

Radiofrequency Radiation Power Density Levels for Smart Meters,
Various Biological Effects, and Exposure Guidelines (Revised April 2015)

Parameter/Effect	Power Density (milliWatts/m ²)	Reference Information
Headaches, concentration difficulties, restlessness, tremor, and sleep disruption associated with chronic exposure to mobile phone base stations.	0.5 to 1.0	<p>“Mobile Phone Base Stations – Effects on Wellbeing and Health,” Kundi M and Hutter HP, <i>Pathophysiology</i>, 2009 Aug; 16(2-3):123-35.</p> <p>Refer to link at: http://www.ncbi.nlm.nih.gov/pubmed/19261451.</p> <p>As stated in the BioInitiative Report 2012: “Kundi and Hutter (2009) reviewed human effects in fourteen (14) mobile phone base station studies and reported ‘(F)rom available evidence [at the time of the study review] it is impossible to delineate a threshold below which no effect occurs, however, given the fact that studies reporting low exposure were invariably negative it is suggested that power densities around 0.5–1 mW/m² [0.05 – 0.1 uW/cm²] must be exceeded in order to observe an effect.’”</p>
Wi-Fi emissions affect brain activity and cognitive functions.	0.6	<p>“Effects of Wi-Fi signals on the P300 Component of Event-related Potentials during an Auditory Hayling Task,” by Charalabos Papageorgiou, et.al., <i>Journal of Integrative Neuroscience</i>, June 2011, pp 189-202.</p> <p>Refer to link at: http://www.ncbi.nlm.nih.gov/pubmed/21714138.</p> <p>“The field strength was 0.49 V/m at the point where the subjects’ head was standing. ... the present findings suggest that Wi-Fi exposure may exert gender-related alterations on neural activity associated with the amount of attentional resources engaged during a linguistic test adjusted to induce WM [working memory].” [0.49 V/m = 0.64 mW/m²]</p>

Radiofrequency Radiation Power Density Levels for Smart Meters,
Various Biological Effects, and Exposure Guidelines (Revised April 2015)

Parameter/Effect	Power Density (milliWatts/m ²)	Reference Information
Laptop Wi-Fi emissions decreases human sperm motility and increases sperm DNA fragmentation.	5 to 10	<p>“Use of Laptop Computers Connected to Internet through Wi-Fi Decreases Human Sperm Motility and Increases Sperm DNA Fragmentation,” by Conrado Avendaño, et.al., American Society for Reproductive Medicine, <i>Fertility and Sterility</i>, volume 97, Number 1, January 2012, pp 39-45; refer to link at: http://www.sciencedirect.com/science/article/pii/S0015028211026781.</p> <p>“With the caveat that these data were obtained with sperm samples incubated in vitro, our findings suggest that prolonged use of portable computers sitting on the lap of a male user may decrease sperm fertility potential.”</p> <p>Exposure levels during the course of the above study varied from 0.5 to 1.0 μwatts/cm² (or 5 to 10 mW/m²).</p>
Changes in cardiac function, including altered heart rate, arrhythmia, and/or tachycardia due to exposure from a cordless phone base station.	30	<p>“Radiation from Wireless Technology Affects the Blood, the Heart, and the Autonomic Nervous System,” Magda Havas, <i>Reviews on Environmental Health</i>, Volume 28 (November 2013), Issue 2-3, Pages 75–84; refer to http://www.degruyter.com/view/j/reveh.2013.28.issue-2-3/reveh-2013-0004/reveh-2013-0004.xml</p> <p>“Some people who are electrically hypersensitive complain of pain or pressure in the chest area, heart palpitations, and/or an irregular heartbeat, accompanied by feelings of anxiety that develop rapidly.”</p> <p>“25 subjects from Colorado were tested, and although most subjects did not react adversely to the radiation from the cordless phone base station, a few did react with either tachycardia (rapid heart rate) or arrhythmia (irregular heart rate). The reaction was often immediate and coincided with exposure to the radiation. When the radiation ceased, the heart returned to normal.”</p> <p>“The level of radiation in this experiment was well below international guidelines. Subjects were exposed to 3 μW/cm² [equivalent to 30 mW/m² at] 2.4-GHz frequencies.”</p> <p>“The cordless phone provocation study has since been repeated for a larger group of subjects and shows similar results.”</p>

Radiofrequency Radiation Power Density Levels for Smart Meters,
Various Biological Effects, and Exposure Guidelines (Revised April 2015)

Parameter/Effect	Power Density (milliWatts/m ²)	Reference Information
Russian and Chinese RF Public Health Standard.	100	<p>Russian Federation Sanitary Norms and Regulations, SanPiN 2.2.4/2.1.8.055-96, "Radiofrequency Electromagnetic Radiation (RF EMR) Under Occupational and Living Conditions."</p> <p>National Standard of the People's Republic of China, UDC 614.898.5 GB 9175—88, "Hygienic Standard for Environmental Electromagnetic Waves."</p>
Wireless smart meter RF levels at 3 feet – based upon a modeled exposure scenario.	400	<p>EPRI Document # 1022270, "Radio-Frequency Exposure Levels from Smart Meters: A Case Study of One Model," February 2011.</p> <p>Refer to link at: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=00000000001022270.</p> <p>This value is <u>calculated</u> for purposes of Table 1 of the EPRI document as a comparison of "Radio-Frequency Levels from Various Sources." This is the calculated peak power density three feet in front of a smart meter with a 1 watt transmitter and an antenna gain of 4. This value has been frequently used by smart grid industry organizations (including the California Council on Science and Technology) to compare RF levels from different emission sources. Sometimes duty cycle factors are applied to the 40 μwatts/cm² (or 400 mW/m²) value in an attempt to reduce the reported number to a lower value.</p>
USA and Canada RF Public Exposure Guideline.	6,000 to 10,000	<p>United States Code of Federal Regulations, 47 CFR - Telecommunications and "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," OET Bulletin 65, August 1997.</p> <p>Health Canada's Safety Code 6 and "Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz - Safety Code 6 (2009)."</p>