MEASUREMENT DIELECTRIC CONSTANT OF TRANSFORMER OIL AT FREQUENCY 18 TO 26GHz (K-BAND)

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ABSTRACT

The complex reflection coefficient (real and imaginary) are measured using Vector Network Analyzer (VNA). In this project, present a method for measurement of dielectric properties of transformer oil using metal-back method. Complex reflection coefficient (S_{11}) is measured for Plexiglas container backed by metal plate. Dielectric constants and loss factors were measured for new and used transformer oil in the frequency range of 18 to 26 GHz (K-Band). The thru, reflect and line (TRL) calibration technique were used to eliminate the effect of undesirable multiple reflection. The measurement system consist of Vector Network Analyzer (VNA), a pair of spot focusing horn lens antenna, mode transitions, coaxial cable and computer .A computer program was developed for calculation of complex reflection coefficient. Data fro VNA measurement is the input to this program.

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CHAPTER 1

INTRODUCTION

There are many applications of microwave techniques that can classify as nondestructive testing. Nondestructive testing can be defined as those testing methods in which the material under this test is not destroyed or the usefulness of the material under test is not impaired [1].

The microwave non-destructive testing is one of the methods to measure the dielectric properties of such materials. Microwave is very sensitive to the dielectric properties of materials. The knowledge of the complex permittivity allows one to measure the primary physical properties of the materials, here we used it to measured complex reflection coefficient.

The microwave non-destructive testing methods are also widely used for geometrical sized and quality control of different material such as liquids, polymers, fiberglass, ceramics, water etc. The control maybe performed either during the fabrication of the products with a view to change some technological parameters or after the fabrication with view to reject bad quality of product.

Microwave radiations are highly directive because of short wavelengths involved, which the devices used often very compact. While many applications are in high power communication and radar system, low power applications are just as common. The choice of microwave is wide and includes low power solids-state devices.