# NEW DEVELOPMENTS IN COMPONENTS FOR UWB RADARS

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**Abstract:**

We consider here recent progress in four components that may be useful in UWB radar systems. First, we provide data to characterize limiters, which are used to protect digitizers from sudden voltage surges. Commercially available limiters are usually tested only for their response to steady-state sine waves, and have not been tested for their response to transients. Ideally, one wants a limiter to faithfully replicate the input voltage at low voltages, without permitting a high-voltage spike to pass. To be effective, a limiter should have this behavior for both polarities of signal. We test a number of commercial devices, and observe a variety of surprising behaviors, including unipolar limiting and passage of voltage spikes that can damage a digitizer. Among the five limiters we tested, we found the best overall performance with the Agilent model 11867A limiter. Next, we consider the optimal position of the feed arms of Impulse Radiating Antennas (IRAs). IRAs were originally designed with feed arms positioned at +/- 45 degrees to vertical. However, recent work has demonstrated that IRAs with feed arms positioned at +/- 30 degrees provide improved gain and reduced crosspol, and equalize the beamwidths in the E- and H- planes. For these reasons, the standard commercial designs have feed arms at +/- 30 degrees. Nevertheless, it has commonly been believed that feed arms positioned at +/-45 degrees are preferred for radar applications, because of an improved impedance match at the resistors and a smoother TDR. This belief was based on early data that was taken on IRAs with feed arms at +/-45 degrees without a balun. But no data was available on IRAs with a balun or with feed arms at +/- 30 degrees. In this paper, we compare the TDRs of IRAs with splitter baluns and with feed arms positioned at both +/- 45 and 30 degrees. We find no appreciable advantage in TDR when positioning the feed arms at +/- 45 degrees. So placing the feed arms at +/-30 degrees would normally be preferred in IRA designs with splitter baluns. It is possible that one might obtain a different result in IRAs without a balun, and we will provide data on that case as well. Next, we report on our efforts to develop UWB high-voltage directional couplers. Most UWB radar systems currently use two separate antennas for transmit and receive. If a single antenna could be used for both functions, a more compact and convenient radar system could be realized. We have built and tested a number of designs, and we report on their characteristics, including coupling coefficient, directivity, and transmission loss. Finally, we have explored a number of conformal antennas that could be printed onto an aircraft wing, and that look out over the wingtip. These antennas include linear tapered slots, spline tapered slots and conical slots. The first two provide horizontal polarization, and the last provides vertical polarization below the wingtip. For the three antenna types we provide data on scale models.