

### Description

The increasing use of microwave technology, in applications ranging from satellite and terrestrial communications to high-speed computing and data transmission, has resulted in a short-fall of appropriately trained engineers and technicians.

Over the three quarters of the century, microwave circuits from bulky waveguide and coaxial components has shifted to planar structures (microstrip, stripline and more) which are low cost, and easily integrated with active circuit devices, such as diodes and transistors, to form microwave integrated circuits. The swing towards micro-strip technology must be reflected in the courses offered at engineering education institutes.

MS-3000A Enhanced Microstrip trainer comprises of Noise Source, Double Balanced Mixer, T/R switch and PIN Diode Modulator, Frequency Synthesized PLL based Microwave source, Digital Step Attenuator and set of low noise, driver and power amplifiers.

The ancillary equipment required to use this trainer is our MS-3000 microstrip trainer and spectrum analyzer (up to 4GHz). MS-3000A covers the measurement of microwave power, frequency, standing wave ratio, and impedance, as well as characterization of basic microwave components such as couplers, resonators, Wilkinson power divider, circulator, and filters.

With this advanced trainer, experiments in the measurement of P1dB, noise figure and OIP3 of an amplifier, phase noise of an oscillator, Double Balance Mixer RF-IF and LO-IF Isolation, Up/Down conversion. Power and Frequency Sweep Analysis



insertion loss, isolation and OIP3 of a RF switch, and noise figure, insertion loss and spurious response of a mixer: can be performed. The trainer provides a very low cost solution for advanced level training in the field of microwave engineering.

The manual is also well written, covering all the aspects of the experiment like theory, procedure and source of errors in the measurements.

### Features

- Latest Microwave Technology
- Gold Plated RF laminate with PTH
- Conveniently packed for inventory control
- RF System design

### Requirements

- Spectrum Analyzer
- MS-3000 Trainer
- Computer Interface Unit



## List of Experiments

- Introduction to Synthesized Frequency Source,
  - Graphical User Interface,
  - Digital Step Attenuator,
  - Commuter Interface Unit
- Measurement of Noise Figure of an amplifier by using Y-Factor method.
- Study of Saturation and 1dB Compression Point P1dB of an amplifier.
- Measurement of 3rd order intercepts point OIP3 of an Amplifier by two-tone analysis.
- Measurements of Insertion Loss of RF BPF and Characterization of Circulator..
- PIN Diode Modulator investigations.
- To design Transmit / Receive switch using PIN diodes.
- Characterizations of Double balanced mixer as up-converter and down-converter
- Measurement and Characterization of the phase noise of a synthesized oscillator.
- Study of Microwave Receiver System

## Accessories

- Synthesized Frequency Source 2000-4000MHz
- Fix Frequency Source 2500MHz
- High IP3 Amplifier
- Medium Power Amplifier
- Low Noise Amplifier
- Double Balance Mixer
- T/R Switch
- PIN Diode modulator.
- Digital Step Attenuator.
- Noise Source.
- IF SAW Filter.
- 3-Port Circulator
- Wilkinson Power Divider

## Specification

### Power Amplifier (GaAs HFET )

Frequency: 0.05-6GHz  
Power Gain: 15dB  
P1dB: 30dBm  
OIP3: 43dBm  
VDS=7V, IDS=200mA

### Medium Power Amplifier (GaAs HBT MMIC)

Frequency: 50-3000MHz  
Gain: 17dB  
P1dB: 19dBm  
OIP3:35dBm  
VDS=4.5V, IDS=100mA

### Low Noise Amplifier (GaAs E-pHEMT MMIC)

Frequency: 30-6000MHz  
Gain: 15dB  
NF: 1.2dB  
VDS=4.5V, IDS=45mA

### Frequency Mixer (Double Balanced)

LO/RF: 5-3500MHz  
IF: 5-2500MHz  
LO Power: +13dBm  
Conversion Loss: 7dBm

### Synthesized Frequency Source 1000-4000MHz

Fractional N Frequency Synthesizer up 6GHz  
Software controllable GUI based  
Minimum Step: 100 KHz

### Fix Frequency Source

Frequency : 2500 MHz  
Output Power: +13dBm

### PIN Diode Modulator

Frequency: 1-4000MHz  
Insertion Loss: 0.2dB

### Noise Source

Frequency: 10Hz to 6GHz  
ENR: 30-35  
Supply: 6-8V @6mA

### T/R Switch

Insertion Loss: 1.2dB  
Isolation: 20dB  
TTL Control

### Circulator

Frequency Range: 2.5-2.9GHz  
Insertion Loss:  $\leq$  0.3dB  
Isolation:  $\geq$  20dB

### IF SAW Filter

Centre Frequency: 70MHz  
3dB BW: 5MHz  
Insertion Loss: 10dB

### Digital 5-Bit Attenuator

Frequency: DC-4000MHz  
Attenuation: 0-31dB step 0.5dB  
Network Loss: 3.5dB

All the components used are Pb-free (RoHS compliant)



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