MICROWAVES TRAINER
DL 2594N

The trainer has been designed to introduce students to the microwave technology. It consists of a set of components, accessories and instruments and can be used as a laboratory test bench to experiment with the microwaves components as well as to study the aspects of wave propagation.

The didactic approach of this trainer is to investigate the behavior and to prove the physical concepts related to the microwave engineering. The microwave technique, as a subdomain of electronics, presents particularities both in theoretical methods and in the experimental apparatuses and procedures used.

For this reason, in a microwave laboratory, besides general-purpose electronic devices, there are also specific devices needed to measure signals and microwave networks. The components of this trainer are easy to install, using screws, nuts and supporting waveguides.

Our 3 cm. waveguide trainer provides users with an in-depth training on frequency transmission characteristics and gives students the possibility to perform all the main exercises in this field. The trainer is provided complete with a detailed educational manual.

Operating frequency: 8.2 - 12 GHz

MAIN FEATURES

- The trainer has been designed to start with a few related concepts providing in-depth coverage of the basic topics related to the propagation of the microwaves through rectangular metal guides.
- As an open system, multiple components can be chosen to form a customized transmission system freely.
- The trainer includes a detailed didactic manual.

COMPONENTS INCLUDED:

The microwave trainer consists of a set of components, accessories and instruments. It can be used as a laboratory test bench to experiment with the components of the microwave as well as to study the aspects of wave propagation.

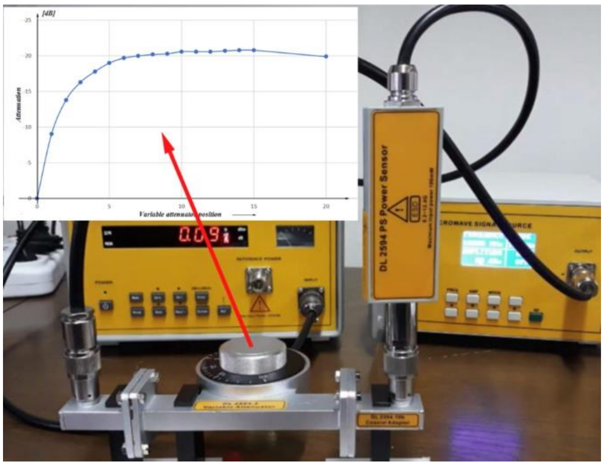
The trainer includes the following:

Power meter	1
SWR METER	1
Function Generator (with DDS PLL built in)	1
Frequency Meter	1
Variable Attenuator	1
Slotted line	1
Hybrid Tee	1
Crystal Detector	1
Waveguide	1
Matched Termination	2
Slide Screw Tuner	1
Horn Antenna	2
Coaxial Adapter	2
Fixed Attenuator 6dB	1
Directional Coupler	1
Waveguide Stands 1 support	4
Waveguide Stands 2 support	2
Shorting plate	1
N50KK cable	1
BNC50JJ cable	1
Screws and nuts	1 set
Tools	1 set

DIDACTIC EXPERIENCE:

- Propagation modes, wavelength and phase velocity in a waveguide
- Q and bandwidth of a resonance cavity
- Power measurement
- Standing wave ratio (SWR) measurement
- Impedance measurement
- Basic properties of a directional coupler
- Attenuation measurement
- Study of a waveguide Hybrid-T

EXPERIMENTS DESCRIPTION



Measurement of the attenuation in a microwave system

The measurement of the microwave attenuation is a rather complex subject. However, the first experiment will help you become familiar with the trainer.

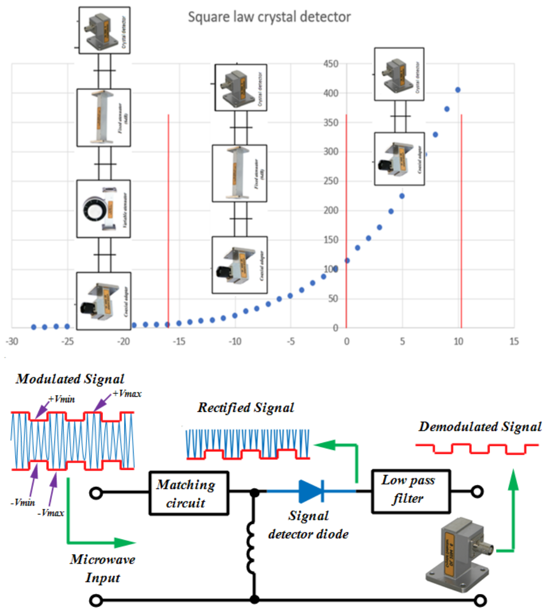
With this experiment, you will also learn to calibrate and to read the measuring instruments correctly. The step-by-step procedure will show how to measure the microwave power signal and how it is affected by different types of attenuators.

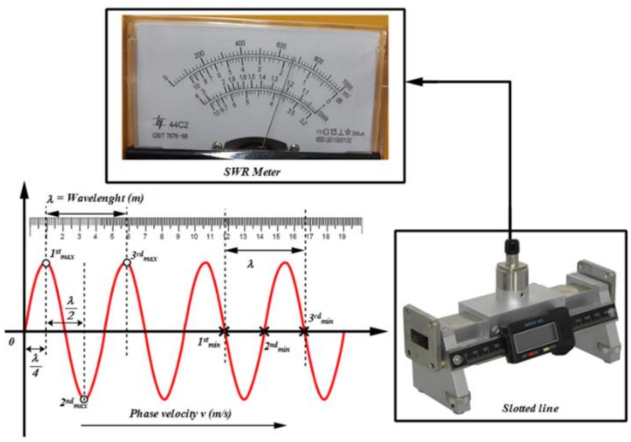
Crystal detector

You will learn about the basics of the crystal detector, including the crystal detector circuit, the characteristics of the crystal detector, and the characteristics of the square law of a crystal detector.

The square law characteristic means that the output voltage is proportional to the square of the input voltage in the first experiment the microwave source and the power meter are used, in this experiment, the SWR meter is used.

You will see how easy it is to set up the microwave source to generate a modulated signal that will be applied to the crystal detector. The crystal detector output signal will be measured with the SWR meter.





Propagation modes, wavelength and phase velocity in the waveguide

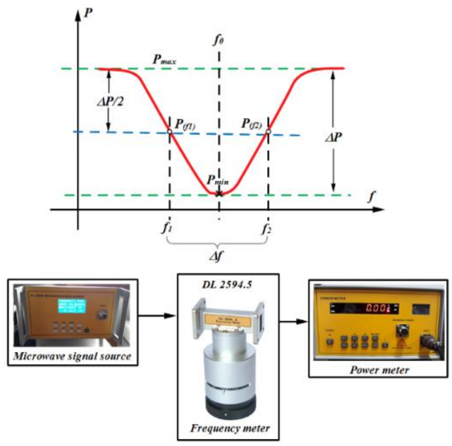
You will gain knowledge about the propagation modes, the cut-off frequency of the waveguide, the guide wavelength, the phase velocity, the group velocity, and the propagation constant.

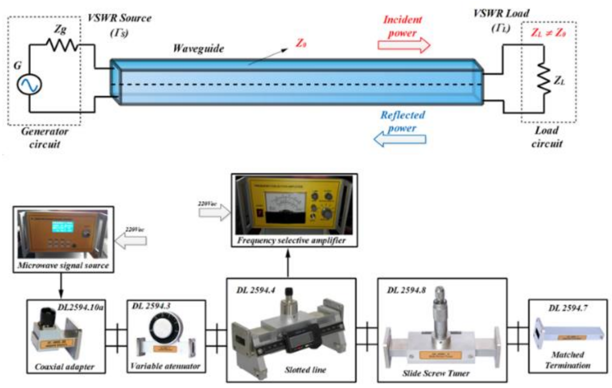
The students can very easily calculate the wavelength of the TE_{10} as the dominant mode of a rectangular waveguide. In addition, the wavelength can be measured experimentally using the slotted line included in the trainer.

Determining the Quality Factor and Bandwidth of a Resonance Cavity

To be able to study the frequency meter, first, you need to understand that it has the same behavior as a microwave resonance cavity. The cavity is a metal box with a cylindrical shape attached to a waveguide and has a simplified scale ruler to measure the frequency.

Following an easy procedure, the students will measure the power drop in the cavity and identify the corresponding frequency. It is then very easy to calculate the quality factor and bandwidth of a resonance cavity.





Power measurement and transmission losses in microwaves systems

The major issue in microwaves systems is the losses that occur during the transmission. This experiment will show how impedance mismatch will influence the reflection of the signal. The impedance mismatch will be created using the slide screw tuner included in the trainer.

The major objective of this experiment is the calculation of the return loss and mismatch loss.

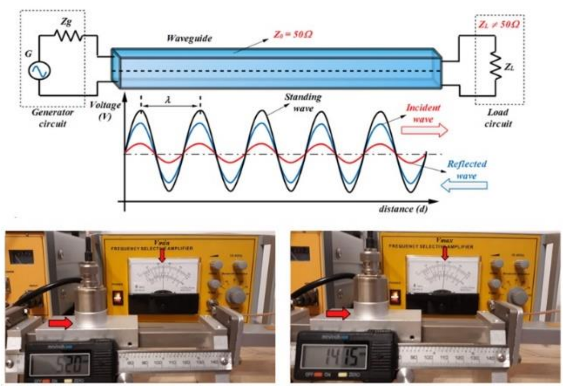
Measuring the standing wave ratio and reflection coefficient in microwave systems

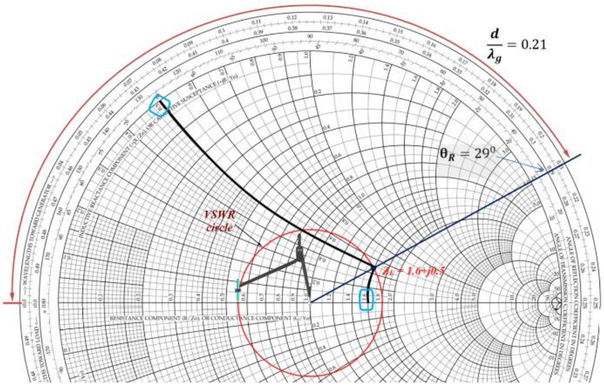
Because it is easier to detect the voltage standing waves, the term VSWR is more often used then SWR, especially within radio frequency (RF) systems.

But what does it SWR mean?

Following this experiment, you will understand what SWR is and how it can be measured or calculated.

To determine how much of the signal propagating on a waveguide is reflected to the source, you will learn how to calculate the reflection coefficient (**Γ**).





Determining the waveguide impedance using the Smith chart

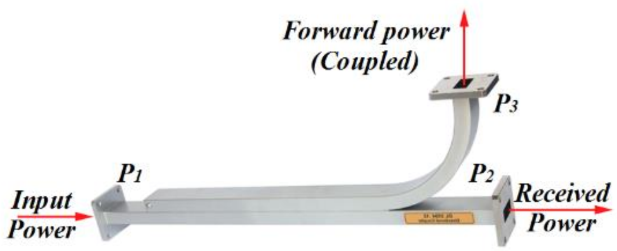
In this experiment, you will use your accumulated knowledge regarding the standing waves (from the previous experiments) to determine the impedance of a waveguide mismatched terminating line.

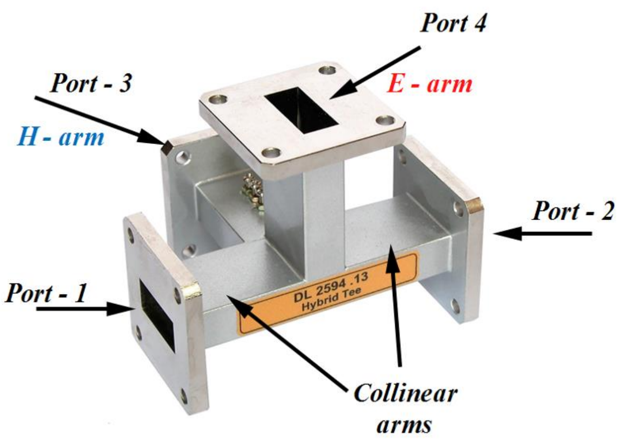
We can call this experiment "*understanding Smith chart by experimenting*" where you to read the standing waves using the slotted waveguide line, and to determine the impedance of the unknown load using the slide screw tuner.

Study the characteristics of directional coupler

How to determine the characteristics used to define the performance of a directional coupler?

You will be able to respond to this question after performing this experiment where you calculate the coupling coefficient, the insertion loss, and the directivity of a directional coupler.





The study of the isolation and coupling coefficient in a Hybrid Tee

Working with this module gives the basic know-how regarding you will learn about the insulation and coupling coefficient of a Hybrid T.

First, the student will measure the input power as a reference power of the Hybrid Tee. By measuring the E-arm power and H-arm power, you will be able to calculate the isolation factor (I) and coupling factor (C).

Microwave communication using a horn antenna system

Students will perform a practical study of horn antenna for the transmission and reception of a microwave signal in free space. The microwave signal used in the previous experiments has now been adapted and sent to in free space by using a specific antenna – the horn antenna.
The radiation pattern of a horn antenna will be plotted based on the propagation microwaves in the free space.