To evaluate if the current EMF safety standards require updating, it is important to understand how the current standards even came about. The current FCC guidelines for safety related health effects of EMF are originally based on studies referenced in a 1982 ANSI standard (https://ieeexplore.ieee.org/document/27810/) which was later revised and superseded by a 1991 standard (https://ieeexplore.ieee.org/document/159488/). The standards are notable because even as they were written the authors expressed significant caveats and concerns about how they might be interpreted and used.

Specifically, figure A3 of the 1982 ANSI paper shows the relationship between the 1982 SAR line of 0.4 W/kg was set and the supporting research of that era.

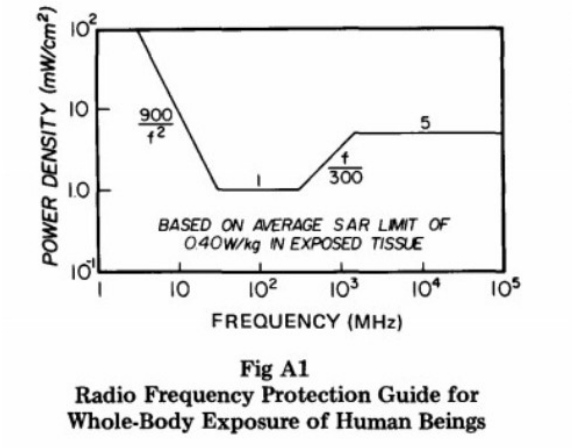


Fig A1
Radio Frequency Protection Guide for
Whole-Body Exposure of Human Beings

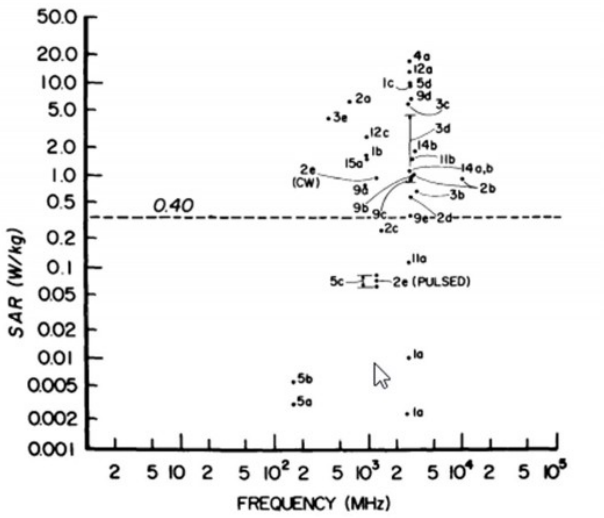


Fig A3
Whole-Body-Averaged SAR
Corresponding to Biological Effects Reported in
Various References of Appendix

Figure 3 uses a log scale, and there were 3 positive studies WELL below that 'safe' line. In the paper, studies 1,2, and 5, all mention calcium efflux and modulation, and because of the log scale occur at doses more than 100x lower than the 10-fold safety factor level, or more than 1000-fold lower than what the ANSI committee considered 'safe' based on this small sample available back in 1982. Even accounting for the additional 5-fold reduction introduced in the later 1992 standard, studies 1 and 5 had known positive studies at levels more 10-20 times lower than the limit as it currently exists. On page 13, the paper describes why:

> "Positive findings were claimed at much lower field strengths than employed by other investigators and because the periods of exposing animals are among the **longest of any reported** in the literature on microwave teratology… In addition, **modulation-specific effects, such as efflux of calcium ions** from brain materials [2], [5] were not considered adverse because of the inability of the subcommittee's members to relate them to human health" (emphasis added).

ANSI further clarifies on page 14.

> "6.8 Other Factors. It was recognized by the subcommittee that the specific absorption rate (SAR), which provides the basis for limiting power densities, **does not contain all of the**

> **factors that could be of importance in establishing safe limits of exposure.** First, other characteristics of an incident field such as **modulation frequency and peak intensity may pose a risk to health**. Again, the data base does not provide the evidence of adversity by which to recommend special provisions for modulated fields. There was an intuitive concern by some members of the subcommittee that caution should be exercised when individuals are exposed to a pulse-modulated field of high peak but low averaged density, or to a sinusoidally modulated field, when either field has a recurrence rate in the range of bioelectric rhythms. A supportable way of expressing this concern, which would be applicable to all exposed populations, could not be reached." (emphasis added)

In other words, in 1982, the subcommittee of industry representatives at ANSI did not state that biologic effects are impossible at 'much lower levels' because they had evidence that it did exist (even at more than 100 times lower levels), even as they made their recommendations back in 1982. Instead, they stated that they didn't know of enough data in human health at the time, and there were too many factors to consider so a solution could not be reached. In essence the authors argued that they did not know how to evaluate it and didn't think it to be of importance for their immediate concern of linemen being burned. In 1982 no federal limits existed at all! The IEEE committee therefore was just trying to do something reasonable and set some kind of a limit to prevent radiation burns, not establish what a 'safe' level was in general.

The 1982 document was superseded in 1991. The authors of ANSI-C95.1-1991, from which the FCC ultimately derived their update 5x lowering to make the 50x safety values, also specifically state warnings about this in the setting of pulsed fields. For example, on page 33:

> "Peak power limits are provided to prevent unintentionally high exposure and to preclude high SA for decreasingly short widths of RF pulses. For some time, it has been recognized that the lack of such consideration in the standard has allowed the peak power density to rise arbitrarily, as long as average power density met the standard. Furthermore, under exposure to pulsed fields it is advisable to be conservative in view of some uncertainty about the value of spatial peak SAR, which could be over twenty times the spatially-averaged SAR."

This history has dramatic importance given the technology changes that have occurred in the last 4 decades. There simply was never any guarantee that the FCC levels would have established this level for any person regardless of their genetics, such as the unusually sensitive patients with EMR Syndrome. In fact the evidence from these reports included significant evidence of biologic effects at much, much lower levels of exposure. But this was ignored, not because it was bad data, but because the committee was worried about a completely different issue.

However today, the old FCC standards are widely quoted and used by the telecom and power industries to claim their modern devices are 'safe' because the FCC has implied this by not setting any more stringent standard. In their eyes, the FCC standard implies that it is essentially impossible to have any biologic effects from non-thermal effects. This completely ignores how the standards came about in the first place, and additionally ignore how exposure environments have dramatically shifted from the time when these standards were developed. Modern devices typically use much higher frequencies with bursts of transmissions that result in very high peak values over a very short time period, while

bypassing the time averaged effects set by the standards. Time averaging was relevant for older continuous wave EMF in the 1980's, but is just a loophole in the standard today. The outdated standard specifically ignores the overwhelming evidence that biologic effects certainly do occur via non-thermal mechanisms. The current standards do not account for the effects of much longer exposure times, nor the additive effects from the numerous devices people are exposed to today.

The evidence that the biologic effects of EMF exposures are not limited to thermal effects is simply overwhelming. There now are literally thousands of peer reviewed scientific studies on this subject in both plants and animals outlining exactly how the pathophysiology works. EMF exposure clearly generates reactive oxygen species and free radical production. Dr. Martin Blank (https://www.physiology.columbia.edu/MartinBlank.html) wrote extensively on how this relates to DNA breakage specifically. Additionally, Dr. Martin Pall believes he has worked out how some proteins such as the voltage activated calcium channel may be directly affected by EMF and has demonstrated the exact regions of this protein that are involved and explained why they are so sensitive. (e.g. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3780531/, https://www.degruyter.com/view/j/reveh.2015.30.issue-2/reveh-2015-0001/reveh-2015-0001.xml, https://www.sciencedirect.com/science/article/pii/S0891061815000599#sec0015). These effects are demonstrated in large randomized trials which have shown clearly causal connections between non-thermal exposures and cancer. (e.g. https://ntp.niehs.nih.gov/sites/default/files/ntp/htdocs/lt_rpts/tr595_508.pdf https://www.sciencedirect.com/science/article/abs/pii/S0013935118300367).

The standard needs to be updated and specifically account for the reality of exposures present in a modern environment.