Experimental Setups and Comparison of the Experimental, Analytical and Numerical Results for the Focal Waveform of Two and Four-Feed Arms Prolate-Spheroidal Antenna (IRA)

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Experimental setups of two and four-feed arms prolate-spheroidal IRA are used to obtain better focusing for a prolate-spheroidal IRA. Analytical and numerical results are used for verification. This paper is a summary of experimental setups and the dimensions of these setups are based on (S.Altunc and C.E.Baum. "Extension of the Analytic Results for the Focal Waveform of a Two-Arm Prolate-Spheroidal Impulse-Radiating Antenna (IRA)", Sensor and Simulation Note 518, Nov 2006). These setups will be used for a biological application. Experimental setups and problems related with measurements or devices are discussed. We compare experimental and analytical results. We discuss the differences among these results and analyze the errors.

The experimental setups include three basic parts: a prolate-spheroidal reflector with feed arms, a sampling-oscilloscope and a pulse generator. B-Dot, slow D-Dot and Fast D-Dot probes are used for our measurements. We use the B-Dot probe to get the magnetic field and calibrate the slow D-Dot probe with this data because we have a TEM wave and $E/H = \eta_0 = 376.7\,\Omega$ for free space. The focal waveforms for the B-Dot, slow D-Dot and Fast D-Dot probes are close and they have three parts: prepulse, impulse and postpulse. We have oscillations in the postpulse and the results are close but for the slow D-Dot sensor we do not have that much oscillations in the postpulse so they have different frequency responses. We have more bandwidth limitation for slow D-Dot sensor. If we use the fast D-Dot sensor we have this oscillation so the oscillation are not due to different type of sensors. If we use the slow sensors, they are more sensitive than slow D-Dot sensor but they are not fast enough so we can not obtain the actual t_{mr} (maximum rate of rise) values. We obtain bigger t_{mr} values and this causes decrease in the amplitude of the impulse of the focal waveform. If we use the fast D-Dot sensor, it is not sensitive enough so we obtain higher amplitudes in the impulsive part but we obtain more errors in the amplitude of the impulsive part of the focal waveform. We have analytical and experimental errors. When the focal fields are calculated the aperture integral does not consider the feed arms and feed-arm thicknesses. This can cause an error in the calculation of the impulse amplitude of the focal waveform. We have errors that are related with the experiments. We are in the limit of our instrumentation so we have less accuracy.