FREE SPACE MICROWAVE INTERFEROMETER TECHNIQUE FOR DIELECTRIC MEASUREMENTS

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MUNAWIR BIN MOHAMMAD
FACULTY OF ELECTRICAL ENGINEERING
MARA INSTITUTE OF TECHNOLOGY
40450 SHAH ALAM
SELANGOR
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ABSTRACT

In the past, a free-space techniques has been used for the measurement of dielectric constant and loss tangent using short-circuited line method and reflection and transmission coefficient method. A microwave interferometer technique is implemented on the free-space microwave measurement system consisting of transmit and receive spot focusing horn lens antenna, a network analyzer, mode transitions and a computer. The dielectric constants and loss tangents will be measured for standard materials such as Teflon and Polyvinyl-Chloride (PVC). A free-space measurement system operating in the 8 – 12.5 GHz frequency range is used to measure the reflection and transmission coefficients, S_{11} and S_{21} of the planar samples, sandwiched between composite reflectors.

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CHAPTER 1

1.0 INTRODUCTION TO MICROWAVE

Microwaves are electromagnetic waves of very short wavelength between 50 cm (600 MHz) and 1.0 mm (300 GHz). Since frequency is inversely proportional to wavelength, microwave frequencies are relatively high. Generally defines operations in the region where distributed constant circuits enclosed by conducting boundaries are used instead of conventional lumped-constant circuit elements. The wavelength and frequency of various kinds of electromagnetic wave are listed in table 1.1

TABLE 1.1 The frequencies and wavelength of various bands of electromagnetic waves

Electromagnetic wave	Frequency	Wavelength
Long waves	30 – 300 kHz	10 – 1 km
Medium waves	300 – 3000 kHz	1000 – 100 m
Short waves	3 – 30 MHz	100 – 10 m
Ultra short waves	30 – 300 MHz	10 – 1m
Microwaves	300 – 30000 MHz	100 – 0.1 cm
Ultra microwaves	30 – 300 GHz	10 – 0.1 mm
Infrared rays	300 – 416000 GHz	0.1 – 0.00072 mm

1.1 Microwave Bands

The frequency band between the higher range of UHF (Ultra high frequency) and the lower range of EHF (Extreme high frequency), is divided into many frequency ranges as shown in table 1.2. Because of much larger bandwidth (compared to the commonly used