

## Hans Gregory Schantz, Ph.D.; Next-RF, Inc.

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RF & electromagnetics consultant specializing in high performance antennas and RF systems, including ultra-wideband antennas, and high efficiency electrically small antennas.

Author of *The Art and Science of Ultrawideband Antennas*, Artech House 2005.

### Technical Experience:

- **(10/02-current) Chief Scientist with The Q-Track Corporation, Huntsville, AL**
  - Develop Q-Track's Near Field Electromagnetic Ranging or "NFER™" technology.
  - Develop high performance, electrically small, narrow band antennas.
  - Provide technical direction for early stage start-up company.
  - Several patents pending.
- **(4/02-current) Consulting Engineer with Next-RF, Inc., Huntsville, AL**
  - UWB antenna design, test, and evaluation
  - UWB antenna training and short courses
  - 6 GHz capable laboratory including
    - HP 8595E 6.5 GHz Spectrum Analyzer w tracking generator and noise figure analyzer,
    - HP 8753D 6 GHz Network Analyzer with time domain analysis option, and
    - TDS 3014 1 Gb/s Digital Sampling Oscilloscope.
  - Provide intellectual property analysis and assist in USPTO Office Action Replies.
  - Several patents pending.
- **(12/99-4/02) RF Engineer with Time Domain, Huntsville, AL.**
  - UWB high data rate system design and prototyping.
  - Provide technical direction to engineers and technicians.
  - UWB antenna design including small elements, horns, arrays, lenses.
  - Invented Time Domain's "BroadSpec™" family of planar UWB dipoles.
  - Provide customer application seminars, and application engineering.
  - Design of broadband filters and baluns; EMC analysis of UWB systems.
  - UWB propagation, systems analysis and generic RF engineering.
  - Twelve patent applications pending (of which ten have issued).
- **Physics Ph.D. dissertation** on electric and magnetic dipole field energy, applications to EMC and spectrum analysis of digital signals.

### Skills:

- Electromagnetic theory, modeling, and analysis.
- UWB antenna design and evaluation; balun and passive circuit design.
- RF system analysis and design;
- Propagation; Electromagnetic Compatibility (EMC).
- Ansoft HFSS, MatLab, Mathematica, MathCad, Intusoft PSPICE, Eagleware, NEC.
- Intellectual property including drafting patent applications.
- Superb written and oral presentation skills.

### Education:

- B.S.I.E. (Industrial Engineering) Purdue University (1988)
- B.S. (Honors Physics) Purdue University (1990)
- Ph.D. (Physics) University of Texas at Austin (1995)

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### U.S. Patents:

- **6,922,177:** *Impulse radar antenna array and method* (July 26, 2005) [w. M. Barnes et al].
- **6,845,253:** *Electromagnetic antenna apparatus* (January 18, 2005).
- **6,822,604:** *System and method for detecting an intruder using impulse radio technology* (November 23, 2004) [w. David Hall, Scott Yano].
- **6,774,859:** *Ultra-wideband antenna having frequency selectivity* (August 10, 2004) [w. G. Wolynec].
- **6,667,724:** *Impulse radar antenna array and method* (December 23, 2003) [w. M. Barnes et al].
- **6,642,903:** *Apparatus for establishing signal coupling between a signal line and an antenna structure* (November 4, 2003).
- **6,614,384:** *System and method for detecting an intruder using impulse radio technology* (September 2, 2003) [w. David Hall, Scott Yano].
- **6,593,886:** *Planar loop antenna* (July 15, 2003).
- **6,539,516:** *Semi-coaxial horn antenna* (March 25, 2003).
- **6,512,488:** *Apparatus for establishing signal coupling between a signal line and an antenna structure* (January 28, 2003).
- **6,437,756:** *Single element antenna apparatus* (August 20, 2002).

### Publications:

- *A Near Field Propagation Law & A Novel Fundamental Limit to Antenna Gain Versus Size*, IEEE APS 2005 (July 2005).
- *Near Field Phase Behavior*, IEEE APS 2005 (July 2005).
- *UWB Planar Bulbous Dipole Antennas*, IEEE APS 2005 (July 2005).
- *Harmonic Dipole Energy Flow and Antenna Efficiency*, IEEE APS 2005 (July 2005).
- **Invited Talk:**  *$\partial/\partial t$ ,  $j\omega$ ,  $Q$ , and UWB Antennas*, 2<sup>nd</sup> International Workshop UWB Radio Communications, (June 2005).
- *Smart Antennas for UWB Spatial Rake Systems*, IEEE APS 2004 (June 2004).
- *A Brief History of UWB Antennas*, IEEE Aerospace and Electronic Systems Magazine, Vol. 19, No. 4, (April 2004), pp. 22-26.
- **Invited Talk:** *Dispersion and UWB Antennas*, IEEE IWUWBS/UWBST 2004 (May 2004).
- *Size vs. Performance: The UWB Antenna Dilemma*, CommsDesign 2004 (March 2004).
- **Plenary Talk:** *An Introduction to UWB Antennas*, IEEE UWBST 2003 (November 2003).
- *A Brief History of UWB Antennas*, IEEE UWBST 2003 (November 2003).
- *Bottom Fed Planar Elliptical UWB Antennas*, IEEE UWBST 2003 (November 2003).
- *Frequency Notched UWB Antennas*, IEEE UWBST 2003 (November 2003) [w. G. Wolynec, M. Myszka].
- *UWB Magnetic Antennas*, IEEE APS 2003 (June 2003).
- *Understanding the Self-Acceleration Paradox*, URSI 2003 (June 2003).
- *Maxwell's Demon and Reciprocity*, URSI 2003 (June 2003).
- *Planar Elliptical Element UWB Dipole Antennas* IEEE APS 2002 (June 2002).
- *Radiation Efficiency of UWB Antennas* IEEE UWBST 2002 (May 2002).
- *The COTAB UWB Magnetic Slot Antenna* IEEE APS 2001 (July 2001) [w. M. Barnes].

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### Publications (continued):

- *The Diamond Dipole: A Gaussian Impulse Antenna* IEEE APS 2001 (July 2001) [w. L. Fullerton].
- *Measurement of UWB Antenna Efficiency* IEEE VTS Conference (May 2001).
- *Electromagnetic Energy Around Hertzian Dipoles*, IEEE Ant. & Prop. Magazine, (April 2001) pp. 50-62.
- *Ultrawideband Technology Gains Boost from New Antennas* Antenna Systems and Technology Vol. 4 Issue 1 January/February 2001, p. 25 <http://time-domain.com/Files/PDF/news/AntennaSchantz.pdf>
- *Time Domain Array Design* UWB SP 5 (May 2000).
- *On the Localization of Electromagnetic Energy* UWB SP 5 (May 2000).
- *Investigation of Feasibility of UWB for Raptor/WAM Applications*, ElectroScience Laboratory Technical Report 738226-1, February, 2000 [With Eric K. Walton, Jonathan D. Young, Lixin Cai].
- *Final Report on TDSI Antenna Measurements*, ElectroScience Laboratory Technical Report 738672-1, February, 2000 [With J.D. Young, L. Peters, Jr.].
- *Spherical Time Domain Electromagnetics*, International UWB Conference (Sept. 1999)
- *Electromagnetic Energy Around Hertzian Dipoles* IEEE APS 1999 (July 1999)
- *Antenna Calibration for TDOA Multipath Mitigation*, ElectroScience Laboratory Technical Report 735820-1, December 1998 [With J.D Young, I.J. Gupta].
- *Electromagnetic Radiation Made Simple* APS/AAPT Joint Meeting (April 1997).
- *Teaching Physics to Premedical Students* APS/AAPT Joint Meeting (April 1997).
- *The Energy Flow & Frequency Spectrum About Electric & Magnetic Dipoles*. Dissertation (August 1995).
- *The flow of electromagnetic energy in an electric dipole decay* Am.J.Phys. **63** # 6, 513-520 (June 1995).
- (With Morris Stern and Justin Beres) *Scattering of a Plane Compression Wave by a Spherical Inclusion in a Biot Medium*. J. Acoust. Soc. Am. 97, 3422 (May 1995).
- (With R. Christensen and J. Shapiro) *On The Range of Validity of the Mori-Tanaka Method*. J. Mech. Phys. Solids 40, No. 1, pp. 69-73 (1992).

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### Principal Laboratory Equipment

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- 🔍 HP 8753D 6 GHz Vector Network Analyzer with Time Domain Analysis Option
- 🔍 Agilent 8595E 6.5 GHz Spectrum Analyzer with Sweep Generator and Noise Figure Option.
- 🔍 Tektronix TDS 3014 100 MHz 1.25 GS/s Digital Phosphor Oscilloscope with various active and passive probes.
- 🔍 HP 8901A 150 kHz - 1.3 GHz Modulation Analyzer
- 🔍 Agilent 33120A 15 MHz Arbitrary Waveform Generator
- 🔍 HP 8447A Pre-amplifier & HP 8447F Pre-amplifier
- 🔍 HP 8640B 500 MHz Signal Generator
- 🔍 Marconi 2018A 520 MHz Signal Generator
- 🔍 Various Mini-Circuits Amplifiers including ZFL-500's & ZKL-2
- 🔍 HP 3575A Gain Phase Meter
- 🔍 HP 4332A LCR Meter
- 🔍 HP 3400A RMS Voltmeter
- 🔍 HP 3404A Digital RMS Voltmeter
- 🔍 HP 435B Power Meter w HP 8481A Power Sensor
- 🔍 HP 6202B Power Supply
- 🔍 Tektronix 1502B Time Domain Reflectometer
- 🔍 Measurement Computing DAS 16/12 PCMCIA Data Acquisition Card
- 🔍 Measurement Computing DAS 16/16 AO PCMCIA Data Acquisition Card
- 🔍 Metcal PS2E Soldering Station
- 🔍 Various couplers, directional couplers, mixers, attenuators, & connectors.
- 🔍 Rhode & Schwarz Type DLK Delay Line

### RF Design Software

- 🔍 Intusoft PSPICE
- 🔍 Eagleware RF Simulator
- 🔍 PCAD
- 🔍 Ansoft HFSS

### Measurement Antennas

- 🔍 Empire 150 kHz - 30 MHz LP-105 Loop Antenna
- 🔍 Empire 150 kHz - 30 MHz LA-105 Whip Antenna
- 🔍 EMCO 6509 1 kHz-30 MHz Passive Loop Antenna
- 🔍 ARA Model MLS-310/A 30-100 MHz Loop Antenna
- 🔍 Model 23473 1-11 GHz Conical Log Spiral Antenna
- 🔍 Next-RF, Inc. Model 310A 3-10 GHz UWB Horn Antenna