Small Cell RF Study City of San Clemente

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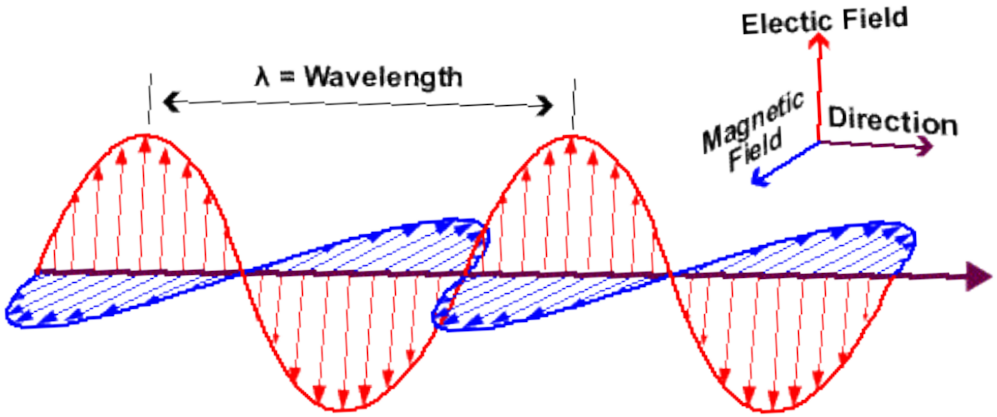
Radio Frequency (RF)

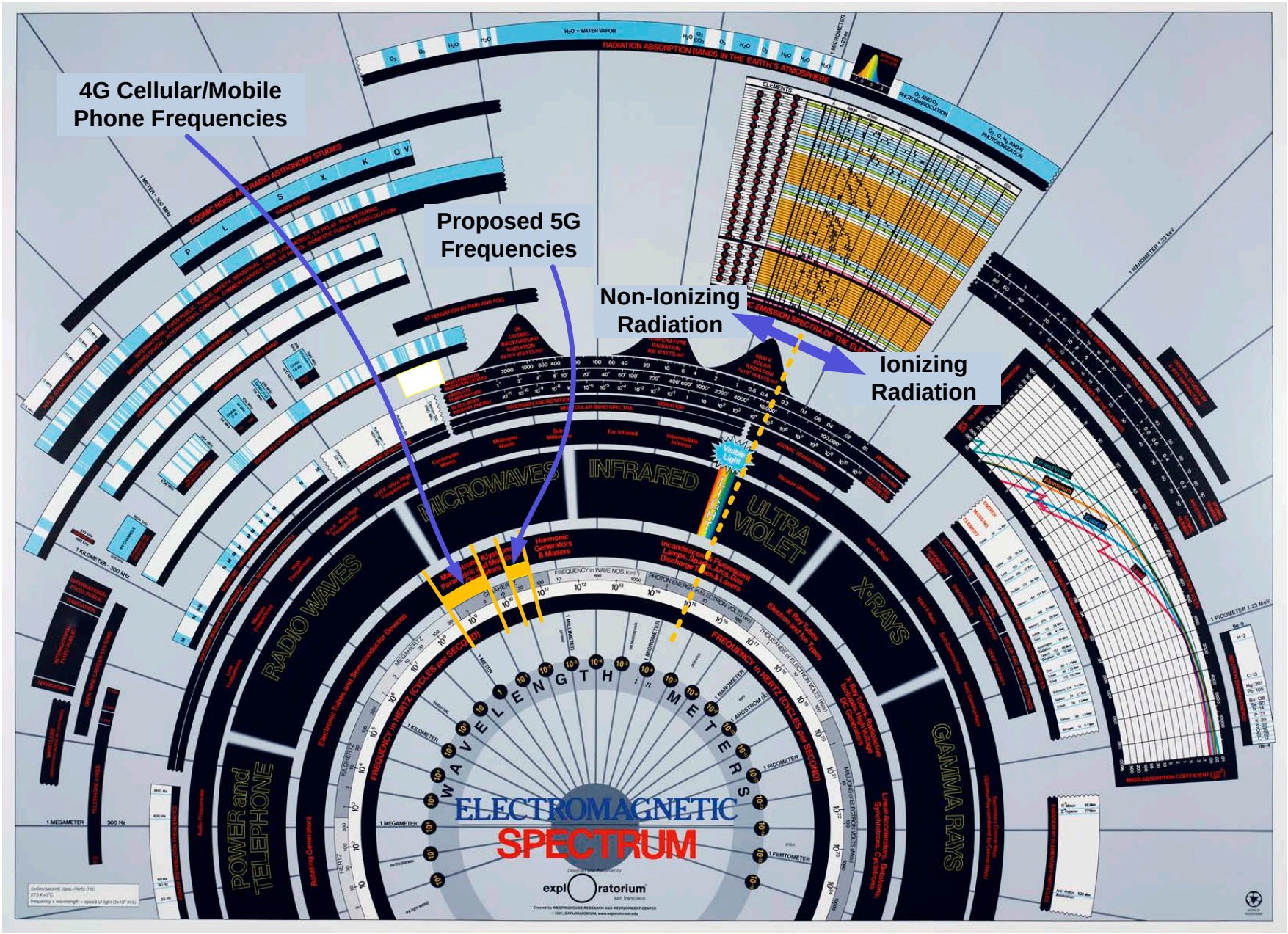


Radio Frequency Energy is Electromagnetic Energy

Forms of Electromagnetic Energy

- Visible Light
- Infrared Radiation (Heat)
- Ultraviolet Radiation (UV)
- Microwave Oven
- FM/AM Broadcast
- Cellular Radio

The Electromagnetic Spectrum



Source of Engineering Safety Guidelines

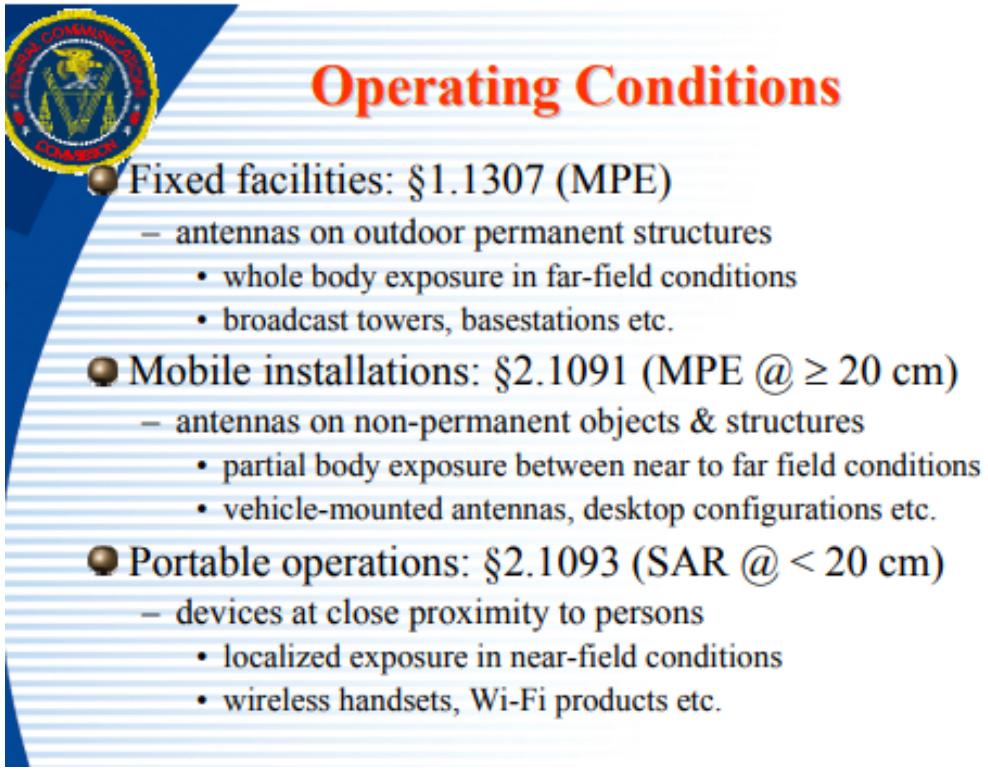
Institute of Electrical and Electronics Engineers

Founded	January 1, 1963; 56 years ago
Type	Professional association
Tax ID no.	13-1656633[1]
Legal status	501(c)(3) nonprofit organization
Focus	Electrical, Electronics, Communications, Computer Engineering, Computer Science and Information Technology[2]
Location	Piscataway, New Jersey, US
Origins	Merger of the American Institute of Electrical Engineers and the Institute of Radio Engineers
Method	Industry standards, Conferences, Publications
Members	420,000+

What Matters for RF Safety?

- **Power of the RF Source, Cell Base Station Transmitter, Measured in Watts (W)**
- **Distance from the RF Source, Measured in Feet or Meters (ft. or m)**
- **Resulting RF Power Density, Measured in Watts per Area (W/m^2)**
- **FCC and IEEE Guideline for Consumer Safety = 580 microwatts/square cm**

Maximum Permissible Exposure (MPE) ≈ 580 $\mu W/cm^2$

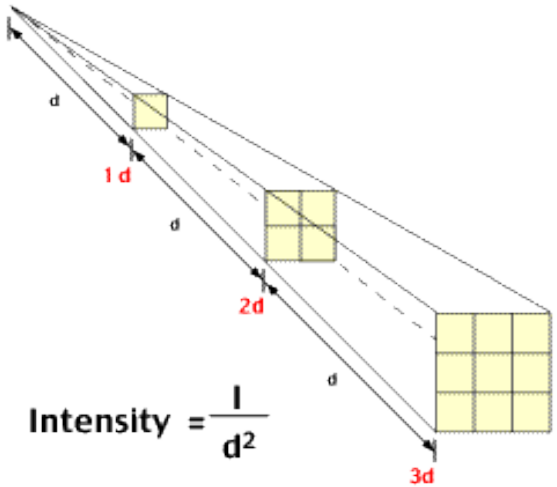


MPE

MPE

Specific Absorption Rate (SAR)

Radio Power Decreases with Distance



Comparison of Safety Guideline with the Sun

FCC/IEEE Safety Guideline:
580 μW/cm²

Sunny Day, Solar Energy Hitting the Ground:
100,000 μW/cm²

San Clemente's Proposed Sites

Radio Base Stations / Antennas

ERICSSON

RADIO 2203

The micro Radio 2203 is part of the Ericsson Radio System portfolio. Radio 2203 has best in class design, superior radio performance and power efficiency when it comes to medium range 3GPP radio products.

Radio 2203 has, by use of its small and smart dimensions, support for a wide range of mounting scenarios and has a pioneering flexibility within its product segment. With the Radio 2203, Ericsson evolves the micro radio portfolio to become even more flexible thus making it easier than ever to make small and efficient single and multi-band micro radio installations.

The Radio 2203 support installations with integrated or external antenna systems and can by use of the versatile optical CPRI interface be connected to any of the efficient Ericsson Baseband WCDMA or LTE modules by use of star or cascade configurations supporting multi sector and multi band.

Radio 2203 support WCDMA and LTE with two duplex TX/RX branches. The Radio 2203 support up to 4 WCDMA carriers or 40 MHz LTE as well as WCDMA and LTE mixed mode configurations.

OUTDOOR SMALL CELL: RADIO 2205 FOR UNLICENSED BANDS

OPERATOR CHALLENGE:

Boost user experience and data speeds with limited spectrum available. Deploy fully integrated micro solution on unlicensed spectrum.

OPERATE MICRO CELLS ON UNLICENSED SPECTRUM

- Outdoor micro for Licensed Assisted Access
- Uses same baseband and network management

RADIO 2205 UNLICENSED

- 4 liter, 4 kg micro 2T/2R Radio with 2*500mW output power
- For unlicensed 5GHz band and up to 3 LTE carriers

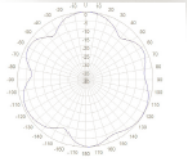
GALTRONICS
WE'RE MAKING WAVES™
A BAYLIN TECHNOLOGIES COMPANY

10" x 24" Outdoor Pseudo Omni Canister Antenna [1695-2400, 3550-3700 and 5150-5950 MHz]

EXTENT™ P6480i

Description:

- Pseudo Omni Canister Antenna for Outdoor DAS and Small Cells.
- 4x ports for AWS/PCS/WCS Band 1695-2400 MHz
- 4x ports for CBRS Band 3550-3700 MHz
- 2x ports for 5GHz Band 5150-5950 MHz



1695-2400, 3550-3700 and 5150-5950 MHz Pseudo Omni Canister Antenna

Electrical Specifications				
Frequency Band [MHz]	1695-2180	2180-2400	3550-3700	5150-5950
Input Connector Type	4x 4.3-10 DIN(F)		4x 4.3-10 DIN(F)	2x 4.3-10 DIN(F)
Isolation (typ.)	-20 dB		-25 dB	-25 dB
Inter-band Isolation	-30 dB (typ)		-30 dB (typ)	-30 dB (typ)
VSWR/Return Loss	1.5:1(Typ.) 1.7:1(Max.) / 14.0 dB(Typ.) 11.8dB(Max.)			
Impedance	50 Ω			
Polarization	Dual slant 45° (±45°)			
Horizontal Beamwidth	Omni (360°)			
Vertical Beamwidth	15°	12°	15°	19°
Max. Gain	9 dBi	9.5 dBi	8.5 dBi	6 dBi(Max.)
Avg. Gain	7.5 dBi	8 dBi	8 dBi	3 dBi
Downtilt	0°			
Max Power / Port	150 Watts		100 Watts	10 Watts
PIM @ 2x43 dBm	<-153 dBc		N/A	N/A

Analysis of Power Densities

San Clemente AT&T Small Cell Power Density Calculations

M. Pettus

11/16/2019

Given Data/Assumptions:

FCC Guideline for Maximum Power Density =	580	$\mu W/cm^2$	(FCC/IEEE C95.1-2005)
Ericsson Radio 2203, Power Output =	10	W	(2 x 5-W transmitters)
Ericsson Radio 2205, Power Output =	1	W	(2 x 0.5-W transmitters)
Base Antenna: Galronics GQ2410-06621.			

$$Power\ Density = \frac{P * G}{4 * \pi * D^2}$$

	Site 1	Site 2	Site 3	Site 4	Site 5
(ft)	62	86	145	78	553
(m)	18.90	26.21	44.20	23.77	168.55

LTE Bands (name)	Frequency (MHz)	Ant Gain (dBi)	Site 1 ($\mu W/cm^2$)	Site 2 ($\mu W/cm^2$)	Site 3 ($\mu W/cm^2$)	Site 4 ($\mu W/cm^2$)	Site 5 ($\mu W/cm^2$)
B1 DL	2140	8.9	1.7	0.9	0.3	1.1	0.02
B3 DL	1840	8.9	1.7	0.9	0.3	1.1	0.02
B8 DL	945						
B66 DL	2145	8.9	1.7	0.9	0.3	1.1	0.02
B5 DL	880						
B2/B25 DL	1960	8.9	1.7	0.9	0.3	1.1	0.02
B12 DL	746						
B13 DL	751						
B17 DL	2655						
B46 Int	5300	10.5	0.25	0.13	0.05	0.16	0.003
B46 Ext	5300	5.5	0.08	0.04	0.01	0.05	0.001


Thank You