

## **Abstract of “The Application of DSP Technology in HF/VHF/UHF Radio Systems” by Richard Groshong**

The availability of high performance Digital Signal Processing (DSP) components has allowed Multi-Band, Multi-Mode Radio Systems to be implemented in fewer and smaller mechanical packages. Wide and narrow bandwidth signals can now be efficiently processed by common DSP hardware, thanks to high speed, wide wordlength A/D and D/A converters, dense RAM-based FPGA devices, and extremely dense, higher speed ASIC's. New DSP modes can be readily downloaded from control interfaces or FLASH memory devices to totally change or reconfigure DSP software algorithms, architectures, and even high speed DSP circuit configurations.

This presentation will concentrate on the “State-of-the-Art” application of DSP technology in HF, VHF, & UHF Radio System designs. Particular emphasis will be placed on the recent push to develop high performance Direct Conversion Radio (DCR) algorithms and architectures, suitable for Modular Avionics Communication, Navigation, & Identification (CNI) applications below 2000 MHz. Typical IF or Bandpass sampling Superheterodyne Radio architectures are discussed, as well, and compared to DCR approaches.

Block diagrams of typical HF/VHF/UHF radio and DSP functions will be presented, along with a discussion of critical DSP Radio design and performance issues. Common problems encountered by inexperienced DSP radio designers will be identified and discussed, concentrating in the areas of understanding A/D & D/A Converter performance, the need for noise dither, and the art of setting up a DSP Receiver gain distribution for best receiver performance.

Finally, some DSP “Tricks-of-the-Trade” will be presented regarding out-of-band noise dither generation, and the design of Multiplier-Less Filters for those high speed or FPGA applications. A final note will be presented regarding the future DSP-based Radio technology.