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Presentation to:

Birmingham, Michigan Public Schools

February 16, 2022



by:

Kent Chamberlin, PhD

Professor & Chair Emeritus

Fulbright Distinguished Chair

Dept. of Electrical & Computer Engineering

University of New Hampshire

Conflict-of-Interest Statement

- My position at the time I joined the New Hampshire State Commission was Professor & Chair of the Dept. of ECE at UNH
 - My bias was and is generally in favor of technological developments
 - I also served on the InterOperability Laboratory Advisory Board, which is an international evaluator of wireless technologies
 - Was active in Project 54, addressing the communications needs of police and first responders
 - I am serving as Vice-Chair for the Virtual Learning Academy Charter School BoT and have served on other educational boards
- I served on the Commission without any compensation, including travel expenses
- Because of my service on the Commission, I am asked to present to various groups, including your group, none of which involve compensation
- I present to you today as a fellow citizen, with no realized or expected financial rewards

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NH Commission on the Health and Environmental Impacts of 5G and Wireless Technology

- The Commission was convened through [bipartisan legislation](#) that was passed by the legislature and signed by the Governor
 - This is the first legislation passed in the United States calling for the formation of a commission to explore the health effects of 5G
- The 13 Commission members had backgrounds that included physics, toxicology, electromagnetics, epidemiology, biostatistics, occupational health, medicine, public health policy, business, and law
- The Commission met over a one-year period and heard from 9 experts.
 - All but one of the experts were unpaid, except for the expert hired by the Telecom Industry; that expert was the only one who said that there were no risks associated with radiation from wireless devices

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Conclusions Reached by the Commission

- Conclusions and recommendations are given in the [Final Report](#)
- Cellphone radiation, including 5G, poses a significant threat to human health and the environment
- This is not a scientific issue, it is a political issue
 - The peer-reviewed science is quite clear about the risks about radiation exposure
 - Technology can be used to significantly lower radiation exposure, but that would come at a cost to the industry

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What Is Known About the Placement of Cell Towers Near to People?



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What happened
when the cell towers
were turned on?

Within a week of installation many firefighters developed unusual symptoms of headaches, fatigue, insomnia, memory loss, confusion, nausea and weakness. After a time, firefighters in stations with adjacent cell towers were found to have forgotten CPR or became lost responding to a fire in a city they grew up in.

[Physicians for Safe Technology](#)

6

Article Title: Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression

Quote from article: “Non-thermal microwave/lower frequency electromagnetic fields (EMFs) act via voltage-gated calcium channel (VGCC) activation. ... Among the more commonly reported changes are sleep disturbance/insomnia, headache, depression/depressive symptoms, fatigue/tiredness, dysesthesia, concentration/attention dysfunction, memory changes, dizziness, irritability, loss of appetite/body weight, restlessness/anxiety, nausea, skin burning/tingling/dermographism and EEG changes.”

Pall, Martin L., Journal of Chemical Neuroanatomy, Volume 75, Part B, 2016, Pages 43-51, ISSN 0891-0618

<https://www.sciencedirect.com/science/article/pii/S0891061815000599>

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Key Question

- What is a safe setback distance for a cell tower?
 - Why did the New Hampshire Commission pick a setback distance of 500 meters (1,640 feet)?

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Article Title:
Mortality by
neoplasia and
cellular telephone
base stations in the
Belo Horizonte
municipality, Minas
Gerais state, Brazil

The article reports on research that analyzed the spatial correlation between how close people lived to a cell tower and cases of deaths by neoplasia. Data obtained from Brazilian government databases.

Covered timeframe 1996-2006; conclusions based on study of 856 cell towers.

The largest power density measured during the study was $40.78 \mu\text{W}/\text{cm}^2$ ($407.8 \text{ mW}/\text{m}^2$)

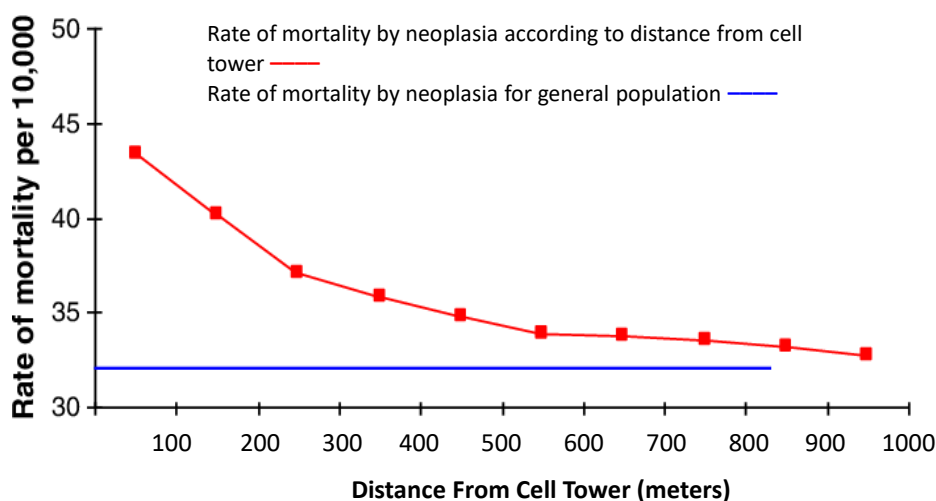
Adilza C. Dode, Mônica M.D. Leão, Francisco de A.F. Tejo, Antônio C.R. Gomes, Daiana C. Dode, Michael C. Dode, Cristina W. Moreira, Vânia A. Condessa, Cláudia Albinatti, Waleska T. Caiaffa,

"Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil", Science of The Total Environment, Volume 409, Issue 19, 2011, Pages 3649-3665, ISSN 0048-9697

<https://doi.org/10.1016/j.scitotenv.2011.05.051>

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Take-Away from Article Referenced on Previous Slide



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Schools and Cell Tower Setback Examples

Many communities have policies, ordinances or zoning that ensures cellular antennas are restricted to a specific minimum distance from schools.

Palo Alto, California: 1,500 feet

<https://mdsafetech.files.wordpress.com/2020/02/palo-alto-unified-school-district-resolution-on-cell-tower-setbacks-2019.pdf>

Los Altos, California: 500 feet (small cells)

https://www.losaltosca.gov/sites/default/files/fileattachments/city_council/page/48421/resolution_no_2019-35.pdf

Walnut City, California: 1,500 feet

<https://ehitrust.org/wp-content/uploads/Walnut-CA-Telcom-Setbacks-1.png>

Bar Harbor, Maine: 1,500 feet

<https://centerforsaferwireless.us/web/main/index.php/20-resources/article-archive/85-cell-tower-setbacks-at-schools-and-daycare-facilities>

Sallisaw, Oklahoma: 1,500 feet

https://www.oklahomacounty.org/Portals/0/CelltowerRegulations2_1.pdf

Stockbridge, Massachusetts: 1,500 feet

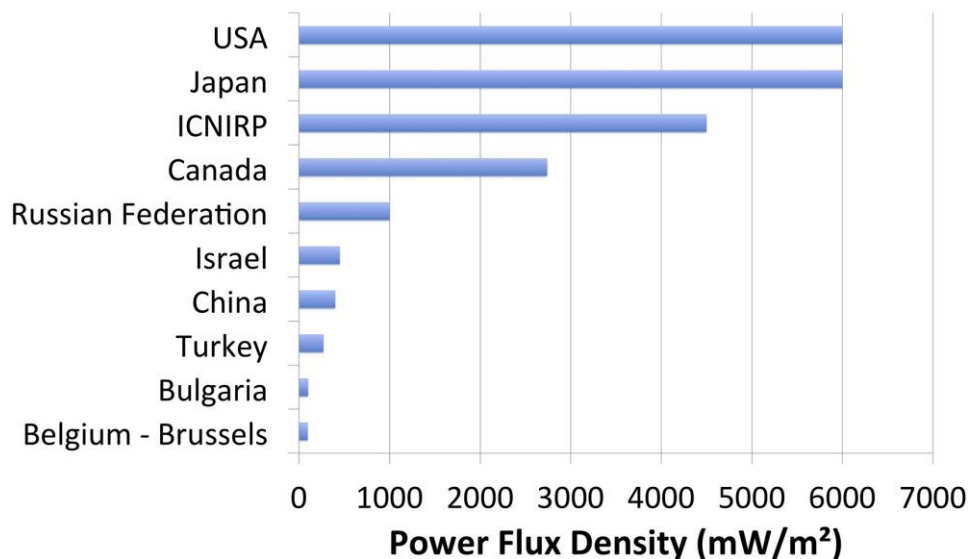
<https://stockbridge-ma.gov/wp-content/uploads/2017/10/TOWN-OF-STOCKBRIDGE-MASSACHUSETTS-Zoning-Bylaws-2017.pdf>

San Diego County California 1,000 feet (small cells)

<https://www.sandiegocounty.gov/content/sdc/pds/advance/smallcellwirelessfacilities.html>

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How Do FCC Standards Compare Internationally?



Frank M. Clegg, Margaret Sears, Margaret Friesen, Theodora Scarato, Rob Metzinger, Cindy Russell, Alex Stadtner, Anthony B. Miller, Building science and radiofrequency radiation: What makes smart and healthy buildings, Building and Environment, Volume 176, 2020, 106324, ISSN 0360-1323, <https://doi.org/10.1016/j.buildenv.2019.106324>.

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These Governments
Measure & Publish
RFR Levels Online

These Governments Measure & Publish RFR Levels Online

France		Switzerland
Spain		Bulgaria
Austria		Tunisia
Greece		Malta
Turkey		Bhutan
India		Brazil
Israel		Bahrain
Gibraltar		Monaco
Brussels Belgium		French Polynesia

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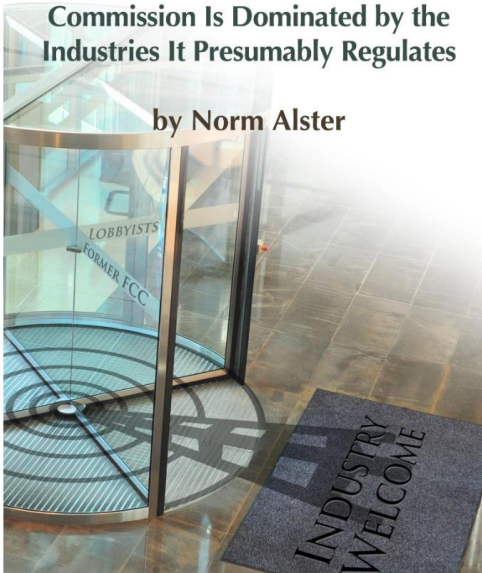
Why Aren't Our
Regulatory
Agencies Doing
More to Protect the
Public?

- There are thousands of refereed publications documenting the harm associated with Radio Frequency Radiation (RFR)
- Many other countries have lower RFR thresholds
- FCC standards were set in the 1990s; a lot has changed electromagnetically since then
- The FCC did not answer questions posed to it by the NH Commission

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Captured Agency:

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates



by Norm Alster

www.ethics.harvard.edu

What Role Do Regulatory Agencies Play?

“Industry controls the FCC through a soup-to-nuts stranglehold that extends from its well-placed campaign spending in Congress through its control of the FCC’s Congressional oversight committees to its persistent agency lobbying.”

<https://ethics.harvard.edu/news/new-e-books-edmond-j-safraresearch-lab>

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Harvard Report Shows Wireless Industry Using a Playbook Similar to the One Used by Big Tobacco

- To ensure its access on Capitol Hill, the wireless industry made \$26 million in campaign contributions in 2016, [according to the Center for Responsive Politics](#), and spent \$87 million on lobbying in 2017.
- The playbook’s key insight is that an industry doesn’t have to win the scientific argument about safety; it only has to keep the argument going.
 - As recently as 1998, even as evidence of tobacco toxicity grew overwhelming, cigarette maker Phillip Morris was writing newspaper advertorials insisting there was no proof smoking caused cancer: [page 20 of Harvard Report](#)

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CTIA Sues Berkeley, CA Over Ordinance Requiring Retailers to Warn Cellphone Users

Berkeley Ordinance: "To assure safety, the Federal Government requires that cell phones meet radio frequency (RF) exposure guidelines. If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation. This potential risk is greater for children. Refer to the instructions in your phone or user manual for information about how to use your phone safely."

Similar information is contained in all cellphones or in their manuals

-For iPhone, go to Settings/General/Legal & Regulatory/RF Exposure

A federal judge [ruled in favor](#) of a wireless communication trade group five years after they claimed the city of Berkeley's law that required retailers to warn customers about cellphone radiation violated their First Amendment rights. *July, 26, 2021*

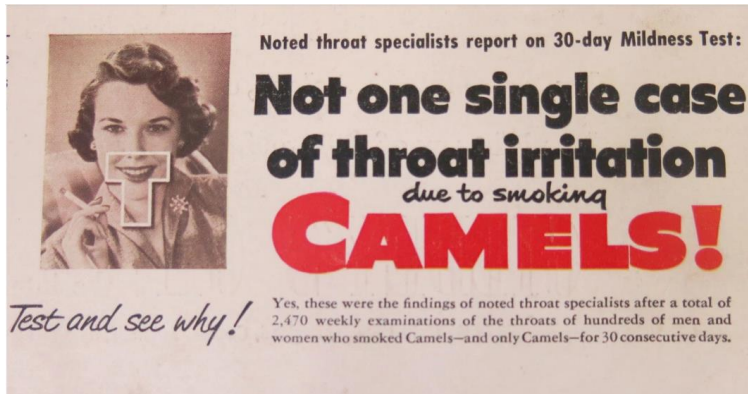
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Verizon
Acknowledges
the Risks of
Wireless
Radiation to
its
Shareholders

From page 17 of [Verizon's 2022 10-K Report](#):

- "...our wireless business also faces personal injury and wrongful death lawsuits relating to alleged health effects of wireless phones or radio frequency transmitters. We may incur significant expenses in defending these lawsuits. In addition, we may be required to pay significant awards or settlements."

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Noted throat specialists report on 30-day Mildness Test:

**Not one single case
of throat irritation
due to smoking
CAMELS!**

Test and see why!

Yes, these were the findings of noted throat specialists after a total of 2,470 weekly examinations of the throats of hundreds of men and women who smoked Camels—and only Camels—for 30 consecutive days.

"Doubt is our product since it is the best means of competing with the "body of fact" that exists in the minds of the general public. It is also the means of establishing a controversy." Tobacco executive (22) in Doubt is Our Product
by David Michaels

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Feb 2021:

FCC sued by
Environmental Health
Trust and others for
dismissing evidence of
serious health impacts
from wireless tech

• What the [Lawsuit](#) is About

- FCC ignored substantial record evidence when it decided that its 1996 RF exposure limits and regulations still provide adequate protection.
- FCC Violated the Administrative Procedure Act because its order is arbitrary and capricious, and not evidence-based as they did not fully address the scientific research findings showing harm in their response when they determined that FCC limits did not need to be changed.
- FCC Violated the National Environmental Policy Act because the FCC did not take a hard look on the environmental impacts of its decision.
- FCC Violated the 1996 Telecommunications Act because the FCC failed, as required by the TCA, to consider the impact of its decision on the public health and safety.
- FCC regs are preempting ADA/FHA accommodation obligations for those afflicted by Radiation Sickness.

During oral arguments one of the judges, Robert Wilkins, told the FCC, "I am inclined to rule against you."

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August 13, 2021



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Peer-Reviewed
Publications Used by
NH Commission to
Draw Conclusions
for Majority Report

- What is shown on next slides are examples of journal articles documenting negative health effects
 - These are not from “fringe publications” nor are they people’s opinions; they have been reviewed by experts in their fields
 - Poor quality journals do exist, but they are readily identified by metrics such as the backgrounds of people serving on their review boards, their reviewers, impact factor, citation indices
 - I was an Assoc. Editor for IEEE Transactions on Antennas and Propagation, and I am aware of how to assess the quality of a journal
 - Articles address exposure to cellphone frequency radiation, and their findings extend to 5G and other forms of high-speed-digital data transmission

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Article Title: Low intensity microwave radiation induced oxidative stress, inflammatory response and DNA damage in rat brains

Quote from article: “In conclusion, the present study suggests that low intensity microwave radiation induces oxidative stress, inflammatory response and DNA damage in the brain by exerting a frequency dependent effect.”

Megha K, Deshmukh P, Banerjee B, et al.,
NeuroToxicology (2015) 51 158-165,
[https://DOI: 10.1016/j.neuro.2015.10.009](https://doi.org/10.1016/j.neuro.2015.10.009)

23

Article Title: Exposure to non-ionizing electromagnetic fields emitted from mobile phones induced DNA damage in human ear canal hair follicle cells

Quote from article: “Results of the study showed that DNA damage indicators were higher in the RFR exposure groups than in the control subjects. In addition, DNA damage increased with the daily duration of exposure.”

Mehmet Akdag, Suleyman Dasdag, Fazile Canturk & Mehmet Zulkuf Akdag (2018), Electromagnetic Biology and Medicine, 37:2, 66-75, DOI: [10.1080/15368378.2018.1463246](https://doi.org/10.1080/15368378.2018.1463246)

24

Article Title: Exposure to Global System for Mobile Communication (GSM) Cellular Phone Radiofrequency Alters Gene Expression, Proliferation, and Morphology of Human Skin Fibroblasts

Quote from article: “These findings show that these electromagnetic fields have significant biological effects on human skin fibroblasts.”

Stefania Pacini, Marco Ruggiero, Iacopo Sardi, Stefano Aterini, Franca Gulisano, and Massimo Gulisano, *Oncology Research*, 2002, Vol. 13, pp. 19–24

DOI: 10.3727/096504002108747926

<https://pubmed.ncbi.nlm.nih.gov/12201670/>

25

Article Title: Radiation and Male Fertility

Quote from article: “From currently available studies it is clear that radiofrequency electromagnetic fields (RF-EMF) have deleterious effects on sperm parameters (like sperm count, morphology, motility), affects the role of kinases in cellular metabolism and the endocrine system, and produces genotoxicity, genomic instability and oxidative stress.”

Kesari et al., *Reproductive Biology and Endocrinology*

<https://doi.org/10.1186/s12958-018-0431-1>, (2018)

26

Article Title: Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus

Quote from article: “The findings of this study show that the students who were exposed to high RF-EMF had significantly higher HbA1c than the students who were exposed to low RF-EMF.”

Meo SA, Alsubaie Y, Almubarak Z, Almutawa H, AlQasem Y, Hasanato RM., *Int J Environ Res Public Health*. 2015;12(11):14519-14528, Nov 13, 2015 doi:10.3390/ijerph121114519

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4661664/>

27

Article Title: Radiofrequency radiation injures trees around mobile phone base stations

Quote from article: “Statistical analysis demonstrated that electromagnetic radiation from mobile phone masts is harmful for trees. These results are consistent with the fact that damage afflicted on trees by mobile phone towers usually start on one side, extending to the whole tree over time.”

Waldmann-Selsam C Balmori-de la Puente, A Breunig H et al., *Science of the Total Environment* (2016) 572 554-569, DOI: 10.1016/j.scitotenv.2016.08.045

https://www.sciencedirect.com/science/article/pii/S0048969716317375?casa_token=MQA3pRIHm0IAAAAA:Dyxz-gx8Lsdf2aWs9kbmQb7E8Hne11dbc_oUABdB8VgEslGopSgtz7LubafACe_QQJAWy8RR7w

28

Article Title:
Electromagnetic
radiation as an
emerging driver
factor for the
decline of insects

Quote from article: “The extent that anthropogenic electromagnetic radiation represents a significant threat to insect pollinators is unresolved and plausible.”

Alfonso Balmori, Science of The Total Environment, Volume 767, 2021, 144913, ISSN 0048-9697,
<https://doi.org/10.1016/j.scitotenv.2020.144913>

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Do all the published studies show harm with cellphone radiation?

Some show harm while others do not (somewhat dependent on who funds the research)

(New York Times- Nov 13, 2010) University of Washington professor Henry Lai analyzed 326 cellphone radiation studies. He found that **only 28 percent of industry-funded studies** showed biological effects from cellphone radiation exposure — but that of the **studies not funded by industry, 66 percent found biological effects.**

<https://www.nytimes.com/2010/11/14/business/14digi.html>

In 2020, Dr. Lai updated his numbers based on around a thousand studies:

- Neurological RFR studies report effects in 73 % of studies on RF radiation
- Genetic effect studies report effects in 65 % of studies on RF radiation
- Free Radical (Oxidative Damage) effect studies report effects in 91 % of studies on RF radiation

<https://bioinitiative.org/wp-content/uploads/2020/09/6-RFR-Neurological-Effects-Abstracts-2020.pdf>

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Concluding Remarks

- Unpaid citizen experts on a State Commission concluded that wireless radiation poses a significant risk to health and the environment
 - None of the Commission members (except for the industry representatives) had any financial interest in Telecom
- Paid industry representatives are telling you that wireless radiation is harmless
 - There is a huge financial benefit for them in perpetuating this myth

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References

- New Hampshire State Commission Final Report
<http://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf>
 - Video Overviews of Final Report
 - Kent Chamberlin video: <https://www.youtube.com/watch?v=gT9g5Mm3lSo>
 - Kent Chamberlin and Cece Doucette: <https://www.youtube.com/watch?v=WqKqKPfIE8>
- Environmental Health Trust: <https://ehtrust.org/>
- Massachusetts for Safe Technology: <https://www.ma4safetech.org/>
- Bioinitiative Color Charts: <https://bioinitiative.org/rf-color-charts/>
- EMF Medical Conference Training (can be used for CME/CE credits and for the public videos): <https://emfconference2021.com/online-cme-ce-courses/>
- Safe Living Technologies EMF/RF Exposure Guidelines: <https://safelivingtechnologies.com/emf-exposure-rf-exposure-guidelines/>
- Americans for Responsible Technology
 Activist/Municipal Toolkit: <https://www.americansforresponsiblettech.org/tool-kit>
- Frank Clegg (former Microsoft Canada Pres.): <https://www.youtube.com/watch?v=h4TdY344Now>

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Appendix

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Electromagnetic-Sensitivity (EMS)

“A phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic or electromagnetic fields (EMFs)” [Bergqvist et al. \(1997\) Sweden](#)

- **Symptoms:** headaches, insomnia, dizziness, irritability, fatigue, heart palpitations, nausea, loss of appetite, feeling of discomfort, poor concentration, memory loss, and neuropsychiatric problems such as depression. <https://www.liebertpub.com/doi/abs/10.1089/eco.2016.0036?journalCode=eco>
- **Mechanisms are known:** [Stein and Udasin \(2020\)](#) wrote a clear summary of electrosensitivity mechanisms, noting the similarities with multiple chemical sensitivities. The mechanism is related to oxidative stress and alteration of calcium channel signaling.
- **Condition is not uncommon:** [Bevington](#) in 2019 published the results of his extensive review of prevalence rates. He estimates about 0.65% of the general population are restricted in their work access due to disabling symptoms of electrosensitivity (EHS-EMF/IEA), about 5% of the general population have moderate symptoms and up to 30% have mild symptoms.
- **The number of people affected by EHS is likely to increase over time:** [Hallberg & Oberfeld-](#) “The number of reported cases of electrosensitivity has been steadily increasing since it was first documented in 1991”

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Electromagnetic-Sensitivity Is Recognized by Medicare

Medicare Accepted ICD-10 codes

- Billable - [W90.0XXA](#) Exposure to radiofrequency, initial encounter
- Billable - [W90.0XXD](#) Exposure to radiofrequency, subsequent encounter
- Billable - [W90.0XXS](#) Exposure to radiofrequency, sequela
- Billable - [W90.1XXA](#) Exposure to infrared radiation, initial encounter
- Billable - [W90.1XXD](#) Exposure to infrared radiation, subsequent encounter
- Billable - [W90.1XXS](#) Exposure to infrared radiation, sequela
- Billable - [W90.2XXA](#) Exposure to laser radiation, initial encounter
- Billable - [W90.2XXD](#) Exposure to laser radiation, subsequent encounter
- Billable - [W90.2XXS](#) Exposure to laser radiation, sequela
- Billable - [W90.8XXA](#) Exposure to other nonionizing radiation, initial encounter
- Billable - [W90.8XXD](#) Exposure to other nonionizing radiation, subsequent encounter
- Billable - [W90.8XXS](#) Exposure to other nonionizing radiation, sequela

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Electromagnetic-Sensitivity Is recognized by the ADA

By the Center for Electrosmog Prevention, 2019

- The following ADA Accommodations Request Packet may be used by ES (electrosensitivity) sufferers to apply for reasonable accommodations to help avoid RF radiation from “small cells” and wifi *in public government areas*, related to accessibility or any other [Title II](#) application. “[Title II of the Americans with Disabilities Act](#) applies to State and Local Governments.

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“Doubt is our product”

- Carlo’s October 7, 1999, letters to wireless-industry CEOs are the smoking-gun equivalent of [the November 12, 1982, memo](#) that M.B. Glaser, Exxon’s manager of environmental-affairs programs, sent to company executives explaining that burning oil, gas, and coal could raise global temperatures by a destabilizing 3 degrees Celsius by 2100. For the tobacco industry, Carlo’s letters are akin to [the 1969 proposal](#) that a Brown & Williamson executive wrote for countering anti-tobacco advocates. “Doubt is our product,” the memo declared. “It is also the means of establishing a controversy...at the public level.”

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Insurance Companies Won’t Insure Against RFR

- *The Nation* has not been able to find a single insurance company willing to sell a product-liability policy that covered cell-phone radiation. “Why would we want to do that?” one executive chuckled before pointing to more than two dozen lawsuits outstanding against wireless companies, demanding a total of \$1.9 billion in damages. Some judges have affirmed such lawsuits, including a [judge in Italy who refused to allow industry-funded research as evidence](#).

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Commonly-Asked Questions

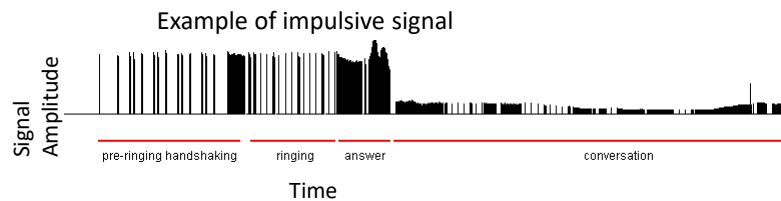
- Why are we concerned about the placement of cell towers?

There is a large and growing body of evidence demonstrating that exposure to cell-phone type radiation is harmful to humans and the environment

- Other types of radiation, such as radiation from radio and TV stations have also been shown to be harmful, but the impulsiveness of cell-phone radiation coupled with the number of transmitters makes them particularly harmful

- What is meant by “cell-phone type” radiation?

High-frequency devices that transmit digital information fall into this category. These devices include: cellphones, cell towers, Bluetooth, baby monitors, smart meters, cordless phones, WiFi (wireless routers) and IoT devices



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Commonly-Asked Questions

- What are the differences between signals from different wireless devices?

They are all transmitted in high frequency bands (600 MHz to 5 GHz) but frequency varies from device to device

- 5G will extend the upper frequency to around 40 GHz

Different device types use different protocols to transmit digital information

- Generally, devices of the same type (such as cellphone and cell tower) use the same protocol when communicating. Because of this, cellphones and cell towers radiate the same types of signals, although at different powers and different periods of time.

Different device types transmit at different power levels

- Bluetooth & WiFi (up to 100 mWatts)
- Smart Meter (≤ 1 Watt)
- Cellphone (600 mWatts – 3 Watts)
- Cell Tower (typically 10 Watts, but can go as high as 50 Watts)

Notes:

1 Hz = 1 cycle/second

1 MHz = 1,000,000 Hz

1 GHz = 1,000,000,000 Hz

1 mWatt = 0.001 Watt

Radiation from all these devices pose health risks

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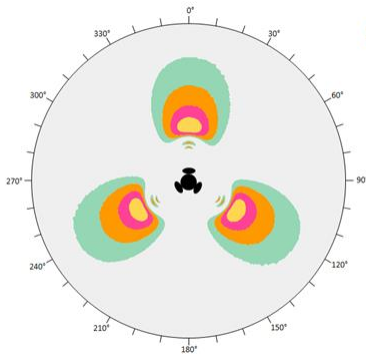
Commonly-Asked Questions

- What does an antenna do to a cellphone signal?

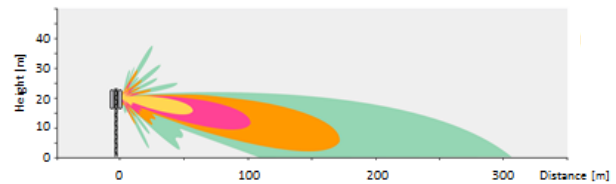
An antenna can focus signal energy in a particular direction, just like a flashlight can focus light in a particular direction; it enables the signal to be concentrated in the direction of the user

An antenna does not change the frequency or information contained in a signal

Example: top-view of 3 directional antennas (horizontal, or azimuthal, pattern)



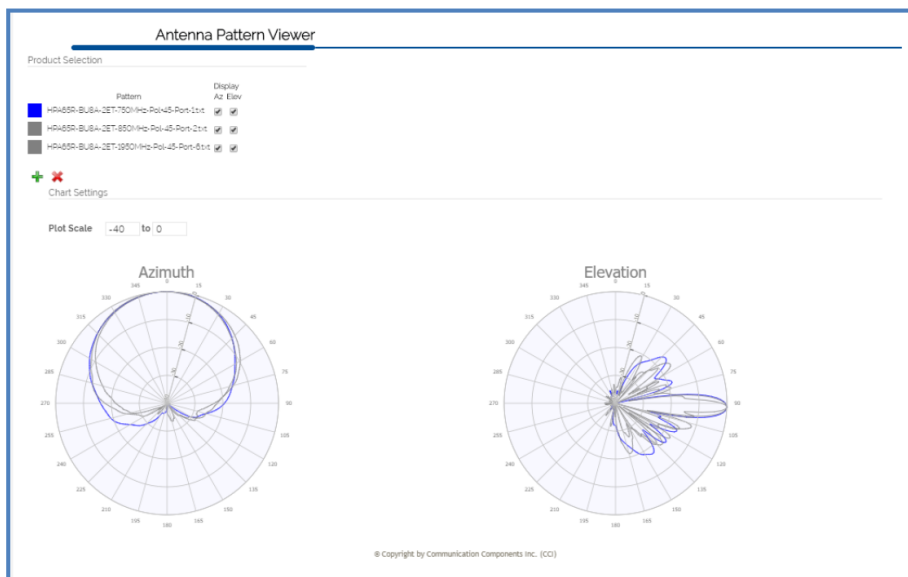
Example: side-view of directional antenna (vertical, or elevation, pattern)



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How Antenna Patterns Relate to the Proposed Site

ANTENNA #2: (AT&T MOBILITY FUTURE PLANNED) CCI HPA65R-BU8A



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Antenna on the Proposed Site (Curtis Building)



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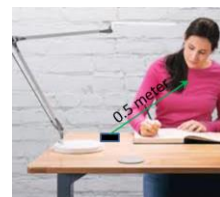
Commonly-Asked Questions

- How does power density from an antenna vary with distance?

Power density varies as inverse square ($\text{Power Density} = P_0/R^2$)



As reference, assume power density at 1 meter is 1 mW/m^2



If phone is moved to a distance of 0.5 m, $P = 4 \text{ mW/m}^2$



In this case, distance is equal to fabric thickness (0.2 mm), so $P = > \text{kW/m}^2$



Definitely not a good idea!

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Proposed Site:

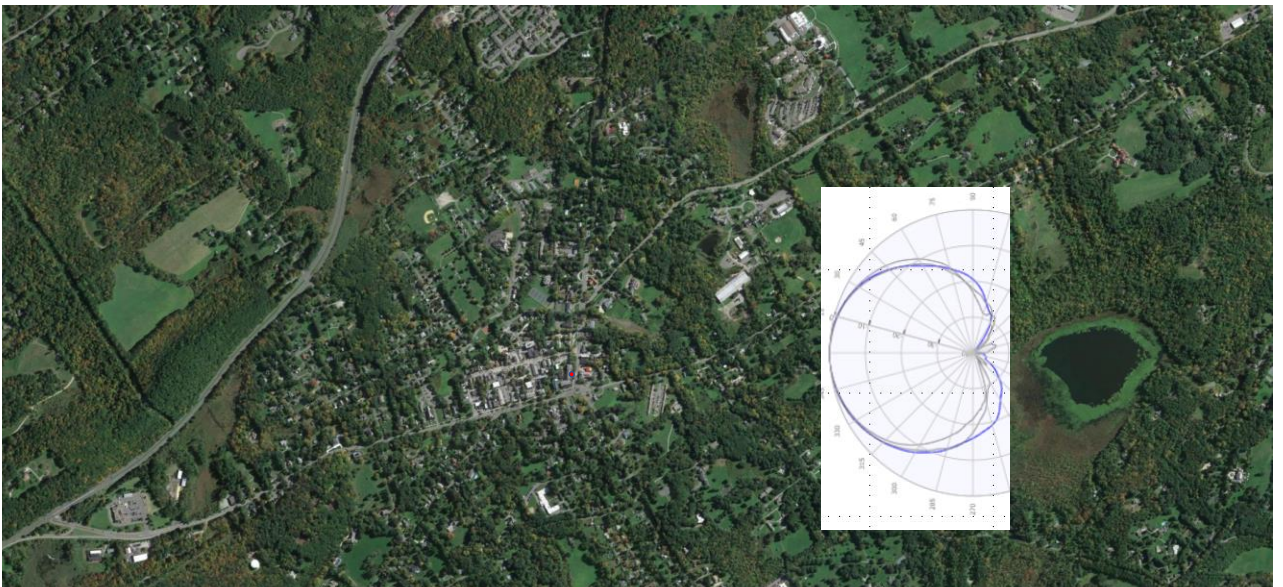
Huge signal variation in coverage area; much of town within 500m of tower



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Example of Site that Provides Safe Coverage

Tall tower away from town



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What Power Density Is Needed for Cellphone Reception?

(calculated for highest required power density; 2100 MHz)

Notes:

1 μ Watt = 1 micro-Watt
= 0.000001 Watt

1 nWatt = 1 nano-Watt
= 0.000000001 Watt

1 pWatt = 1 pico-Watt
= 0.000000000001 Watt

Great Signal (4 to 5 bars)

-50 to -79 dBm or 6.16 to 0.0078 μ W/m² or one-millionth of FCC limit

Good Signal (3 to 4 bars)

-80 to -89 dBm or 6.16 to 0.775 nW/m² or one-billionth of FCC limit

Average Signal (2 to 3 bars)

-90 to -99 dBm or 616 to 77.5 pW/m² or 0.1 billionths of FCC limit

Poor Signal (1 to 2 bars)

-100 to -109 dBm or 61.6 to 7.75 pW/m² or 0.01 billionths of FCC limit

Very Poor Signal (0 to 1 bars)

-110 to -120 dBm or 6.16 to 0.775 pW/m² or one-trillionth of FCC limit