POYNTING VECTOR METER

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ABSTRACT

Poynting vector meter is a meter that is used to measure loss density in watt/m^2 by multiplying two signals of electric field strength **E** and magnetic field strength **H**. The two signals come from a probe consists of a small coil for measuring **H** and sharp pins for measuring **E.** The directions of **E** and **H** are arranged to be perpendicular to each other in order to omit the effect of sin θ.

The report consists of four main parts: Power circuit, Probe, Poynting vector meter (practical electronic circuit) and Simulation of circuit on computer.

To check up the circuit, the probe is fixed on a lossy conductive surface to sense the electric and magnetic field that will be the input to the poynting vector meter circuit and the output will be the loss density in watt / m^2 for different positions of the lossy conductor.

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1.0 INTRODUCTION

Power losses in loads such as in a very large transformer, shunt reactors stators in electrical machines and other electromagnetic devices which have lagging power factor can be determined by using calorimetric methods[1]. This method cannot provide the accuracy which the manufacturer required for purchaser in the market. By the way it was tedious and costly. The economic impact and the development of the latest technology needs the units that can reduce the losses to the minimum and can improve the efficiency to the maximum. An accurate measurement become critical because of the equipment stated above have a power at very low power factor whereas the current responsible for power flow is very small fraction compared to the total current supplied to the load. This fraction become smaller when the ratio of resistance to reactance of the load decrease and the phase angle (θ) between the terminal voltage and the current approaches 90^0 .

For loads with leading power factor such as in high voltage capacitors, the losses are determined by bridge method and recently using current comparator-based capacitance bridge (frequency compensated capacitance bridge)[2] by measuring the complementary angle (δ). The bridge methods are being developed to measure loss in high voltage reactors.

The advantages and drawbacks of each of this bridge methods were discussed in a paper by Moore and Raftis[3]. However this are complex, require expensive high-voltage capacitors and current comparators and not suitable