



Biological Effects of Radio Frequency Radiation (RFR) on Fertility
Measured in Microwatts per Meter Squared ($\mu\text{W}/\text{m}^2$) and SAR (Watts/Kilogram)
By Stephanie Sage Kerst, [EMRS](#)

10,000,00 $\mu\text{W}/\text{m}^2$	US FCC public safety limit for power density (frequencies above 1000 MHz).
11,680-10,530 $\mu\text{W}/\text{m}^2$	Irreversible infertility in mice after five generations of exposure to RFR from 'antenna park' (Magras, 1997).
5,000-10,000 $\mu\text{W}/\text{m}^2$	WiFi intensity laptop exposure for 4 hours decreased sperm viability and caused DNA fragmentation. Sperm placed in petri dishes under a laptop connected to the internet via WiFi (Avendano, 2012).
700-1000 $\mu\text{W}/\text{m}^2$	Sperm head abnormalities in 39%-46% of sperm at cell tower levels of RFR. Pin-head and banana-shaped sperm heads (abnormal shape). Adverse effects on reproductive health of humans living in close proximity to GSM base stations (Otitoloju, 2010).
> 1000 $\mu\text{W}/\text{m}^2$	Building Biology Extreme Concern Level SBM2015
10-1000 $\mu\text{W}/\text{m}^2$	Building Biology Severe Concern Level SBM2015
0.1-10 $\mu\text{W}/\text{m}^2$	Building Biology Slight Concern Level SBM2015
3-6 $\mu\text{W}/\text{m}^2$	Bioinitiative 2012 Precautionary Target Level
< 0.1 $\mu\text{W}/\text{m}^2$	Building Biology No Concern Level SBM2015

1.6 W/kg	FCC Specific Absorption Rate (SAR) for torso and head (for a 30 min exposure).
1.8 W/kg	900 MHz whole body RFR resulted in sperm cell death, deformation of sperm cells, prominent clumping of sperm into 'grassy rafts' with deformed tails, unable to swim or separate (Yan, 2007).
1.5 W/kg	GSM cell phone exposure affected gene expression and heat shock protein was significantly increased, indicating cell stress (Czyz, 2004).
1.46 W/kg	850 MHz cell phone radiation decreased sperm motility and viability. Decrease dependent on amount of time spent on a cell phone (Agarwal, 2008).
1.0 W/kg	Motility, sperm count, sperm morphology and viability impaired in dose-response manner with increasing RFR (De luliis, 2009).
1.0 W/kg	Human semen degraded by cell phone radiation via oxidative damage (Agarwal, 2008).
< 1.0 W/kg	STANDBY ONLY mode decreased ovarian follicles. RFR has toxic effects on ovaries of offspring when exposed in utero (Gul, 2009).
0.9 W/kg	Decreased sperm count and more sperm cell death (Kesari, 2012).
0.795 W/kg	Significant decrease in ovarian development and size due to DNA damage. Premature death of nurse cells and follicles in ovaries (Panagopoulous, 2012).
0.43 W/kg	Significant decrease in sperm mobility, drop in sperm concentration and decrease in seminiferous tubules in testes with 800 MHz, 8-hr day, 12-week exposure on STANDBY MODE (in rabbits) (Salama, 2010).
0.141 W/kg	Structural changes in the testes (Dasdag, 1999).
0.091 W/kg	Wireless internet at 2450 MHz increased DNA damage, reduced DNA repair at intensities below 802.11 WiFi limits. Threatens sperm cell integrity and poses risk to male fertility (Atasoy, 2012).
0.014 W/kg	Sperm damage from oxidative stress and lower melatonin levels (Kumar, 2012).

References:

Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. 2008. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. *Fertil Steril.* 89(1):124-8.

Agarwal A, Desai NR, Makker K, Varghese A, Mouradi R, Sabanegh E, Sharma R. 2009. Effects of radiofrequency electromagnetic waves (RF-EMW) from cellular phones on human ejaculated semen: an in vitro pilot study. *Fertil Steril.* 92(4) 1318-1325.

Atasoy HI, Gunal MY, Atasoy P, Elgun S, Bugdayci G. 2012 Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *J Pediatr Urol.* [Epub ahead of print].

Avendano C, Mata A, Sanchez Sarmiento CA, Doncei GF. 2012. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. *Fertility and Sterility.* American Society for Reproductive Medicine, Published by Elsevier Inc. doi:10.1016/j.fertnstert.2011.10.012.

BiolInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BiolInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Radiation at www.bioinitiative.org, December 31, 2012.

Building Biology Institute Guidelines SBM2015: <https://buildingbiology.com/site/downloads/richtwerte-2015-englisch.pdf>

Czyz J et al, 2004. High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells. *Bioelectromagnetics* 25: 296-307.

Dasdag, S et al, 1999. Whole-body microwave exposure emitted by cellular phones and testicular function of rats. *Urological Research* 27(3):219-223.

De Iuliis GN, Newey RJ, King BV, Aitken RJ. 2009. Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. *PLoS One* 4(7):e6446.

FCC Guidelines: https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf.

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

Kesari KK, Behari J. 2012 Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats: Role of ROS. *Electromagn Biol Med.* 31(3):213-22,

Otitolaju AA, Obe IA, Adewale OA, Otubanjo OA, Osunkalu VO. 2010. Preliminary study on the induction of sperm head abnormalities in mice, *Mus musculus*, exposed to radiofrequency radiations from global system for mobile communication base stations. *Bulletin of Environmental Contamination and Toxicology* 84(1):51-4.

Magras, IN & Zenos, TD, 1997. RF Radiation-induced changes in the prenatal development of mice. *Bioelectromagnetics* 18:455-461.

Panagopoulos DJ. 2012. Effect of microwave exposure on the ovarian development of *Drosophila melanogaster*. *Cell Biochem Biophys.* 63(2):121-132.

Sage C (2017). Testicular Cancer in Teenage Boys: Is Cell Phone Radiation a Risk Factor for Young Boys Who Wear their Cell Phone on a Belt or in a Front Pocket? *PLOS ONE*/ DOI:10.1371/journal.pone.0172986 February 24, 2017. Comment on PLOS paper reporting 'that for boys in the 15-19 age group, that testicular cancer annual incidence increased by 1.55% as diagnosed between 2008 and 2012.

Salama N, Kishimoto T, Kanayama HO. 2010. Effects of exposure to a mobile phone on testicular function and structure in adult rabbit. *Int J Androl.* 33(1):88-94.

Yan JG, Agresti M, Bruce T, Yan YH, Granlund A, Matloub HS. 2007. Effects of cellular phone emissions on sperm motility in rats. *Fertility and Sterility* 88(4):957-64.