



Biological Effects of Radio Frequency Radiation (RFR) on Cognition, Memory and Behavior in Adults and Children

Measured in Microwatts per Meter Squared ($\mu\text{W}/\text{m}^2$)

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10,000,00 $\mu\text{W}/\text{m}^2$	US FCC public safety limit for power density (frequencies above 1500 MHz).
40,000 $\mu\text{W}/\text{m}^2$	RFR caused changes in hippocampus (brain, memory and learning) (Tattersall, 2001).
2100-12,800 $\mu\text{W}/\text{m}^2$	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increased headaches (Riddervold, 2008).
1200 $\mu\text{W}/\text{m}^2$	RFR from 3G cell towers decreased cognition and well-being (Zwamborn, 2003).
> 1000 $\mu\text{W}/\text{m}^2$	Building Biology Extreme Concern Level SBM2015
500-1,000 $\mu\text{W}/\text{m}^2$	RFR related to headache, concentration and sleeping problems, fatigue (Kundi, 2009).
100-1100 $\mu\text{W}/\text{m}^2$	RFR from cell towers caused fatigue, headaches, sleeping problems (Navarro, 2003).
100-500 $\mu\text{W}/\text{m}^2$	Adults (18-91 yrs) with short-term exposure to GSM cell phone radiation reported headache, neurological problems, sleep and concentration problems (Hutter, 2006).
50-400 $\mu\text{W}/\text{m}^2$	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated (Thomas, 2008).
50 $\mu\text{W}/\text{m}^2$	In adults (30-60 yrs) chronic exposure caused sleep disturbances, (but not significantly increased across the entire population) (Mohler, 2010).
30-500 $\mu\text{W}/\text{m}^2$	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems) (Thomas, 2010).
30-200 $\mu\text{W}/\text{m}^2$	In children and adolescents (8-17 yrs) short-term exposure caused headache, irritation, concentration difficulties in school (Heinrich, 2010).
10-1000 $\mu\text{W}/\text{m}^2$	Building Biology Severe Concern Level SBM2015
6-128 $\mu\text{W}/\text{m}^2$	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardiovascular problems reported with exposure to GSM 900/1800 MHz cell phone signal at base station level exposures (Oberfeld, 2004).
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

Source: BioInitiative 2012 Report, RF Color Charts and Bibliography, C. Sage, 2012 as amended.

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