PROBLEMS WITH NIER

MEASUREMENT LIMITATIONS

FCC INTERPRETATIONS

Port of Seattle Crane
Induced RF From Nearby MW Station

Make Up of IEEE Committee

– Research (University 37, Nonprofit 8, Military 15 & Government Research 30)	90
– Industry	12
– Industry Consulting	4
– Government	5
– General Public	14
– TOTAL	125

IEEE Standards

- Based on 321 Research Papers
- Two Tier Standard
  - Controlled Environment (Occupational)
  - Uncontrolled Environment (Public)
- Specific Absorption Rate (SAR) where “potentially-deleterious health effects occur”

IEEE Standards

- SAR for standard is 4 W/kg
- Maximum Permissible Exposure (MPE)
  - 1/10 of SAR for Occupational
  - 1/50 of SAR for Public
- No verified reports of injury to humans or adverse effects on the health of humans who have been exposed to electromagnetic fields within the limits

Lifespan and Cancer in Laboratory Mammals Exposed to Radiofrequency Radiation

Joe A. Elder, Ph.D.
Motorola Florida Research Laboratories
Plantation, FL 33322

In conclusion, the weight-of-evidence in RF studies describing lifespan data and cancer in the same animal populations shows that RF radiation does not adversely affect lifespan or cancer incidence at whole-body SARs $\leq$1.5 W/kg and brain SARs $\leq$2.3 W/kg.

IEEE Occupational Standards

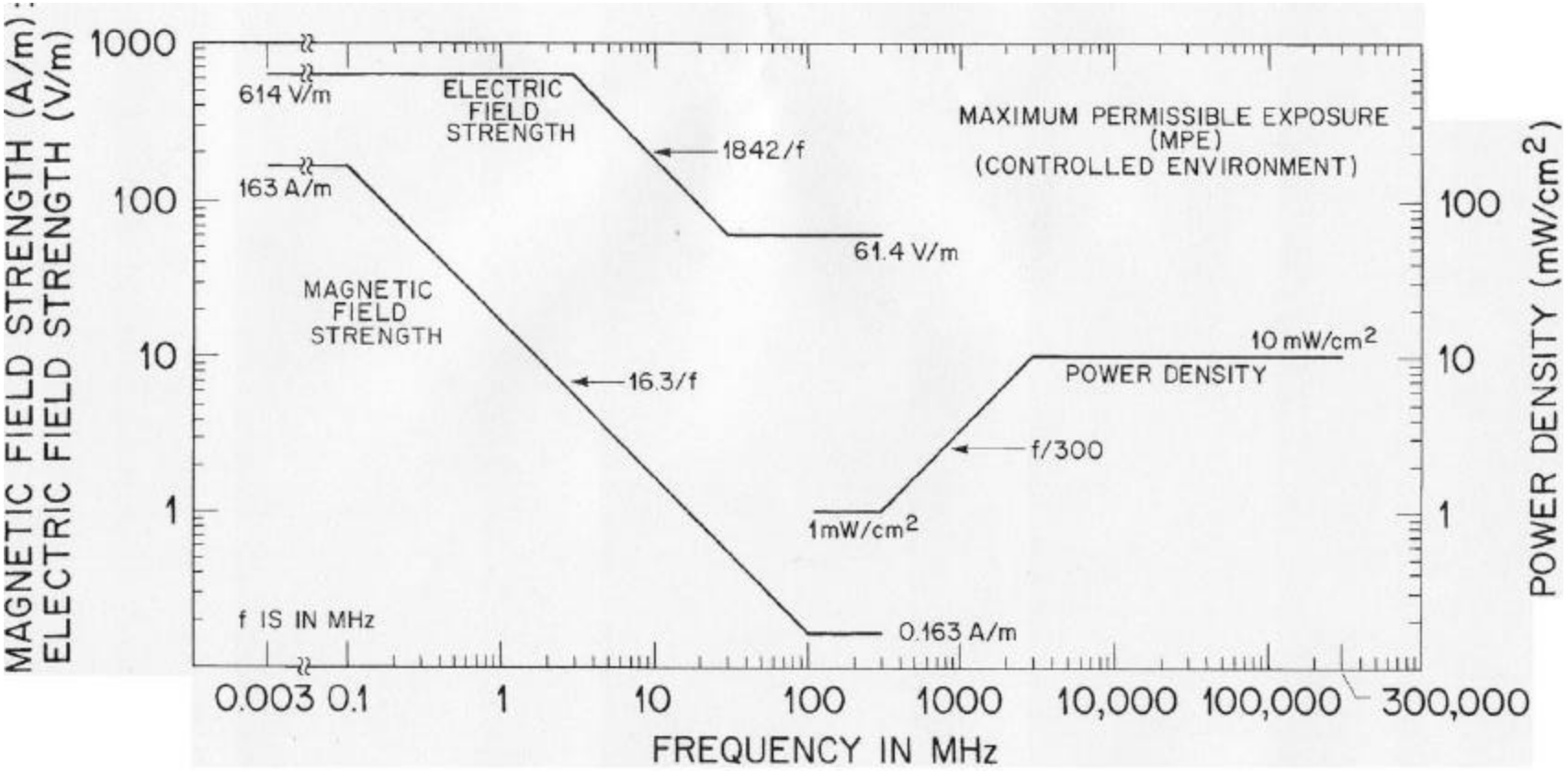


Figure E.2—Graphic representation of maximum permissible exposure in terms of fields and power density for a controlled environment

IEEE Public Standards

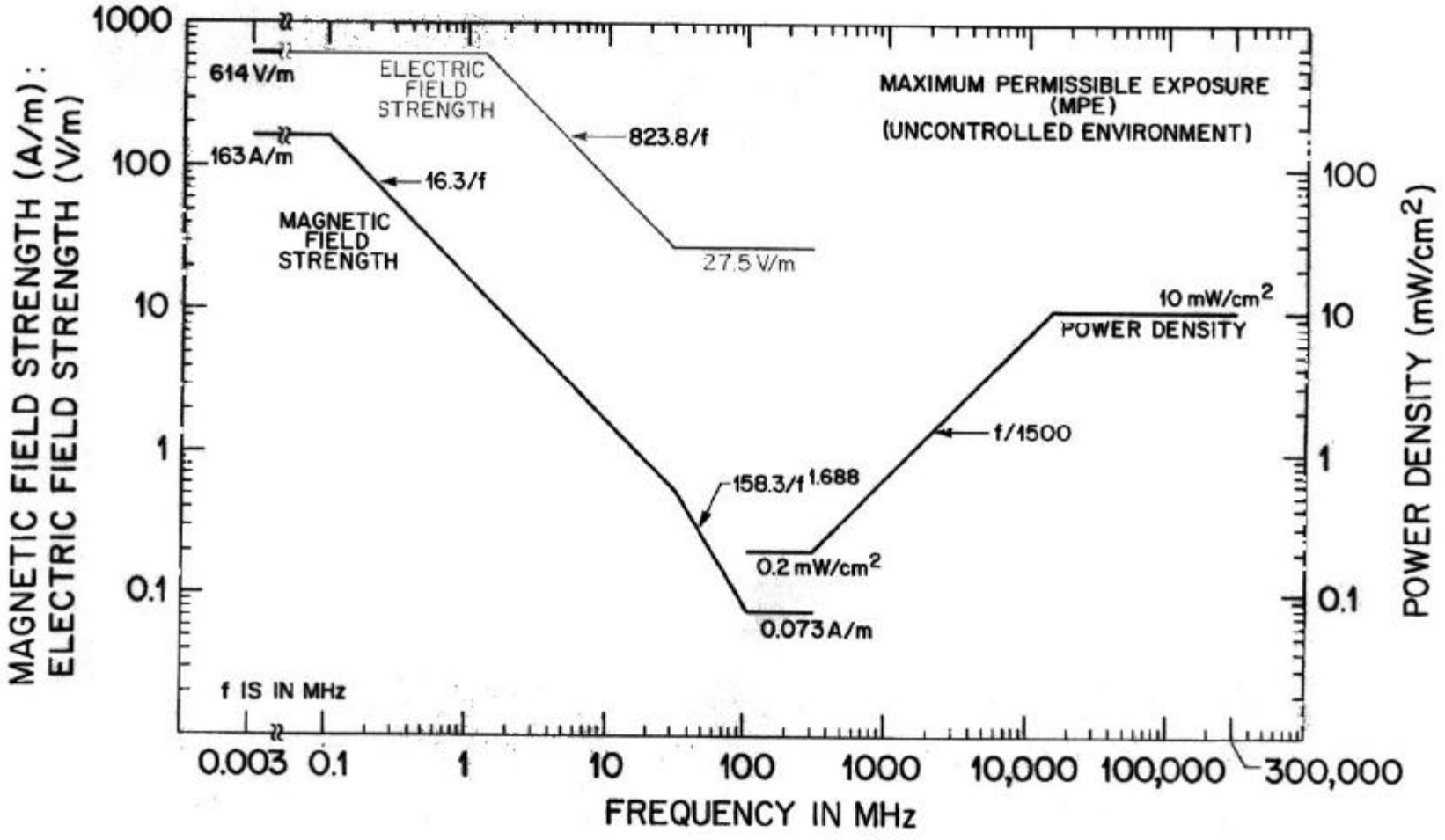


Figure E.4—Graphic representation of maximum permissible exposure in terms of fields and power density for an uncontrolled environment

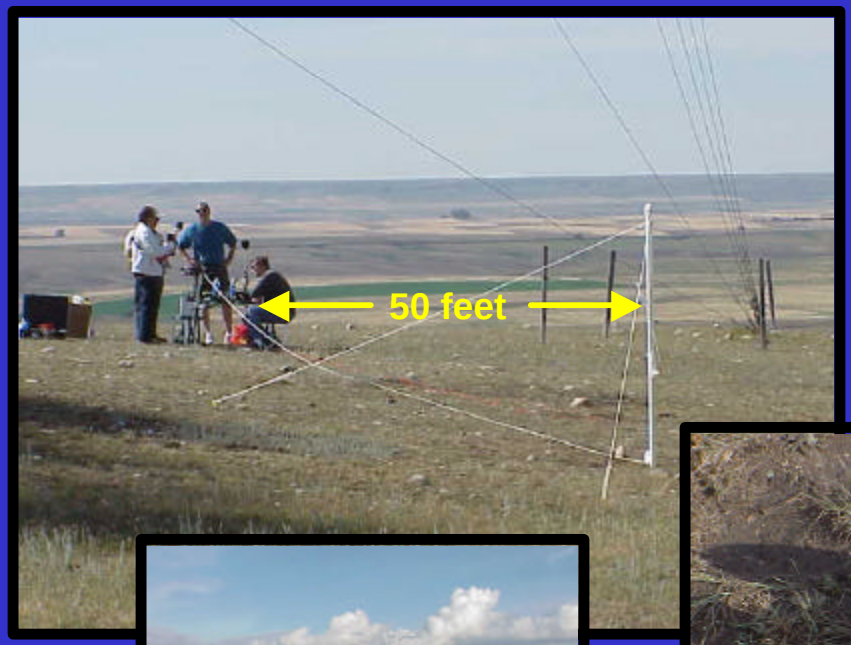
Comparison of Occupational Standards

Frequency	IEEE	ICNIRP
300 kHz	614 V/m – 54.3A/m	610 V/m – 5.33 A/m
1 MHz	614 V/m – 16.3 A/m	610 V/m – 1.60 A/m
3 MHz	614 V/m – 5.43 A/m	203 V/m – 0.53 A/m
10 MHz	184 V/m – 1.63 A/m	61 V/m – 0.16 A/m
30 MHz	61.4 V/m – 0.54 A/m	61 V/m – 0.16 A/m

Comparison of Public Standards

Frequency	IEEE	ICNIRP
300 kHz	614 V/m – 54.3A/m	87.0 V/m – 2.43 A/m
1 MHz	614 V/m – 16.3 A/m	87.0 V/m – 0.73 A/m
3 MHz	274 V/m – 5.43 A/m	50.2 V/m – 0.24 A/m
10 MHz	82.4 V/m – 1.63 A/m	27.5 V/m – .073 A/m
30 MHz	27.5 V/m – 0.54 A/m	28.0 V/m – .073 A/m

The Test Site – Shelby, Montana



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Factors Affecting RF Measurement Accuracy and Meaning

- Probe calibration accuracy
- Probe frequency response
- Multiplicity of fields (rms response)
- Polarization of fields
- Spatial distribution of fields
- Interference with field to be measured by observer (field perturbation)

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Studying the Effect of Field Perturbation on Measured RF Fields

- Establish a “pure” test environment
- Determine the “unperturbed” field
- Measure influence of field perturbation caused by observer

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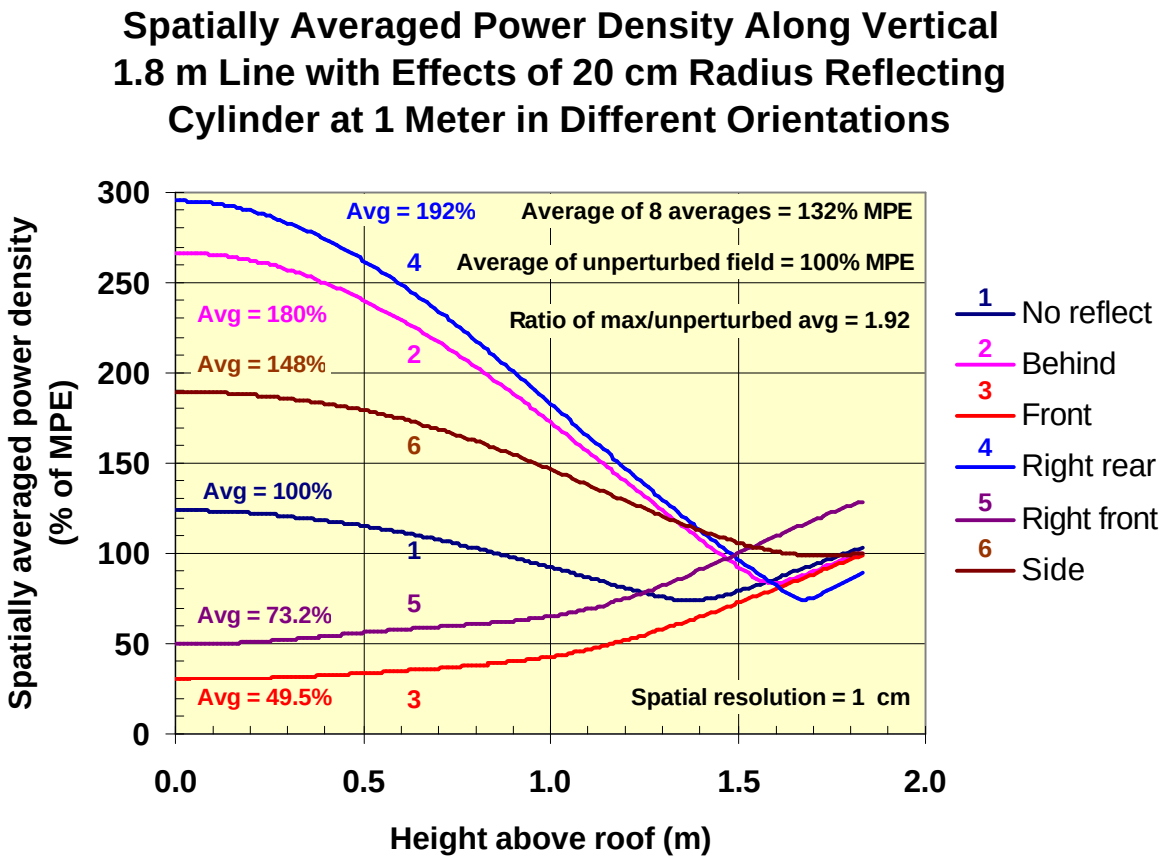
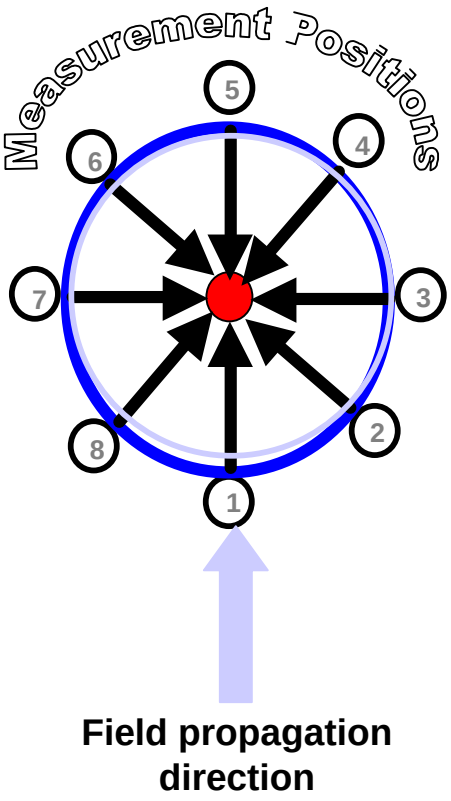
A Theoretical Assessment of Operator Interaction with Fields





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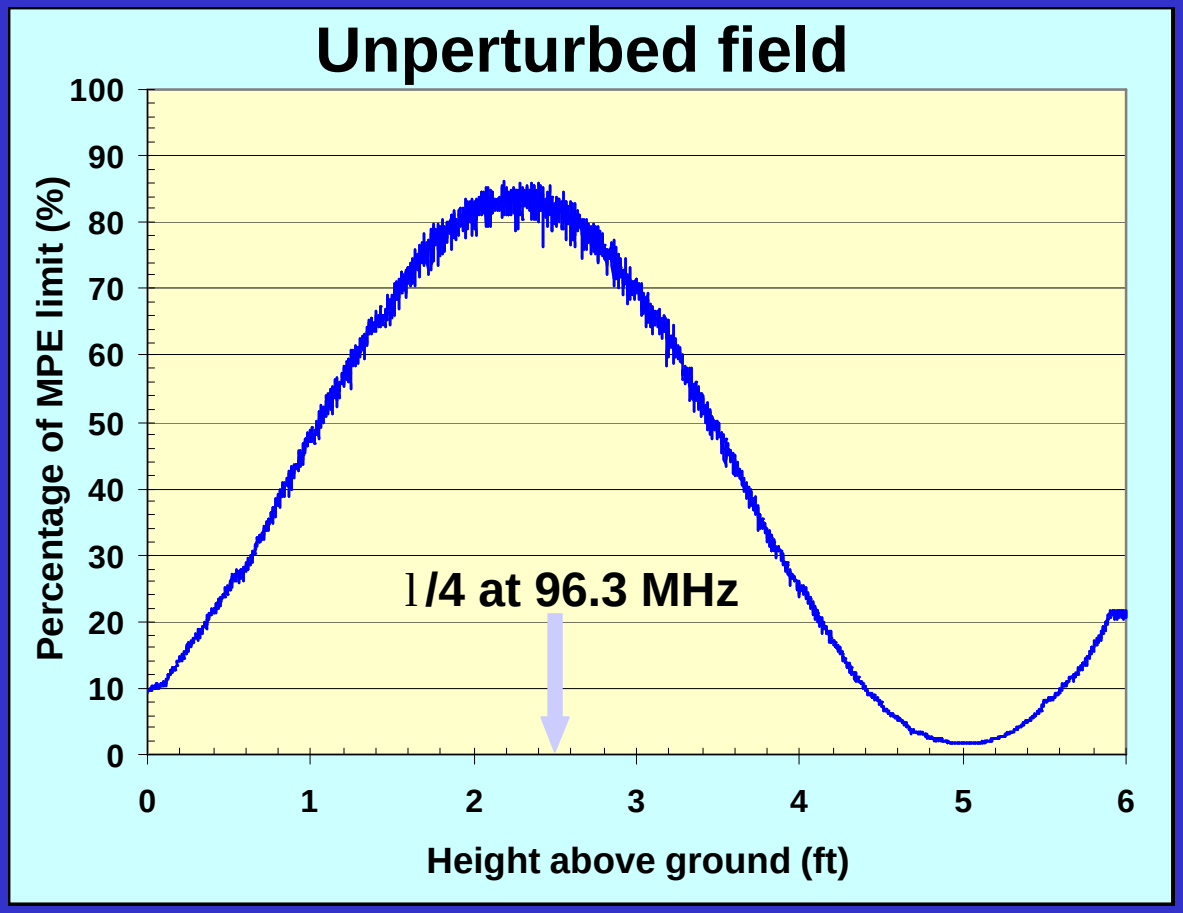
Typical Spatial Variation of Power Density at 30 Feet from KZIN Tower, Shelby, Montana



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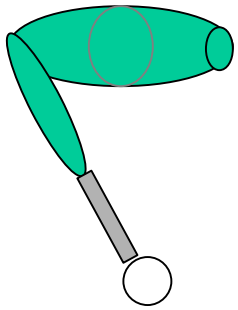
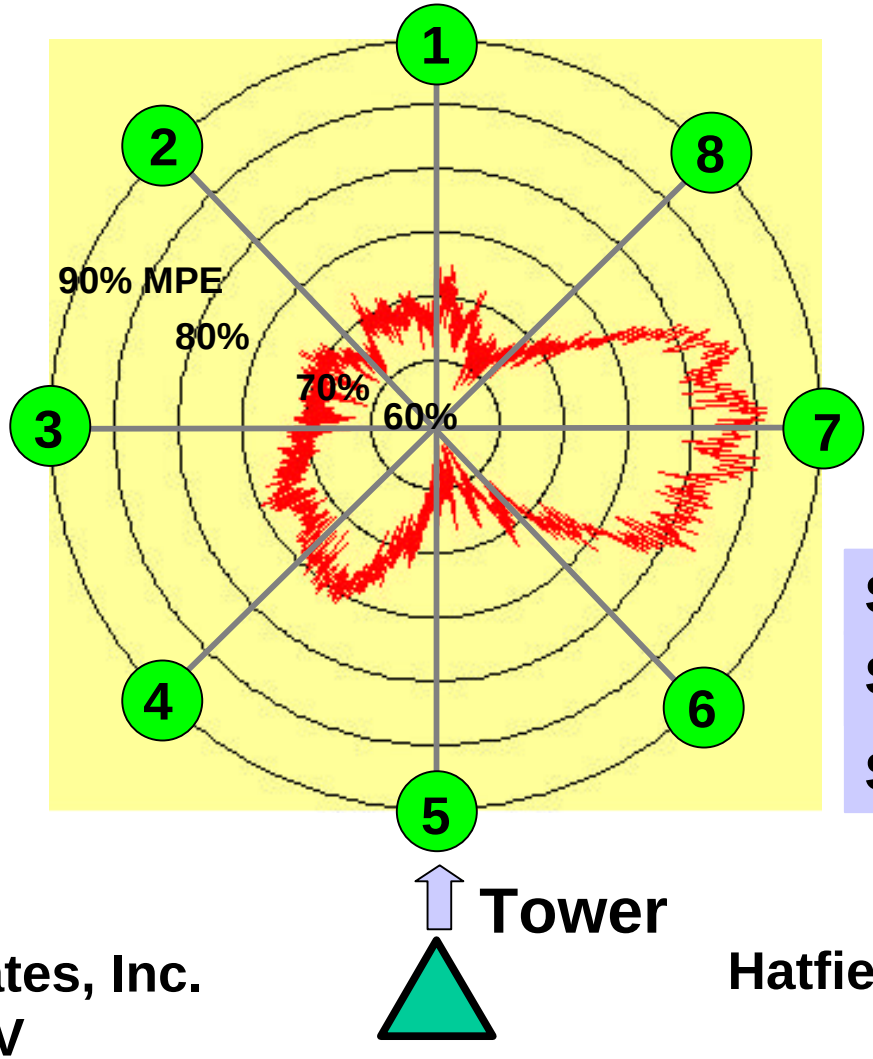
Polar Plot of Field Perturbation Caused by Observer



Technician faces measurement point from all directions.

KZIN FM 96.3 MHz Shelby, MT 8-1-2001



Plotted for height of maximum unperturbed field of 86.5% MPE.

S_{max}=85.8% MPE

S_{min}=61.7% MPE

S_{avg}=71.2% MPE

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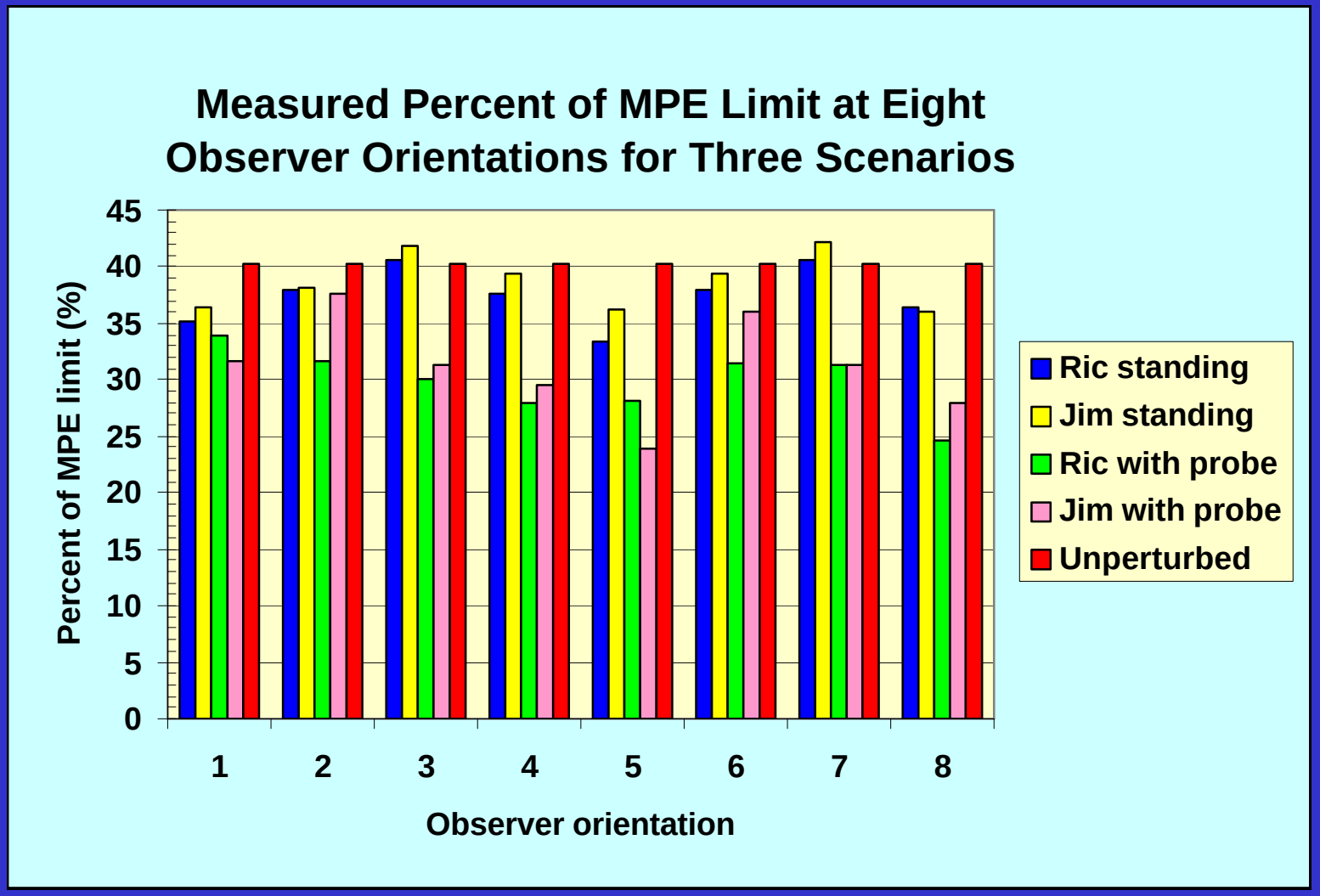
Preliminary Spatial Average Measurement Results



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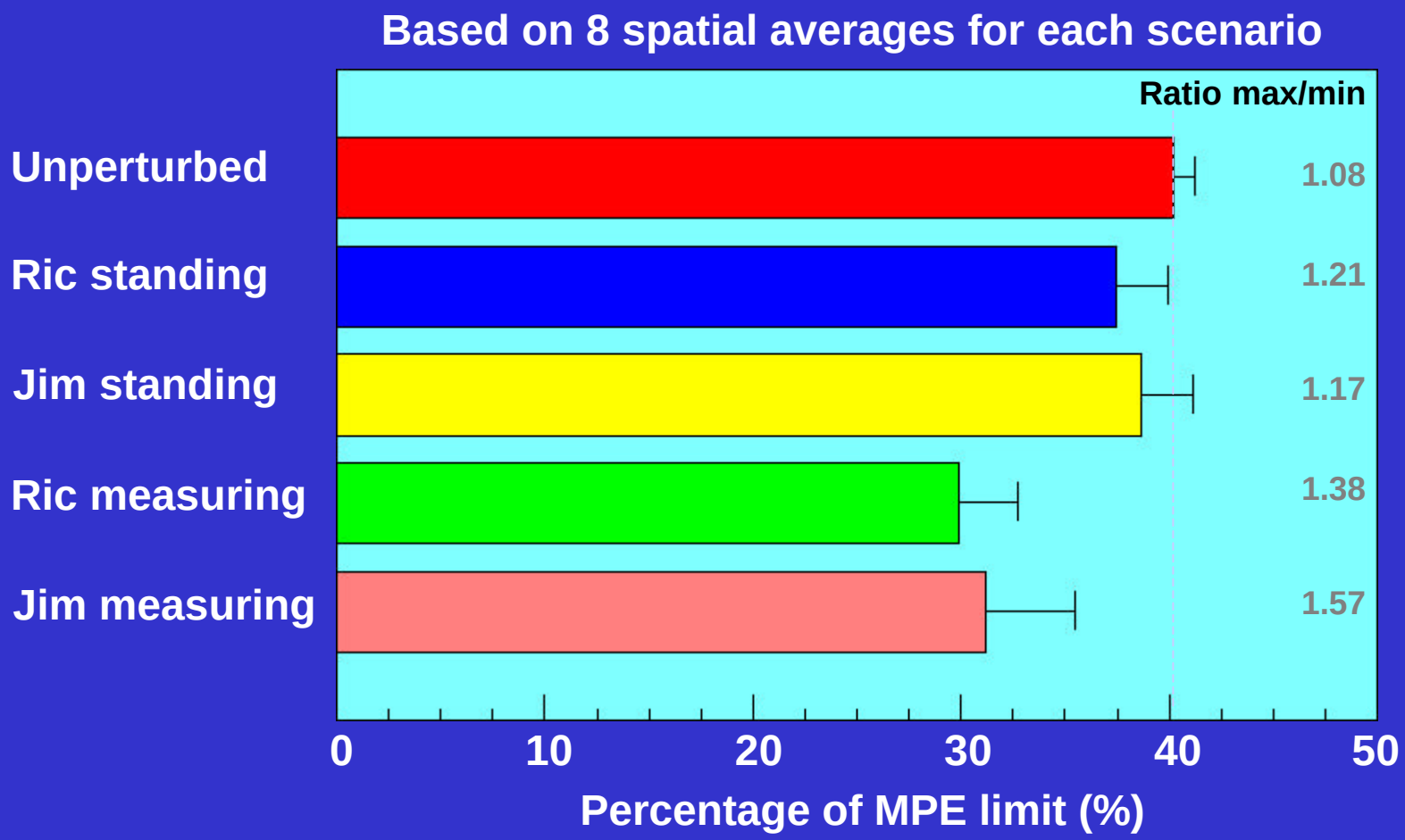
Overall Average of Spatial Average Measurements



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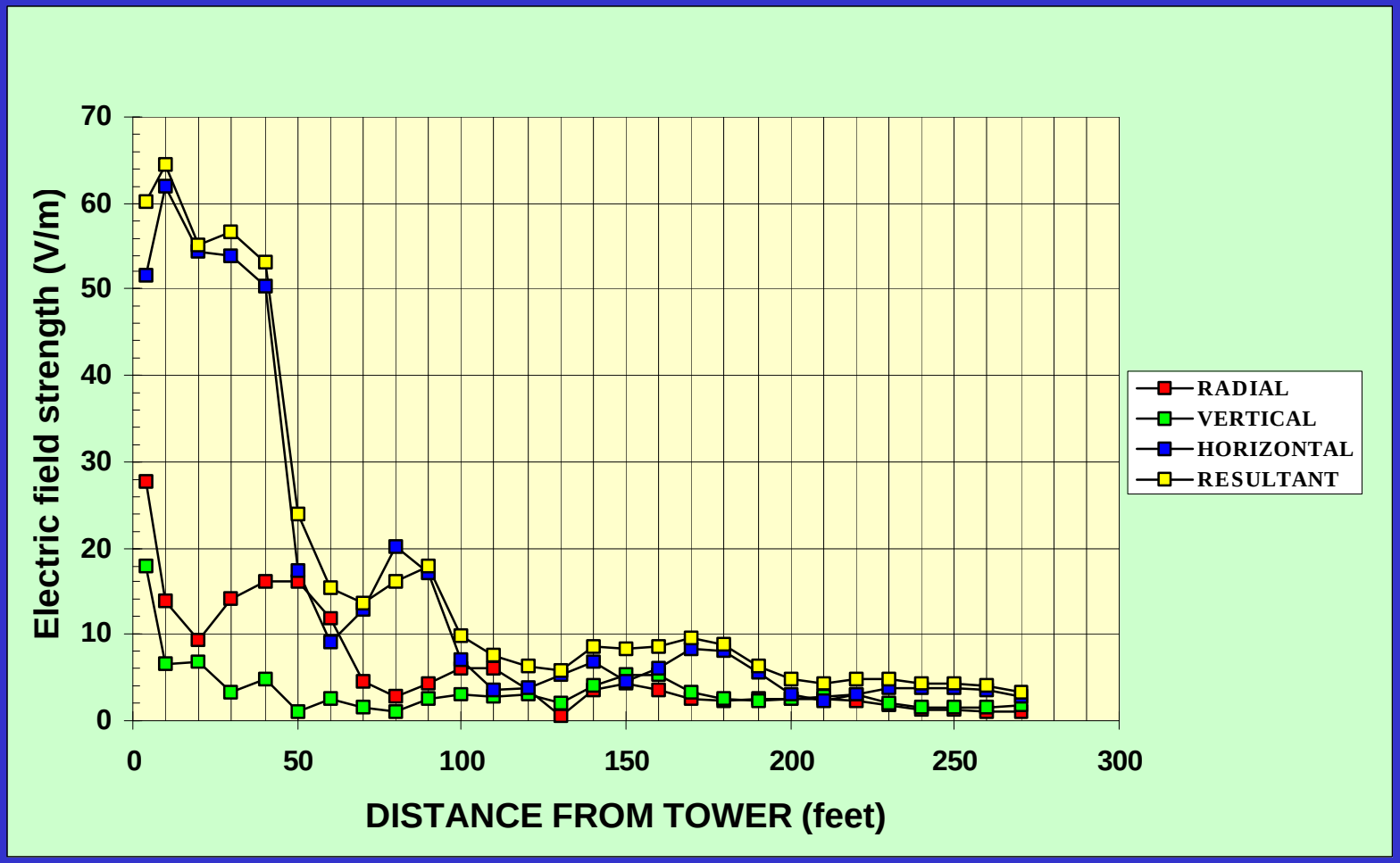
Electric Field Strength Polarization Components vs. Distance from KZIN Tower



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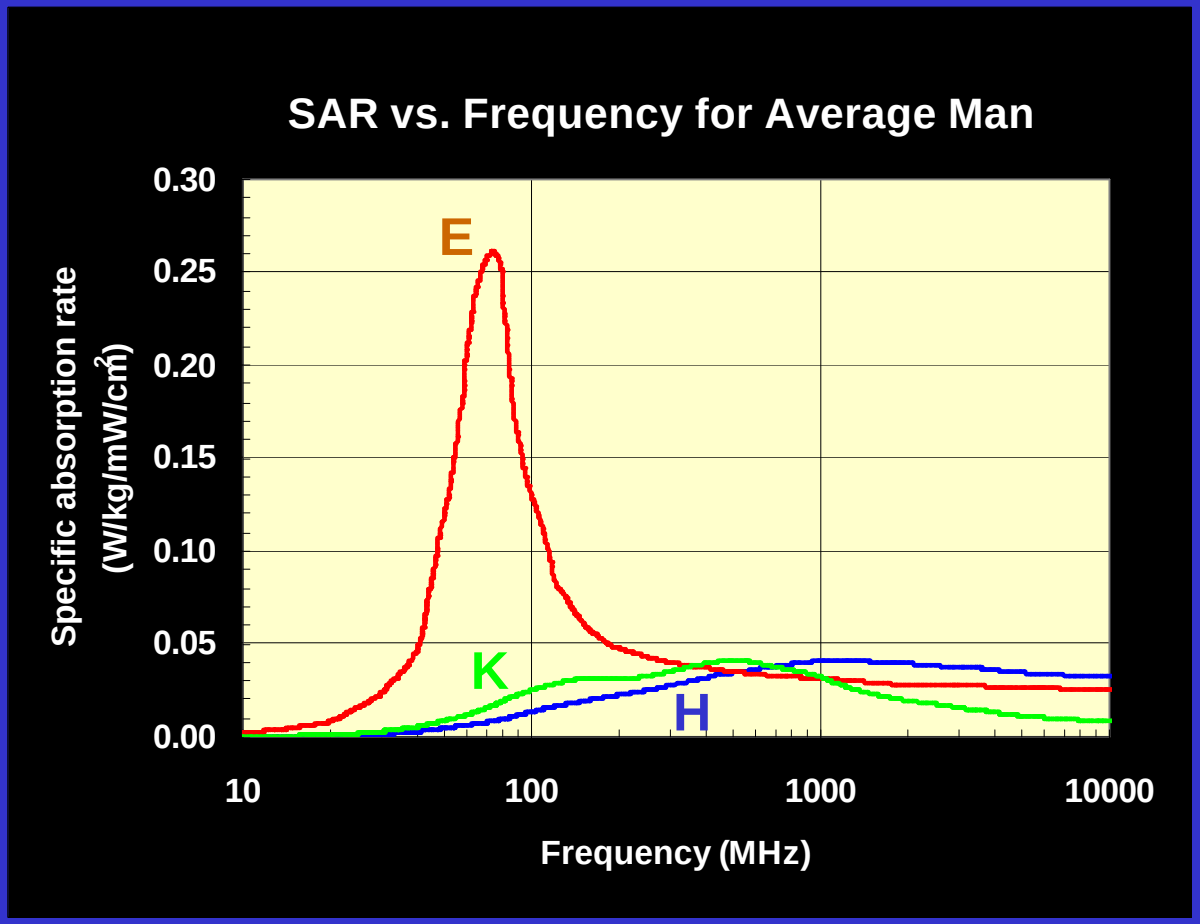
Polarization and SAR

Isotropic field probes will generally overestimate resulting SAR



Relative SAR Contribution

F = 96.3 MHz

E: 100%

H: 9.3%

K: 17.6%

Total SAR from all field components at test point = 10% of the SAR that would be implied from a measurement of the resultant field.

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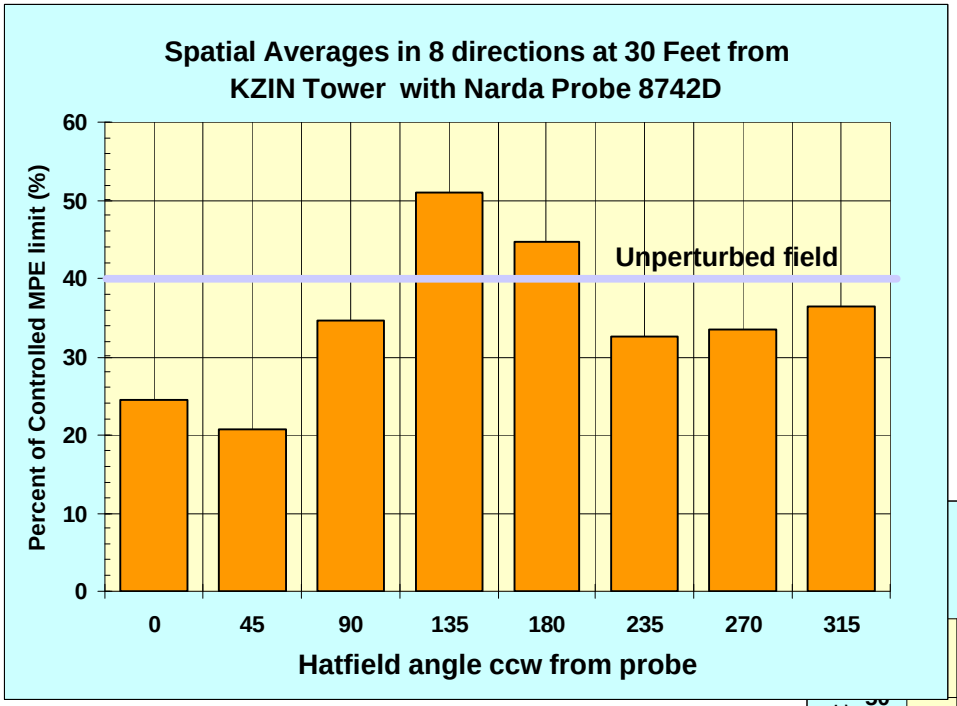
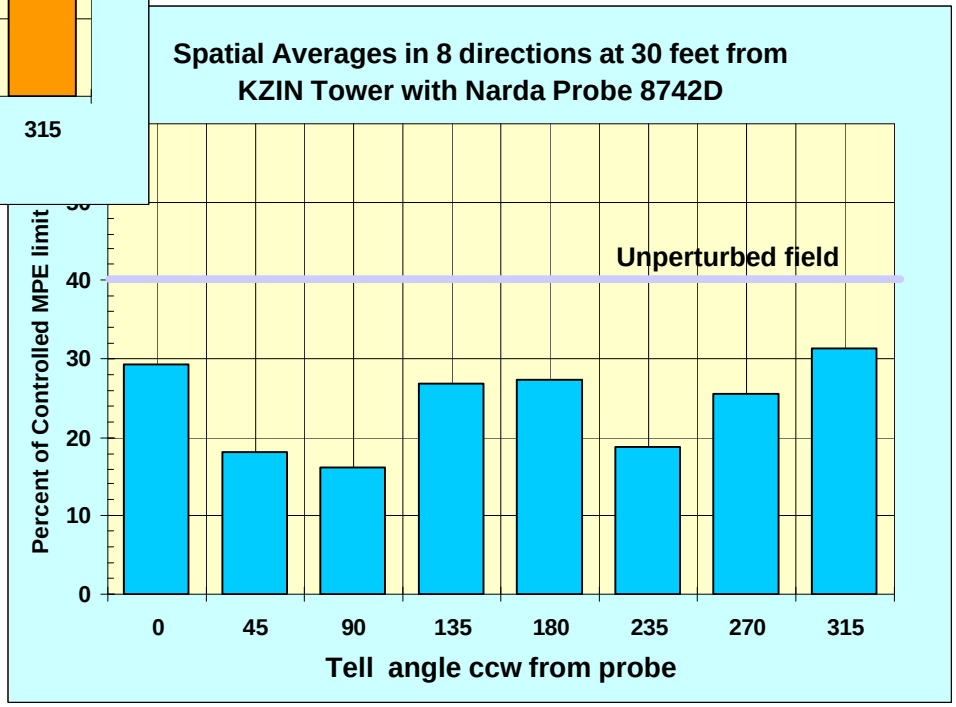


Comparison of measurements of spatially averaged RF fields



Assessing compliance with exposure limits can be difficult.

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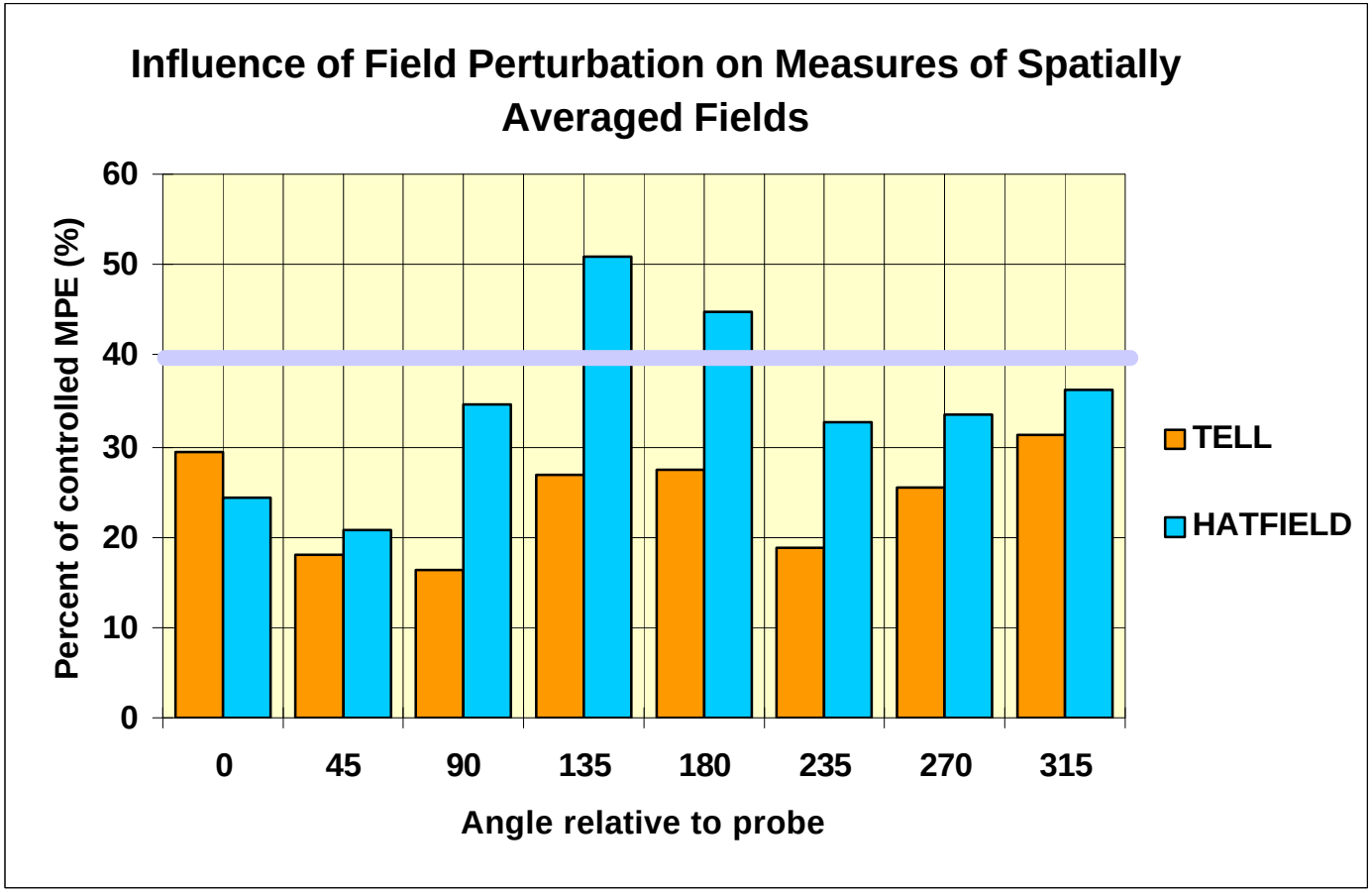
Comparison of Two Persons Using the Same Probe at Same Point



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How Strong is that Field?

- The FCC maximum permissible exposure (MPE) limits are in terms of spatially averaged values of plane wave equivalent power density over the body.
- The limits are derived from the presumption of uniform exposure to a field having the specified MPE limit.
- The most accurate assessment of exposure, relative to determining compliance with the FCC limits, is in the absence of any field perturbing effects introduced by either the person being exposed or the person attempting to measure the exposure.

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Tentative Conclusions

- Measures of spatially averaged RF fields are inherently fraught with uncertainty caused by field perturbations.
- Operator interaction with the field can lead to significant differences in compliance measurements at antenna sites.

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