Measurement and Simulation for the Properties of Small Anechoic Chamber

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ABSTRACT

In this study, the properties of EMC/EMI and antenna measurement of an anechoic chamber were established by using a simulation program and a data-calibration technique. In the simulation of electromagnetic (EM) characteristics of an EMC chamber, the image theory, Snell ’ s law, and a ray-tracing method were used to establish a simulator, which was written using Matlab. The simulator can deal with the normalized site attenuation (NSA), normalized site transmission loss (NSTL), field uniformity (FU), and reflectivity level (RL) of a chamber. For calibration purposes, data measured in the NYUST EMC chamber were compared with those collected in MiTAC ’ s and SPORTON ’ s chambers, both in EMC and antenna measurements. The NYUST anechoic chamber can be used for both EMC/EMI tests and antenna measurements. For EMC/EMI tests, some techniques were used to suppress ambient EM noises in the chamber. An EMC site source was developed for conducting the correlation test between a small fully anechoic chamber and a standard 10-m semi-anechoic chamber. A correction factor was established for the NYUST anechoic chamber. As a result of taking the correction factor into account, the measurement became more accurate and reliable than before. For antenna measurements, a double ridge horn was developed for conducting the correlation test between a small fully anechoic chamber and a standard fully anechoic chamber. A correction factor was computed for the NYUST anechoic chamber. The correction factor was hence used to improve the antenna-pattern measurement performed in this chamber. NSAs of AIDC ’ s semi anechoic chamber and NSTLs of USI ’ s fully anechoic chamber were measured and compared with simulation results. Both the simulated and measured NSAs of AIDC ’ s chamber were observed to comply with the ANSI C63.4 directive except for the simulated vertical-polarization part below 40 MHz. It was also found that the second-order reflected rays should not be omitted in the simulation of NSAs if the return-loss level of the RF absorber is less than 20 dB for a 9-6-6 chamber. Furthermore, both the simulated and measured NSTLs of USI ’ s chamber agree with the theoretical values computed using the Friis transmission equation.

Keywords : Anechoic chamber ; Ray tracing ; Normalized Site Attenuation ; Normalized Site Transmission Loss ; Site Correction Factor ; Site Source

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