

## Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter <sup>2</sup> - uW/cm <sup>2</sup> )		Reference
As low as (10 <sup>-13</sup> ) or 100 femtowatts/cm <sup>2</sup>	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA)	Belyaev, 1997
5 picowatts/cm <sup>2</sup> (10 <sup>-12</sup> )	Changed growth rates in yeast cells	Grundler, 1992
0.1 nanowatt/cm <sup>2</sup> (10 <sup>-10</sup> ) or 100 picowatts/cm <sup>2</sup>	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin condensation (DNA) intensities comparable to base stations	Belyaev, 1997
0.00034 uW/cm <sup>2</sup>	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count,	Behari, 2006
0.0005 uW/cm <sup>2</sup>	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure	Velizarov, 1999
0.0006 - 0.0128 uW/cm <sup>2</sup>	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardio-vascular problems reported with exposure to GSM 900/1800 MHz cell phone signal at base station level exposures.	Oberfeld, 2004
0.0009 uW/cm <sup>2</sup>	RFR induced 10%-40% increase in DNA synthesis in glioma cells (brain)	Stagg, 1997
0.003 - 0.02 uW/cm <sup>2</sup>	In children and adolescents (8-17 yrs) short-term exposure caused headache, irritation, concentration difficulties in school.	Heinrich, 2010
0.003 to 0.05 uW/cm <sup>2</sup>	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems)	Thomas, 2010
0.005 uW/cm <sup>2</sup>	In adults (30-60 yrs) chronic exposure caused sleep disturbances, (but not significantly increased across the entire population)	Mohler, 2010
0.005 - 0.04 uW/cm <sup>2</sup>	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.006 - 0.01 uW/cm <sup>2</sup>	Chronic exposure to base station RF (whole-body) in humans showed increased stress hormones; dopamine levels substantially decreased; higher levels of adrenaline and nor-adrenaline; dose-response seen; produced chronic physiological stress in cells even after 1.5 years.	Buchner, 2012
0.01 - 0.11 uW/cm <sup>2</sup>	RFR from cell towers caused fatigue, headaches, sleeping problems	Navarro, 2003

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

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0.01 - 0.05 uW/cm <sup>2</sup>	Adults (18-91 yrs) with short-term exposure to GSM cell phone radiation reported headache, neurological problems, sleep and concentration problems.	Hutter, 2006
0.005 - 0.04 uW/cm <sup>2</sup>	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.015 - 0.21 uW/cm <sup>2</sup>	Adults exposed to short-term GSM 900 radiation reported changes in mental state (e.g., calmness) but limitations of study on language descriptors prevented refined word choices (stupified, zoned-out)	Augner, 2009
0.05 - 0.1 uW/cm <sup>2</sup>	RFR linked to adverse neurological, cardio symptoms and cancer risk	Khurana, 2010
0.05 - 0.1 uW/cm <sup>2</sup>	RFR related to headache, concentration and sleeping problems, fatigue	Kundi, 2009
0.07 - 0.1 uW/cm <sup>2</sup>	Sperm head abnormalities in mice exposed for 6-months to base station level RF/MW. Sperm head abnormalities occurred in 39% to 46% exposed mice (only 2% in controls) abnormalities was also found to be dose dependent. The implications of the pin-head and banana-shaped sperm head. The occurrence of sperm head observed increase occurrence of sperm head abnormalities on the reproductive health of humans living in close proximity to GSM base stations were discussed."	Otitolaju, 2010
0.38 uW/cm <sup>2</sup>	RFR affected calcium metabolism in heart cells	Schwartz, 1990
0.8 - 10 uW/cm <sup>2</sup>	RFR caused emotional behavior changes, free-radical damage by super-weak MWs	Akoev, 2002
0.13 uW/cm <sup>2</sup>	RFR from 3G cell towers decreased cognition, well-being	Zwamborn, 2003
0.16 uW/cm <sup>2</sup>	Motor function, memory and attention of school children affected (Latvia)	Kolodynski, 1996
0.168 - 1.053 uW/cm <sup>2</sup>	Irreversible infertility in mice after 5 generations of exposure to RFR from an 'antenna park'	Magras & Zenos, 1997
0.2 - 8 uW/cm <sup>2</sup>	RFR caused a two-fold increase in leukemia in children	Hocking, 1996
0.2 - 8 uW/cm <sup>2</sup>	RFR decreased survival in children with leukemia	Hocking, 2000
0.21 - 1.28 uW/cm <sup>2</sup>	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increases In headaches.	Riddervold, 2008

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