

# Healthy Wiring Practices: The Building Biology Method

## Design & Build For Wellness Building Biology Conference

October 8, 2017

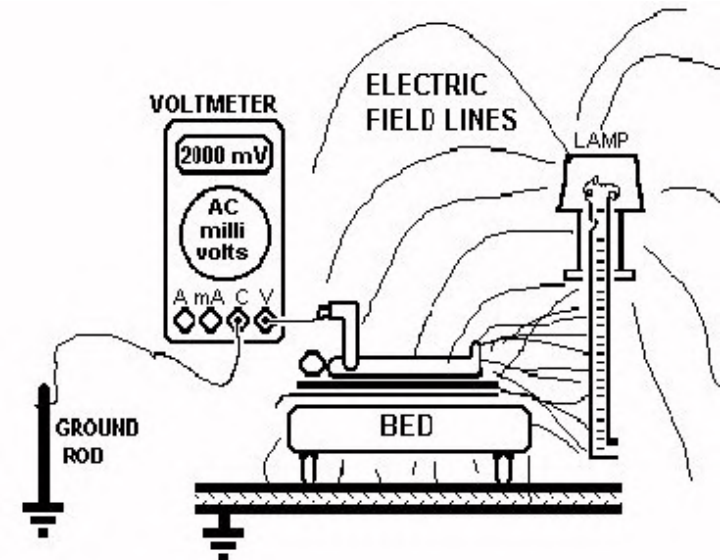
Oram Miller, BBEC, EMRS

Certified Building Biology Environmental Consultant,  
Electromagnetic Radiation Specialist

[www.createhealthyhomes.com](http://www.createhealthyhomes.com)

# Goals of Building Biology®

- ▶ Find and reduce sources of toxicity in the home or office
  - IAQ, EMFs, Outgassing Building Materials
- ▶ Strengthen the client's tolerance to toxic influences when outside the home
- ▶ Accomplish this by reducing exposure to household toxins and creating an EMF-free sleeping environment



Courtesy Spark Burmaster, EE, BBEC, EMRS

# Building-Related Causes of Ill Health

## Two groups of clients:

- ▶ 60-70 % of clients are electrically hypersensitive (EHS)
- ▶ Two thirds of these clients are also symptomatic
- ▶ 30-40% of overall clients are not sensitive or symptomatic, just health conscious
- ▶ Always have a balance between sources of EMF toxicity versus diet, heredity, stress levels, healing modalities

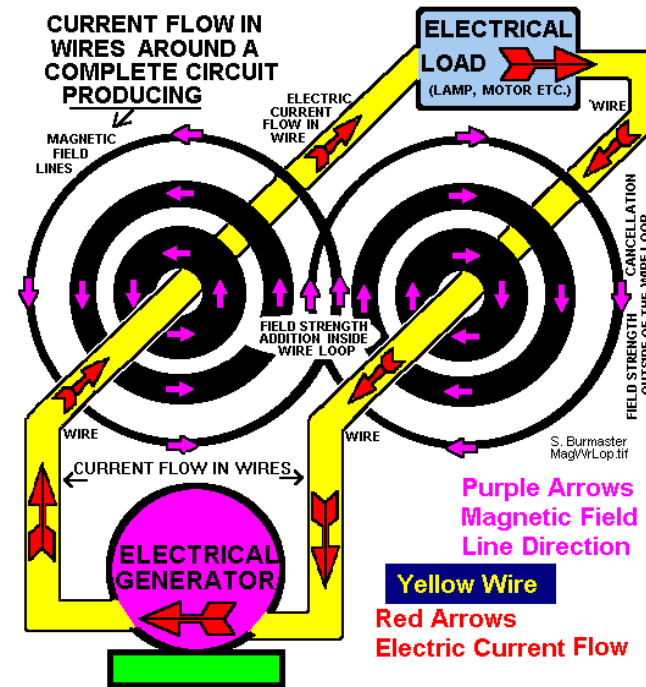
# Building-Related Causes of Ill Health

## Among the General Public:

- ▶ Only 3-5% are known to be electrically hypersensitive (EHS)
- ▶ Yet, up to one third are estimated to be symptomatic from chronic exposure to EMFs
- ▶ *Everyone* has cellular damage from wireless RF exposure
- ▶ Thus, two-thirds of population can repair the cellular damage at night and do not become symptomatic (a number that is expected to decrease)
- ▶ Your risk ratio for disease is one out of three chances

# Four types of “EMFs”

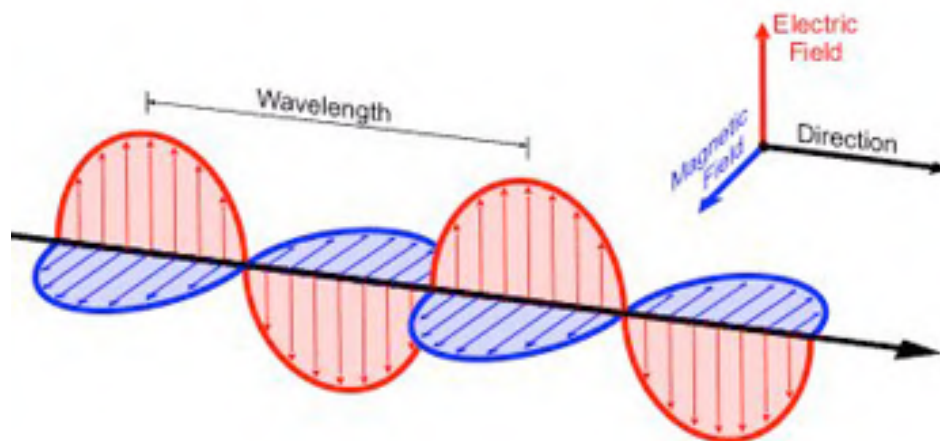
- ▶ AC Electric Fields
- ▶ AC Magnetic Fields
- ▶ Radio Frequency (RF) Fields
- ▶ “Dirty Electricity” from harmonic frequencies



Courtesy Spark Burmaster, EE, BBEC, EMRS

# Electric & Magnetic Field (EMF) Exposure

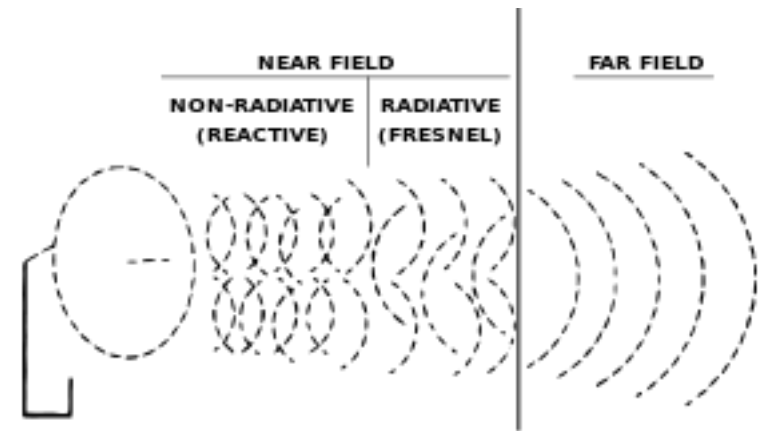
- ▶ AC Electromagnetic Fields are created by alternation of polarity (positive to negative to positive) of AC electricity on electric power lines, circuits and power cords, at 60 times per second
- ▶ The “M” in EMF is the magnetic field component
- ▶ The “E” in EMF is the electric field component
- ▶ These fields emit off power lines, circuits and power cords at right angles to each other
- ▶ They enter our living space and can affect our health



[www.ixquick.com](http://www.ixquick.com)

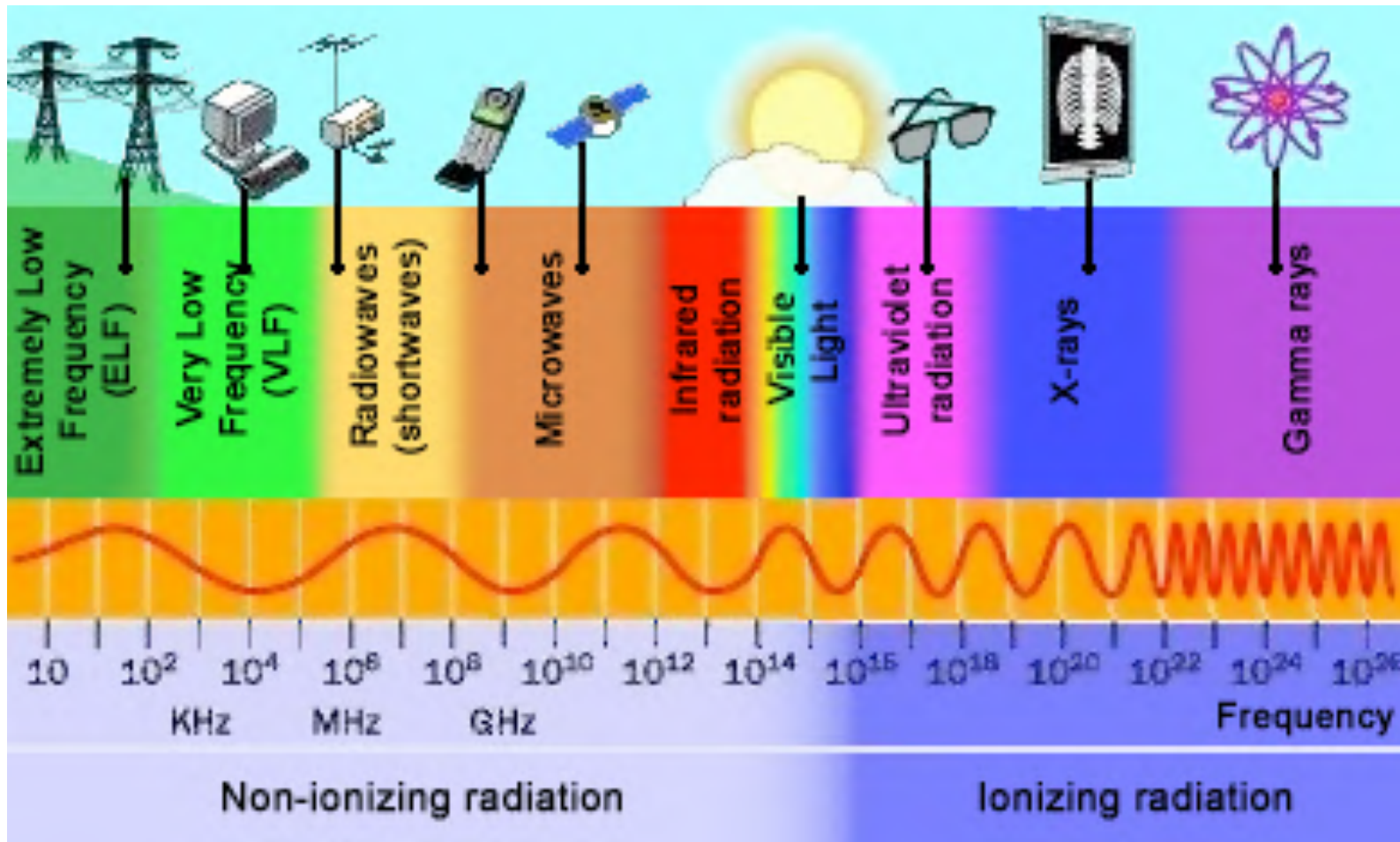
# Electric & Magnetic Field (EMF) Exposure

- ▶ Electric and magnetic fields are coupled in the far field
- ▶ Far field is defined as 3 wavelengths from source
- ▶ Within near field, electric and magnetic fields are uncoupled
- ▶ Wavelength for 60 Hz is 3,100 miles — always in near field
- ▶ Electric and magnetic fields must be measured separately
- ▶ Can have one without the other
- ▶ Electric fields are often missed (“unknown EMF”)



[www.ixquick-proxy.com](http://www.ixquick-proxy.com)

# Electro-Magnetic Spectrum

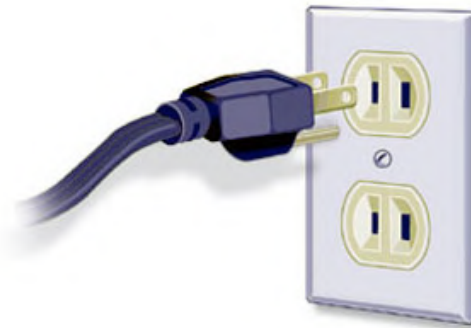


[www.astrosurf.com](http://www.astrosurf.com)



# Three Main “Deal Breakers”

- ▶ 1. Outside overhead power lines with high magnetic fields — Shielding is ineffective
- ▶ 2. Cell tower in close proximity
- ▶ 3. Knob and tube or ungrounded NM Romex circuits
- ▶ Cause high electric fields and the inability to ground computers and appliances



# Remainder of EMFs Can Be Mitigated

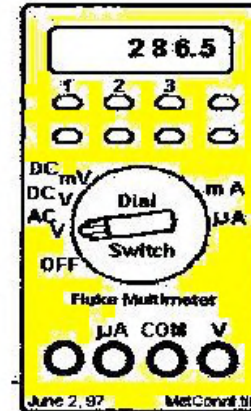
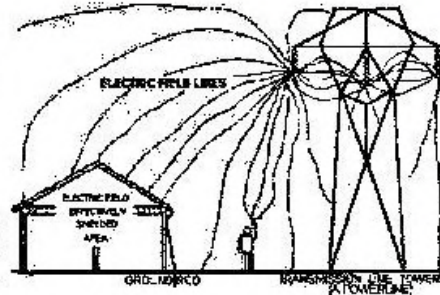
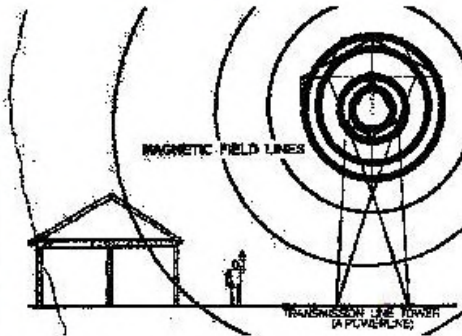
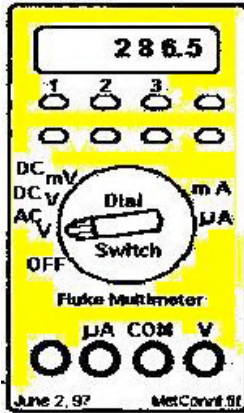
- ▶ They include:
- ▶ AC Magnetic field EMFs from wiring errors, current on grounding paths (metal water service pipe, TV cable sheathing) and from point sources (transformers and motors)
- ▶ AC Electric field EMFs from NM (non-metallic) Romex in sleeping areas and ungrounded computers
- ▶ Radio frequency EMFs from wireless devices

COMPARISON OF AC MAGNETIC AND AC ELECTRIC FIELDS

**MAGNETIC FIELDS**

**ELECTRIC FIELDS**

28-Fs



ARE THE ENERGIZATION OF THE SPACE AROUND ELECTRIC CURRENT FLOW

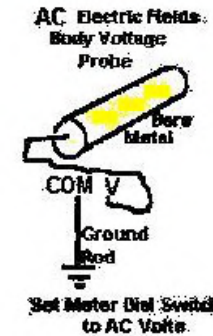
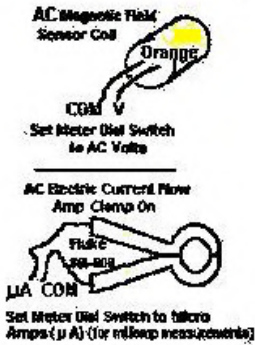
ARE THE ENERGIZATION OF THE SPACE BETWEEN VOLTAGE DIFFERENCES

**PRODUCED BY ELECTRIC CURRENT FLOW**

**PRODUCED BY VOLTAGE**

DETECTED/ MEASURED BY:  
GAUSSMETER/ AMP METER

DETECTED/ MEASURED BY:  
VOLT METER



Burmaster June 2, 1997 S. Burmaster SAS&mf3.wpd

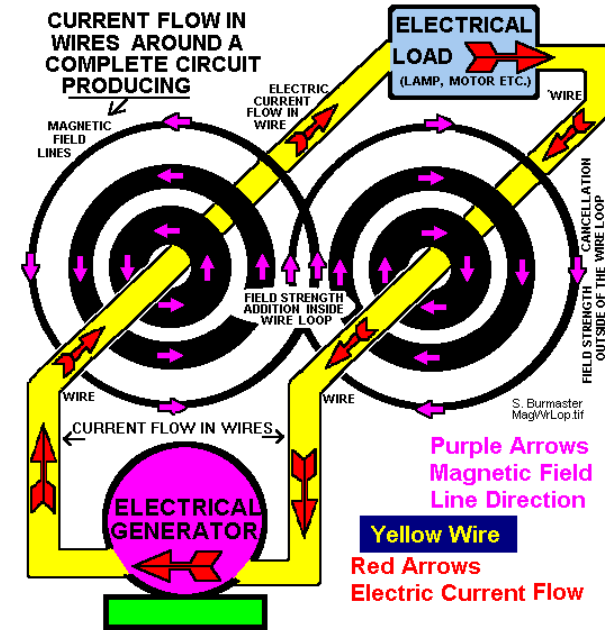
Courtesy Spark Burmaster, EE, BBEC, EMRS



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# AC Magnetic Field Basics

- ▶ AC Magnetic Field exposure produced by current flow through a closed loop
- ▶ Occurs *only* when current is flowing, when load is on
- ▶ Like *flow* of water through garden hose (not pressure)

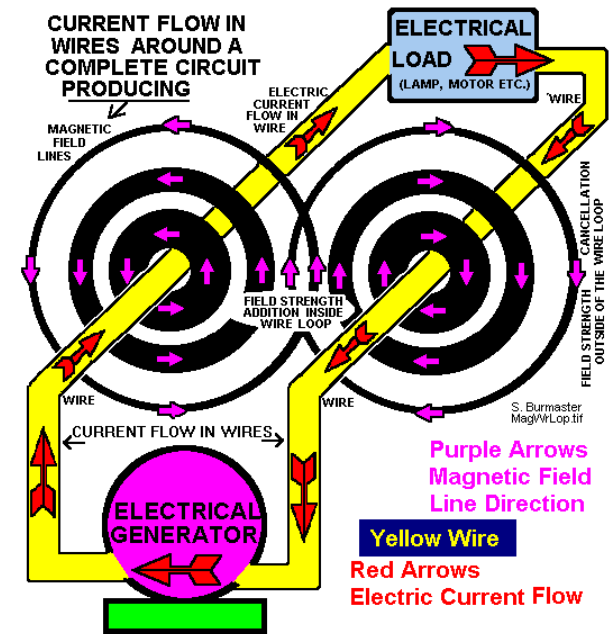


Courtesy Spark Burmaster, EE, BBEC, EMRS

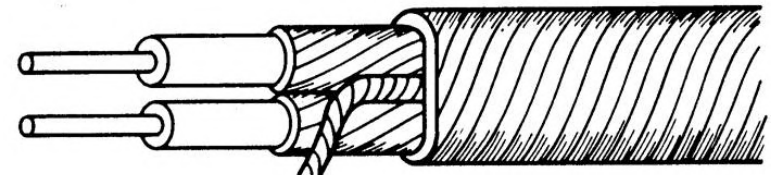


# AC Magnetic Field Basics

- ▶ Decreases with distance from the source
- ▶ Extends only 2-4 feet from typical point sources
- ▶ Can extend 6-10 feet from current on grounding system
- ▶ Occurs when wires are separated (hot from neutral)
- ▶ Fields are cancelled when wires run together (and are balanced)

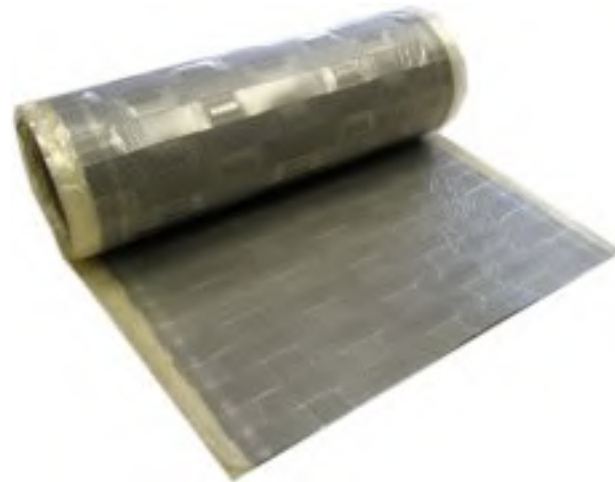


Courtesy Spark Burmaster, EE, BBEC, EMRS



# AC Magnetic Field Basics

- ▶ Shielding is difficult
- ▶ Requires special materials, such as G-Iron  
[www.slt.co](http://www.slt.co)
- ▶ Best to eliminate or move yourself several feet away from source
- ▶ “Distance is your friend”



G-Iron

# Sources of AC Magnetic Field Exposure

Four major sources of AC magnetic fields in homes:

1. Outside overhead power lines, especially high tension power lines – wires are widely separated



2. Point sources: motors (refrigerator), transformers, electric meter, breaker panel

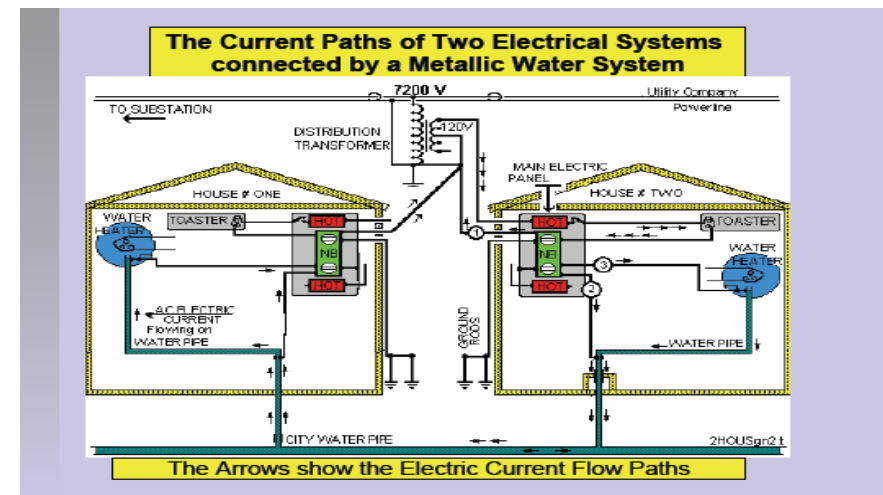
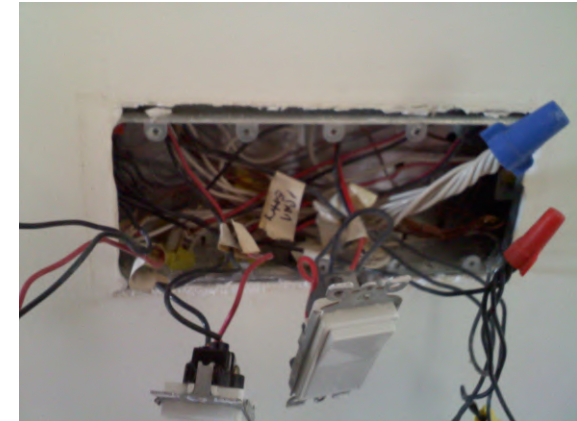


# Sources of AC Magnetic Field Exposure

Major sources in homes  
(continued):

3. Wiring errors in branch circuits – parallel paths; Knob & Tube wiring – wires are separated

4. Current on grounding system. Enters from neighbor's homes on incoming metal water pipe and on incoming cable TV sheathing – both are parallel paths

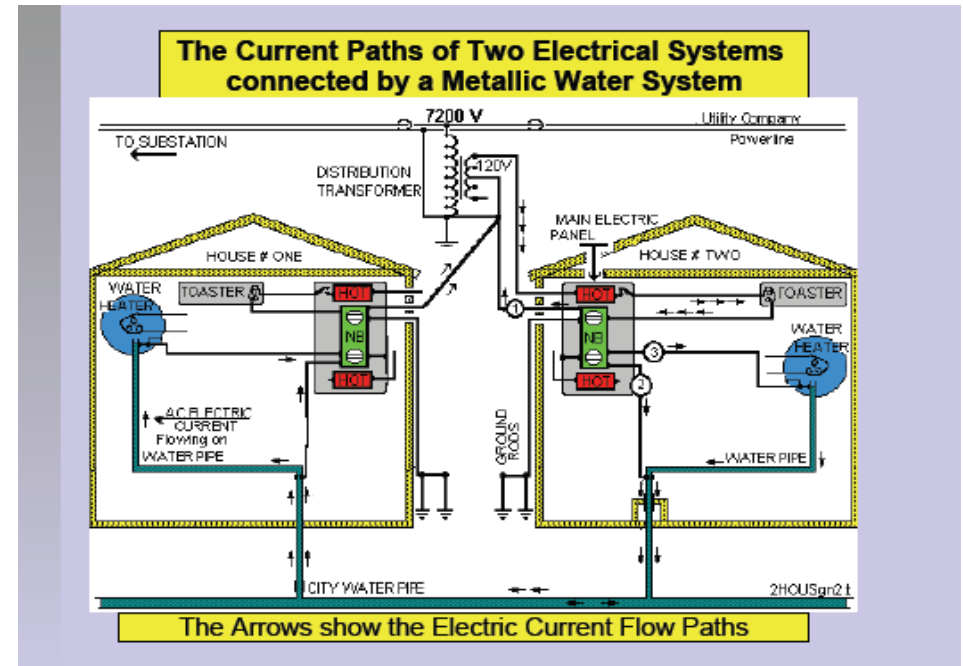


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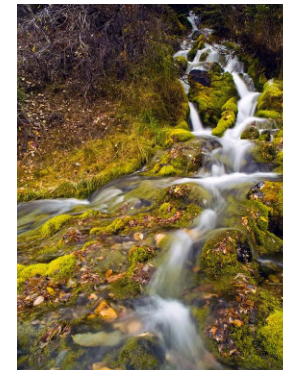


# Sources of AC Magnetic Field Exposure

- ▶ Electricity takes all available paths
- ▶ Not *only* the path of least resistance
- ▶ Similar to a stream taking all available paths to flow down a mountain



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# Service Drop Configurations



Poor Meter and Panel Location:  
Next to Occupied Space.  
Worse Case: Sleeping Area.



Better: Meter &  
Panel on Garage  
Far Wall.



Best: Meter & First Panel  
Away from House.  
Central Point  
for Feeds to Well  
and Out Buildings.

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# EMF Meters and Instruments Magnetic Fields

- ▶ GigaHertz Solutions ME3030B (single axis)
- ▶ NFA Series (triple axis)
- ▶ Available from Safe Living Technologies — [www.slt.co](http://www.slt.co)
- ▶ “Buzz Stick”
- ▶ Triplet 9200A Clamp Meter, Clamp Leaker



Hand-held Meters



[www.amazon.com](http://www.amazon.com)

Triplet Clamp Meter



Clamp Leaker



Buzz Stick

*Oram Miller, BBEC, EMRS*

# Wiring Errors

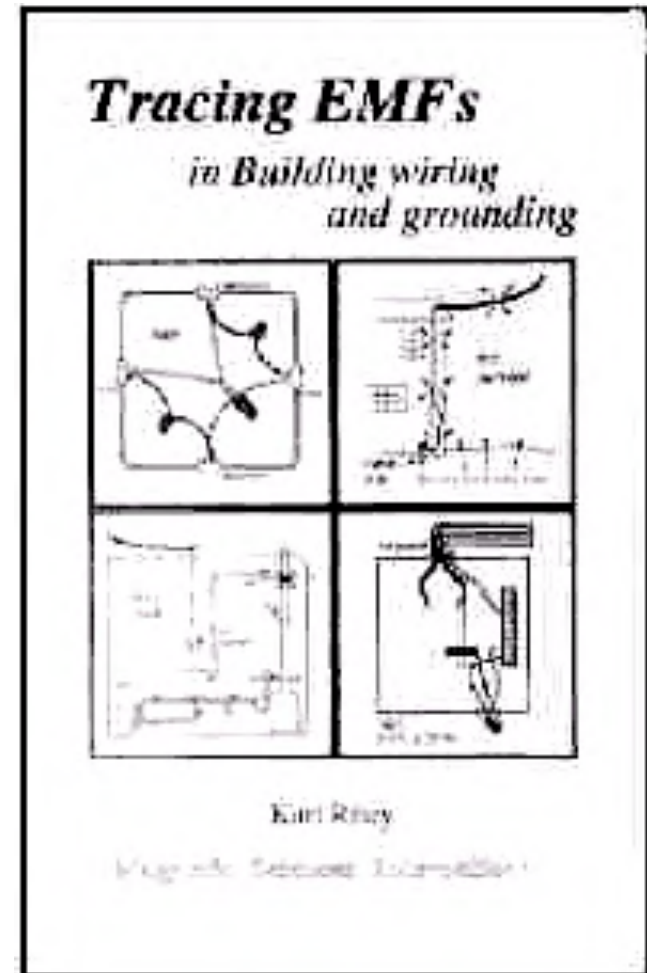
- ▶ Preventable, fixable cause of magnetic fields in homes and condo/apartment buildings
- ▶ Up to one-third of homes in US have wiring errors
- ▶ Misconfigured wiring connections in switch, outlet and lighting fixture (junction) boxes
- ▶ Can be neutral-to-neutral or neutral-to-ground interties, also current on grounding paths
- ▶ ARC-Fault and GFCI breakers trip when first turned on if wiring errors are present
- ▶ Electricians are only now paying attention to them

# Wiring Errors

- ▶ Violations of National Electric Code:
- ▶ “All conductors of the same circuit — including the neutral and all equipment grounding conductors — must be run in the same raceway, cable tray, trench, cable, or cord” — NEC 301-3(b)
- ▶ “...prohibits connecting a neutral to another neutral such that a parallel return path to the panel is set up, unless the conductors are 1/0 or larger and meet exacting conditions” — NEC 310-4
- ▶ City code inspectors have not been looking for wiring errors

# Wiring Errors

- ▶ Tracing EMFs in Building Wiring and Grounding
- ▶ Karl Riley, 3rd Edition
- ▶ Available as book and DVD from [www.lessemf.com](http://www.lessemf.com)
- ▶ DVD of Karl produced by Southern California Edison provided by their EMF consultants to customers

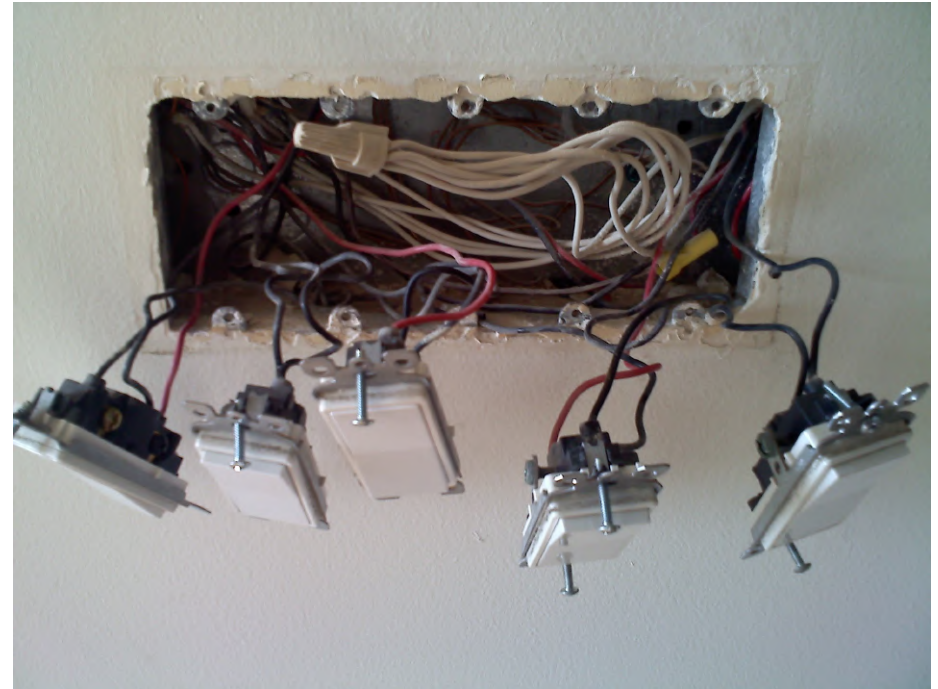


# Screening for Wiring Errors

- ▶ Hold Gauss meter 2 feet from wall, 2 feet above light switches
- ▶ Measure magnetic field with lights off
- ▶ Turn lights on — Magnetic field level should not increase
- ▶ If magnetic field is present, likely due to wiring error

# Neutral-to-Neutral Wiring Errors

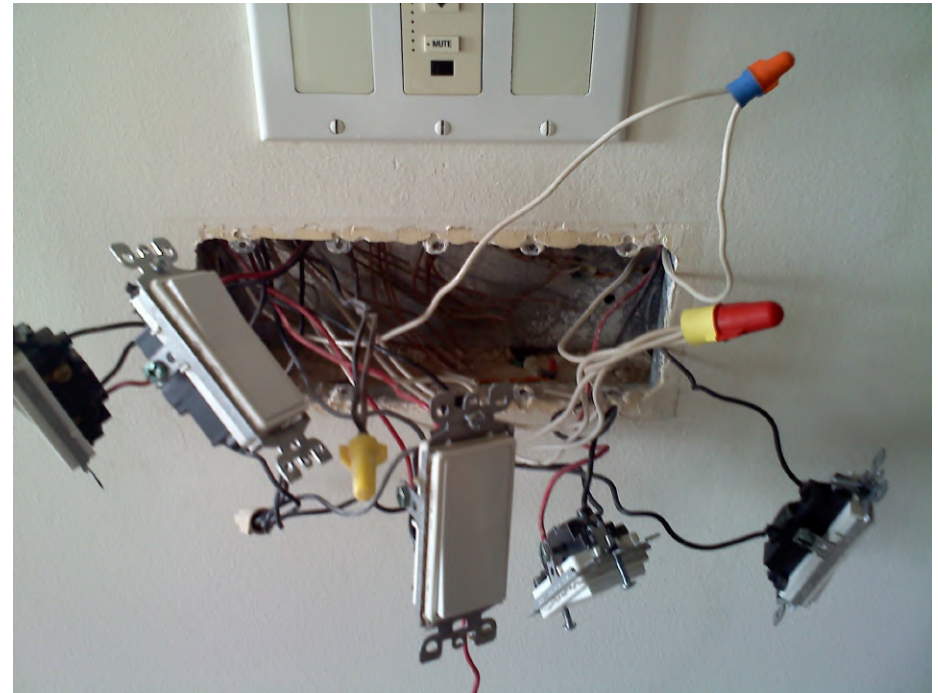
- ▶ Two 12-3 circuits in box
- ▶ Hot conductors are separated
- ▶ Neutral conductors of both circuits are wire-nutted together
- ▶ Results in net current and lack of cancellation of magnetic fields on hot and neutral conductors of each circuit to breaker panel





# Neutral-to-Neutral Wiring Errors

- ▶ Neutral conductors are now properly separated and follow paths of hot conductors
- ▶ Neutrals always need to follow hot conductors of their circuit and not be mixed with neutrals of another circuit



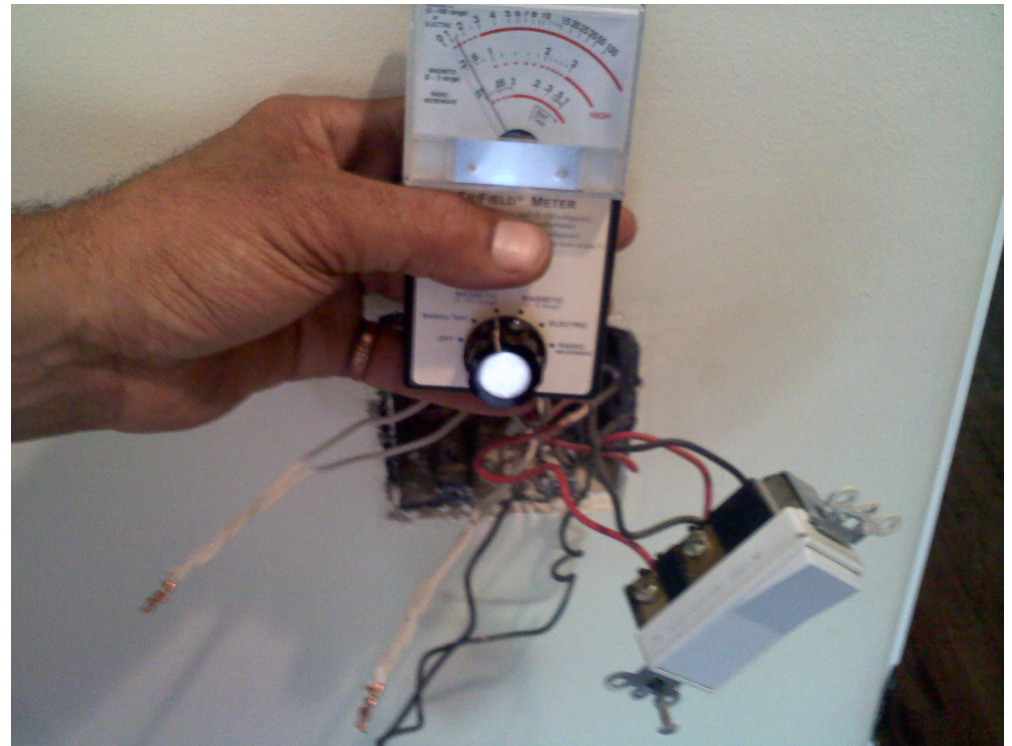
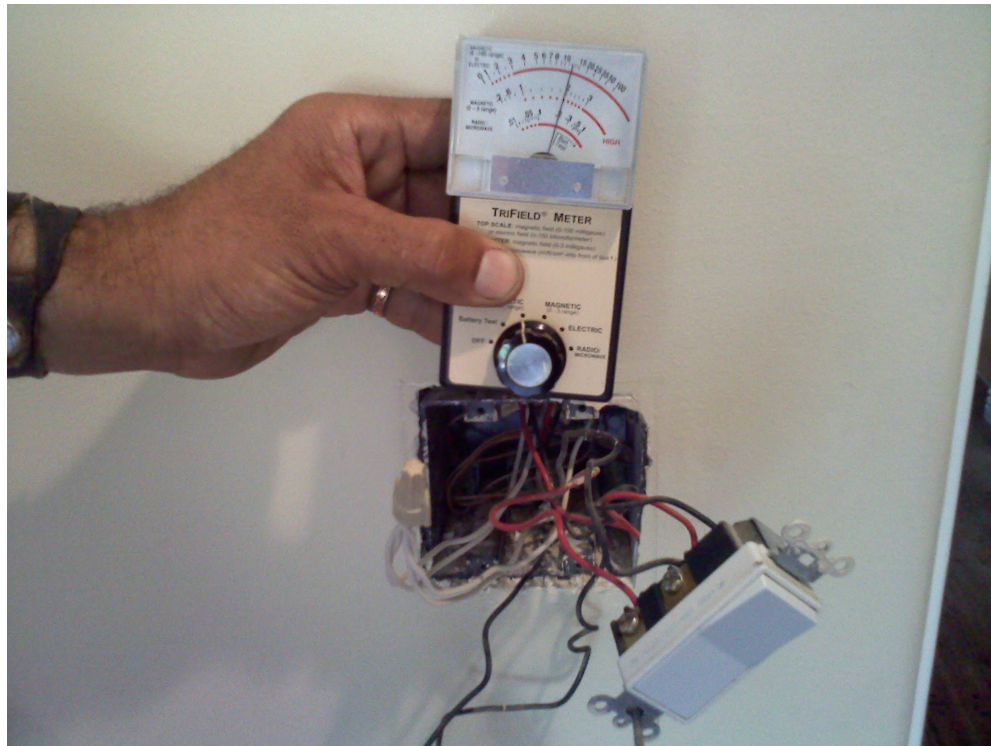
# Measuring Neutral-to-Neutral Wiring Errors

- ▶ Measure for net current with Amp clamp
- ▶ Net current clears up when neutrals are properly separated



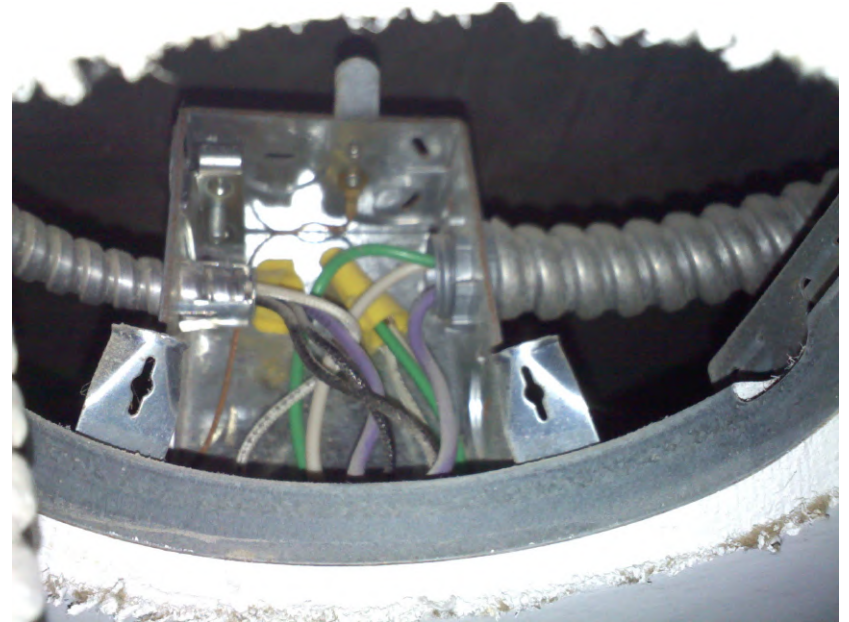
# Neutral-to-Ground Wiring Errors

- ▶ Two 12-3 circuits in J-box
- ▶ Neutrals incorrectly together on left, producing magnetic field
- ▶ Neutrals properly separated on right, no net magnetic field



# Neutral-to-Ground Wiring Errors

- ▶ Includes:
- ▶ Bare ground wire touching neutral screw in outlet — Best to tape over contacts on outlets when installing
- ▶ Ground mixed with neutral conductors under wire nut
- ▶ Nick in insulation of neutral as it crosses lip of metal box



# Neutral-to-Ground Wiring Errors

- ▶ Sub-panel: neutrals and grounds cannot be together
- ▶ Bonding strap must not be connected to neutral bus
- ▶ If grounds are on neutral bus, current will flow back to main panel on grounding paths
- ▶ Neutral conductor has less current than hot conductors — Results in net current and magnetic fields
- ▶ Remove bonding strap or screw
- ▶ Grounds on separate bus



justanswer.com



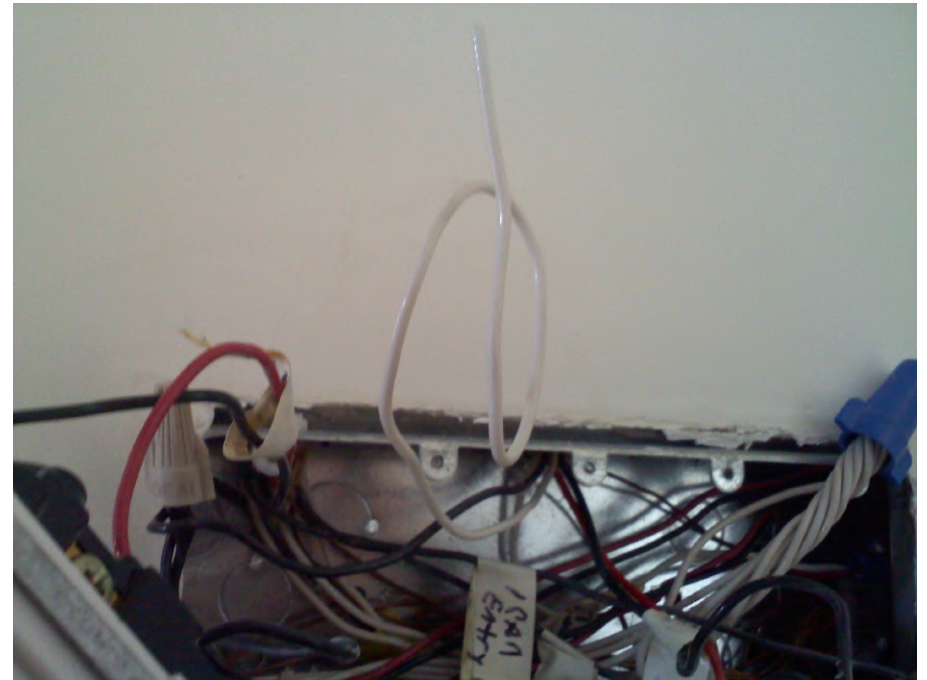
hammerzone.com



doityourself.com

# Wiring Errors

- ▶ Unused hot or neutral conductor
- ▶ Current only flows on one conductor, not both: Therefore, no cancellation
- ▶ Must find where return current flows and restore it on this neutral
- ▶ Often seen when hot is abandoned but neutral is left connected

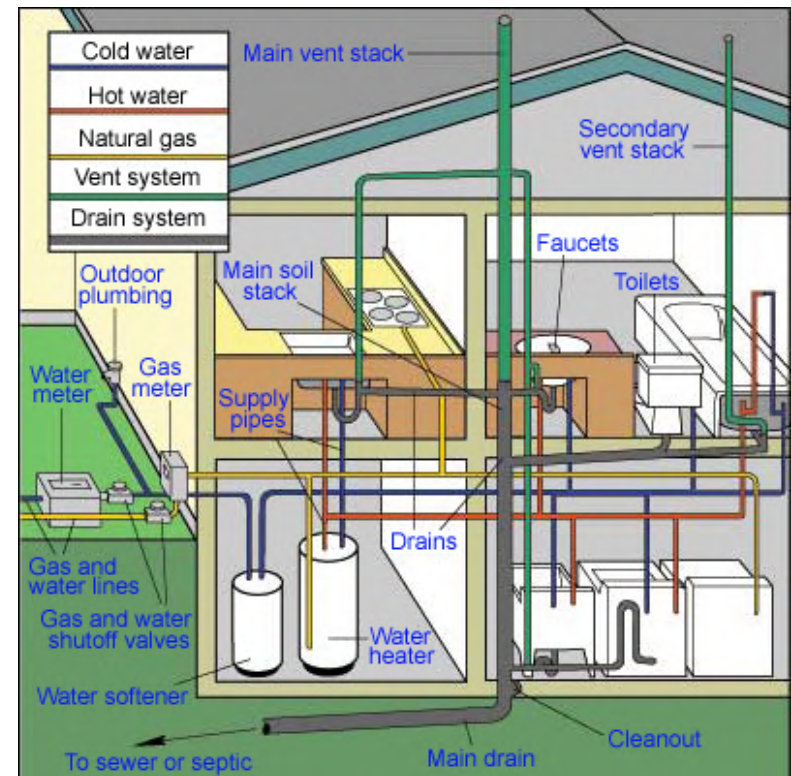


# Avoid Wiring Errors

- ▶ Follow these three easy steps to avoid wiring errors:
- ▶ Hot and neutral wires always together in same path
- ▶ Current on return neutral wire always same as current on outgoing hot wire, no more, no less – net zero Amps
- ▶ No current on grounding paths, except in emergency
- ▶ Remember, ARC Fault and GFCI Breakers will trip if wiring error is present

# Current on Grounding Paths

- ▶ Current should only flow on grounding paths in cases of lightning strike or over-current
- ▶ Current flowing on grounding paths has no cancellation of magnetic field
- ▶ Includes metal water pipes, grounding conductors, cable TV sheathing
- ▶ Can be mitigated with dielectric union in water pipe and cable isolation filter in TV cable coming in from street





# Reduce Magnetic Field Exposure

- ▶ Plastic water service supply pipes avoid electrical connectivity to neighbors' homes
- ▶ Or insert dielectric union
- ▶ Represents largest avoidable source of AC magnetic field exposure in homes
- ▶ Use PEX for domestic water lines for same reason



# Reduce Magnetic Field Exposure

- ▶ Do not live near high tension power lines
- ▶ Do not sleep near electric meter or breaker panel
- ▶ Do not sleep or sit on other side of refrigerator or entertainment center

# Reduce Magnetic Field Exposure

- ▶ Transformer at front of stove for digital clock and electronics can cause magnetic field at abdomen when standing to cook, if transformer is right behind clock
- ▶ Ideally purchase stove with clock and electronics at back or side of stove
- ▶ Even gas stoves without visible clock or electronics can have transformer at front – must check with Gauss meter
- ▶ Dishwasher lids may also have transformer – check with Gauss meter
- ▶ Avoid induction cooktops altogether – cause massive magnetic fields when on



ovens.review.com



thesweethome.com



consumerreports.com

# Reduce Magnetic Field Exposure

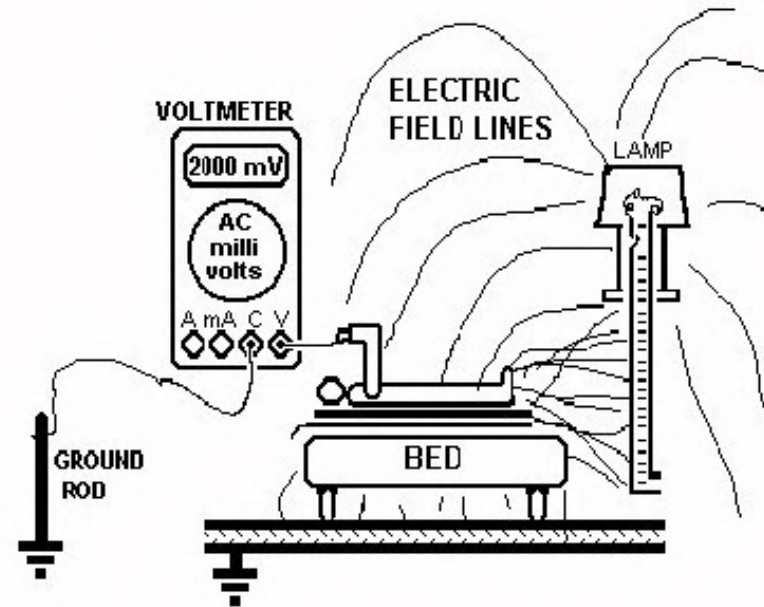
- ▶ Keep transformer for halogen track lighting away from beds and sitting areas
- ▶ Do not sleep over fluorescent light fixtures or fan motors in ceiling of room below
- ▶ No motorized or electric beds without plugging AC power cord into switched power strip – *always* switch off at night



Halogen Track Lighting

# AC Electric Field Basics

- ▶ Produced by differences in electric voltage
- ▶ Measured with Electric Field meter (not Gauss meter)
- ▶ Similar to *pressure* in water hose (not flow)
- ▶ Considered the “Unknown EMF”



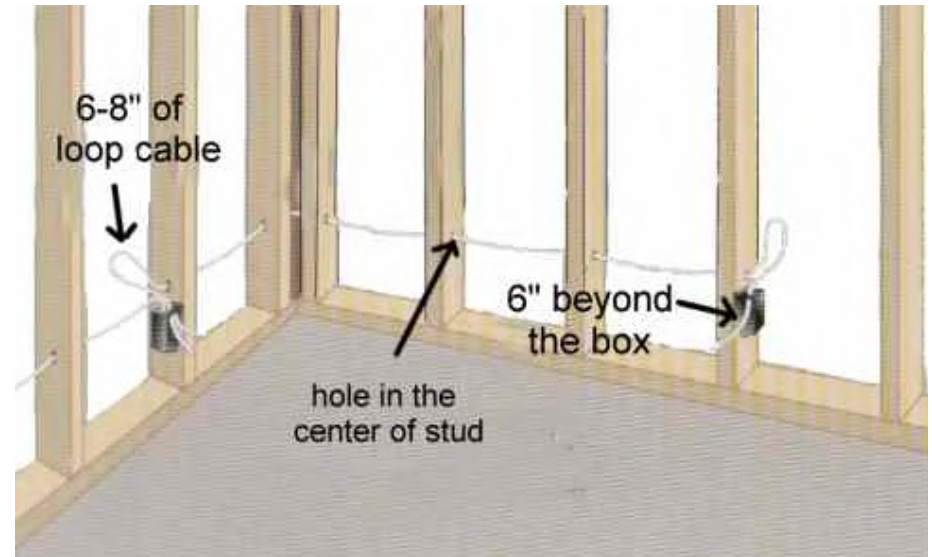
Courtesy Spark Burmaster, EE, BBEC, EMRS



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# Sources of AC Electric Field Exposure

- ▶ AC Electric fields present even if current is not flowing (e.g., lamp is off)
- ▶ Extends up to 6-8 feet into room from plastic-jacketed NM Romex wiring in walls
- ▶ Also extends 6-8 feet from un-shielded AC power cords
- ▶ Decreases with distance
- ▶ Affects people primarily while sleeping, also daytime from ungrounded laptops



Unshielded Romex Wiring



Bedside Lamp Cord

[www.etsy.com](http://www.etsy.com)

# Sources of AC Electric Field Exposure

Large electric field exposure from:

1. Electric blankets
2. Electric heating pads
3. Water bed heaters

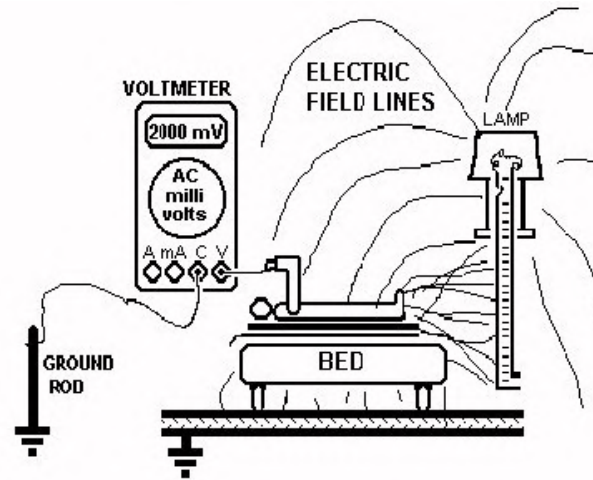
Fields are present even when these devices are turned off but plugged in



# EMF Meters and Instruments

## Electric Fields

- ▶ Hand-held Meters
- ▶ Body Voltage Meter
- ▶ Available from Safe Living Technologies
- ▶ [www.slt.co](http://www.slt.co)



Courtesy Spark Burmaster, EE, BBEC



Hand-held Meters



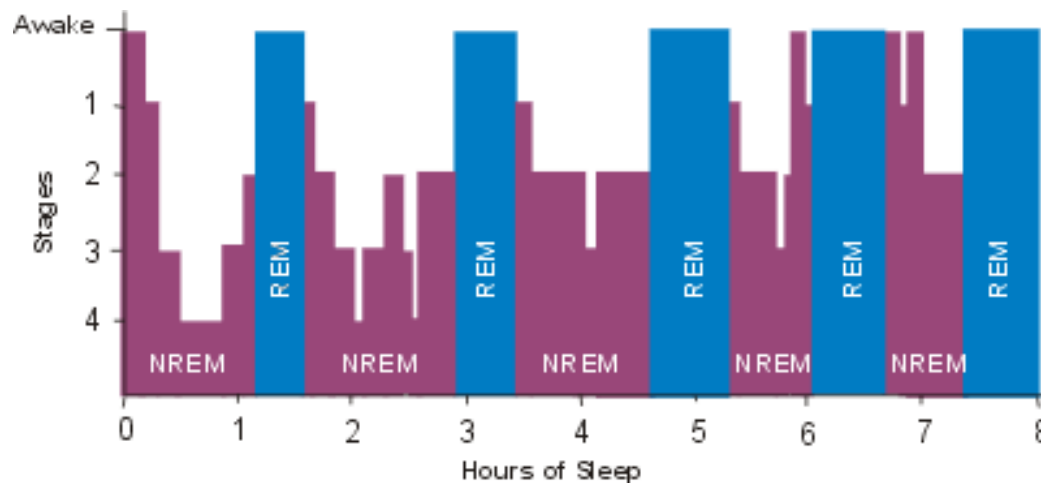
Body Voltage Kit

Oram Miller, BBEC, EMRS



# Adverse Health Effects from Exposure to AC Electric Fields

- ▶ Prevents deep, Stage Four Sleep
- ▶ Diminishes normal night time production of melatonin
- ▶ Causes chronic fatigue, fibromyalgia, sleep disorders, restless leg syndrome, allergies
- ▶ Also hyperactivity, depression, headaches



Sequences of states and stages of sleep on a typical night

Oram Miller, BBEC, EMRS

# Improvements With Reduction of AC Electric Fields

- ▶ Deeper levels of Stage Four sleep
- ▶ Increase in normal night time melatonin production
- ▶ Results in:

Increased vitality and alertness

Reduction of muscle pain and joint stiffness

Increase in flexibility and range of motion

Reduction of fatigue, allergies, depression, cancer

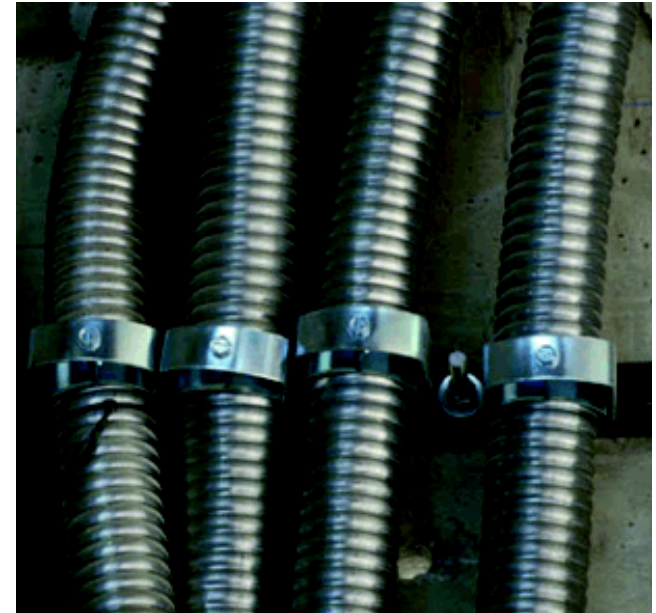
Greater response to medical therapies

# Comments from Clients

- ▶ “My wife and I have not slept this soundly since we moved in!! ... I sleep undisturbed until 6:30 or 7 AM without interruption.”  
– j.r., North Tustin
- ▶ "I'm sleeping better. I used to wake up 5-7 times a night. Now I wake up maybe once, and sometimes not at all... My husband's sleeping better, too. Seems to be a big difference.”  
– n.j., Santa Ana
- ▶ "We slept so good. We shut off all necessary (marked) breakers. Just like you said, it felt like we were camping.”  
– d.b., Long Beach

# Reduce Electric Field Exposure

- ▶ Create an electrically clean sleeping environment
- ▶ Shut-off switch for NM Romex circuits within 6-8 feet of bed
- ▶ Ideally use flexible steel or aluminum MC (metal clad) or rigid (EMT) conduit for entire house, or at least for circuits near desk, couch, easy chair, play area
- ▶ Rewire lamps near bed or chair with shielded AC MuCord from LessEMF



Flexible Metal Clad Wiring

# Reduce Electric Field Exposure

- ▶ Sweet Ohms wiring — [www.sweetohms.com](http://www.sweetohms.com)
- ▶ Flexible dual-extruded plastic, semi-conductive inside
- ▶ Shields Electric Fields — Verified by Healthy Building Science, San Francisco, [www.healthybuildingscience.com](http://www.healthybuildingscience.com)
- ▶ Avoids Magnetic Fields when properly installed (no wiring errors) — hot and neutral conductors are twisted
- ▶ Being brought to North America from France
- ▶ Projected to cost one-half price of flexible metal-clad (MC) conduit

**Sweet ohMS**



*Oram Miller, BBEC, EMRS*

# Reduce Electric Field Exposure

- ▶ Remotely shut off NM Romex circuits (Contactor/Remote Switch) [www.slt.co](http://www.slt.co)
- ▶ Metal clad Flex/EMT circuits require shut off switch at the wall
- ▶ Re-wire lamp with Mu-Cord
- ▶ Avoid electric blankets and electric heating pads (watch for reverse polarity on plug)
- ▶ Use battery-operated clocks
- ▶ AC laptop power cords: 3-pronged, grounded



# Reduce Electric Field Exposure

## Earthing Pad

- ▶ Thousands of testimonials from satisfied customers
- ▶ Negative ions from earth flow up to body (“earthing”)
- ▶ However, can also shunt man-made electric fields to earth through body from nearby NM Romex circuits in walls & plastic AC cords (“grounding”)
- ▶ Problem for electrically-sensitive people — Voltage runs through body, even though “body voltage” meter shows low levels, causes some to feel agitated
- ▶ Solution is to always reduce electric field exposure levels in bedroom first, then use earthing pad



[radiantlifecatalog.com](http://radiantlifecatalog.com)

# Reduce Electric Field Exposure

## Ungrounded Laptop AC Power Cords – PCs

- ▶ Big source of unhealthy, vitality-draining electric fields
- ▶ Many laptops have two-pronged (ungrounded) plugs
- ▶ Plug needs to be three-pronged (grounded)
- ▶ If not, purchase USB Ground Cord from [LessEMF.com](http://LessEMF.com)



- ▶ Also, test outlet for proper grounding



[www.popscreen.com](http://www.popscreen.com)

- ▶ Purchase circuit tester from hardware store to test ground at outlet – *both* amber lights need to be lit

Two-pronged plug:



[www.ebay.com](http://www.ebay.com)

Three-pronged plug:



[www.popscreen.com](http://www.popscreen.com)



# Reduce Electric Field Exposure

## Ungrounded Laptop AC Power Cords – Macs

- ▶ For Mac laptops, use the AC power adapter with the three-pronged plug
- ▶ Do not use the two-pronged adapter that slides directly into the transformer
- ▶ Pull the two-pronged adapter, shown on the left in the upper right corner, off the transformer, and slide on the cord shown on the right with the three-pronged plug

Two-pronged plug:



[laptopbattery.com](http://laptopbattery.com)

Three-pronged plug:



[mactechgear.com](http://mactechgear.com)



[shop.accessory4you.com](http://shop.accessory4you.com)

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# Sources of Radio Frequency Field Exposure Outside Home

- ▶ Radio and TV broadcast towers
- ▶ Cell phone antennas
- ▶ City-wide Wi-Fi
- ▶ Wi-Fi routers in neighbors' homes and businesses
- ▶ Small Cell 5G Towers



# Sources of Radio Frequency Field Exposure Inside Home

- ▶ Wi-Fi routers and laptops
- ▶ Cordless telephone base station is “always on”
- ▶ Both emit continuous pulsed digital carrier frequencies in standby mode
- ▶ Think of them like ashtrays with burning lit cigarettes, filling room with smoke
- ▶ Entering the era of the Internet of Things (IoT)



[velocidaddeinternet.com](http://velocidaddeinternet.com)



[china-telecommunications.com](http://china-telecommunications.com)



[photographersdirect.com](http://photographersdirect.com)

# Sources of Radio Frequency Field Exposure Inside Home

- ▶ Tablets
- ▶ e-Readers
- ▶ Smart Electric Meters



[www.nickolexie.en.busytrade.com](http://www.nickolexie.en.busytrade.com)



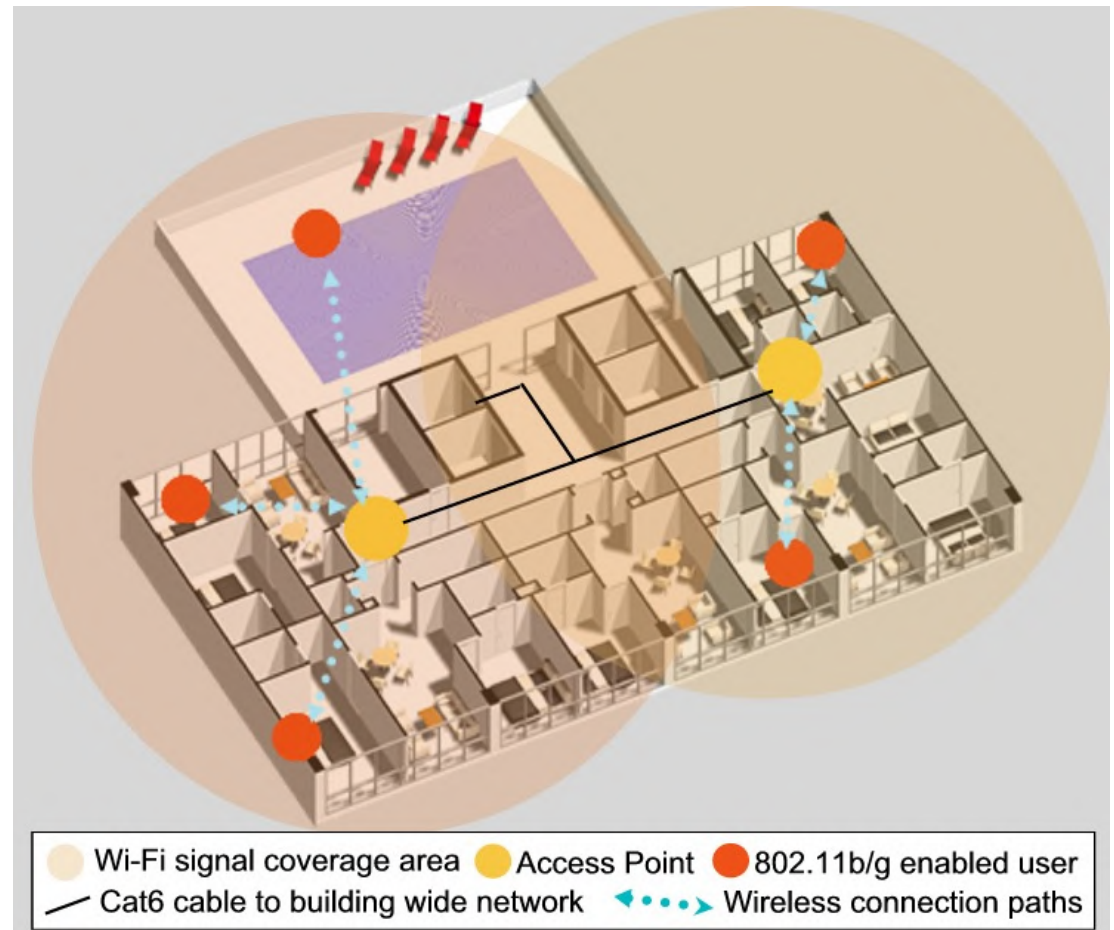
[en.wikipedia.org](http://en.wikipedia.org)

# Sources of Radio Frequency Field Exposure Inside Home and Office

Exposure from Wi-Fi router and Wireless Access Points (WAPs)



cnet.com



# EMF Meters and Instruments

## Radio Frequency (RF) Fields

- ▶ Hand-held RF Meters
- ▶ Available from Safe Living Technologies
- ▶ [www.slt.co](http://www.slt.co)



Acoustimeter



Gigahertz Solutions HF35C

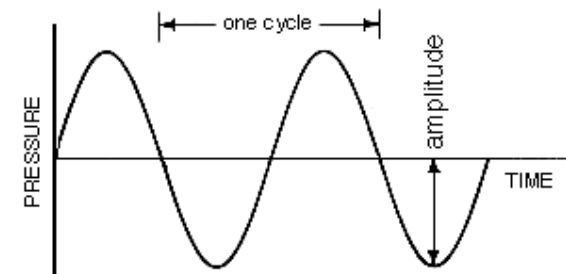


Gigahertz Solutions HF59B

# Radio Frequency Field Exposure

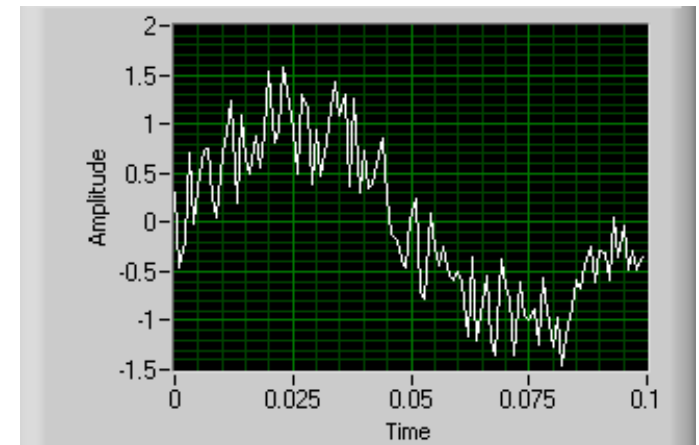
Harm comes from:

- ▶ Frequency
- ▶ Power Output
- ▶ Distortion of Waveform
- ▶ Smooth analog wave form is best
- ▶ Pulsed digital frequencies interfere with biological functions
- ▶ Effects are cumulative



[www.sfu.ca](http://www.sfu.ca)

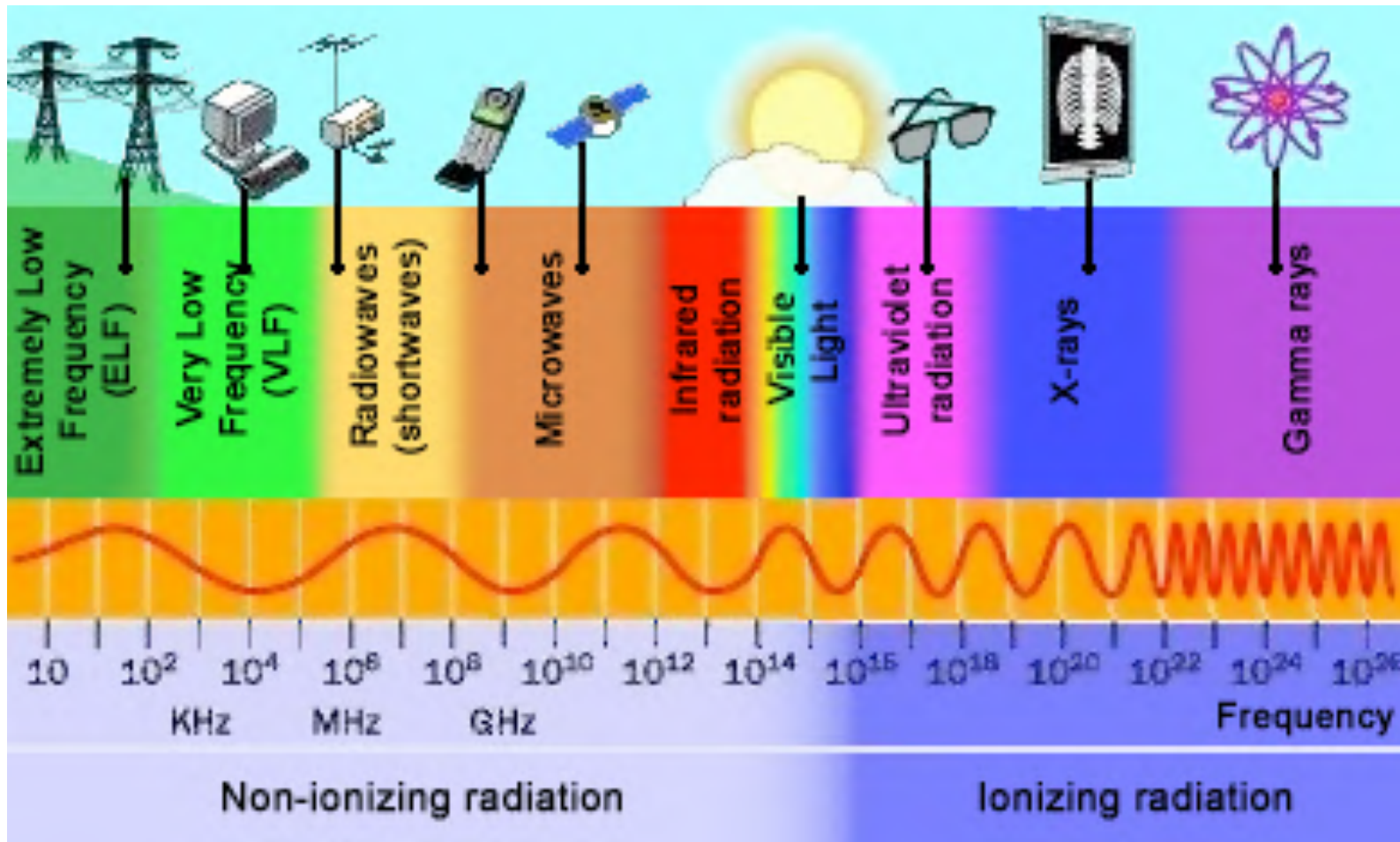
Smooth Analog Signals –  
Well Tolerated



Zone.ni.com

Pulsed Digital Signals –  
Not Well Tolerated

# Electro-Magnetic Spectrum



[www.astrosurf.com](http://www.astrosurf.com)



# FCC Compared to the Rest of the World

- ▶ FCC's safe exposure guidelines for cell phones listed at 1.0 milliWatts/centimeter squared ( $\text{mW}/\text{cm}^2$ )
- ▶ Yet that translates to 10 *million* microWatts/meter squared ( $\mu\text{W}/\text{m}^2$ ), the units used by rest of the world
- ▶ Other countries recommend lower RF safe exposure levels than the US
- ▶ Building Biology recommends RF levels of one hundred thousand to one million times less than FCC (100-10  $\mu\text{W}/\text{m}^2$  or 0.000,1-0.000,001  $\text{mW}/\text{cm}^2$ )
- ▶ FCC's guidelines based solely on thermal effects; ignore non-thermal, biological effects

# Official FCC Safe Exposure Guidelines for Radio Frequencies (RF)

**Table 1. LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)  
(B) Limits for General Population/Uncontrolled Exposure**

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time E/2, H/2 or S (minutes)
0.3-1.34	614	1.63	-100	30
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1,500	--	--	f/1,500	30
1,500-100,000	--	--	1.0	30

# Conversion Table

milliWatts per square centimeter	microWatts per square meter
0.000,000,01 mW/cm <sup>2</sup>	0.1 μW/m <sup>2</sup>
0.000.000,1 mW/cm <sup>2</sup>	1 μW/m <sup>2</sup>
0.000,001 mW/cm <sup>2</sup>	10 μW/m <sup>2</sup>
0.000,01 mW/cm <sup>2</sup>	100 μW/m <sup>2</sup>
0.000,1 mW/cm <sup>2</sup>	1,000 μW/m <sup>2</sup>
0.001 mW/cm <sup>2</sup>	10,000 μW/m <sup>2</sup>
0.01 mW/cm <sup>2</sup>	100,000 μW/m <sup>2</sup>
0.1 mW/cm <sup>2</sup>	1,000,000 μW/m <sup>2</sup>
1.0 mW/cm <sup>2</sup>	10,000,000 μW/m <sup>2</sup>
10 mW/cm <sup>2</sup>	100,000,000 μW/m <sup>2</sup>
100 mW/cm <sup>2</sup>	1,000,000,000 μW/m <sup>2</sup>
1,000 mW/cm <sup>2</sup>	10,000,000,000 μW/m <sup>2</sup>
10,000 mW/cm <sup>2</sup>	100,000,000,000 μW/m <sup>2</sup>

# Comparative Chart on International Safe Exposure Guidelines

1800 MHz Public Exposure Guidelines	PFD $\mu\text{W}/\text{m}^2$	Equivalent V/m	c.f. speed m.p.h.
<b>FCC (USA) OET-65</b>	<b>10,000,000</b>	61	3000
ICNIRP (1998), WHO	9,000,000	58	2847
Belgium (exc Wallonia)	1,115,000	21	1002
Italy (sum of frequencies)	100,000	6	300
Russia, PRChina	100,000	6	300
Switzerland, Lichtenstein, Luxembourg	95,000	6	292
Belgium Wallonia	24,000	3	147
Typical 100m from a base station (0.2 to 6 V/m)	10,000	1.9	95
Vienna (sum GSM)	10,000	1.9	95
Italy (single frequency)	1,000	0.6	30
Salzburg 1998 (sum GSM)	1,000	0.6	30
EU-Parl, GD Wissenschaft, STOA GSM (2001)	100	0.2	9
Median level, 15 US cities 1977 (mainly VHF & TV)	48	0.14	7
Salzburg GSM/3G outside houses (2002)	10	0.06	3
Salzburg GSM/3G inside houses (2002)	1	0.02	1
Burgerforum BRD proposal, waking areas (1999)	1	0.02	1
Burgerforum BRD proposal, sleeping areas (1999)	0.01	0.002	0.1

<http://www.powerwatch.org.uk/science/intguidance.asp>

Miller, BBEC, EMRS

# Building Biology Safe Exposure Guidelines for RF

Building Biology Evaluation Guidelines for Sleeping Areas, SBM-2008, Page 1

Radiofrequency Radiation (High Frequency, Electromagnetic Waves)

	No Concern	Slight Concern	Severe Concern	Extreme Concern
Power Density in microWatts/meter squared ( $\mu\text{W}/\text{m}^2$ )	< 0.1	0.1 - 10	10 - 1,000	> 1,000

# The Bottom Line

If you use a cell phone, cordless phone, tablet or laptop, you must ask yourself:



[turbohealthcare.com](http://turbohealthcare.com)

“How many cigarettes am I willing to smoke on a daily basis?”

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Reduce Use
- ▶ Increase Distance
- ▶ Prefer speakerphone and texting
- ▶ Air tube earphone for cell phones and cordless telephones  
[www.rfsafe.com](http://www.rfsafe.com)  
[www.lessemf.com](http://www.lessemf.com)
- ▶ Place “snap bead” on earphone cord  
[www.lessemf.com](http://www.lessemf.com)



Ferrite “Snap”  
Bead



RF3 Air Tube Ear Phone

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Keep landline telephone and use it
- ▶ Corded telephones rather than cordless
- ▶ Tell family and friends to call your home telephone number first
- ▶ Hardwired network using Ethernet cables
- ▶ Must disable Wi-Fi on router *and* computer
- ▶ Put tablet, e-Reader, laptop & cell phone in Airplane mode when not receiving or transmitting



Corded Telephone



CAT-5e or 6 Wiring



# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Internet network should be hardwired using Ethernet cable
- ▶ Create Local Area Network, or LAN
- ▶ Use Ethernet cables to connect devices (computers, printers, TVs) to router
- ▶ Use data switch for multiple computers, printers in one room



[www.cableorganizer.com](http://www.cableorganizer.com)



[www.amazon.com](http://www.amazon.com)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ You *must* manually disable Wi-Fi on router *and* laptop or desktop computer to avoid Wi-Fi radio frequencies
- ▶ Plugging in Ethernet cable does *not* automatically disable Wi-Fi
- ▶ Consult with router's manufacturer, manual, or Internet Technology (IT) person to disable Wi-Fi on router and computer



[iccinforcentre.com](http://iccinforcentre.com)



[piratstudenterna.se](http://piratstudenterna.se)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ No cordless keyboard and mouse
- ▶ Replace with *corded* keyboard and mouse
- ▶ Disable Bluetooth on computer
- ▶ Turn off power on cordless keyboard and mouse — will still transmit in the drawer



[en.wikipedia.org](http://en.wikipedia.org)



[ebay.pl](http://ebay.pl)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Mac Air and Macbook have no Ethernet port
- ▶ Use Thunderbolt-to-Ethernet or USB-to-Ethernet adapter



[www.apple.com](http://www.apple.com)



[www.apple.com](http://www.apple.com)



[iphonehoesjeshop.nl](http://iphonehoesjeshop.nl)

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Newest MacBooks have no USB port, only USB-C
- ▶ Use USB-C Digital Multiport Adapter, then USB-to-Ethernet adapter



[www.amazon.com](http://www.amazon.com)



[www.amazon.com](http://www.amazon.com)

# Protect Yourself from Harmful Radio Frequency Field Exposure

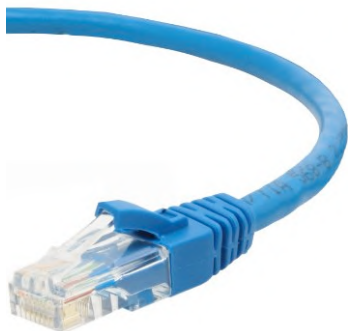
- ▶ Hardwired workaround for iPad and iPhone
- ▶ Put in Airplane mode — Internet access without RF
- ▶ Plug USB Ground Cord into USB hub to avoid electric fields



USB Camera Adapter



USB Extension Cable



Ethernet Cable



USB-to-Ethernet Adapter



Powered USB Hub  
*Oram Miller, BBEC, EMRS*

# Protect Yourself from Harmful Radio Frequency Field Exposure

- ▶ Hardwired connection to TV for streaming video — Netflix
- ▶ Plug Ethernet cable into Roku or Apple TV device
- ▶ Automatically disables Wi-Fi on Apple TV 1 & 2
- ▶ With Apple TV 3, must disable Airplay with onscreen command
- ▶ Verify with RF detector



[commons.wikimedia.org](https://commons.wikimedia.org)



[zdnet.com](http://zdnet.com)

# Protect Yourself from Harmful Radio Frequency Fields from Outside

- ▶ Look up location of cell and broadcast antennas near your home
- ▶ [www.antennasearch.com](http://www.antennasearch.com)



Steelintheair.com



Longdistancecarriers.us



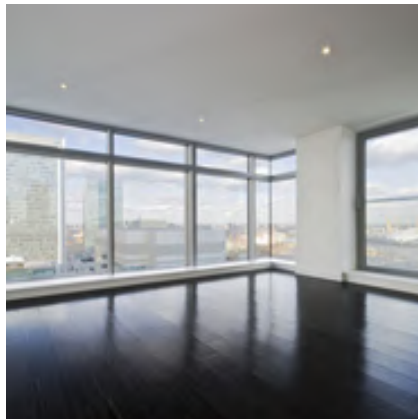
# Protect Yourself from Harmful Radio Frequency Field Exposure

Block RF from outside sources (cell towers, smart meters, radio & TV towers):

- ▶ RF shielding paint and foil
- ▶ Metal window screen or film on windows
- ▶ Fabric, bed canopy
- ▶ Available from Safe Living Technologies
- ▶ [www.slt.co](http://www.slt.co)



Y-shield® Paint



Signal Protect Window Film



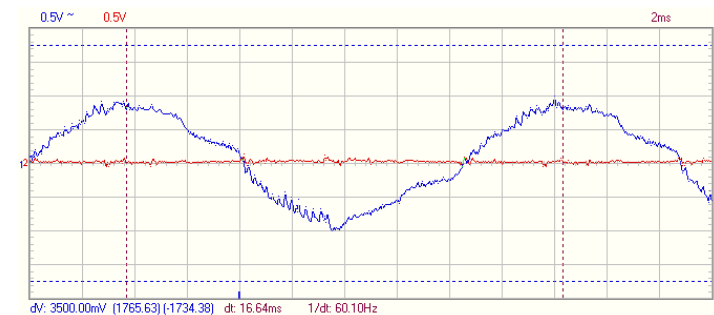
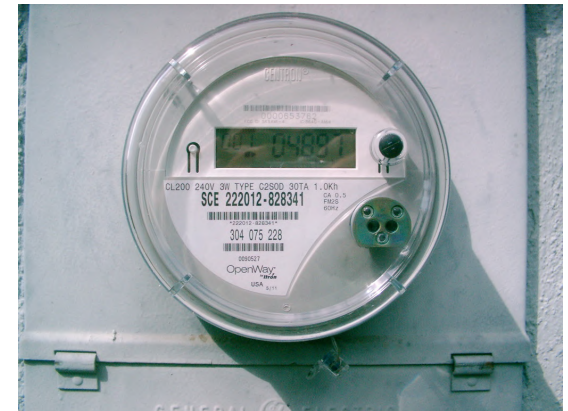
Bed Canopy



RF Shielding Foil

# Protect Yourself from Smart Electric Meters

- ▶ Transmits data once to several times per day
- ▶ Emit “beacon signals” twice or more per minute on average to “synchronize” smart meters in mesh network
- ▶ Signal strength varies from manufacturer to manufacturer
- ▶ Many people experience health symptoms
- ▶ Some models also emit harmonics of “dirty electricity”
- ▶ Opt Out programs available from some electric utilities, either voluntary or mandated by state’s Public Utility Commission



*Oram Miller, BBEC, EMRS*

# Sources of Dirty Electricity Exposure

- ▶ Electronic dimmer switches
- ▶ Compact Fluorescent Lamps (CFLs)
- ▶ Switched Mode Power Supplies



[www.conrad.com](http://www.conrad.com)

# Protect Yourself from Harmful “Dirty Electricity” Exposure

- ▶ Ideally eliminate sources
- ▶ Avoid Compact Fluorescent Lamps
- ▶ Use Halogen incandescent bulbs
- ▶ LED bulbs
- ▶ Install straight on/off switches rather than dimmer switches
- ▶ Greenwave or Stetzer Filters (repair wiring errors first)



# Summary of EMF Basics

- ▶ Flow of current produces magnetic fields
- ▶ Pressure of voltage produces electric fields
- ▶ EMFs found at various frequencies
- ▶ Meters and instruments used as detectors
- ▶ Can cause health problems
- ▶ Design home and office to avoid EMFs in first place

# Summary of Steps to Reduce EMFs Magnetic Fields

- ▶ Keep current on intended paths: insulated hot and neutral conductors within circuits
- ▶ Keep current off grounding paths: water pipes, TV cable sheathing
- ▶ Check for wiring errors prior to occupancy
- ▶ Avoid proximity to point sources: breaker panel, refrigerator, transformer, digital clock at front of stove
- ▶ Do not build on property near power lines

# Summary of Steps to Reduce EMFs Electric Fields

- ▶ Metal clad circuits (Flex or EMT) in and around bedrooms, desks, easy chairs, couches, play areas
- ▶ Shut off switch for outlets within 6-8 feet of bed
- ▶ With Romex circuits, use remote shut off switch for circuits
- ▶ Rewire lamps with shielded cord (MuCord)
- ▶ Keep unshielded cords away from you at computer desk
- ▶ Use three-pronged, grounded AC power cords for laptops

# Summary of Steps to Reduce EMFs Radio Frequencies

- ▶ Reduce Use
- ▶ Increase distance
- ▶ Favor hardwired connections for Internet, telephone, media, security system, speaker, thermostat, intercom, & baby monitor connections
- ▶ Opt out of smart meters or use shielding
- ▶ Half mile to three-quarters of mile from most cell towers
- ▶ Use shielding when necessary



# Summary of Steps to Reduce EMFs Dirty Electricity

- ▶ Replace CFLs with traditional light bulbs or LED bulbs
- ▶ Prefer straight on/off switches to dimmers
- ▶ Central control system dimmers (Lutron, Crestron) cleaner than off-the-shelf dimmers
- ▶ Avoid ECM variable speed HVAC motors
- ▶ Replace smart utility electric meter with analog meter

# Create Healthy Homes

Oram Miller, BBEC, EMRS

Los Angeles, California

310.720.7686

[www.createhealthyhomes.com](http://www.createhealthyhomes.com)