Environmental effects of Wireless radiation

Professional Awareness - overview

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RF Radiation Effects - Overview

1. Scientific Data
2. Radiation types
3. RF sources – We encounter daily
4. Tower types (with examples)
5. Personal devices
6. Safety Limits – Towers and Proximity devices
7. Recommendations

1. Scientific data

- Data has been gathered over several decades and analyzed systematically.
- The best known measure is SAR (Specific Absorption Rate), which measures the RF power absorbed by the human body.
- Major agencies (both academic and federal) denote RF energy in W / kg of body mass, taken over a volume of 1 gram of tissue.
- Studies from the following agencies endorse it:
  - Academic (University of Oklahoma and others)
  - Professional (FCC, IEEE, OSHA, WHO and others)

2. Radiation types

"Higher the frequency deeper the effect"

Increasing Frequency

- **Radio Frequency (natural, man made)**

  Effect: Molecular rotation and torsion results in heating, mainly due to power absorbed by tissue. IT IS NON IONIZING
- Infrared – Warming of skin surface, non ionizing
- Visible – Electron level changes, non ionizing

- Ultra violet – Ionizing but skin deep effect (Sunburn)
- X-ray (medical, TV screens) - Ionizing effect (deep)
- Nuclear (natural / power plants) – Ionizing effect, radiation hazard is deeper and risk of cancer)
- Gamma ray (radioactive process) - Ionizing effect (risk of mutation and cancer)

3. RF Sources –We encounter daily

- Broadcast (TV / Radio) – kW in VHF / UHF
- Portable phones (5 W in VHF / UHF range)
- Pager / Cordless phone (< 1 Watt in VHF)
- Microwave oven – source produces 2000W, but only 5 mW leaks out of the door (2.4GHz)
- Cellular phones operate in 800/1900MHz bands, Cell Towers power can be up to 25 W; phone can put out 0.5 W (800 MHz, 1900 MHz, 1700MHz, 2100 MHz)
- Wireless LAN / WiFi (Access points power is <1W, PDA power is in mW) – 2.4 and 5.3GHz
- Satellite Communications 4 – 40 GHz
- Microwave repeaters 4 – 80 GHz

4. Tower types

a) **Broadcast communication (TV, Radio)**

b) **Communication towers**

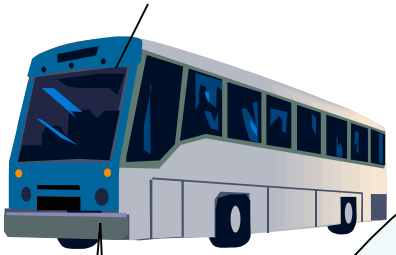
c) **Cellular antenna towers / Access Points**

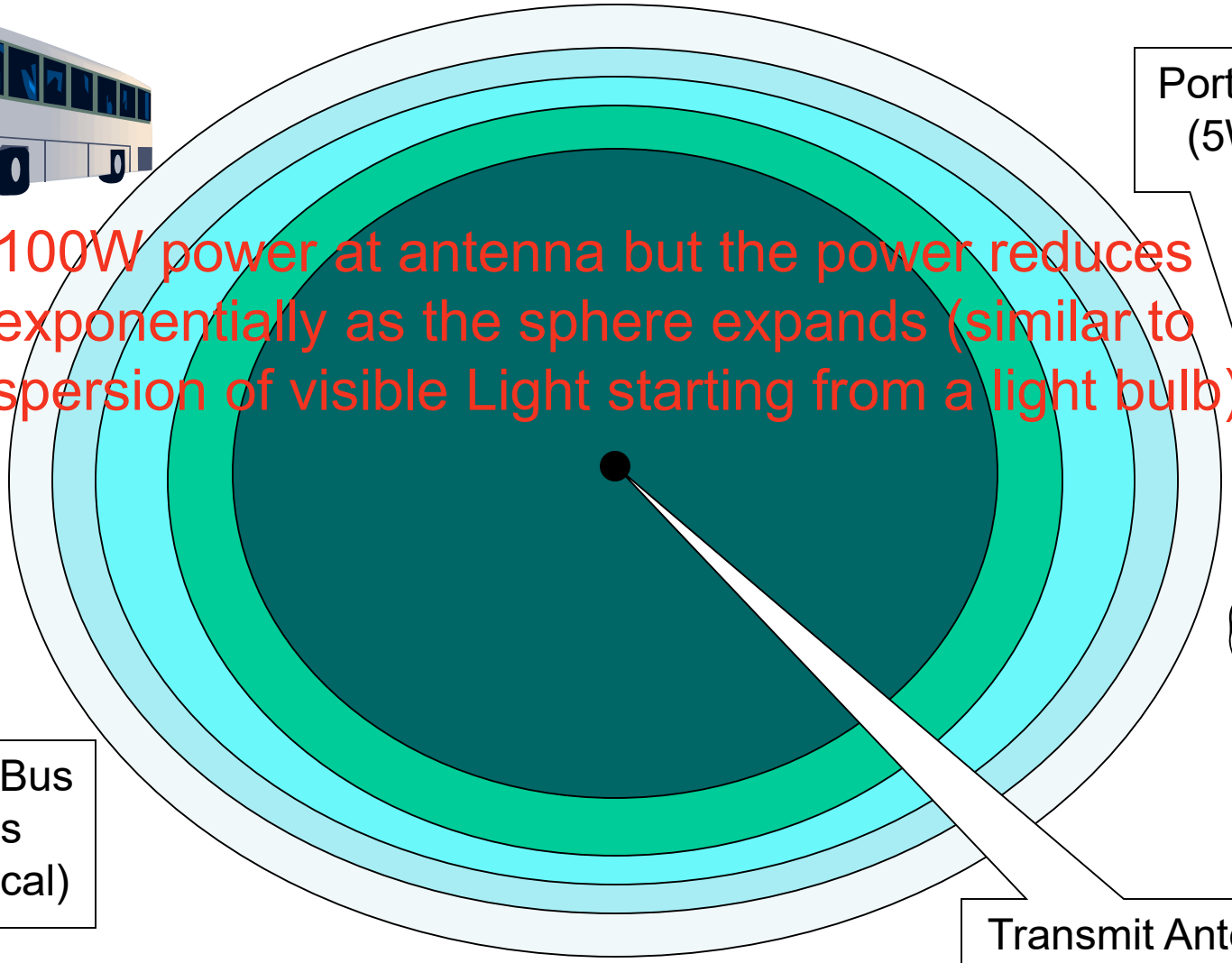
- Microwave repeaters (these antennae look at each other, don't interfere with the public)
- Satellite dishes (they point towards the sky and don’t interfere with the public)

4. (a) Broadcast Towers (TV, Radio)

- 10MW Max, 10kW or less typical.
- Broadcasts are high power, but one way systems. Our TV / Radio units don't transmit, they only receive.

4. (b) Communication Tower (VHF/UHF)





Portable Radio (5W typical)

Mobile in Bus or trains (10W typical)

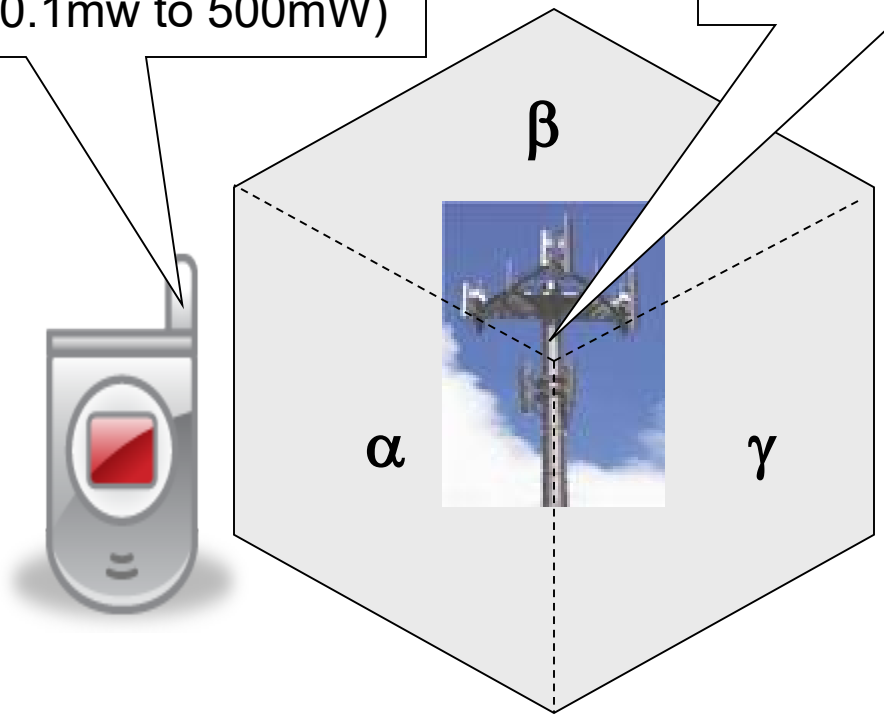
Transmit Antenna (100W typical)

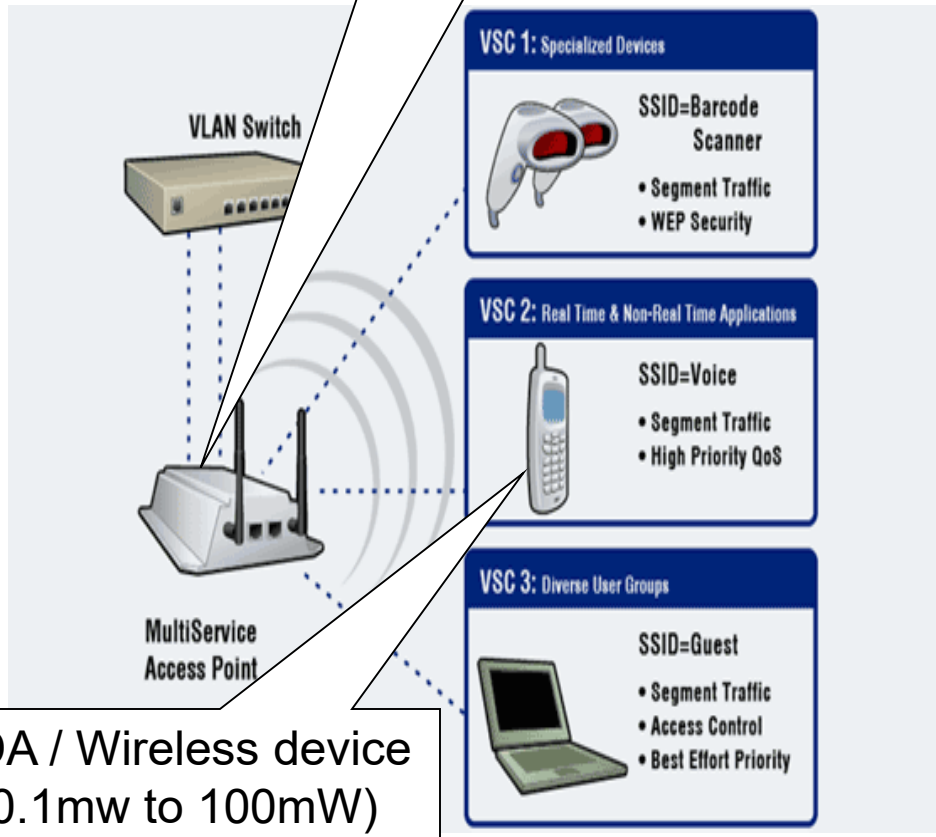
4 (c) Cellular Tower / Access Points

Cell phone transmit (0.1mw to 500mW)

Cell tower (25W, max, 10W typical)

Wireless Access Point (0.1mW, to 100mW typical)





PDA / Wireless device (0.1mw to 100mW)

Safety limits – Towers

Towers	FCC /OSHA	Typical	Comment
Broadcast tower (Radio or TV)	8W / kg of body mass (below 450 MHz)	100 KW to 1MW at the tower	Within safety limit at the either TV / Radio receiver (in premises).
Cell phone tower - public	0.08W /kg over whole body	10 W to 25 W at the tower	Below 0.08W / kg for public
Comm. tower (professional services)	8W/kg of body mass	100 W at the tower	Below 8W / kg at portable

Personal (Proximity) devices

- Cell phone / PDA
- Laptop / Home LAN
- Medical devices
- Security Monitors
- Bar code readers
- Wireless devices – any device that avoids wires (typically uses 2.4 GHz or 5 GHz band)

Safety Limits – Proximity devices

Devices	FCC /OSHA	Typical	Comment
Portable phone (VHF / UHF) in controlled environment	7 W / kg in the 300KHz to 1GHz range	5 W at the handset (work related / professional)	5 W / kg at worker level - constant
Cell phone / mobile phone / PDA / Scanner	1.6 W/kg over 1 gram of body mass, 4 W near hands, wrists, feet and ankles	0.1mW to 0.5W at the handset	0.5 W if user is at edge of the cell, 0.1mW if user is near a cell tower +

+Therefore, more the number of towers, less will be power transmitted by your cell phone

Recommendations - 1

- **In conversation with colleagues**

  - Use known power levels and frequency bands to compare data*
  - Provide clear context on what numbers are being used and the purpose.
  - Be proactive in following safety guidelines.

- ***If there is a tower proposed in your community***

  - *Obtain RF power levels, frequency band proposed*
  - *Height and purpose of the tower / installation*
  - *If your township opposes a tower or cell site, be proactive, check the data*, not just emotions.*

*Compare data with Recommendations in FCC 96-396, ET docket No.93-62 dated Aug, 1996.

Recommendations - 2

- *For personal use at home, follow safety guidelines (limit proximity & length of use)*
- *If you are a frequent user, use headphones.*

- See Wireless technology as a friend that provides mobility to enhance quality of life.
- In conversations on the topic don't ignore or exaggerate concerns – state known studies that span over many decades*

*Recommendations documented in FCC 96-396, ET docket No.93-62 dated Aug, 1996.