A Time Domain Antenna Range

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We have been developing a time domain antenna range that appears to have a number of advantages over frequency domain systems. In this paper we provide a review of the status of that program.

The system we are developing includes a fast pulser, fast sampling oscilloscope, sensor, azimuth/elevation positioner, computer controller, and software for data acquisition and data processing. It is intended to be stored in a shed and quickly deployable in the field. Such a range is more easily used outdoors than frequency domain ranges, because temperature stability is less of a problem. In addition, the equipment required for a time domain range is considerably less expensive than the corresponding equipment for a frequency domain range.

We have compared the performance of our antenna range to that of a frequency domain range by measuring a number of different antennas on both ranges. In most cases, our time domain range compares favorably to the frequency domain measurements. The time domain range appears to be especially well suited to measuring non-dispersive Ultra-Wideband antennas, such as Impulse Radiating Antennas, because their impulse response dies out quickly. The advantage comes from being able to measure two decades or more of bandwidth with a single waveform. On the other hand, the time domain range may be less well suited to measuring the more dispersive log periodic dipole arrays, whose impulse response is a rather long decaying exponential. In this case, we must use a long time window, which adds ground reflection and noise to the measurements.

We provide here a general status of the hardware and software associated with the time domain antenna range. We also provide preliminary data on the antenna types that the range may be used to measure, and the expected accuracy as a function of frequency. The accuracy of the system appears to be at least as good as that needed for early-stage antenna development, and it may prove to be competitive to that of frequency domain ranges.