

# Characterization of Materials and Determination of Dielectric Properties using Vector Network Analyzer

## Abstract

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Every material has a unique set of electrical characteristics that are dependent on its dielectric properties. Accurate measurements of these properties can give valuable information to properly incorporate the material into its intended application for more solid designs. A dielectric materials measurement can provide critical design parameter information for many electronics applications. Dielectric measurement is important because it can provide the electrical or magnetic characteristics of the materials, which prove useful in many research and development fields such as material science, microwave circuit design, absorber development, etc.

Many methods have been developed to measure these complex properties such as methods in time domain or frequency domain with one port or two ports, etc. Every method is limited to specific frequencies, materials and applications by its own constraint. With the advance of new technologies, the methods can be employed with a software program that measures the complex reflection and transmission coefficients with a vector network analyzer and converts the data into the complex dielectric property parameter.

The project aims to measure the dielectric properties of materials with Vector Network Analyzer. Following work has to be done to realize above mentioned objective:

1. Study the concepts about dielectric constant, simple and complex dielectric properties of materials and their application.
2. Understanding the working of a Two Port Vector Network Analyzer and concepts of S-Parameter measurements.
3. Characterizing various dielectric materials through S-Parameters measurements.
4. Converting S-Parameter data to simple and complex dielectric constant with the help of standard methods and software programs

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## Academic Project Requirements:

**1) Required No. of student(s) for academic project: 1**

**2) Name of course with branch/discipline: M.E./M.Tech Electronics and Instrumentation Engineering**

**3) Academic Project duration:**

**(a) Total academic project duration: 52 Weeks**

**(b) Student's presence at IPR for academic project work: 3 Full working Days per week**

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