

ANTENNA FACTOR DETERMINATION FOR ANTENNAS IN  
THE NEAR FIELD OF A LARGE RADIATING APERTURE

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This paper will present the results of an analysis for determination of antenna factors in an environment over real ground in the near field of a large radiating aperture for some commonly used measurement antennas. The large radiating aperture that was simulated as a source was a medium-voltage electric utility power line 340 meters in length carrying HF and low VHF radio frequency signals. The probe antennas that were used to measure the electric and magnetic fields were at separation distances that were well within the near field of this power line. The probe antennas were also at separation distances that were both in the near and far field of the probe antennas. It was necessary to have antenna factors that better represented this scenario over a real ground. These antenna factors were significantly different than those supplied by the antenna manufacturers. Some measured data was also available to compare to analysis results. The antenna factor is a quantity by which one multiplies the output voltage of a receiving antenna to obtain either the incident electric or magnetic field. The antenna factor generally includes losses and mismatches in the antenna which could account for a balun, matching transformer, or other device incorporated into the antenna. The antenna factor is very dependent on what impedance is used to load the antenna in the process of measuring the antenna output voltage. Since the probe antennas used to measure the electric and magnetic fields of the large aperture were in the near field of the large aperture and in the near fields of the probe antennas themselves, the mutual impedance between the antennas must also be taken into consideration when determining the antenna factors of the probe antennas. Manufacturer's data usually include an antenna factor calibration for a measurement scenario that is quite unlike the scenario in which the antenna will actually be used. Usually this will be a free-space antenna factor measured in an anechoic chamber or some other scenario. The separation distances for the manufacturer's measurement of antenna factor may be unspecified. A more precise antenna factor in a scenario that better represents the actual antenna environment will permit a more confident determination of the electric and magnetic fields in close proximity to the power lines.

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