage. Use of the harmonized standard allows handsets to operate within a greater power range when needed thereby increasing the ability to connect to cellular networks, extend cell coverage and to maintain call quality in areas where handsets designed to current US standards will struggle.

Adoption of the international standard would allow a device to utilize additional transmission power ('TX') when needed which current US models can't in order to ensure compliance with the FCC's current standards. We provide further technical details on the extent of this additional TX power in Annex D.

Importantly, this additional TX power would only be relevant when the handset was being asked to operate at its current maximum – and that only occurs in areas of very poor coverage or signal strength such as in rural and regional areas or in difficult urban areas such as a basement garage.

The additional TX power available within the handset as a result of harmonization would also have the added benefit of extending the effective coverage of a given cell by 35-40% or increasing its capacity by around 30%. In urban areas the additional capacity will be useful to handle greater data

demands while in areas with marginal existing coverage the extended coverage will make a significant improvement to users experience. Calculations for this additional coverage and capacity are also included in Annex D.

It is also important to note though that the additional TX power that would come from a change in the standards does not imply that most consumers would be exposed to greater RF emissions. As for devices in use today, the power control in the network will only instruct the device to operate at the level needed to make or maintain a call. Therefore in areas with good coverage the actual TX level of both an existing handset and one designed to comply with the international standards would, in the same location and utilizing the same frequencies, be the same. The key difference though would be in areas where existing handsets are struggling to make and maintain a call or connection, whereby the additional TX power would make a noticeable difference for the consumer.

The reported maximum SAR for a given device is often the result of taking into account the impact of multiple transmitters being active simultaneously. For example, a US device with a maximum reported SAR of 1.50 W/kg, might have a 'cellular' component equating to 1W/kg on a particular band with the remaining 0.50W/kg being contributions from simultaneously active Wi-Fi and Bluetooth antennas. Thus even with the current standards, manufacturers are not able to fully utilize the available TX power for cellular bands as they must ensure compliance in situations where simultaneous transmissions can occur. Adoption of the international standards would not change the need to take into account multiple transmitters, but it would allow manufacturers to adjust TX power in

the cellular bands while still ensuring compliance when testing with multiple transmitters.

Also, the FCC is aware of the complex nature of SAR measurement and the many factors that can influence it. It should not therefore be assumed that even if a change in the FCC's standards occurred that every handset would have a higher SAR. Constant innovation in device design, internal layout and improvements in antenna performance and design will all still continue to take place and will continue to have significant influence on the resulting SAR for a device.

While the exact impact of these changes involves rather complex modeling to ensure directly comparable results (the FCC's standards for both base stations and handsets differ from those adopted in IEEE C95.1- 2005 and those used elsewhere in the world), the data[64] clearly demonstrates that US consumers would enjoy a number of direct benefits from the international harmonization of the FCC's standards.

## 7 – HARMONIZATION HELPS MEET CONSUMER DEMAND FOR COVERAGE

In the US, trends in mobile wireless services continue to evolve from primarily voice-centric to data-centric according to the FCC's 16th Mobile Competition

[64] See Annex D for further details

Report.[65] U.S. mobile data traffic increased 270 per cent from 2010 to 2011 and has more than doubled each year for the past four years.

U.S. mobile networks carried 69 per cent more data traffic in 2012 than in the prior year, but roughly the same number of voice minutes and fewer SMS messages, according to the CTIA.[66] In 2012, smartphone adoption increased, with 55.5 per cent of mobile wireless consumers reported to have smartphones as of July 2012, up from 41 per cent in July 2011.

Around the world consumer expectations for mobile coverage are changing and this trend is also likely to become more evident in the United States as more users adopt smartphones and other wireless devices that require fast and reliable mobile broadband connections. As has been detailed in the preceding section, a key benefit for adopting the international standards is the improved coverage, greater network capacity and better data rates over an extended area – all of which will lead to a better wireless telephony and broadband experience for consumers.

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[65] FCC 16th Mobile Competition Report March 21, 2013: http://www.fcc.gov/document/16th-mobile-competition-report

[66] CTIA Semi-Annual Year-End 2012 Wireless Industry Survey: http://www.ctia.org/advocacy/research/index.cfm/AID/10316

## 8 – HARMINZONISATION STRENGTHENS US TECHNOLOGY LEADERSHIP

With the deployment of LTE, the United States currently enjoys a position of considerable technology leadership. The speed at which the technology has been deployed and the consumer uptake has been such that a recent report by the GSM Association estimates that by the end of 2013, 19% of US connections will be on LTE compared to only 2% in the European Union[67].

But as has often been seen, this technological lead can quickly be lost in this rapidly changing environment. Already manufacturers are finding the compliance framework established by the FCC for LTE devices exceptionally complicated and time consuming. Our concerns in this area are detailed separately, but standards harmonization would make the design and development of new devices much easier since there would only be one standard in the world to design for.

As the US Chamber of Commerce remarked recently, 95% of the world's consumers live outside of the United States[68], and harmonization can only help US companies gain greater access abroad. Manufacturers would clearly benefit from being able to design products for a global market and not just for the US market.

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[67] *Mobile Wireless Performance in the EU and the US*, GSM Association, May 2013
[68] U.S Chamber of Commerce, *U.S Chamber Welcomes Executive Order on International Regulatory Cooperation*, Press Release, May 01, 2012

Likewise, retention of the existing outdated standards also hurts US interests. India, recently decided to adopt the FCC's standards for handsets, but rather than this being a good development for US companies, it has caused considerable disruption and problems for all players in the market. India essentially uses European frequency bands, and thus by adopting the FCC standards for handsets, has effectively created a 'third' set of compliance requirements for the industry to design and test to. Despite the disruption that this has caused US and other manufacturers, the United States has no grounds upon which to complain since the Indian Government has adopted the FCC's standard - yet few would argue that this benefits anyone.

Thus if the FCC, and by extension the United States, wants to remain an influential and thought leader in this domain, international harmonization needs to be seen as being in the best interests of the United States.

**C - CONSUMER INFORMATION**

The MMF supports the FCC's statement that "[s]everal general strategies are available for users of portable devices that want to reduce their exposure." including "increasing distance from the device and decreasing time of use are obvious actions to reduce exposure"[69]. Information such as that already provided by the FCC is extremely helpful in reminding consumers that they can limit or reduce their exposure should they wish to. This advice is also consistent

[69] Id. Paragraph 233

with the statements made by the WHO[70]:

> *In addition to using "hands-free" devices, which keep mobile phones away from the head and body during phone calls, exposure is also reduced by limiting the number and length of calls...*

Members within the MMF also provide information consistent with the above to consumers within the SAR information section of their user guides and/or their websites. This includes the following statement:

> *Organizations such as the World Health Organization and the US Food and Drug Administration have stated that if people are concerned and want to reduce their exposure they could use a hands-free device to keep the phone away from the head and body during phone calls, or reduce the amount of time spent on the phone.*

In addition to the above information the MMF has also expanded our SAR reporting program – now known as SAR Tick. The SAR Tick initiative incorporates a number of elements:

(a) The introduction of a SAR Tick (see below) to provide a visual confirmation that the phone has been tested for SAR compliance and provides a link to a new consumer-oriented website on SAR issues; and

(b) The inclusion of additional information in the "health and safety section/important product information section" of the user manual; and

(c) The modification of the existing SAR information text to include a clear table of the maximum SAR values for the device and the operating conditions under which they were recorded.

[70] http://www.who.int/mediacentre/factsheets/fs193/en/

With regards to (a & b) some manufacturers now include a new SAR Tick logo in the front section of the user manual or in the short guide that accompanies the phone, similar to the following:

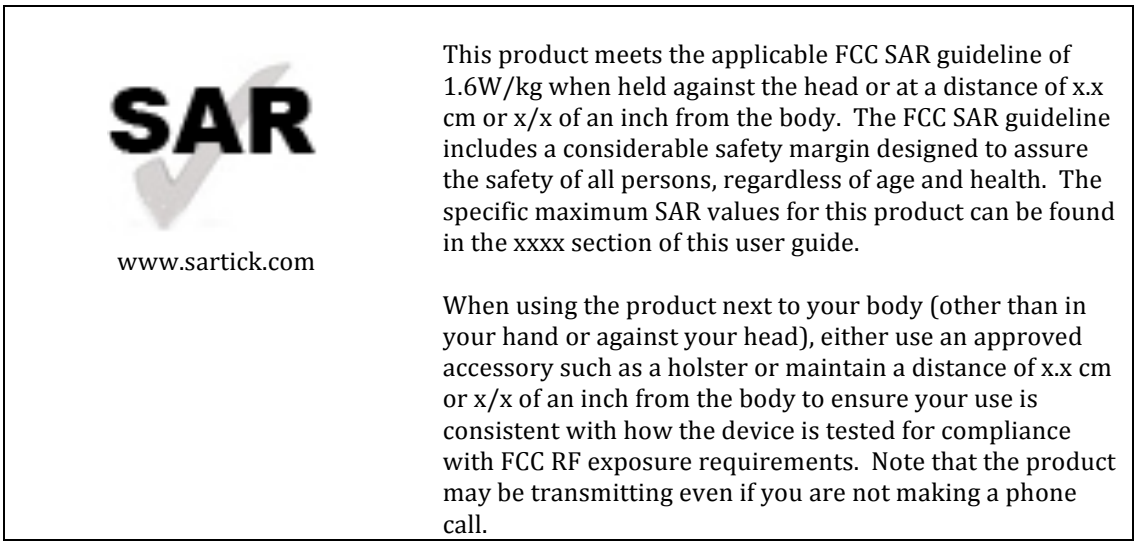


**Figure 1: Example of SAR Tick logo and accompanying text.**

The logo serves to visually reinforce the text, and provides a short summary of the essential compliance information for the device. The text also provides a reference to the full SAR compliance information that is often located elsewhere in the manual. This format meets the key outcomes raised by stakeholders for (a) greater visibility within the manual, and (b) providing key information in the safety or 'important product information' section that appears 'up front'. Such an approach also allows manufacturers the flexibility to provide a full explanation and proper context to SAR in the section of their user manual that best fits with the overall structure/layout of the document.

The SAR-tick logo also includes a link which directs consumers to www.sartick.com - a new comprehensive and dedicated website focussing on SAR which consolidates existing and new SAR resources for the general public.

With regard to element (c) discussed above, some MMF members are now including additional information in the full SAR compliance information section of the user manual. This information includes the maximum SAR recorded for both head and at the body and includes the operating conditions that this maximum was recorded at. The presentation of this information is clearer and again addresses concerns raised by stakeholders. The information is provided with explanatory text that helps consumers know more about what SAR is and how it is measured as well as the practical advice that the FCC and the FDA have provided for those consumers who wish to reduce their exposure – as mentioned above. The full text of this SAR explanatory text is provided in Annex E.

In addition to the information provided, we have also commissioned an international survey of consumer attitudes and knowledge about SAR issues. In 2011, the MMF along with other partner organizations including the GSMA, commissioned Circle Research in the United Kingdom to undertake a study in nine countries, including the United States. The purpose of the research project was to provide a robust measurement of understanding of safety compliance information for mobile phones that can be monitored over time, including:

- The importance of key factors determining the choice of mobile phone, including the SAR value;

- The extent to which people may be worried about possible health risks associated with using mobile phones;
- The incidence at which people may request information about the possible health risks that may be associated with using mobile phones;
- Awareness and understanding of SAR, a technical measure for mobile phone compliance;
- Understanding of SAR compliance testing;
- Determining how people might go about obtaining information about SAR;
- Understanding how people would go about reducing exposure to radio signals when using a mobile phone.

Two of the key findings from this study relevant to this proceeding include:

1. That the SAR value was the least important out of the 21 factors which determine the choice of mobile phone; and
2. There is slightly less concern in the US about possible health risks associated with using a mobile phone than elsewhere and fewer people in the US look at or request information about possible health risks.

In view of the above, and to answer the question posed by the FCC about

whether additional disclosure of the SAR is required[71], the MMF submits that with information available from the FCC[72,73], the FDA[74], Manufacturer websites[75,76,77,78, 79,80] and user manuals, trade association websites such as the MMF[81,82], GSMA[83] and CTIA[84], as well as numerous third party sites including popular consumer sources such as CNET[85] – that information about SAR is readily available should a consumer have an interest in the issue. The above survey indicates that consumers in the United States are not that interested in the issue, indicating it as the least important factor in the purchasing decision, and that few people are concerned about the issue or ask for information on it.

The MMF also questions the rationale behind the FCC's statement that "there is inconsistency in the supplemental information voluntarily provided in the manuals provided with portable and mobile devices" and that "for a variety of reasons, the maximum SAR value that is normally supplied is not necessarily a reliable indicator of typical exposure and may not be useful for comparing

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[71] Id. Paragraph 234
[72] http://transition.fcc.gov/oet/rfsafety/rf-faqs.html and http://www.fcc.gov/guides/wireless-devices-and-health-concerns
[73] http://www.fcc.gov/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you
[74] http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116282.htm
[75] http://www.nokia.com/global/about-nokia/people-and-planet/emf-health/sar/sar-information/
[76] http://rfhealth-sar.motorola.com/SAR/sar.html
[77] http://blogs.sonymobile.com/about-us/sustainability/health-and-safety/sar/
[78] http://www.ericsson.com/ericsson/corporate_responsibility/health/
[79] http://www.samsung.com/sar/sarMain.do?site_cd=global&prd_mdl_name=GT-I9100
[80] http://www.apple.com/legal/rfexposure/
[81] http://www.mmfai.org
[82] http://www.sartick.com
[83] http://www.gsma.com/publicpolicy/mobile-and-health
[84] http://www.ctia.org/consumer_info/safety/index.cfm/AID/10371
[85] http://reviews.cnet.com/cell-phone-radiation-levels/

different devices." [86]

The MMF considers that the FCC's own advice to consumers available on its website[87] indicates the purpose of SAR values and that they are not intended to show typical exposure:

> *..the SAR values collected by the FCC are intended only to ensure that the cell phone does not exceed the FCC's maximum permissible exposure levels even when operating in conditions which result in the device's highest possible – but not its typical - RF energy absorption for a user.*

The MMF considers that this explanation of what SAR is intended for, is important and helps to correct attempts to paint SAR as being some form of 'relative safety indicator', which is clearly wrong and inappropriate. As the FCC itself advises consumers:

> *Consequently, cell phones cannot be reliably compared for their overall exposure characteristics on the basis of a single SAR value for several reasons (each of these examples is based on a reported SAR value for cell phone A that is higher than that for cell phone B):*
>
> *- Cell phone A might have one measurement that was higher than any single measurement for cell phone B. Cell phone A would, therefore, have a higher reported SAR value than cell phone B, even if cell phone B has higher measurements than A in most other locations and/or usage configurations. In such a case, a user generally would receive more RF energy overall from cell phone B.*
>
> *- Cell phone A might communicate more efficiently than cell phone B, so that it operates at lower power than cell phone B would under comparable conditions. Consequently, a user would receive more RF energy overall from cell phone B.*
>
> *- The highest value from cell phone A might come from a position which the user seldom or never employs to hold a phone, whereas that user might usually hold a phone in the position that resulted in the highest value for cell phone B. Therefore, the user would receive the highest RF exposure that cell phone B delivers but would not receive the highest RF exposure that cell phone A delivers.*

Therefore the MMF does not support the FCC's contention of any

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[86] Id. Paragraph 234
[87] http://www.fcc.gov/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you

"inconsistency"[88], as the SAR values provided accurately reflect the conditions under which manufacturers are required to test by the FCC and that the values are not intended to be used for comparison purposes.

With regards to the question posed by the FCC as to whether it should also take actions to better enable consumers to correlate the make and model number of their device to an FCC ID[89] the MMF would support this action in principle. The MMF notes though that the current structure of the FCC's website in this regard reflects its process of granting authorizations and these are not directly related to the model names and numbers that a consumer would typically be searching for. While supporting efforts to improve consumer access to this information the MMF would be concerned if this change resulted in additional burdens or delays for manufacturers in obtaining the necessary authorizations. This would particularly be the case for manufacturers of radio modules. Ultimately the MMF prefers the FCC to encourage consumers to access the SAR information directly from manufacturers own sites, since then the information does not need to be duplicated and the FCC database can continue to serve the function that it was intended to.

With regards to the request for comment[90] on how consumers with disabilities can access this information the MMF notes that alternative formats of user manuals are already available to consumers with disabilities. These alternative user manuals include the same information as normal user manuals with regards to RF and are available upon request from manufacturers in different formats

[88] Id. Paragraph 234
[89] Id. Paragraph 235
[90] Id. Paragraph 231

including Braille, Large Print and Audio Cassette/CD.

The FCC also requests comment on what additional information should be developed relating to exposures from common fixed sources such as network infrastructure.[91] The MMF certainly supports the need for information sources to be available, and has itself developed a number of resources designed to address questions from the general public including the website EMF Explained[92] which has been developed in co-operation among the MMF, the GSM Association and the Australian Mobile Telecommunications Association (AMTA). Such resources reference national and international health agencies where possible to provide answers to common questions and to provide explanation on topical issues. The MMF notes that there also exists a large number of information resources on the topic[93,94,95,96] and while we would support the FCC further developing its own materials[97], we would encourage the FCC to adopt or collaborate with other bodies and agencies that have already produced materials to ensure timely development and consistency in the advice being provided.

**D - EXPOSURE REDUCTION POLICIES**

The MMF supports the FCC's statement that it "has a responsibility to provide a

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[91] Id. Paragraph 233
[92] http://www.emfexplained.info
[93] See for example: http://www.who.int/peh-emf/about/en/ and http://www.who.int/peh-emf/publications/facts/fs304/en/index.html
[94] http://www.arpansa.gov.au/pubs/eme/fact6.pdf
[95] http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/RadioWaves/BaseStations/
[96] http://www.cancer.org/cancer/cancercauses/othercarcinogens/athome/cellular-phone-towers
[97] http://transition.fcc.gov/oet/rfsafety/rf-faqs.html

proper balance"[98] between protection for the public (and for workers) and allowing industry to provide telecommunications services to the public in the most efficient and practical manner possible. The MMF believes that this balance and the responsibility that accompanies it, is well met through the adoption of internationally harmonized science-based exposure standards which provide a high level of protection for all members of the community.

The comment that "[i]mposing additional precautionary restrictions on device design and/or on the siting of fixed transmitting facilities to reduce exposure may entail significant costs that licensees and equipment manufacturers would need to consider when developing communications systems or designing equipment"[99] is indeed true, which we summarize below.

**1 - NETWORK INFRASTRUCTURE**

There are a large number of unintended consequences from adopting additional precautionary measures and, as we have seen in Europe, in many cases these measures have been ineffectual in allaying concerns, and in some cases, have resulted in increased concerns. Recent research into these policies has likewise cast doubt on their effectiveness.

It is interesting to note that in Europe where the product standard EN 50360[100] applies under the Radio & Telecommunications Terminal Equipment (R&TTE)

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[98] Id. Paragraph 236
[99] Id. Paragraph 238
[100] EN 50360: product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz - 3 GHz). OJ C 208, 26.07.2001

Directive[101] and requires compliance with the exposure limits set out in Council Recommendation (1999/519/EC) of 12 July 1999[102] - i.e., ICNIRP values[103] - there is little concern about the devices. Contrast this with the varying national regulations that have been imposed on the deployment of base stations, which has resulted in a variety of 'precautionary' and restrictive siting policies and other measures – that have resulted in increased community concerns rather than less.

One of the main consequences of adopting maximum exposure values that are not based in science is that compliance distances quickly become unrealistically large, thereby restricting public access within a much larger area than what is otherwise required. Table 1 lists the changes to the calculated typical compliance distance for various antenna types caused by an arbitrary reduction in power density exposure limits below those recommended by ICNIRP.[104]

**Table 1. Typical compliance distances at 1800 MHz**

| **Antenna type** | **Compliance distance (m) at ICNIRP limit (58 V/m)** | **Compliance distance (m) at a limit 10 times below ICNIRP (18 V/m)** |
|---|---|---|
| Sector antenna (~100 W) | 8 | 25 |

[101] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity

[102] Council Recommendation (1999/519/EC) of 12 July 1999 on the limitation of the exposure of the general public to electromagnetic fields (0Hz – 300 GHz)

[103] see http://europa.eu/rapid/press-release_IP-01-1190_en.htm?locale=en

[104] Over the years many different limit values have been proposed by activists including 18,14, 6, 3 and 0.6V/m. Rather than document the implications of each, we have used 18V/m @1800 MHz to model the various implications. Compliance distances will therefore only expand further out from the base station with lower limit values.

| | | |
|---|---|---|
| Sector antenna (~20 W) | 2 | 10 |
| Microcell antenna (5 W) | 0.5 | 3 |

As a result of the adoption of these arbitrary reductions site sharing often also becomes more difficult, if not impossible, to undertake, because the compliance boundaries for each antenna begin to overlap. The examples in Figures 2 & 3 highlight the difficulty of site sharing if limits of 18-19 V/m at 1800 MHz and 2100 MHz were implemented. The resulting compliance zone means that access would need to be restricted in areas where people normally reside, or more realistically, necessitate the antennas be installed on separate sites.

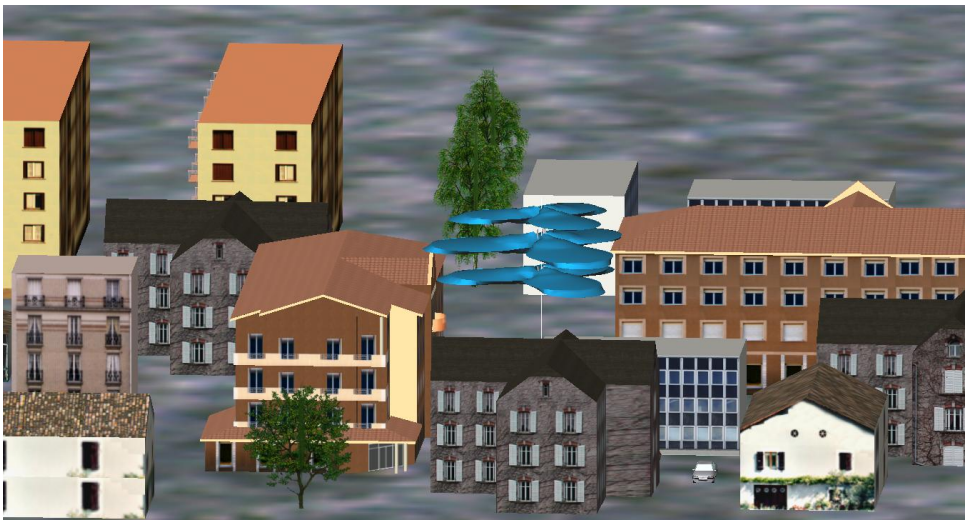

**Figure 2: Two operators share a mast with a total of nine GSM1800 and WCDMA2100 antennas (80-120 W per antenna), which at ICNIRP levels results in one separate compliance boundary for each of the antennas.**

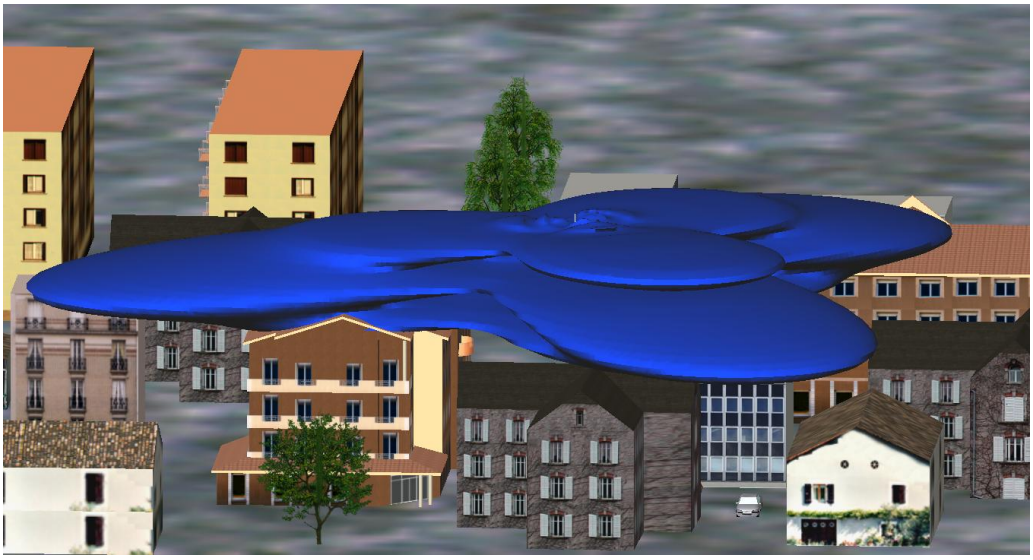

**Figure 3: At lower limits (18 V/m at 1800 MHz and 19 V/m at 2100 MHz) the compliance boundaries of the antennas overlap, resulting in one very large compliance boundary extending about 40 meters from the mast.**

In much the same way as site sharing would become a problem, operators who wish to deploy additional radio technologies or antennas at a given site would also find it difficult to ensure manageable compliance distances. Again, the compliance boundaries for each additional antenna that would be located on a site could overlap thereby extending the effective compliance boundary for the overall site. This may act as a barrier to the deployment of higher data rate mobile technologies that are integral to the policies of many governments to promote access to broadband.

This very problem is being experienced today in Brussels in Belgium, where as a result of a number of political decisions in recent years, the limits have been reduced to the point where the deployment of 4G services cannot be undertaken. This has resulted in the European Commission having written to the Brussels Environment Minister saying that the limits are insufficient to allow the mobile

network operators to roll-out an effective 4G network in the capital and are "damaging the economy without protecting the population."[105]

The situation in Belgium, like other countries that have adopted similar 'precautionary' policies, has come about because of continued pressure to adopt lower and lower exposure limits. The Brussels region has reduced their limit values several times[106] in the last decade and, as is evident in some European countries today, it is essentially a race to the bottom. Further evidence of this on going push to lower the values can be seen in a 2012 report[107] by the BioInitiative group in which the two editors recommend a limit of just 0.0003 μW/cm$^2$. This level would result in typical compliance zones around base station sites that would extend about a hundred meters around pico sites, through to several hundred meters for micro base stations and through to several kilometers for a macro base station. Such a policy would thereby render wireless communications services including radio and TV broadcasting impossible to provide.

One of the few means of addressing arbitrary reductions, where they have been introduced, is to reduce the power output of antennas. This has the effect of reducing the compliance zone back within a manageable area. However in an established network, such reductions have a direct impact on network coverage, usually resulting in the need for additional base stations to fill gaps created by

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[105] http://www.deredactie.be/cm/vrtnieuws.english/Brussels/1303044G_Brussels+
[106] http://www.mmfai.org/public/docs/eng/MMF%5Fvp%5FBelgium%5FImpactLowLimits%5Ffinal2%2Epdf
[107] http://en.wikipedia.org/wiki/Bioinitiative_Report

the reduced cell coverage area. In a new network, it can result in the deployment of more base stations than would otherwise be needed.

Therefore one of the ironies of adopting arbitrary reductions below the levels recommended in the international standards is that it inevitably results in the need for more sites, and it is often site deployment that has created the community questions and concerns in the first place, since the pubic want the service but they often do not want the infrastructure.

In addition to the impacts mentioned above:

- Reductions in network coverage can adversely impact the emergency services as well as consumers who are relying on their mobile phone to contact emergency services;
- Arbitrary reductions can be interpreted by the public as evidence that there is something to be concerned about regarding the safety of base stations; and
- Lower limit values create the perception that base station emissions are now much higher when viewed as a percentage of the relevant limit compared with the international standard;
- The adoption of arbitrary values lack any scientific justification, and as such, resisting calls for further reductions becomes a matter of political will rather than of scientific merit;
- Arbitrary reductions to the international standards do not provide any measurable improvement with regards to the effects of EMF exposure, as both ICNIRP and the IEEE standard are already well below the threshold level that can cause adverse effects.

- Consistent international experience is that 'precautionary measures' can increase the level of concern within the public rather than reduce it.

Further to the last point, there is now a growing body of evidence that such 'precautionary measures' can actually heighten concern within communities. In 2010 the European Commission undertook EU wide survey of community attitudes relating to EMF and found that the countries that had lowered RF standards and/or adopted other precautionary measures actually had higher levels of community concern than those EU countries that had maintained ICNIRP guidelines for base stations[108].

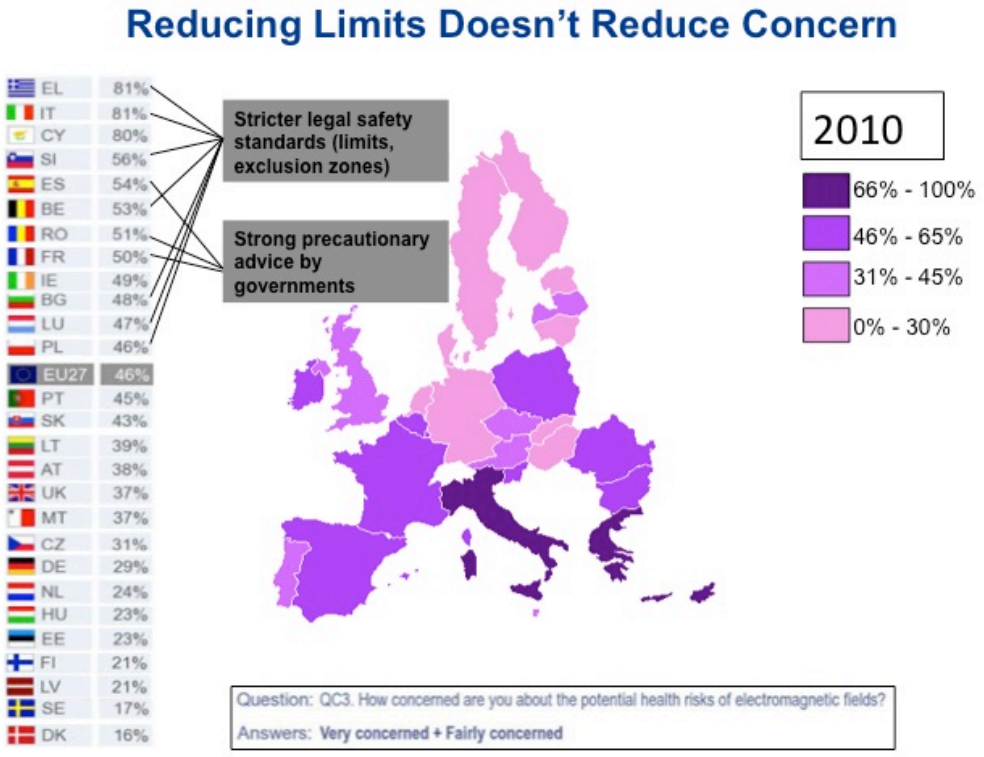


**Figure 4: Data from Eurobarometer 73.3 Electromagnetic Fields[109],**

[108] In the European Union, Council Recommendation (1999/519/EC) of 12 July 1999 adopts ICNIRP limit values

[109] Special Eurobarometer 347. Electromagnetic Fields. Brussels. 2010. Available at: http://ec.europa.eu/public opinion/ archives/ebs/ebs 347 en.pdf. Accessed on August 10, 2012.

**Conducted by TNS Opinion & Social Directorate General for Health and Consumer Affairs. Country order here is rearranged from highest to lowest and additional explanatory notes added alongside results.**

Interestingly a number of recent social science research papers[110,111] have suggested that, at least in the area of EMF, precautionary measures have often resulted in public misunderstanding and concern – or to put it in the language of the researchers, 'amplified risk perception'. In a nine country multinational experimental study, Wiedemann et al.[112] found that informing people about implemented precautionary measures did not decrease public concerns. Likewise "framing the information on precautionary measure as 'protecting public health' versus 'avoiding health risks' did not result in different risk perceptions."

Notwithstanding the above, the FCC also seeks comment on those jurisdictions that have adopted the concept of "prudent avoidance" and whether any technical approach to reduce exposure below the FCC's standards in some situations is appropriate or feasible, particularly in cases in which there is no specific quantitative goal for improvement.[113]

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[110] Timotijevic L, Barnett J. Managing the possible health risks of mobile telecommunications: Public understandings of precautionary action and advice. Health, Risk & Society, 2006; 8(2): 143–164

[111] Wiedemann PM, et al., The impacts of precautionary measures and the disclosure of scientific uncertainty on EMF risk perception and trust. Journal of Risk Research, 2006; 9(4): 361–372.

[112] Wiedemann PM, et al., "When Precaution Creates Misunderstandings: The Unintended Effects of Precautionary Information on Perceived Risks, The EMF Case", DOI:10/1111/risa.12034

[113] Id. Paragraph 238

The MMF notes that the approach adopted in Australia seeks to provide the sort of balance that the FCC has inherently recognized[114], whereby in addition to the ARPANSA Radiation Protection Standard "Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz" the Australian Communications and Media Authority (ACMA) also have registered an industry Code of Practice established by the Australian Communications Industry Forum (ACIF) called *Industry Code for the Deployment of Mobile Phone Network Infrastructure C564* (the "ACIF Code").

According to the ARPANSA[115]:

> *The Code supplements the requirements already imposed on carriers under the existing legislative scheme by requiring them to better inform and consult with the local community and to adopt a precautionary approach in planning, installing and operating telecommunications infrastructure.*

Therefore in the Australian context, a precautionary approach in relation to planning, installing and operating network infrastructure sits comfortably alongside the adoption of ICNIRP guidelines as part of their national standard. In response to misapplications of the precautionary principle, in 2000 the European Commission produced a *Communication on the Precautionary Principle*[116] that made it clear that a proper risk assessment was the basis of using the principle and safety measures such as exposure standards should not be arbitrary. The report concluded:

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[114] Id. Paragraph 236
[115] ARPANSA Fact Sheet No. 6: "About Mobile Phone Networks"
[116] http://ec.europa.eu/dgs/health_consumer/library/pub/pub07_en.pdf

> *The Commission also considers that every decision must be preceded by an examination of all the available scientific data and, if possible, a risk evaluation that is as objective and comprehensive as possible. A decision to invoke the precautionary principle does not mean that the measures will be adopted on an arbitrary or discriminatory basis.*

It is also useful to recall that the European Commission itself considers the adoption of the EU Council Recommendation (i.e., ICNIRP guidelines) as being an exercise in the application of the precautionary principle[117], which is enshrined in the Treaty on the European Union (also known as the Maastricht Treaty). In 2010 the European Commission published a meeting report[118] saying that, "the Council Recommendation already contains a certain level of precaution." The European Commission then went on to say that a revision of the exposure limits was not justified and concluded:

> *The Precautionary Principle excludes a purely hypothetical approach to risk. Safety factors must be applied to established facts in a consistent way to avoid an open ended process. So far, there are no new elements that would justify applying additional safety factors to the Council Recommendation.*
>
> *The differences in exposure limits between Member States are confusing for the public opinion. A common approach would be good for everybody, but this is in the hands of Member States.*

It should be noted that, consistent with the findings outlined above, that if a precautionary approach is to be adopted, then the manner in which it is communicated can in fact send mixed messages to the public and may risk increasing community concern.[119]

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[117] http://ec.europa.eu/health/archive/ph_risk/documents/ev_20090211_co01_en.pdf,
[118] http://ec.europa.eu/health/electromagnetic_fields/docs/ev_20100503_mi_en.pdf

[119] Dolan M & Rowley J: The Precautionary principle in the Context of Mobile Phone and Base Station Radiofrequency Exposures, Environ Health Perspectives. 2009 September; 117(9): 1329–1332 also cites Barnett J, et al., Public responses to precautionary information from the Department of Health (UK) about possible health risks from mobile phones., *Health Policy. 2007 Jul; 82(2):240-50,*

## 2 - DEVICES

In relation to the precautionary aspects of devices, the MMF notes that a recent analysis of the FCC's own data has shown that the maximum SAR for approved devices has decreased over time:

> *The FCC data also provide insights regarding some changing RF exposure factors over time. It is noteworthy that maximum SARs decreased over the period from 1999 to 2005, mainly reflecting a trend toward lower maximum power communication systems as well as lower SARs for bar-type phones with internal antennas and lower SARs from slider phones with all types of antennas….To the extent that the types of phones tested over the years approximate the use in the US population, these data would suggest a decrease in population exposures per unit time of use.* [120]

While the trend of decreasing SAR has been influenced by changes in form factors, technology, antenna design and performance, it is worthwhile noting in the context of the FCC's consideration of RF exposures, that the data shows a decrease in population exposure 'per unit of time of use' over the years.

And as we discuss further in Annex C, the impact of power control and discontinuous transmission on the devices also ensures that phones operate well below their maximum for the vast majority of time. The study by Persson et al.[121] for example, found that after assessing output power from more than

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[120] Kuehn et al., Analysis of mobile phone design features affecting SAR in a human head *Bioelectromagnetics.*, Vol. 34, Pg. 479 - 488, 2013

[121] Persson et al., Output power distributions of terminals in a 3G mobile communication network *Bioelectromagnetics.*, Vol. 33, Pg. 320 - 325, 2012

800,000 hours of voice calls, the average level for 3G voice calls was below 1mW across all environments including rural, urban, and dedicated indoor networks. These results were consistent with the findings of an earlier study by Wiart et al.[122] of mobile phone use in everyday life, which found that when talking on a mobile phone while walking around a major city or inside city buildings, smartphones typically operate at less than one per cent of the phones maximum power output. This equates to 100 times less emissions than the maximum exposure level measured in SAR compliance tests. The researchers stated:

> *Finally, 90% of all collected measurements (indoor, outdoor) are less than 4dBm (1% under the maximum possible emitted power). The real exposure due to mobile phones in terms of Specific Absorption rate (SAR) is then well below (100 times below) the normative values given at the maximum powers.*

While mobile phones and network base stations have always reduced power output to the minimum level required to make a quality connection, 3G technologies have significantly improved this ability. The ability of the handset and network to adapt their power levels is now much faster and if one person is not talking during the conversation the phone stops transmitting – except for occasional handshake signals to let the network know they are still connected and still listening to the call – a technical feature known as discontinuous transmission.

Researchers have also investigated other factors, which might increase power output such as using a phone in less populated areas with less network coverage

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[122] Wiart et.al. *Exposure induced by WCDMA Mobile Phones in Operating Networks*, IEEE Trans on wireless communications Vol. 8 No 12 2009

or while driving around the city where a phone has to regularly look for and handover the call to new cells in the network. However, this has not been shown to make a significant difference and average handset power did not rise beyond 2% of the phones maximum. This is because 3G networks now handle the handover connections between each cell in the network more efficiently and the phone does not need to use maximum power during handover to a new cell.

An earlier study in 2000 by Wiart et al.[123] looked at the impact of power control on 2G networks and found that these required more power during handover and average output increased to 20% to 50% of the phones' maximum for a short time. In that particular study, the average power output of a mobile phone operating on 2G networks was 35% of the phone's maximum power output.

A further analysis undertaken by Gati et al.[124] of more than 3.5 million power samples – made from specially designed 'trace mobiles' that can register the transmitted and received powers during a call – on both 2G and 3G networks confirmed these results. A further analysis by Persson et al.[125] concluded:

> *The average output power of a 3G WCDMA voice call was below 1 mW for any environment, which is less than 1 % of maximum available level.*
>
> *The typically very low output power puts it on an equal or even lower level than other commonly used wireless devices such as DECT and Bluetooth.*

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[123] Wiart, Dale et al. *Analysis of the Influence of the Power Control and Discontinuous Transmission on RF exposure with GSM Mobile Phones*, IEEE Transactions on Electromagnetic Compatibility, Vol 42, No 4, November 2000.
[124] Gati et al. *Duality Between Uplink Local and Downlink Whole-Body Exposures in Operating Networks*, IEEE Transactions On Electromagnetic Compatibility, 1-8, Published Online: 20 September 2010.
[125] Persson et al., Output power distributions of terminals in a 3G mobile communication network *Bioelectromagnetics.*, Vol. 33, Pg. 320 - 325, 2012

Therefore the existing environment in which the industry is operating within has seen both the maximum reported SAR for devices reduce over time, as well as the devices operating at average power levels of between 1% to 35% of their maximum as a result of power control and discontinuous transmission.

While some may argue that while the maximum SAR of devices may have decreased over time, average call use has substantially increased. However, the available data for average call duration and overall voice traffic suggests that voice traffic and call durations have remained relatively stable over time.

The CTIA's Semi-Annual Wireless Industry Survey includes data for 25 years of local call data and almost 20 years of roaming data, showing that the averages year-on year have remained relatively constant and overall average only 2.4 and 3.2 minutes respectively.[126]

Likewise, the CTIA's data also shows that, for example between 2008 and 2012, minutes of usage (MOU's) across all networks, has only modestly increased rising from 2,203 billion MOU's in 2008 to 2,300 billion in 2012. Taking into account the subscriber growth during this period then the number and duration of calls per user is not growing substantially.

Consumers are certainly making use of their devices for longer periods than ever before, reflecting the variety of uses other than for voice. It is interesting to note

[126] http://files.ctia.org/pdf/CTIA_Survey_YE_2012_Graphics-FINAL.pdf

that the growing data usage as is shown in the graph below from Ericsson[127], which is also forecast to continue.

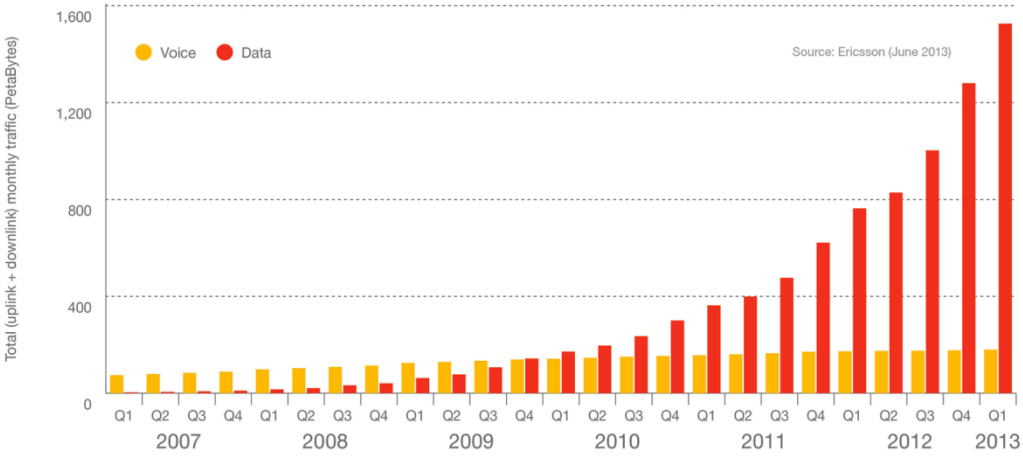


**Figure 5: Global total data traffic in mobile networks, 2007-2013**

It is useful to recall that when a user is accessing data services, they are not typically using the device against the head or even against the body. The more typical use for accessing wireless data is when the device is away from the body – either in the hand or on another surface – such as when accessing the internet and email, watching a streaming video or undertaking a video conference call. Ericsson in its latest report is forecasting that video will account for around half of global mobile data traffic by 2018.[128]

Therefore with the maximum reported SAR for devices having effectively reduced over the years through technical improvements to the design and efficiency of antennas and other factors, the substantial reduction on real output power of a device caused by power control and other network features that

[127] Ericsson Mobility Report, June 2013
[128] Ericsson Mobility Report, June 2013, page 10.

ensure greater efficiency – coupled with the fact that voice call traffic has remained relatively constant over time, the MMF submits that there is no need for the FCC to consider additional measures to reducing exposures further. In fact, continued innovation in the technology and the push for greater network and device efficiency are effectively delivering this outcome.

For the above reasons, the mobile communications industry believes that the adoption of arbitrary reductions below the values recommended in the international standards represents a poor policy choice, and one that actually threatens the proven safety, security and economic benefits that mobile communications provides to the community at large. However, as has been shown in several cases, the adoption of internationally harmonised standards is also considered by several governments as being an application of precaution and consistent with a precautionary approach to the issue.

**E – EVALUATION**

The MMF agrees with the comment that "evaluation is a rapidly evolving area…most effectively guided by good engineering practice rather than specific regulations."[129]

[129] Id. Paragraph 244

Wireless devices have become increasingly complex working over multiple frequency bands and communications technologies and with an ever-increasing demand by consumers for higher capacity and higher speed data services. The current state of the art technology supplied to consumers is LTE and commonly referred to as 4G services. However, the overly conservative FCC testing requirements mean a very significant increase in the number of SAR tests facing manufacturers and the associated time to market delays and costs. According to the current FCC SAR test procedures for LTE devices[130], some handsets are required to undergo in excess of 100 SAR tests for head and body exposure in only two LTE frequency bands, which equates to 4 – 6 weeks (double shifts) for type approval SAR testing and this figure is unreasonably high given that the typical product life cycle is 12 months or so.

Other national approaches[131,132,133] which are based on the international 3GPP standards[134] rely more on the initial screening of conducted power levels to ascertain which combination of channels, channel bandwidth, resource block (RB) allocation and offset, modulation and maximum power reduction will yield the highest SAR, thereby minimizing the amount of SAR testing required to show compliance. In fact the maximum SAR found by comparing the four international approaches have shown an average deviation of 5% or less.[135]

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[130] 941225 D05 SAR for LTE Devices v02r02
[131] ARIB STD-T56 ver. 3.1, 18 Dec. 2012. (in Japanese)
http://www.arib.or.jp/english/html/overview/st_ej.html
[132] ARIB T56 ver. 3.2 In preparation
[133] Notice of National Radio Research Agency (No. 2012-43, December 6, 2012) "Technical details on SAR measurement procedure" Annex 3 Method of measuring SAR for LTE terminals
[134] 3GPP TS 36.521-1 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing
[135] Report to IEC 62209 MT Update of LTE SAR Ad-hoc WG, Newbury May 2013

Research sponsored by the MMF has shown that conducted power results and SAR are linearly related and that other factors (channel bandwidth, modulation, RB allocation and offset) are of lesser significance. Thus, the conducted power measurements are the key for the efficient identification of LTE modes resulting in highest SAR conditions. This principle is already implemented in several FCC KDBs related to other communication systems (CDMA, WLAN etc.), where only certain test mode is required to be SAR tested unless some other modes have significantly higher conducted power. This same approach should be expanded to LTE SAR testing, to avoid the excessive amount of SAR testing described above.

The MMF also notes that there are several standards committees that are constantly monitoring and reviewing the standards and preparing updates. The FCC is actively involved in many of these[136], (including the filing of numerous comments all of which are required to be addressed), yet the FCC does not adopt these standards when they are published[137], or worse, mandates contrary requirements[138]. The MMF believes that where the FCC is actively involved in a standards committee then there should be a presumption of adoption of these standards once published as they do represent, by their consensus approach, best engineering practice by which to ensure and measure compliance. Their formal adoption once published is also consistent with the requirements of the

[136] Including IEEE C95.1-2005, IEC 62209-1, IEC 62209-2, IEEE 1528.
[137] Such as IEC 62209-2 (2010)
[138] Such as the requirement to test using two fluids contrary to the requirements of IEC 62209-2 (2010)

NTTAA and OMB Circular A-119 discussed earlier in this submission. The MMF would further submit that these could be adopted via the KDB process.

## IV – CONCLUSIONS

In response to the FCC's Further Notice of Proposed Rulemaking ("FNPRM") the MMF submits:

- That the development and use of the KDB's should be governed by a number of principles, including that KDB's:
    - Should be released in draft in order with an adequate notice period during which stakeholders can provide input;
    - When issued in final form should provide adequate time for an orderly transition of practices;
    - Must provide testing guidance that is consistent, as much as possible, both with current standards and international practices. (Where departure from international standards and practices are called for by a KDB, a clear rationale for such departure should be provided.); and
    - Should provide adequate flexibility to allow for innovation in both testing and technology.

- That the Commission should use the KDB process to embrace harmonization, consistent with the Commissions own stated objectives as

well as those that are required of it via the Office of Management and Budget (OMB) Circular A-119.

- We support the inclusion of exceptions from SAR testing for various transmitters through reliance on maximum time-averaged power or ERP evaluations. This approach has a number of practical benefits while still ensuring inherent product compliance and that we encourages the FCC to adopt IEC 62479-2010 as part of this process.

In relation to the NOI, the MMF acknowledges the sensitivities involved in discussions around exposure guidelines and that there are many misconceptions surrounding the adoption of the international standards[139]. However the MMF would summarizes our submissions in relation to the current FCC standards as follows:

- The scientific basis of the existing FCC's standards is more than 20 years old and there is very strong policy, practical and scientific grounds to justify an alignment with the ICNIRP/IEEE C95.1- 2005 standard.

- The current standard was based on early dosimetry considerations alone, whereas the IEEE C95.1-2005 standard is based on a

[139] See Annex F that provides responses to many of the common misconceptions.

significantly improved understanding of RF and thermal dosimetry and biological/health effects.

- International and national health authorities and expert bodies continue to maintain the consensus view that there are no established health effects below the levels recommended by ICNIRP and IEEE C95.1-2005.

- These international standards are also recognised as providing ample protection for children and any other vulnerable groups in the community.

- The standards have taken issues such as lifetime exposure, increased absorption, increased penetration and stages of childhood development into account.

- IEEE C95.1-2005 provides a very conservative framework for the protection of persons exposed to RF fields. From the substantial safety margin inherent in the standards themselves, through to the specificity of SAR measurement protocols and how the devices are tested compared to how they typically operate.

- The adoption of consistent science based standards has been shown to increase consumer confidence and reduce community concerns. Likewise, any arbitrary reductions can have significant unintended

consequences which would make the operation of telecommunication networks difficult or in most cases impossible to achieve as already demonstrated is some parts of Europe.

- The telecommunications network is inherently precautionary. Studies of cell phones in everyday use show that when talking on a mobile phone while walking around a major city or inside city buildings, smartphones operate at less than one per cent of the phones maximum power output.

- The best way for members of the community who have concerns about their exposure from cell phones is to follow the FCC's own advice, which in turn is consistent with the WHO's advice, and that is to use 'hands-free' devices which keep cell phones away from the head and body during calls and to limit the number and length of calls. This information along with other information on the topic is already made available by the industry as well as other stakeholders.

- Another benefit for adopting IEEE C95.1-2005 is the improved capacity and coverage benefits in rural and regional areas leading to improved user experiences, fewer dropped calls, sustained data rates over greater areas and expanded access to emergency services.

- Such benefits would also help meet consumer demand and expectations for mobile coverage as more users adopt smartphones

and other wireless devices that require fast and reliable mobile broadband connections.

And finally, in relation to the evaluation of devices, the MMF submits that the FCC's current LTE testing requirements are unduly onerous and that alternative approaches based on initial screening of conducted power are being used internationally and have been shown to be as effective as the current FCC specified approach. These alternative processes involve considerably less testing time – an important factor for products that often have a market life cycle of 12 months or so. The MMF would also like to see a presumption of adoption operating where the FCC is actively involved in standards committees, rather than have all parties invest considerable time and resources into standards development only to see the FCC fail to adopt them or to mandate contradictory requirements.

The MMF wishes to thank the FCC for its consultation and the opportunity to provide our views on these important issues.

Respectfully submitted,

By: 

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September 3, 2013

## ANNEX A: CONCLUSIONS OF RECENT EXPERT ADVISORY BODIES AND HEALTH AGENCIES ON EMF SAFETY

The following summaries are from recent relevant scientific reviews and reports.

### 2013

#### Sweden

Recent Research on EMF and Health Risk (Eighth report from SSM's Scientific Council on Electromagnetic Fields, 2010), Swedish Radiation Safety Authority[140]:

> *Recent research on exposure from transmitters has mainly focused on cancer and symptoms, using improved study designs. These new data do not indicate health risks for the general public related to exposure to radiofrequency electromagnetic fields from base stations for mobile telephony, radio and TV transmitters, or wireless local data networks at home or in schools.*

#### The Netherlands

Health Council of the Netherlands. Mobile phones and cancer. Part 1: Epidemiology of tumours in the head. The Hague: Health Council of the Netherlands, 2013; publication no. 2013/11 [141]

> *[T]he final conclusion from this systematic analysis is then: there is no clear and consistent evidence for an increased risk for tumours in the brain and other regions in the head in association with up to approximately 13 years use of a mobile telephone, but such risk can also not be excluded. It is not possible to pronounce upon longer term use.*

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[140] http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Stralskydd/2013/SSM-Rapport-2013-19.pdf

[141] http://www.gr.nl/en/publications/environmental-health/mobile-phones-and-cancer-part-1-epidemiology-tumours-head

## 2012

### European Union – EFHRAN

Risk analysis of human exposure to electromagnetic fields (revised), European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN)

> *6.3. High frequencies*
> *Inclusion of recent data regarding adult brain tumours (…) is now considered to be best described as being limited. However, this classification is subject to uncertainty, because the evidence for an increased risk of brain tumours is restricted to two large-scale case-control studies, and there are unresolved questions relating to possible biases and errors inherent to retrospective epidemiological studies. Further, the time-trend analyses are also not compatible with a large increase in brain tumour incidence in relation to mobile phone use.*
> *…*
> *Inclusion of recent data on other endpoints has not necessitated any revisions to the existing consensus opinions of EMF-NET (2009) or SCENIHR (2009a).*

### United Kingdom

The possible harmful biological effects of low-level electromagnetic fields of frequencies up to 300 GHz, Institution of Engineering and Technology position statement, 8 May 8, 2012.[142]

> *In summary, the absence of robust new evidence of harmful effects of EMFs in the past two years is reassuring and is consistent with our findings over the past two decades. The widespread use of electricity and telecommunications has demonstrable value to society, including health benefits. BEPAG is of the opinion that these factors, along with the overall scientific evidence, should be taken into account by policy makers when considering the costs and benefits of both the implementation of precautionary approaches to public exposure and also in the development of public exposure guidelines.*

### United Kingdom

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[142] http://www.theiet.org/factfiles/bioeffects/emf-position-page.cfm?type=pdf

Health Effects from Radiofrequency Electromagnetic Fields – RCE 20, Advisory Group on Non-ionising Radiation (AGNIR), Health Protection Agency, April 2012.[143]

> *In summary, 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 adults or children.*

**Sweden**

Radiofrequency electromagnetic fields and risk of disease and ill health: Research during the last ten years, Swedish Council of Working Life and Social Research (FAS), 2012.[144]

> *Research on mobile telephony and health started without a biologically or epidemiologically based hypothesis about possible health risks. Instead the inducement was an unspecific concern related to a new and rapidly spreading technology. Extensive research for more than a decade has not detected anything new regarding interaction mechanisms between radiofrequency fields and the human body and has found no evidence for health risks below current exposure guidelines. While absolute certainty can never be achieved, nothing has appeared to suggest that the since long established interaction mechanism of heating would not suffice as basis for health protection.*

**Norway**

Low-level radiofrequency electromagnetic fields – an assessment of health risks and evaluation of regulatory practice, Folkehelseinstituttet Norwegian Institute for Public Health], FHI report, 12 September 2012.[145]

> *It is reasonable to assume that the gradually increasing and widespread use of mobile phones would have led to an increased cancer incidence over time,*

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[143] http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368
[144] http://www.fas.se/
[145] http://www.fhi.no/

*if use was carcinogenic. …The results of the incidence studies show no evidence of increasing incidence of these cancers over time.*

*…*

*Exposure from base stations and radio and television transmitters is significantly lower than from using a mobile phone and the available data do not suggest that such low exposure could increase the risk of cancer.*

**Germany**

Biologische Auswirkungen des Mobilfunks Deutsche Strahlenschutzkommission

(German Radiation Protection Commission)[146]

*(Translation): The results of the DMF (German mobile communications research programme) show that the initial fears about health risks could not be confirmed. … In line with other international bodies (ICNIRP 2009, WHO 2011) can be determined that the underlying concepts of the existing protection limits are not in question.)*

**2011**

**Spain**

Report analysing the possible health effect of WiFi systems, Scientific Advisory

Committee on Radio Frequencies and Health (CCARS)[147]

*The Scientific Advisory Committee on Radio Frequencies and Health (CCARS) has drafted a report analysing the possible health effect of WiFi systems, which overwhelmingly concludes that, at least to date, there is absolutely no scientific evidence that exposure to the low emission levels of these systems produces adverse health effects in schoolchildren.*

**Netherlands**

Influence of radiofrequency telecommunication signals on children's brains. The

Hague: Health Council of the Netherlands, 2011; publication no. 2011/20E:[148]

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[146] http://www.ssk.de/de/werke/2011/kurzinfo/ssk1109.htm

[147] http://www.ccars.es/en/news/there-no-scientific-evidence-wifi-systems-produce-adverse-health-effects-schoolchildren

*In summary, the Committee concludes that there is no cause for concern based on the knowledge about short-term effects outlined in this advisory report. Available data do not indicate that exposure to radiofrequency electromagnetic fields affect brain development or health in children.*

**International**

International Commission for Non-Ionizing Radiation Protection Standing Committee on Epidemiology 2011. Mobile Phones, Brain Tumours and the Interphone Study: Where Are We Now? Environ Health Perspectives:-. doi:10.1289/ehp.1103693:[149]

*Such evidence as it provides, combined with the results of biological and animal studies, other epidemiological studies, and brain tumour incidence trends, suggest that within the first 10-15 years after first mobile phone use there is unlikely to be a material increase in risk of adult brain tumours resulting from mobile phone use.*

**South Africa**

Health Effects Of Cellular Base Stations, Directorate 'Radiation Control, Department of Health

*Measurement surveys conducted in South Africa and around the world have shown that the actual levels of public exposure, as a result of base station emissions, invariably are only a fraction of the ICNIRP guidelines….*

*At present there is **no** confirmed scientific evidence that points to any health hazard associated with the very low levels of exposure that the general public would typically experience in the vicinity of a cellular base station. …*

*The Department is therefore satisfied that the health of the general public is not being compromised by their exposure to the microwave emissions of cellular base stations.*

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[148] http://www.gezondheidsraad.nl/sites/default/files/201120E.pdf

[149] http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.1103693/

**Spain**

Report on Radio Frequencies and Health (2009-2010), Scientific Advisory Committee on Radio Frequencies and Health (CCARS) (Published 2011):[150]

> *Present evidence from clinical and epidemiological studies indicates that there is no causal relationship between exposure to the radio frequency fields used in mobile telephony and adverse effects on health.*

[150] http://www.ccars.es/sites/default/files/Report_on_RF__health_2009-2010_EN.pdf

## ANNEX B: AVERAGING TIMES

The IEEE C95.1-2005 recommends an averaging time of 30 minutes at 100 MHz – 5 GHz then ramping down to 25 minutes between 5 and 6 GHz for members of the general public. There has been considerable information published on what are the typical lengths of time for cell phone calls.

Vrijheid et al[151] published the following data as part of the 13 nation Interphone study:

**Table 2** Description of software-modified phone (SMP) users and calls recorded by the SMPs by study centre

| Study centre | Dates of SMP use | No of users | No of calls | No of operators | No of users per operator | No of days of SMP use | | No of calls per day | Call duration (minutes) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min–max | Mean | Min–max | Mean | Mean |
| Australia | Nov 03–Jun 04 | 48 | 6782 | 1 | 48 | 32.8 | 17–49 | 4.5 | 1.71 |
| Canada | Jan–Jul 05 | 37 | 3395 | 2 | 13–24 | 31.8 | 12–48 | 3.2 | 2.08 |
| Denmark | Aug–Oct 03 | 46 | 3458 | 5 | 2–16 | 29.1 | 12–41 | 2.5 | 1.80 |
| Finland | Feb–Mar 02 | 46 | 4581 | 4 | 1–29 | 27.2 | 11–38 | 3.9 | 2.80 |
| France | Jan–May 01 | 24 | 3796 | 3 | 3–11 | 25.4 | 13–39 | 6.7 | 1.88 |
| Germany | Nov–Dec 01 | 49 | 3023 | 2 | 22–27 | 25.8 | 8–42 | 2.7 | 1.51 |
| Israel | Aug–Dec 02 | 41 | 15058 | 1 | 41 | 34.2 | 9–50 | 10.9 | 1.84 |
| Italy | Feb–Mar 03 | 53 | 8049 | 3 | 16–20 | 27.6 | 19–33 | 5.4 | 1.67 |
| New Zealand | Nov 03–Mar 04 | 27 | 2466 | 1 | 27 | 37.3 | 22–72 | 2.5 | 1.61 |
| Norway | Sept–Nov 04 | 48 | 3946 | 3 | 2–24 | 31.3 | 14–52 | 2.7 | 2.42 |
| Sweden | Apr–May 03 | 46 | 5461 | 5 | 1–24 | 27.3 | 8–42 | 4.5 | 1.78 |
| UK North 1* | Feb–Mar 01 | 17 | 607 | 1 | 17 | 20.3 | 9–32 | 1.6 | 2.45 |
| UK North 2 | Apr–Jul 03 | 34 | 2529 | 5 | 3–14 | 27.0 | 10–35 | 2.9 | 2.17 |
| Total | | 516 | 63151 | 36 | 1–48 | 29.3 | 8–72 | 4.2 | 1.96 |

*In the 2001 study in the UK, problems with the phones' software led to part of the collected data being lost, resulting in few included subjects; the study was therefore repeated in 2003 with a different set of volunteers.

This shows that across 13 nations, 516 users, 36 operators and a total number of calls in excess of 63,000 the mean call duration was approximately 2 minutes.

[151] M Vrijheid et al., Determinants of mobile phone output power in a multinational study: implications for exposure assessment Occup. Environ. Med. 2009;66:664-671

Based on US statistics[152] for 25 years of local call data and almost 20 years of roaming data the respective overall averages were 2.4 and 3.2 minutes respectively.

Based on either a 6 minute or a 30 minute averaging time there is considerable conservatism inherent in the exposure standards through behavior based time averaging. This is consistent with the messaging provided to consumers by government agencies, health authorities and industry – if you are concerned about exposure during cell phone use one can use a headset or limit the length and number of calls.

[152] CTIA Semi-annual Wireless Industry Survey Results December 1985 – June 2012.

## ANNEX C: EFFECT OF POWER CONTROL

Several features of cellular phones systems ensure that the network infrastructure and devices operate at the lowest power necessary to complete a quality connection both for voice and data transmissions. Whilst these features were designed primarily to limit interference and extend device battery life their impact in the context of personal exposure levels is to always ensure the lowest possible exposure levels to the individual.

There have been numerous studies[153,154,155,156,157] on the effect of power control on the uplink power of devices. Taking power regulation, discontinuous transmission (DTX) and 6 minutes time averaging into account, for 95% of the time the real output power is more than 10dB below maximum for 3G/WCDMA terminals, and around 4dB below maximum for 2G/GSM terminals. For 4G/LTE terminals, the output power is very similar as for 3G/WCDMA terminals.

This means that there is an additional 4dB to 10dB conservativeness built in to the measurement standard depending on the wireless technology being tested.

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[153] Persson et al., Output Power Distributions of Terminals in a 3G Mobile Communication Network, Bioelectromagnetics 2011 DOI 10.1002/bem.20710

[154] Wiart et al. Analysis of the Influence of the Power Control and Discontinuous Transmission on RF exposure with GSM Mobile Phones, IEEE Trans Electromagn Compatibility 2000;42(4):376–385.

[155] Gati et al., Exposure induced by WCDMA Mobile Phones in Operating Networks, IEEE Trans Wireless Commun 2009;8:5723–5727

[156] Vrijheid et al., Determinants of mobile phone output power in a multinational study implications for exposure assessment, Occup Environm Med 2009;66:664-671

[157] Joshi MSc Thesis "Assessment of realistic output power levels for LTE devices" Lund University 2012

This is also supported by the research of Kuehn et al.[158] who analyzed SAR data from the FCC database (1999-2005) that included 957 different phones, 2,188 operational modes and fourfold more SAR data when the tests made for touch/tilt and left/right configurations were reported. They found:

1. Service technology accounts for the greatest variability in compliance test SARs that ranged from AMPS (highest) to CDMA, iDEN, TDMA, and GSM (lowest); and
2. Time-line trend including both the 800 and 1900 MHz bands revealed a clear trend of decreasing SAR over time.

[158] Kuehn S et al., Analysis of Mobile Phone Design Features Affecting Radiofrequency Power Absorbed in a Human Head Phantom, *Bioelectromagnetics* Vol. 34, Pg. 479 - 488, 2013

## ANNEX D: TECHNICAL IMPACTS OF HARMONIZATION

Adoption of the international standard would allow a device to utilize additional transmission power ('TX') when needed which current US models can't in order to ensure compliance with the FCC's current standards. Without taking into account the averaging mass, the change from 1.6W/kg to 2W/kg alone would allow for an effective 25% increase in the available TX power when operating at the handsets maximum power.

In addition, when one also takes into account the accompanying change from a 1g to 10g averaging volume, the additional TX power that would be available at maximum power would increase by around 50%. Although there is no fixed mathematical relationship between SAR measured in 1g compared to 10g cubic averaging volumes there is published numerical data that shows for 500 MHz and 1 GHz the SAR difference is between 45% and 53% respectively and higher for higher frequencies[159]. Measurements on modern smartphones also show an average of approximately 50% difference between the SAR measured using a 1g averaging mass and those measured against the 10g averaging mass when tested at the devices full power. The graph below shows some typical data from a recent FCC filing for a product type approval and compares the different recorded 1g to 10g SAR values. From these values, a ratio between the 1g and 10g values has also been plotted.

[159] McIntosh R. and Anderson V. 2011. SAR Versus VAR, and the Size and Shape That Provide the Most Appropriate RF Exposure Metric in the Range of 0.5-6 GHz. *Bioelectromagnetics* 32:312-321.

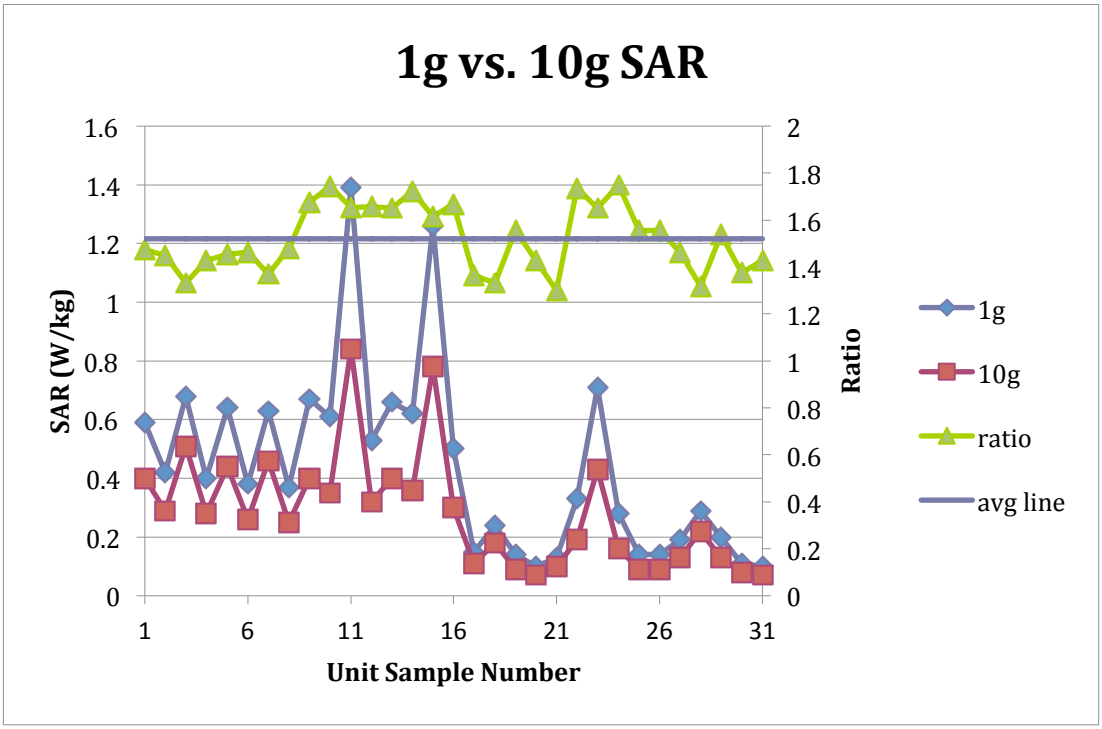


**Figure 6: Sample of 1g and 10g SAR values along with the average relationship between the two sets of values.**

From Figure 1 above, an average difference of 50% in the SAR values measured between 1g and 10g averages can be seen. This, in turn, means that an average 50% more TX power would be available from the use of 10g averaging versus 1g averaging while still ensuring compliance of the device with the international standards.

The combination of these two factors - the 25% increase in TX power resulting from the change from 1.6 W/kg to 2 W/kg and the 50% increase in TX power from the use of 10g averaging rather than 1g averaging – means that handsets could have an additional TX power increase of almost 90% (1.25 x 1.5), which corresponds to 2.7 dB, and still comply with the international standards.

The MMF is well aware that the FCC already has limits on the effective radiated

power (EIRP) that restricts the maximum transmit power of cellular, PCS and AWS band mobile devices[160]. The MMF is not suggesting that any changes are required to these levels. However, we do note that the current 1.6W/kg in 1g SAR standard does restrict the effective maximum transmit power of a device to a level below that which could be utilized within the FCC's existing EIRP limits. In contrast, the adoption of 2.0W/kg in 10g SAR will more closely harmonize these two practical limits on maximum transmitter power within a device. Another way of viewing this point is as follows:

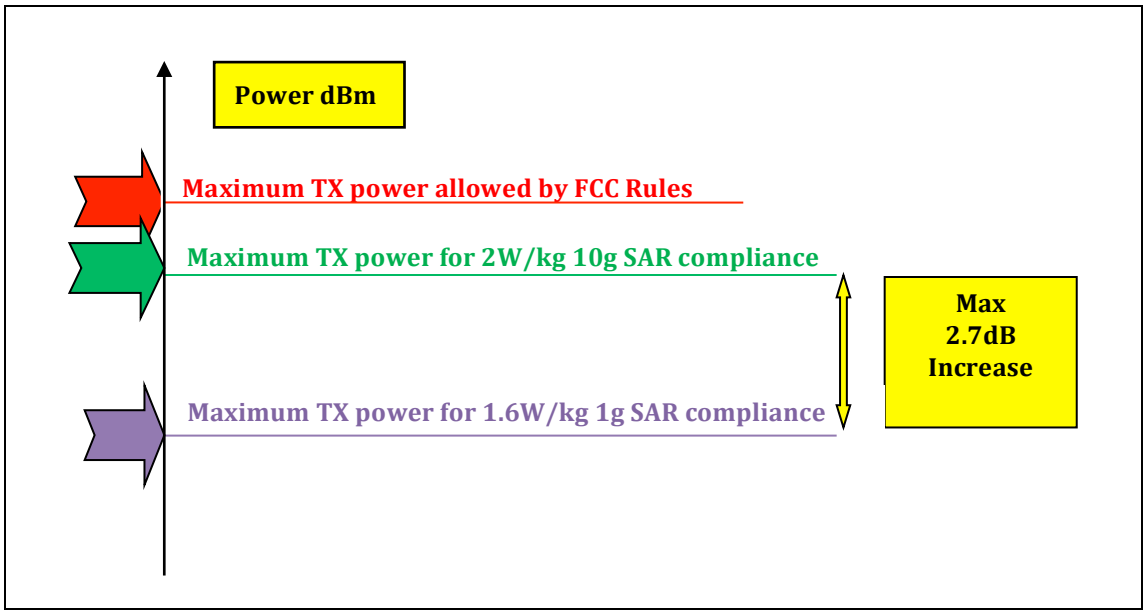


**Figure 7: Effective Maximum TX Powers for Compliance Purposes[161] vs Maximum TX Power provided under Current FCC Rules.**

The additional TX power available within the handset as a result of harmonization would also have the added benefit of extending the effective coverage or capacity of a given cell.

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[160] CFR Title 47 Sections 22.913 (a)(2), 24.232 (c) and 27.50 (d)(4).
[161] The various transmitters that a device contains will influence the actual maximum TX power for that device.

An additional uplink power in the device of 2.5-3 dB, will increase the capacity of a 3G or 4G/LTE cellular network by about 30%, i.e. a cell in the system can handle 30% more traffic without any change of the bit rate performance at the cell edge.

This is illustrated in Figure 8, which for example shows that if a LTE network is designed to offer an uplink bit rate of 1 Mbps at the cell edge, then the system can deliver about 1.5 GB/user/month to users at the cell edge (lowest 5$^{th}$ percentile) assuming an uplink power of 21 dBm. If the power is increased by 3 dB, the traffic that can be handled increases to about 2.3 GB/user/month.

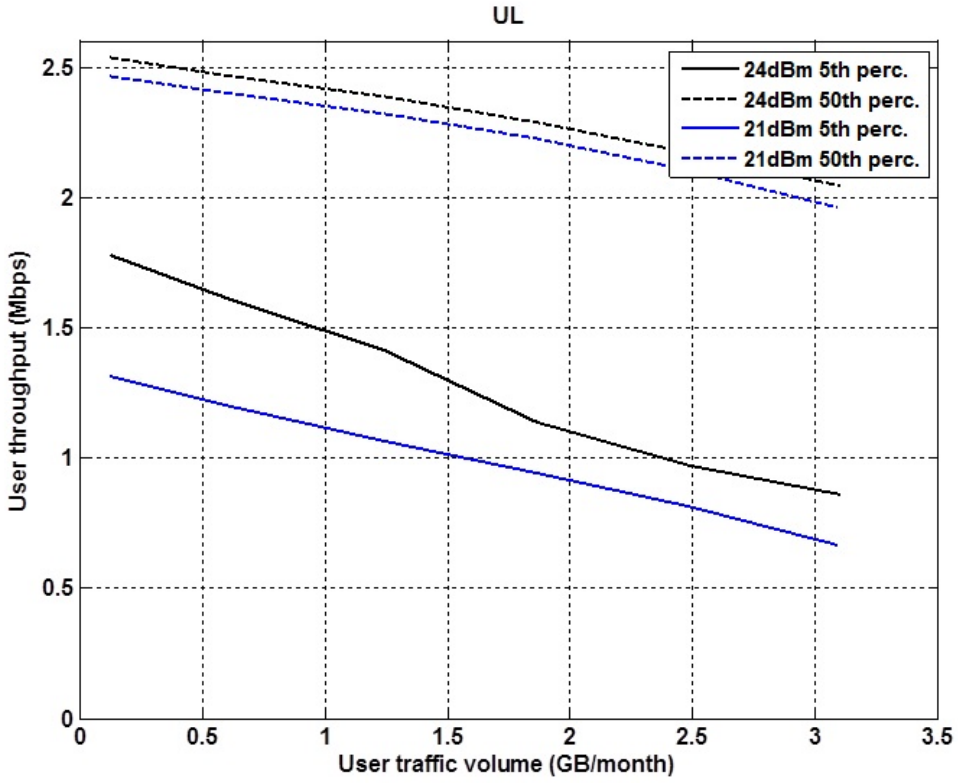


**Figure 8: Simulations of uplink performance for a heterogeneous network (LTE) in the US, Source: Ericsson**

Alternatively, as shown in Figures 9 & 10 the cell coverage could be expanded,

meaning that the 1 Mbps cell edge data rate (for LTE) and (512kbps for WCDMA) would be pushed out a considerable distance and increasing the cell size by between 35-40% - equivalent to an estimated 30+ square miles of additional coverage in the Figures shown. This would provide continued data access for consumers over a greater geographical area and a better mobile broadband experience overall and provide access to services for those that currently may not have any.

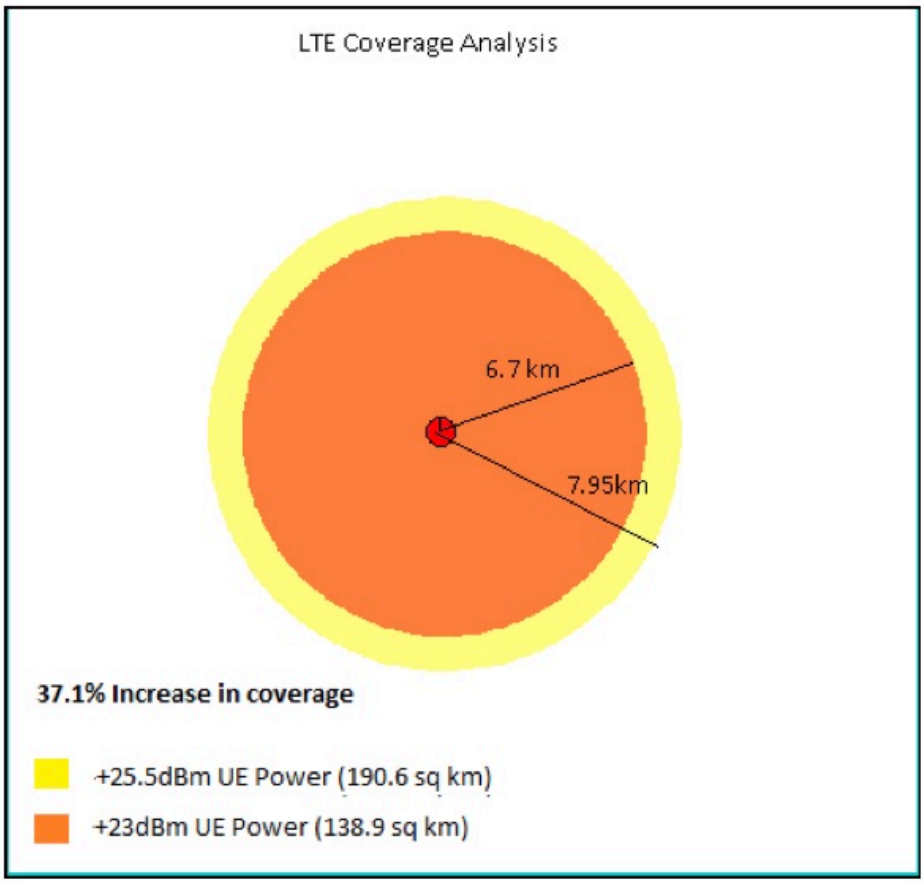


**Figure 9: Coverage plot for LTE 9dBi Omni antenna at height of 20m from existing User Equipment ('UE') and additional +2.5dB Uplink from UE. Source: Telstra**

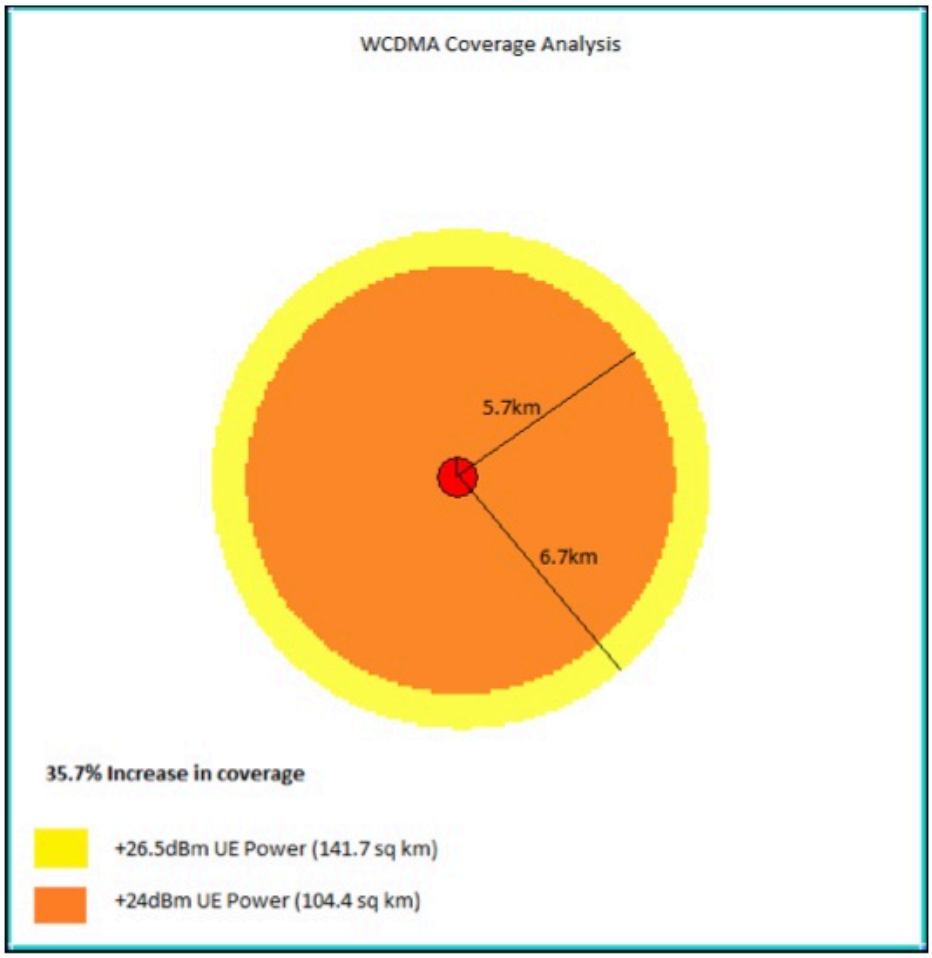


**Figure 10: Coverage plot for WCDMA 9dBi Omni antenna at height of 20m from existing User Equipment ('UE') and additional +2.5dB Uplink from UE. Source: Telstra**

## ANNEX E: USER MANUAL/WEBSITE SAR EXPLANATORY TEXT

The following is the MMF's recommended SAR text language:

### THIS DEVICE MEETS FCC GUIDELINES FOR EXPOSURE TO RADIO WAVES

Your mobile device is a radio transmitter and receiver. It is designed not to exceed the guidelines for safe exposure to radio frequency (RF) energy adopted by the FCC based on recommendations by independent scientific expert non-government organizations, such as the Institute of Electrical and Electronics Engineers and the National Counsel on Radiation Protection and Measurements, and input from federal health and safety agencies, such as the FDA. The guidelines include a considerable safety margin designed to assure the safety of all persons, regardless of age and health.

The FCC RF energy exposure guidelines use a unit of measurement known as the Specific Absorption Rate, or SAR. SAR is a measure of the rate of RF energy absorption from the source being measured -- in this case, a mobile device. The SAR limit for mobile devices is 1.6 W/kg. Tests for SAR are conducted using standardized models of the human head and body in various specific positions, including against the head and next to the body (body-worn), with the device transmitting at its highest certified power level in all tested frequency bands. The highest SAR values under the FCC guidelines for this device model are:

| **Maximum SAR for this model and conditions under which it was recorded.** | | |
|---|---|---|
| **Head SAR** | UMTS 1900 + Wi-Fi | x.xx |
| **Body-worn SAR** | GSM 1800 + Wi-Fi + Bluetooth | x.xx |

During normal use, the actual SAR values for this device are usually well below the values stated above. This is because, for purposes of system efficiency and to minimize interference on the network, the operating power of your mobile device is automatically decreased when full power is not needed.

FCC guidelines require body-worn SAR testing to be carried out using an approved accessory or at a separation distance of x.x. cm. When using this product next to your body (other than in your hand or against you head), the device should be in an approved accessory or positioned at least x.x cm away from the body to ensure your use is consistent with how the device is tested for compliance with the FCC RF energy exposure guidelines. If you are not using an approved accessory, ensure that whatever product is used does not contain any metal and that it positions the phone at least x.x cm away from the body -- again, to ensure your use is consistent with how the device is tested.

The FCC and FDA have stated that present scientific information does not indicate the need for any special precautions for the use of mobile devices. But if you are interested in reducing your exposure they state that you can do so by limiting your usage, using a hands-free kit to keep the device away from the head, and by texting rather than talking -- **but don't text while you are driving**.

For more information, see FCC website links: http://transition.fcc.gov/cgb/cellular.html; http://www.fcc.gov/guides/wireless-devices-and-health-concerns; http://www.fcc.gov/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you; and FDA website links: http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/default.htm.

## ANNEX F: MISCONCEPTIONS ABOUT THE STANDARDS

The internet is awash with misconceptions about the RF exposure standards – many of which were first observed in the self-published 1999[162] and 2002[163] papers by Dr Neil Cherry which heavily criticised the ICNIRP Guidelines when they were adopted in New Zealand.

Many of these allegations continue to be made today, for example, a recent documentary[164] titled *Resonance: Beings of Frequency* alleges health effects from exposure to electromagnetic fields in the environment and makes a number of similar allegations about the ICNIRP Guidelines that were first made by Cherry.

Similarly, in the U.S, citizen activist groups have also alleged[165] ,[166] ,[167] ,[168] the FCC's safety standards needed to be updated because of the recent IARC

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[162] Cherry N 1999, *Criticism of the proposal to adopt the ICNIRP Guidelines for cellsites in New Zealand,* viewed 1 July 2013, http://www.salzburg.gv.at/ICNIRP-Kritik1.pdf

[163] Cherry N 2002, *Criticism of the health assessment in the ICNIRP Guidelines for radiofrequency and microwave radiation* (100 kHz – 300 GHz), viewed 1 July 2013, http://neilcherry.com/documents/90_m4_EMR_ICNIRP_critique_09-02.pdf

[164] Resonance: Beings of Frequency 2013, online documentary, Patient Zero Productions, produced by James Russell, viewed 1 July 2013, http://www.youtube.com/watch?v=IF_rorl5LRQ

[165] Media Release 26 July 2011, Health & Environmental Advocates Ask Congress to Request the U.S. Federal Communications Commission (FCC) to Update Its Obsolete Cell Tower Safety Regulations, viewed 1 July 2013, http://electromagnetichealth.org/electromagnetic-health-blog/take-action/

[166] Childs, D 2011, FCC Test to Measure Cellphone Radiation Flawed, Group Says, *ABC News*, viewed 1 July 2013, http://abcnews.go.com/Health/fcc-test-measure-cellphone-radiation-cancer-risk-flawed/story?id=14750275#.

[167] Davis, D 2013, Cicadas and Cell Phones: Welcome to the 21st Century, *The Huffington Post,* viewed 1 July 2013, http://www.huffingtonpost.com/devra-davis-phd/cell-phones-cancer_b_3157171.html

[168] Media Release 2013, New study shows cell phones exceed FCC exposure limits by as much as double for children, viewed 1 July 2013, http://ehtrust.org/press-release-new-study-shows-cell-phones-exceed-fcc-exposure-limits-by-as-much-as-double-for-children/

classification, claims about harm from "non-thermal" effects and suggestions that the SAM phantom is unrepresentative of the general population.

As many of these claims will no doubt be made in submissions to the FCC in response to the current proceeding, and in the interests of providing a comprehensive and considered view of the standards some of the most common criticisms and allegations are addressed below.

## RESPONSE TO COMMON CLAIMS ABOUT THE STANDARDS

**Claim 1:**
***The ICNIRP guidelines are out of date***

**Response:**
The ICNIRP guidelines are set by an independent committee of international experts – who carefully review all relevant scientific literature and keep the guidelines under regular review.

In 2009, ICNIRP released a two-page statement[169] to reconfirm that their exposure guidelines are still valid until further notice and which said:

> *It is the opinion of ICNIRP that the scientific literature published since the 1998 guidelines has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields.*

Although the guidelines are dated 1998 this simply reflects the last time the standards needed to be changed, it does not mean that ICNIRP have not reviewed or ignored the latest scientific evidence.

[169] ICNIRP statement 2009, *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)*,.Health Phys. 2009 Sep;97(3):257-8. doi: 10.1097/HP.0b013e3181aff9db.

**Claim 2:**
***The guidelines ignore biological based scientific evidence such as genotoxic evidence and the epidemiological evidence of cancer effects and reproductive effects***

**Response:**
RF Exposure standards above 100 kHz are based on heating effects because it is a known established mechanism for harm.

However, biological effects (at levels not known to be caused by heating) are not disregarded.

More importantly, ICNIRP and IEEE C95.1- 2005 do consider both thermal and non-thermal effects as outlined in the guidelines[170] themselves:

> *Overall, the literature on athermal effects on AM (amplitude modulated) electromagnetic fields is so complex, the validity of reported effects so poorly established, and the relevance of effects to human health so uncertain, that it is impossible to use this body of information as a basis for setting limits on human exposure to these fields.*

ICES also reviewed extensively biological effects ascribed to exposure to low-level fields, i.e., at or below the corresponding basic restrictions in the frequency range 3 kHz to 300 GHz. ICES's position on the low levels effects is:

> *Despite more than 50 years of RF research, low-level biological effects have not been established. No theoretical mechanism has been established that supports the existence of any effect characterized by trivial heating other than microwave hearing. Moreover, the relevance of reported low-level effects to health remains speculative and such effects are not useful for standard setting.[171]*

Also the WHO supports the ICNIRP's comprehensive evaluation process as currently shown on their EMF Project website[172]:

> *The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognised by WHO, were developed following reviews of all the peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of biological effects that have been established to have health consequences.*

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[170] ICNIRP (International Commission on Non-Ionizing Radiation Protection) Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz) Health Phys.1998;74(4):494–522.
[171] Annex C.1.2, page 82 of C95.1-2005
[172] World Health Organization 2013, EMF Project, Standards and Guidelines, viewed 1 July 2013, http://www.who.int/peh-emf/standards/en/

*The main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health.*

An in-depth scientific review of possible genetic damage by the Irish Government Expert Group[173] concluded:

*The scientific evidence suggests that RF fields do not cause mutation in the DNA or initiate, progress or promote tumour formation.*

Another review by US National Council on Radiation Protection (NCRP)[174] on possible biological effects of modulated RF fields concluded that:

*…there is no established mechanism by which RF fields modulated or not, can produce observable biological effects at electric field levels within tissue that correspond to exposure levels permitted by present safety guidelines.*

**Claim 3:**
***ICNIRP systematically rejects or ignores all epidemiological and animal evidence of non-thermal effects, for which there is a large body.***

**Response:**
A large number of studies have looked for non-thermal biological effects. Most of these studies have reported negative results. Some studies have reported various biological effects but these are generally small in magnitude.

Furthermore, these findings have generally not been replicated, and in some cases attempts at replication have been unsuccessful.

Biological systems respond to many stimuli, and in most cases these responses (or "biological effects") are simply fluctuations typical of normal living and represent no increased health risk[175].

ICNIRP continues to review all available scientific evidence under review and recently said[176]:

*With regard to non-thermal interactions, it is in principle impossible to disprove their possible existence but the plausibility of the various non-thermal mechanisms that have been proposed is very low.*

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[173] *Health Effects of Electromagnetic Fields*, Expert Group on Health Effects of Electromagnetic Fields, Department of Communications, Marine and Natural Resources, March 2007
[174] "Biological effects of modulated radiofrequency fields" NCRP Commentary, National Council on Radiation Protection and Measurements, Bethesda, Maryland, USA December 2003
[175] Repacholi, MH, ed. 1998, *Low-level exposure to radiofrequency fields: Health effects and research needs*. Bioelectromagnetics 19: 1-19. 69
[176] ICNIRP statement 2009, *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)*,.Health Phys. 2009 Sep;97(3):257-8. doi: 10.1097/HP.0b013e3181aff9db

All major reviews of the available scientific database have carefully considered biological effects and their implications for human health.

For example, the UK Government's Mobile Telecommunications and Health Research Programme concluded[177]:

> *None of the research supported by the Programme and published so far demonstrates that biological or adverse health effects are produced by radiofrequency exposure from mobile phones.*

In fact, the Committee considered that there was no need for further investigation of biological effects.

The 2012 statement[178] by the Institution of Engineering and Technology (IET) – Europe's largest body of engineering and technology professionals – said:

> *The ubiquitous nature of our exposure to mobile phones means that, even if the risk to individuals is low, a large number of people could still experience health effects. However, experimental studies have failed to demonstrate consistent effects and no mechanism has been established whereby low-level exposure to radio-frequency fields can cause biological effects.*

**Claim 4:**
***The guidelines are only based on the view that only possible and only established effect of RF exposure is tissue heating (the RF-Thermal View) and ICNIRP rejects or omits all evidence that conflicts with this view***

**Response:**
Recently the former leader of the World Health Organisation's International EMF Project and Chairman Emeritus of ICNIRP – Dr Michael Repacholi – explained[179] there is a widespread misunderstanding about the 'weight of evidence' approach used for health risk assessments.

"Weight of evidence is NOT counting the number of positive and negative studies and then concluding there are more positive study results than negative, or vice versa," Dr Repacholi said.

A true weight of evidence approach requires that each study, both positive and negative, be evaluated for quality, he said.

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[177] *Mobile Telecommunications and Health Research Programme (MTHR) Report* 2007, MTHR Programme Management Committee, September 2007
[178] *The possible harmful biological effects of low-level electromagnetic fields of frequencies up to 300 GHz*, Institution of Engineering and Technology position statement, 8 May 8, 2012.
[179] Repacholi, M 2013 *Guest Blog from Mike Repacholi*, viewed 1 July 3013, http://betweenrockandhardplace.wordpress.com/2013/03/16/guest-blog-from-mike-repacholi/

"Quality assessment criteria for all study types are well known and studies can be given more or less weight, where those studies that conducted experiments correctly according to these criteria are given more weight or believability in the outcome, than those deemed low quality," Dr Repacholi said.

"All 'blue-ribbon' reviews use this approach. WHO has used this approach for over 50 years and it is a very well accepted, tried and true method for assessing health risks from any biological, chemical or physical agent."

**Claim 5:**
***WHO'S International Agency for Research on Cancer has classified RF Radiation as a "Possible Carcinogen" based on new research.***

**Response:**
The IARC working group undertook a hazard identification process, which is designed by default to red flag any potential concerns. This is especially useful for agents we don't know much about and might need to start taking precautions with.

However, this is not the case for mobile phones, which have been studied and reviewed extensively and already have added precautions, such as the 50-fold safety margin built into the standards.

An editorial[180] in the *Journal of The National Cancer Institute* explained the significance of the classification:

> *The change from "no conclusive evidence" to "possibly carcinogenic" was not new research, and it has understandably led to widespread public as well as media concern and confusion. The footnote accompanying the IARC press release is often missed—that a "possibly carcinogenic to humans" (2B) classification by IARC is based on "limited evidence of carcinogenicity" and that "chance, bias, or confounding could not be ruled out with reasonable confidence" for the few positive associations reported in the literature. A published summary of the IARC Working Group conclusions noted that some members found the epidemiologic evidence to be inadequate to support the 2B classification. Viewed in this context, "possibly carcinogenic" is not a signal to abandon mobile phones and return to landline phones. Rather, it is a signal that there is very little scientific evidence as to the carcinogenicity of cell phone use.*

IARC did not quantify the risk or likelihood of cancer. The assessment of health risks is the responsibility of another part of the WHO - the International Electromagnetic Fields (EMF) Project, which was set up in 1996

[180]Boice JD, Tarone RE, 2011, *Editorial: Cell Phones, Cancer, and Children* JNCI J Natl Cancer Inst, doi:10.1093/jnci/djr285

to assess the scientific evidence of possible adverse health effects from electromagnetic fields.

This group also provide information to governments around the world and produces the fact sheets on mobile phones and health as expert advice for the public.

Following the IARC announcement in early June 2011 the WHO updated its factsheet[181] on electromagnetic fields and public health in mid-June 2011 and while acknowledging the IARC classification have said mobile phones were not known to cause any health problems:

> *A large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use.*

The factsheet also explains why there appears to be a fundamental difference between the positions of IARC and another part of the WHO - the International Electromagnetic Fields (EMF) Project – who publish the factsheet.

The factsheet says the INTERPHONE project did not find any overall increase between the most common types of brain cancer and mobile phone use:

> *The international pooled analysis of data gathered from 13 participating countries found no increased risk of glioma or meningioma with mobile phone use of more than 10 years.*

However, the indications of a link with heavy users, which IARC largely based its classification, was inconsistent and the researchers could not rule out with any confidence that these indications were caused by biases or errors in the study:

> *There are some indications of an increased risk of glioma for those who reported the highest 10% of cumulative hours of cell phone use, although there was no consistent trend of increasing risk with greater duration of use. The researchers concluded that biases and errors limit the strength of these conclusions and prevent a causal interpretation.*
>
> *Based largely on these data, IARC has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), a category used when a causal association is considered credible, but when chance, bias or confounding cannot be ruled out with reasonable confidence.*

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[181] World Health Organization (WHO) Fact Sheet No. 193. Electromagnetic fields and public health: mobile phones, May 2010, viewed 1 July 2013, http://www.who.int/mediacentre/factsheets/fs193/en/index.html

Additional validation studies also found evidence that people diagnosed with a brain tumour over-reported their past mobile phone use and that this 'recall bias' may be more likely if subjects perceive that mobile phone use is associated with brain tumours, as has been widely speculated in the media.

Professor Patricia McKinney, epidemiologist at the University of Leeds and leader of the UK North part of the study, said in a statement:

> *For the estimated total (cumulative) hours of phone use there was an apparently increased risk of glioma seen in the highest ten percent of users. However, some of these had reported improbable levels of use, for instance 12 or more hours every day; there was no trend of increasing risk with greater phone use for people in the nine lower use categories; and there was no relation to risk for the cumulative number of phone calls made. These factors suggest that the apparently increased risk with the highest cumulative hours of use cannot be interpreted as evidence of mobile phones causing brain tumours.*

This extreme result is no more plausible than the results which showed users were protected by their mobile phone use – both are related to biases which are common in this type of study which is based on subjects' long-term recall of phone use.

IARC define evidence in human studies in which these sorts of biases cannot be ruled out as 'limited' – one level below sufficient evidence.

Although the authors of the Interphone study had highlighted these potential errors this evidence even if considered 'limited' it automatically put mobile phones in the 'possible' category.

Put simply, this comprehensive scientific review identified some suggestive evidence in the human studies but no consistent support from animal and cell studies.

**Claim 6:**
***Evidence for RF Damage to the Ecosystem is Mounting***

**Response:**
There is no solid evidence of RF damage to the environment and it is definitely not increasing – perhaps the allegations in the media and on the internet are increasing but these invariably found to be false or unsupported by scientific evidence.

A comprehensive review[182] of the research on environmental impacts of RF concluded:

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[182] Foster KR, Osepchuk JM, and Repacholi MH , 2002 *Environmental impacts of electromagnetic fields from major electrical technologies*. Environmental Health Perspectives

*Overall, it appears that the human EMF exposure limits recommended by the International Commission on Non-Ionizing Radiation (ICNIRP, 1998) would also be protective of the environment.*

The World Health Organisation (WHO) investigated the effects of electromagnetic fields (EMF) on the environment in their 2005 information sheet[183]. The WHO concluded:

*The limited number of published studies addressing the risk of EMF to terrestrial and aquatic ecosystems show little or no evidence of a significant environmental impact, except for some effects near very strong sources. From current information the exposure limits in the ICNIRP guidelines for protection of human health are also protective of the environment.*

A more recent review[184] by the German Federal Office for Radiation Protection (BfS) also concluded that there is no reliable scientific evidence of RF damage on animals and plants below existing standards.

**Claim 7:**
***The process to determine RF exposure from cellphones involves the use of a mannequin model that they say approximates a 6-foot-2, 220-pound person. Because the model represents only about 3 percent of the population, the test will not accurately predict the RF exposure of the other 97 percent of the population, including children.***

**Response:**
The SAM phantom was developed by IEEE ICES TC34 during the development of IEEE 1528-2003[185]. SAM model was designed to provide a conservative result to cover the user population, including children of various ages. The combination of higher tissue conductivities, a large head size, a thin ear and the exclusion of a hand holding the handset were chosen to provide a conservative estimate of the peak spatial-average SAR associated for the operating configurations expected by typical wireless handset users. Both a large head with a relatively flat cheek and thin ear bring the mobile phone closer to the head simulating liquid and therefore to induce conservatively higher peak SAR. A 14 laboratory

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[183] International EMF Project, Information Sheet, February 2005 Effects of EMF on the Environment, viewed 1 July 2013, http://www.who.int/peh-emf/publications/facts/envimpactemf_infosheet.pdf

[184] German Federal Office for Radiation Protection (BfS) Opinion on the question of possible effects of high frequency and low frequency electromagnetic fields on animals and plants, viewed 1 July 2013, http://www.bfs.de/de/bfs/forschung/stellungnahmen/EMF_Tiere_und_Pflanzen.html

[185] IEEE Std 1528-2003 *Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices – Measurement Techniques,* Institute of Electrical and Electronics Engineers, New York. 19 December 2003

comparison[186] and several other simulation studies on MRI-based realistic human models of various head sizes have shown that the SAM phantom is conservative for the user population.

> *This leads us to conclude that the SAM does produce a conservative estimate of SAR in the head and assures compliance with respect to the international exposure guidelines. The larger (adult) head resulted in a statistically higher peak SAR than did the smaller (child) head for all conditions[83].*

Therefore all phones tested using the SAM phantom that are found to be within the standards are approved for all users, including children.

**Claim 8:**
***The standards do not consider long-term side effects, such as infertility in males who carry phones in their pockets.***

**Response:**
It is simply incorrect to say that the exposure for carrying phones next to the body was 'unaccounted for' in the certification process.

Initially the tests were only done to make sure mobile phones cannot exceed the exposure standards when they are held close to sensitive organs such as the brain and eyes when making a voice call.

However, as mobile phones developed uses beyond voice calls and began to download and send data, a procedure was also developed to test 'smartphones' when they are being held near to the body and could be sending data, resulting in the development of IEC 62209-2 (2010).

**Claim 9:**
***Computer simulation of RF penetration, in contrast to estimating RF exposure using the fluid-filled plastic mannequin, demonstrates much greater exposures, particularly for children and small adults, than previously understood.***

**Response:**
The computer simulation methodology, known as Finite Difference Time Domain (FDTD) while an approved SAR assessment methodology doesn't provide any major benefit to existing compliance methodologies. Extensive studies have shown that when the FDTD computer modeling methodology is

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[186] Beard et al., 2006 *Comparisons of computed mobile phone induced SAR in the SAM phantom to that in anatomically correct models of the human head*, IEEE Transactions On Electromagnetic Compatibility Vol. 48, Pg. 397 - 407, 2006.

compared to the current test method – the current method covers all people including children.

One study compared computer models of an anatomically correct virtual family, based on MRI scans of real humans (including a 7-year-old child) and the current test method that uses an oversized SAM phantom model.

Because of the on-going interest in the media about this issue, an international task force of experts from 14 government, academic, and industrial research institutions was set-up to conduct independent test of both methods. The tests specifically looked at the influence of the smaller head size of the 7-year-old child model compared to the adult models and the SAM phantom model.

When all the data from all 14 labs was combined the study found the variations of results from the computer modelling and the experimental measurements made in phantoms were comparable and the computer modelling did not provide significant improvements in test methodology or accuracy.

When the exposure test results using both methods were compared the study[187] found:

> *This leads us to conclude that the SAM does produce a conservative estimate of SAR in the head and assures compliance with respect to the international exposure guidelines. The larger (adult) head resulted in a statistically higher peak SAR than did the smaller (child) head for all conditions.*

Therefore, international test procedures used to make sure mobile phones meet exposure standards cover all users including children.

It should also be remembered that the exposure standards for the general public includes an added safety factor of 50 fold or 5000%.

**Claim 10:**
***Because billions of young children and adults with heads smaller than SAM are now using cell phones extensively, and because they absorb proportionally greater cell phone radiation, it is essential and urgent that governments around the world revise approaches to setting standards for cell phone radiation, to include sufficient protection of children***

**Response:**
It is entirely understandable that some parents may be concerned about mobile phone safety and their children's use of mobiles. Concerns have also been raised about the possibility of greater vulnerability for children because

[187] Beard et al. Comparisons of computed mobile phone induced SAR in the SAM phantom to that in anatomically correct models of the human head in IEEE Transactions On Electromagnetic Compatibility Vol. 48, Pg. 397 – 407 2006

of an increased susceptibility to health risks during developmental stages and because young people will use mobile phones for most of their lives.

However, a number of independent reviews of all available science by international health authorities and governments have carefully considered this concern and found no evidence of any additional risk to children from mobile phone technologies. The reviews have also considered the 1996 paper which forms the basis of this question.

The most recent independent review to specifically look at this issue, conducted in 2009 by seven internationally recognised experts, found:

> *Overall, the review of the existing scientific literature does not support the assumption that children's health is affected by RF EMF exposure from mobile phones or base stations.*

Similarly a 2007 review by the Irish Government Expert Group, which conducted an in-depth scientific review of all the science on mobile phones and children, found:

> *There is no data available to suggest that the use of mobile phones by children is a health hazard.*

Also, international safety standards have taken these concerns and potential risks into account when developing their recommendations. The guidelines have been developed using worst-case scenarios and include added safety margins to ensure children are protected.

For example, the Chairman of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which developed the international safety standard, has concluded:

> *The protection system using basic restrictions and reference levels makes the ICNIRP guidelines flexible and applicable to virtually any exposure condition, and any group of population. Therefore, there is no need, or justification, for a special approach to the protection of children.*