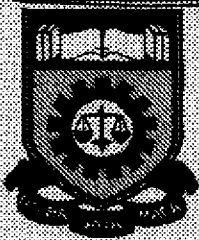


**MICROWAVE NONDESTRUCTIVE TESTING OF
TIMBER USING A FREE - SPACE TECHNIQUE**

**This is presented in partial fulfilment for the award of the
Bachelor of Electrical Engineering (Hons) of
INSTITUT TEKNOLOGI MARA**



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ABSTRACT

The concern of this project is to develop a free-space measurement system at microwave frequencies. Microwave Nondestructive Testing (MNDT) Techniques will be used for measuring moisture content, volume density, loss tangent ($\tan \delta$) and power absorption coefficient (PAC) for different type of timber (Light Red Meranti, Yellow Meranti and Keruing). Reflection and transmission measurements will be performed on a free-space microwave measurement set up in frequency range of 8.0 to 12.5GHz. Free-space set-up consists of two spot-focusing horn lens (transmit and receive antennas), wave guide transitions, coaxial cables and microwave Wiltron 372698 vector network analyzer . Errors due to diffraction effects at the edges of the specimen is minimized because of far field focussing ability of antennas and multiple reflections between antennas via the surface of specimen are eliminated by using free-space LRL (Line , Reflect and Line) calibration technique. Complex dielectric permittivity of timber will be measured to estimate moisture content of different types of timber from permittivity values . This MNDT technique is a simple , fast , nondestructive , contactless and accurate method for evaluating properties of timber.

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CHAPTER 1

1.0 INTRODUCTION TO MICROWAVES

1.1 Microwave Definition :

The elusiveness of a standard definition for the term microwave can be seen if we consider the four following dictionary definitions. The four definitions are as follows :

An electromagnetic wave of length between 50 cm (600MHz) and 1.0 mm (300GHz).

Oxford American Dictionary

A term applied to radio waves in the frequency range of 1000MHz (1.0GHz) and upward. Generally defines operations in the region where distributed constant circuits enclosed by conducting boundaries are used instead of conventional lumped-constant circuit elements.

Modern Dictionary of Electronics

Designating or of that part of the electromagnetic spectrum lying between the far infrared and some lower frequency limit; commonly regarded as extending from 300GHz to 300MHz.

Webster's New World Dictionary

A term used to signify radio waves in the frequency range from about 1000MHz (1.0GHz) upwards.

IEEE Standard Dictionary