DEVELOPMENT OF ELECTRIC AND MAGNETIC FIELD STANDARDS AND CALIBRATION SERVICE TO MEET THE ANEEL RESOLUTION Nº 398/2010

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Abstract: This article aims to show the development of instrumentation for measuring electric field and development of standards for calibration of electric and magnetic field in the *Centro de Tecnologia da Eletrobras Eletronorte (CCT)* in Belém, Brazil to meet the ANEEL Resolution 398/2010.

Key words: Electrical Metrology, Electric Field Measurement, Magnetic Field Measurement.

1. INTRODUCTION

Resolution ANEEL 398/2010 published on march 29, 2010 defined the limits of human exposure to electric and magnetic fields from the generation facilities, transmission and distribution of electric energy at frequency of 60 Hz and determined that the utilities should send memorial or calculation and measurement results of electric and magnetic field in a period varying from 120 days for installations with voltage less than 500 kV up to 300 days to less than or equal to 230kV and 138kV or greater from the publication of this resolution.

At this moment Eletrobras Eletronorte had no instruments for measuring electric and magnetic fields, and according to the 8666 brazilian law (law of bidding) and the need for imports of instruments for measuring electric and magnetic fields there would be time for purchase of instrumentation needed to implement Measurement of activities in the field to meet the deadlines set by ANEEL.

Considering the facts mentioned above the CCT development the necessary instrumentation to measure electric field, the methodology for the measurement and calibration system for electric and magnetic field, to avoid the application of penalty ANEEL, these issues will be presented in this work.

2. METER DEVELOPMENT

The meter was developed based on a capacitive sensor that exposed to an electric field generates a voltage at their terminals for a voltmeter that measure will have a voltage value proportional to the electric field in the region where it is exposed. The meter is designed so that the capacitive sensor stayed involving the digital voltmeter in such a way that would also shield the purpose of this electronic instrument, as shown in Figure 1-2 below.

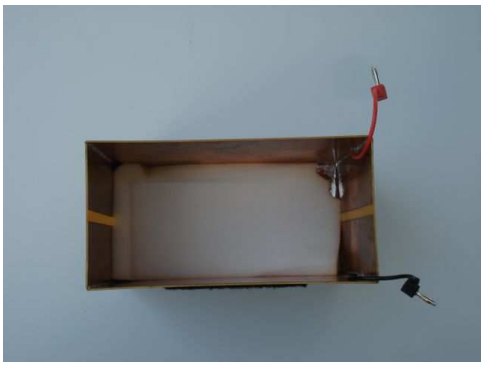

Fig. 1. The meter developed based on a capacitive sensor

Fig. 2. The meter developed based on a capacitive sensor

2.1. Meter Constant

To determine the value of the constant that is multiplied to the value read on the voltmeter providing the value of the electric field was obtained through a simulation in a software-Fields, which shows the distribution of the electric field along a transmission line, where this value was compared with the field measurements obtained with the meter developed. After that it was made a comparison between the value calculated by the program and the measured value as shown in Figure 3 below.

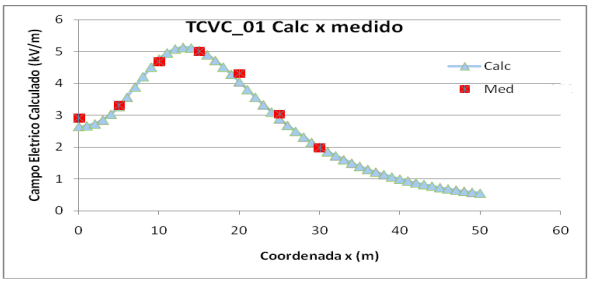

Fig. 3. Comparison of field simulation with the value measured on a 69kV line

3. CALIBRATION SYSTEM

It was also developed two calibration systems, one for electric field and another to magnetic field measurements. Magnetic field was created from a coil of 51 turns with a diameter 30cm and it circulated a current that generated a magnetic field known inside as shown in the figure 4-5 below.

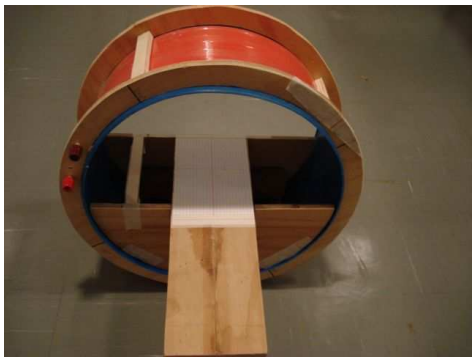

Fig. 4. Coil for field calibration Magmeter

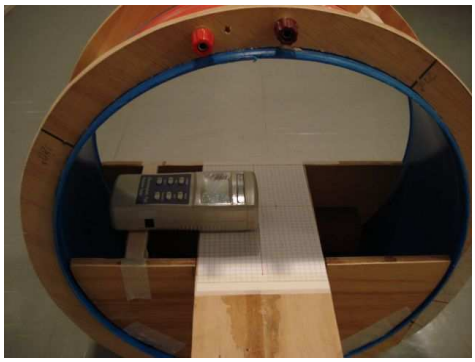

Fig. 5. Magmeter inside the coil for calibration

For the electric field, has assembled a system composed of two parallel plates (1m x 1m = 1m ²) separated by a distance of 1 m so that when there was a potential difference between the plates would be a uniform electric field inside (the geometric center of the set).

Initially we applied tension in one of the cards and then grounding another, but that arrangement could not obtain a uniform field with erroneous calibration. Later it was riding a new arrangement of binding with two potential transformers, so that the voltage applied between the plates were symmetrical as shown in figure 6 below.

Fig. 6. Parallel plates for calibration of electric field.

4. CONCLUSION

Making a business case first in a simple manner the material used in making the meters are low cost, in total less than R$ 1.000,00. The amount of man hours used in the manufacture of meters and calibration system was approximately R$ 15.000,00. The value of a commercial meter is in the range of R$ 50,000.00. The amount of man hours that would be used to develop and manage the purchase requisition materials would be around R$ 8.000,00. Therefore the savings amounted to R $ 42,000.00.

We also consider that failure of ANEEL resolution implies a range of penalties the company and of course the metrological reliability of these measurements is another fact that can't be overlooked

In addition to the measurable costs detailed above we have acquired knowledge in the development and calibration of meters of electric and magnetic field.

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