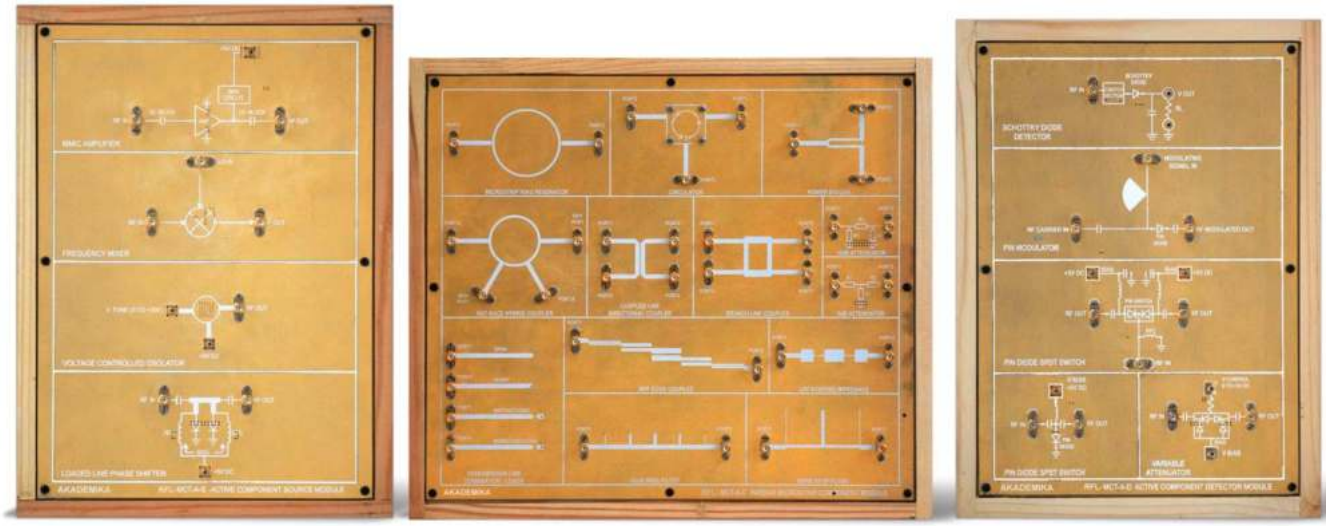
RFL- MCT-A-3G

Advance Microstrip Component Trainer

- Frequency Range up to 3GHz
- Dedicated Boards for both active and passive microstrip components
- Robust and integrated board platform
- Superior performance
- Good Power handling capacity
- Gold plated components in an accurate
- S-Parameters Measurement
- Analysis of Filters characterization
- RF System design
- Highly Reliable

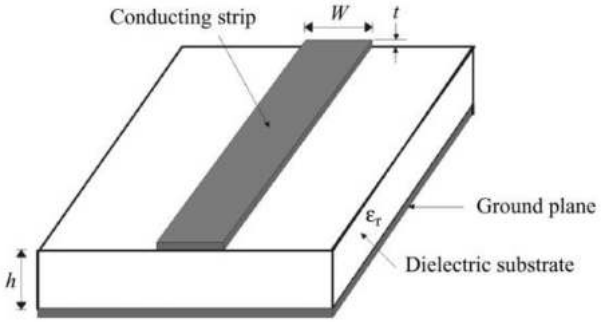


RFL-MCT-A-3G

The RFL-MCT-A-3G kit is designed to introduce the fundamentals of microstrip line technology with emphasis on Basic and Advance Microstrip Active and Passive Circuit design concepts. The design frequency range of component is up to 3GHz.The Trainer kits contains gold plated components in accurate, robust and integrated board platform.

Planer Microstrip Lines

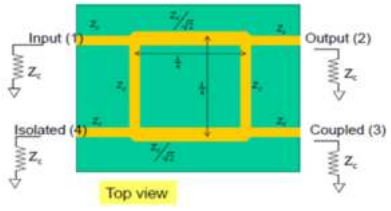
Microstrip is a type of electrical transmission line which can be fabricated using printed circuit board technology, and is used to convey microwave-frequency signals. It consists of a conducting strip separated from a ground plane by a dielectric layer known as the substrate. Microwave components such as antennas, couplers, filters, power dividers etc. can be formed from microstrip, with the entire device existing as the pattern of metallization on the substrate. Microstrip is thus much less expensive than traditional waveguide technology, as well as being far lighter and more compact.



General microstrip structure

Microstrip Directional Coupler

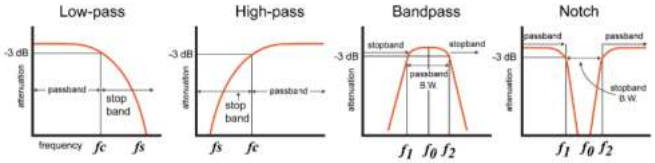
Quadrature hybrids are 3dB directional couplers with a 90 deg phase difference in the outputs of the through and coupled arms. It is usually implemented in microstrip or stripline form



Directional coupler

Microstrip Filters

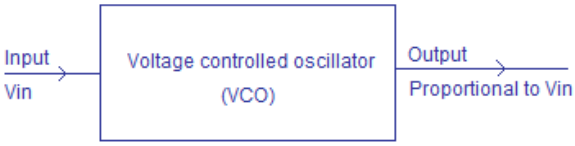
Filter networks are used to select/reject or separate/combine signals at different frequencies in a host of RF/microwave systems and equipment. Although the physical realization of filters at RF/microwave frequencies may vary, the circuit network topology is common to all.



Response curves for the four major filter types

Voltage controlled oscillator(VCO)

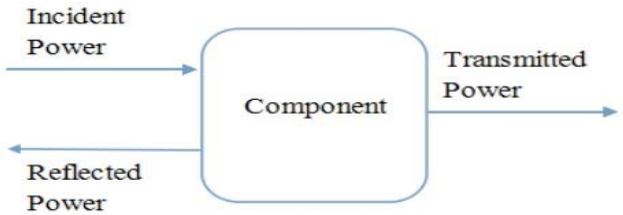
Voltage controlled oscillator is a type of oscillator where the frequency of the output oscillations can be varied by varying the amplitude of an input voltage signal.



block diagram of Voltage controlled oscillator

Insertion Loss Measurement

Insertion loss is the loss of signal when traveling in and out of a given circuit or traveling into a component and out of the component. If your signal is at 100% going into a component, and coming out there is a loss, its described as insertion loss and is measured in decibels (dB). 3 dB is described as the end point for any component and is equivalent to the signal strength being reduced by 50%.

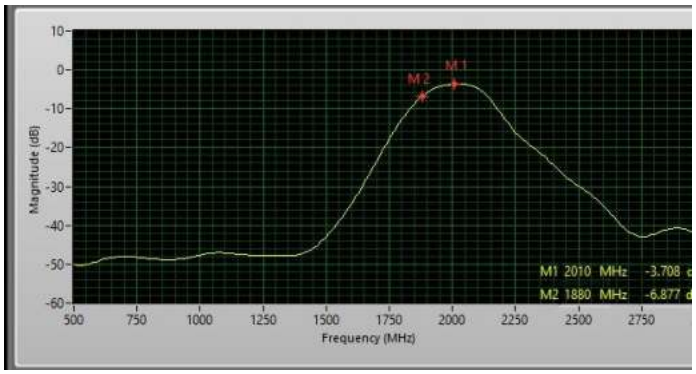


$$\text{Insertion Loss} = \frac{\text{Transmitted Power}}{\text{Incident Power}}$$

$$\text{Return Loss} = \frac{\text{Reflected Power}}{\text{Incident Power}}$$

KEY PARAMETERS

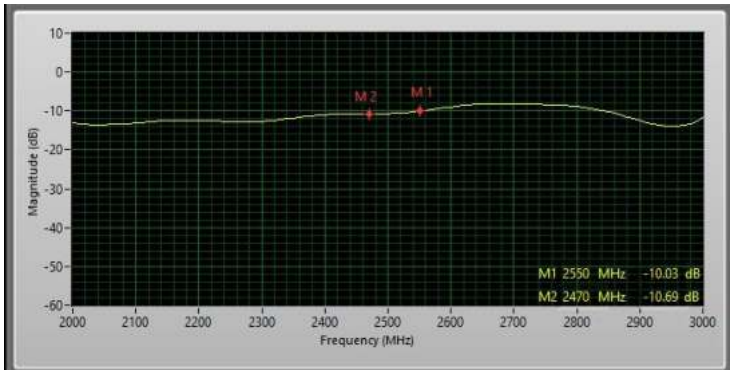
1. Insertion Loss (S_{12})



Insertion Loss of BPF

Graph shows insertion loss of passive Microstrip BPF filter. It shows 3dB bandwidth of Microstrip BPF is 260MHz

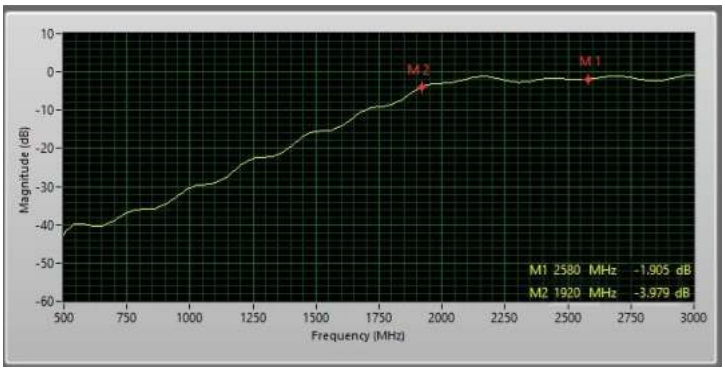
2. Isolation (S_{41})



Isolation of directional coupler

Graph shows isolation of directional coupler. It shows -10.6dB isolation at 2470MHz.Directional coupler is 4 ports device. For S41 measurement remaining two ports will be terminated by 50 Ohm load.

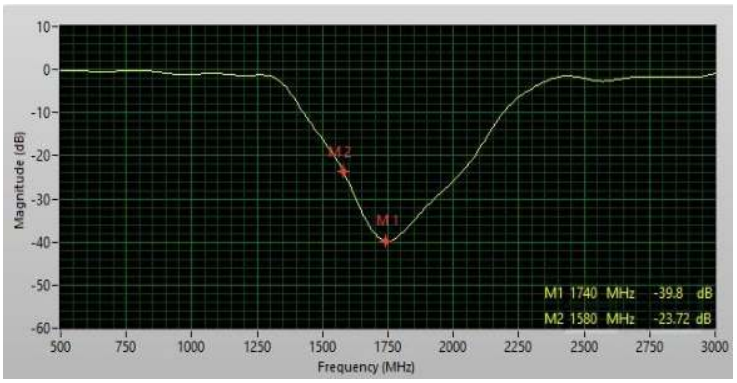
3. S-Parameters (S_{21})



S_{21} of High Pass Filter(HPF)

Graph shows the S parameters of HPF and it show 3dB cut frequency of HPF is 1920MHz

4. S-Parameters (S_{22})



S-Parameter of BPF

Graph shows S-Parameter of microstrip BPF filter. It shows S_{11}= -39.8 dB at 1740MHz.The Bandwidth of BPF Filter is around 400MHz.

TECHNICAL SPECIFICATIONS

Active Component Source Module

MMIC Amplifier

- Frequency : 100 MHz to 3GHz
- Gain (Typical) : 15 dB @ 2GHz
- Noise Figure : 2.9 dB @ 3GHz
- Reverse Isolation : 20 dB (typical)

VCO

- Frequency : 1300 MHz ~ 3GHz
- Power Output : 8 dBm (typical)
- Tuning Voltage : 0.5 V to 10 V

Frequency Mixer

- RF / LO Frequency : 1300 MHz to 3GHz
- LO Power IN : +7 dBm
- IF Out : DC to 1000MHz
- Conversion Loss : 6.3 dB (typical)
- Isolation : 20 dB (typical)

Passive Microstrip Component Module

Microstrip Filters

LPF

- Frequency Range (3dB cut-off +/- 50 MHz) : 100 MHz to 2 GHz
- Insertion Loss : < 1.5 dB

HPF

- Frequency Range (3dB cut-off +/- 50 MHz) : 1.9 GHz
- Insertion Loss : < 1.5 dB

BPF

- Center Frequency : 2 GHz (+/- 50 MHz)
- Bandwidth : ~ 300 MHz @ 3 dB
  : ~ 800 MHz @ 30 dB

BSF

- Center Frequency : 1.8 GHz (+/- 50 MHz)
- Bandwidth : ~ 850 MHz @ 3 dB
  :~ 400 MHz @ 25 dB

Attenuators

- Tee Attenuator : 5 dB
- Pi Attenuator : 10 dB

Coupled Line Directional Coupler

- Center Frequency : 2 GHz (+ /- 50 MHz)
- Coupling : 13 dB
- Isolation : > 20dB

Branchline Coupler

- Center Frequency : 2.45 GHz (+/- 50 MHz
- Isolation : > 25dB

Rat Race Coupler

- Center Frequency : 2.45 GHz (+/- 50 MHz)
- Isolation : > 25dB

Ring Resonator

- Center Frequency : 2.45 GHz (+/- 50 MHz)
- Bandwidth : 60 MHz

Circulator

- Frequency : 2 .5GHz

Power Divider

- Frequency : 2 GHz to 2.5GHz
- Isolation : > 20 dB

Transmission Line Terminations / Loads

- OPEN Termination
- SHORT Termination
- MATCHED Load
- MISMATCHED Load

Active Component Detector module

Pin Diode Switch

- SPST Switch Frequency : 300 MHz to 1GHz
- SPDT Switch Frequency : 1GHz to 2 GHz
- Insertion loss : < 3dB

Pin Diode Variable Attenuator

- Frequency : 1.5 GHz to 2.5GHz
- Attenuation range : 7 dB to 17dB
- Variable Voltage : 0 V to + 5 V

Schottky Diode Detector

- Frequency : 2.2 GHz to 2.5GHz
- Input power : -30dBm to 10dBm

DELIVERABLES

- Active Component Source Module : 01nos
- Passive Microstrip Component Module: 01nos
- Active Component Detector module : 01nos
- SMA (M) to SMA (M) 50 ohm RG316 cable 50cm: 02nos
- Type N (M) to SMA (M) 50 ohm Coaxial Cable: 02nos
- SMB (Plug) to Crocodile clips DC supply cable: 02nos
- 50-ohm Termination: 02nos
- Manual: 01nos

RECOMMENDED EQUIPMENTS

- RFL-RFGD Generator and Detector
- Spectrum Analyser with TG
- Vector Network Analyser(VNA)

***Note: not supplied along with module**

TUTORIALS

- Determination of Power division characteristics (S_{21},S_{31})
- Measurement of Insertion Loss and Isolation for directional Coupler (S_{21},S_{41})
- Measurements of Insertion Loss of RF BPF and Characterization of Circulator
- Determination of 3dB cut off frequency of HPF and LPF filter
- Measurement of attenuation power for Pi attenuator
- Determination of insertion loss (S_{21}) and harmonics for Microstrip Ring Resonator
- PIN Diode Modulator investigations
- Gain Measurement of MMIC Amplifier
- Characterization VCO and RF Mixer
- Characterization of SCHOTTKY DIODE DETECTOR
- Impedance and VSWR measurement of transmission line termination.