

## Recommended additional material (1/7)

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### Basics of RF (didactic):

- [http://www.educatorscorner.com/cbt/wireless\\_rf/Main.swf](http://www.educatorscorner.com/cbt/wireless_rf/Main.swf)
  - This material 'Radio Frequency Fundamentals' reviews basic terms and concepts whose understanding is needed to deal with real-world wireless communication systems and their building blocks and specifications

### Spectrum analyzer (didactic):

- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2491](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2491);
  - This interactive Java applet simulates the operation of a Super heterodyne Spectrum Analyzer

### RF measurement uncertainty (didactic):

- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2490](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2490);
  - This interactive Java applet simulates the effect of external interfering signal on the Measurement Uncertainty at RF

## Recommended additional material (2/7)

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### Transmission lines (didactic)

1. [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2483](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2483)
  - This spectral simulation illustrates Wave Propagation along a Transmission Line using an interactive Java applet.
2. [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2553](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2553)
  - This material '*Transmission-Line Fundamentals*' is designed for those who have a basic knowledge of electricity and wish to learn about the electrical characteristics of transmission lines. It gives a basic knowledge of the technology, terminology, and measurement techniques of transmission lines. Contains quizzes. It is free, but must be registered. The [Agilent-TLF.exe](#) is a self-extracting file that will install the software on your computer.
3. <http://www.ece.gatech.edu/research/ccss/education/Java/ASEE/transline/index.html>
  - Analyzes and displays the distribution of the voltage and current waveforms along a transmission line. Most of the simulation parameters can be changed via the graphical user interface. This is a student project in Transmission Line Analysis (in Java), fully documented. Could serve as an example to be followed at your university.

## Recommended additional material (3/7)

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### Transmission lines (didactic)

- <http://www.amanogawa.com/archive/transmissionA.html>
  - Interactive applets on basic properties of transmission lines, standing wave patterns, lossless and lossy lines, stripling, micro strip, impedance matching, plus instructional material (pdf)

### Electromagnetic waves (didactic)

- <http://www.amanogawa.com/archive/wavesA.html>
  - Interactive applets on electromagnetic wave propagation, polarization, waveguides, plus instructional material (pdf)

### Antennas (didactic)

- <http://www.amanogawa.com/archive/antennaA.html>
  - Interactive applets on antennas – linear dipole antenna, 2-antenna array, n-antenna array, plus instructional material (pdf)

### Electromagnetic compatibility (didactic)

- <http://www.amanogawa.com/EMC-EMI.html>
  - Interactive applets on EMC/EMI – radiation, susceptibility and shielding, plus instructional material (pdf)

## Recommended additional material (4/7)

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### Time & Frequency (didactic)

- <http://www.clarkson.edu/%7Esvoboda/eta/phasors/Phasor10.html>;
    - Associating 1 phasor (complex number) to 1 sinusoid
  - <http://www.clarkson.edu/%7Esvoboda/eta/phasors/MatchPhasors10.html>;
    - Matching 1 phasor to 1 sinusoid.
  - <http://www.clarkson.edu/%7Esvoboda/eta/phasors/AddPhasors10.html>;
    - Adding 2 phasors (complex numbers, the same frequency)
  - <http://www.jhu.edu/%7Esignals/phasorlecture/index.htm>;
    - Adding harmonic phasors, Fourier series, Gibbs effect, windowing
  - <http://www.jhu.edu/%7Esignals/phasorapplet2/phasorappletindex.htm>;
    - Further experiments with Fourier series 'phasor factory'
  - [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2488](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2488);
    - Spectrum of pulses in freq-time-amplitude (3D) space;
  - [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2489](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2489);
    - Time domain vs. frequency domain, harmonics in 3D space;
- Note: These presentations contain interactive graphics, explanatory text, & equations.

## Recommended additional material (5/7)

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### Sampling (didactic)

- <http://www.jhu.edu/%7Esignals/sampling/index.html>;
  - This interactive simulation illustrates various problems in analog-to-digital and digital to analog conversions and in sampling theory
- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2487](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2487);
  - This interactive spectral simulation deals with the generation of pulses. This applet can simulate up to 35 harmonics and a duty cycle as low as 0.05.

### • Modulation: analogue & digital

- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2478](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2478);
  - This interactive simulation deals with various modulation formats, analogue (Amplitude Modulation - AM, Frequency Modulation - FM, and Phase Modulation - PM) and digital (QPSK, 16QAM, etc.)
- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2485](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2485);
  - This interactive simulation introduces Amplitude Modulation
- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2484](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2484);
  - This interactive simulation introduces Single-Side-Band Demodulation with reinserted carrier

## Recommended additional material (6/7)

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### Impedance matching & Smith chart

- [http://www.educatorscorner.com/index.cgi?CONTENT\\_ID=2482](http://www.educatorscorner.com/index.cgi?CONTENT_ID=2482);
  - This is a computerized Smith Chart, a simple but powerful graphic tool in working with transmission lines, antennas, RF amplifiers, etc. The chart translates the reflection coefficient into complex impedance and back. To be downloaded.
- <http://contact.tm.agilent.com/Agilent/tmo/an-95-1/classes/imatch.html>;
  - This is an Interactive Impedance Matching Model. You can experience using a Smith Chart and s-parameters to optimize transmitted power in simple matching networks of L and C components. Includes quizzes/ tests.

## Recommended additional material (7/7)

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- Power budget calculations and analysis of LOS and non-LOS radio links
  - <http://www.qsl.net/n9zia/> (Green Bay Professional Packet Radio)
  - <http://gbppr.dyndns.org:8080/wireless.super.main.cgi> (Interactive Wireless/ RF Design Utilities - wireless Network Link Analysis – Super Edition)
  - <http://www.ydi.com/calculation/index.php> (YDI Wireless)
  - <http://www.ydi.com/deployinfo/wp-planning-microwave-link.php> (YDI Wireless)