

MICROWAVE NONDESTRUCTIVE TESTING OF COATINGS AND PAINTS

This project report is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Hons) (Electrical)
Universiti Teknologi MARA

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ACKNOWLEDGEMENTS

First of all, I would like to express my sincere gratitude and appreciation to my supervisor, Associate Professor Dr. Deepak Kumar Ghodgaonkar for his ideas, suggestions and guidance towards the completion of my final project thesis. I also would like to thank my panels that have given their time and effort to assess my thesis and my mother for full support, encouragement and unending prayers for me in doing my final project. Finally a special thanks to Puan Norhayati Bt. Hj. Hamzah and all staff of Electrical Engineering Lab (Communication Lab Assistant) for their cooperation during the measurement of the project.

ABSTRACT

Microwave non-destructive testing is used as a technique of testing of coatings and paints on brass metal and glass. The method used here is free space method operating in the far-field region employing spot-focusing horn lens antennas. The measurement technique is contactless and measures the magnitude and phase reflection coefficient of dielectric materials in the frequency range of 8.0 – 12.5 GHz. In this project the objective is to analyze and measure a microwave nondestructive characteristics of coatings and paints on materials such as brass metal and glass. The obvious advantage of this technique is that the sample is not damaged during the process of measurement.

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CHAPTER 1

INTRODUCTION TO MICROWAVES

1.1 Definition of Microwave [5]

The term microwaves are used to define all electromagnetic radiation waves whose frequencies lay between 300 MHz and 300 GHz. These frequencies correspond to a range of free-space wavelengths in vacuum from one meter to one millimeter, respectively. In vacuum or air, microwaves travel at the velocity of light, c ,

$$c = 2.997 \times 10^8 \text{ meters per second}$$

Microwaves are fairly commonplace in our daily lives. The public first became familiar with them as the form of energy used for radar. Microwave ovens are commonly used both to cook and to dry foods. Telephone and communication circuits use microwave relay stations to transmit signals over distances of many miles.

Television signals are often transported by means of microwaves, and are sent and received by the typical dish antennas which, in larger sizes, are used also for space communications and for radio astronomy. Guidance, tracking and control of spacecraft also employ microwaves. To a much lesser degree, microwaves are used for nondestructive testing and spectroscopy.

1.2 Microwaves for Testing

Basic property of microwaves allowed the penetration of microwave radiations in Non-conducting materials such as plastic, polymer and composites easily compared to conducting material (conductors).