Measuring Specific Absorption Rate of Antennas Placed Near the Human Body

Samah Beg, Miguel Gonzalez
Dr. Christopher Davis, John Rzasa

Maryland Optics Group

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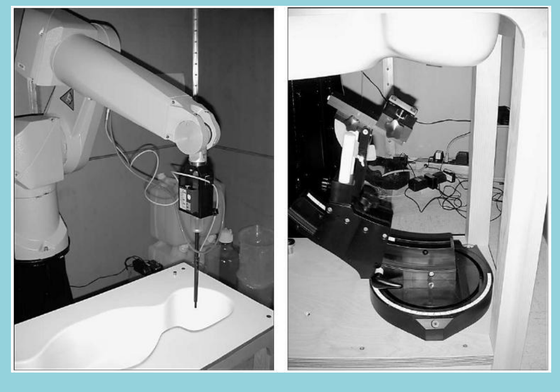
Motivation

Current FCC regulations have been put in place to ensure that overexposure to RF energy from wireless devices does not occur. Existing methods used to test devices such as cell phones can be improved to be faster and less costly. The goals of this project are to explore potential improvements to a novel method of SAR testing.

Specific Absorption Rate (SAR)

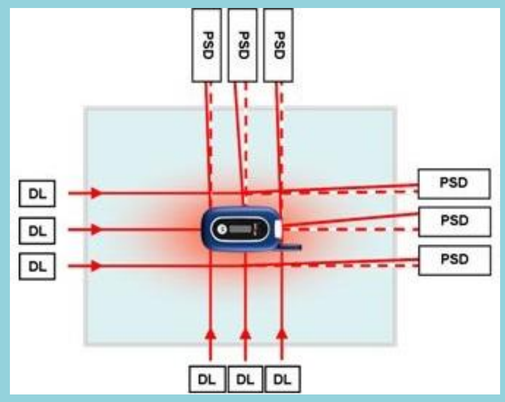
- Rate at which energy is absorbed by the human body when exposed to RF
- Averaged over 1 gram/10 grams of human tissue
- FCC standard: maximum 1.6 W/kg
- Direct correlation to thermal change induced by RF

Existing Method



Problems: speed, size, cost, accuracy

Current Functional System



- Manual operation of base station emulator
- Sealed human phantom model
- Diode lasers
- Position sensitive detectors

Our Contribution

- Characterization of laser pointing stability
- Mechanical stabilization of mounted components

660 nm, single mode, fiber-pigtailed laser mounted to three-axis stage

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3x microscope objective lens and 0.5 mm pinhole mounted to solid aluminum blocks

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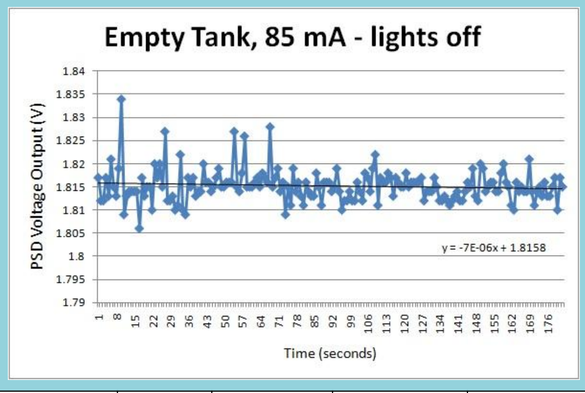
- **Test 1** — Open Air
- **Test 2** — Empty Tank
- **Test 3** — Enclosed Tank
- **Test 4** — Stimulant-Filled Tank

Results



	Open Air	Empty Tank	Enclosed Tank	Stimulant-Filled Tank
Ave. Drift (μm)	0.284	0.251	0.078	0.269
Std. Deviation	3.162	1.075	1.09	2.642
Ave. Drift Range (μm)	10.7	9.64	9.215	15.375
Std. Deviation	1.565	2.116	1.704	4.518

Sources of Error

- Collimation of laser beam
- Mechanical instability
- Optical power loss
- A/D conversion
- Environmental factors

Conclusion

The preliminary tests we performed to characterize the pointing stability of the fiber-pigtailed laser may be built upon with future tests, including determining the effects of RF radiation on the laser beam, under more controlled conditions, and with less potential sources of error.

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