

Three-dimensional mapping of static magnetic fields over a semi-anechoic chamber

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Abstrak

The geomagnetic field is a kind of natural potential field in the Earth. A three-year research program for exploration of this field has been conducted in the Lombok Island-Indonesia, where extreme geomagnetic anomalies with two very strong dipolar structures exist. The research aims to construct a system to collect and concentrate geomagnetic fields, in order to possibly use the concentrated fields for geomagnetic power plants or to integrate the system with a field pick-up unit scheme by means of wireless power transfer. The designed geomagnetic concentrator system has been tested in a self-arranged semi-anechoic chamber with a pair of Helmholtz coils, induced with DC currents to simulate the regional ambient static geomagnetic fields. Several tests have proven the performance of the system in one-dimensional space. This paper presents the results of detailed three-dimensional measurements of static magnetic fields in the semi-anechoic chamber. Static magnetic fields over the entire chamber are drawn in their magnitudes and directions, by interpolating data obtained in regular grids of $50\text{cm} \times 50\text{cm}$. In specific areas, where the Helmholtz coil is placed, extra grids of $25\text{cm} \times 25\text{cm}$ are inserted to sharpen the fields' depictions. Results show that by inducing 1 A current on each of coils will produce magnetic fields, concentrated over the surrounding area of Helmholtz coil. The intensities of magnetic fields over this area are about 15,000-45,000 nT, which can be used to model the geomagnetic fields of Lombok Island. Using the results of 3D field mapping, it will be possible to get the optimum placement of the geomagnetic concentrator system when it is tested on the chamber.