The 10209H 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.

FEATURES

- 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

PASSIVE MICROSTRIP COMPONENT MODULE

SPECIFICATIONS

Microstrip Filters

LPF

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

HPF

Frequency Range	: 1.9 GHz (3dB cut-off +/- 50 MHz)
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)
Isolation	: > 20dB
Coupling	: 13 dB

Banchline 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	: 500 MHz to 3 Ghz
Isolation	: > 20 dB

Transmission Line Terminations / Loads

OPEN Termination
SHORT Termination
MATCHED Load
MISMATCHED Load

ACTIVE COMPONENT SOURCE MODULE

SPECIFICATIONS

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	: 1200 MHz - 3GHz
Power Output	: 8 dBm (Typical)
Tuning Voltage	: 0.5Vto 10V

Frequency Mixer

RF / LO Frequency	: 1200 MHz to 3GHz
LO Power IN	: +7 dBm
IF Out	: DC to 1000MHz

Phase Shifter

Note: Specifications are subject to change.

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Frequency : 500 MHZ 3GHz
Tuning Voltage : 0V to 5V

ACTIVE COMPONENT DETECTOR MODULE

SPECIFICATIONS

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

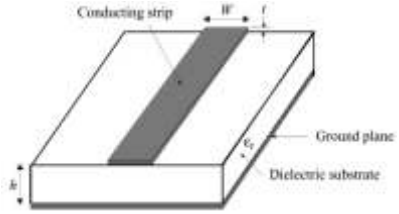
Frequency : 1.5 GHz to 2.5GHz
Attenuation range : 7 dB to 17dB
Variable Voltage : 0 Vto+ 5V

Schottky Diode Detector

Frequency : 2.2 GHz to 2.5GHz
PIN Modulator : 1 GHz to 3GHz

PLANER MICROSTRIP LINES

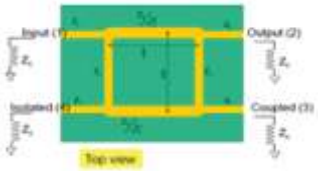
- Microstrip is a type of electrical transmission line which can be fabricated using printed circuit board technology, and is used to convey microwave-frequency signals.
- Microwave components such as antennas, couplers, filters, power dividers etc. can be formed from microstrip, with the entire device existing as the pattern of metallization on the substrate.



General Microstrip Structure

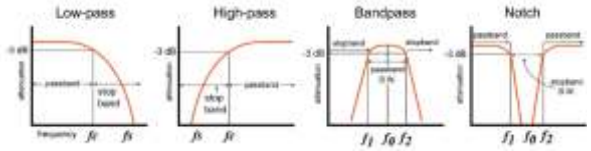
MICROSTRIP DIRECTIONAL COUPLER

- 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



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



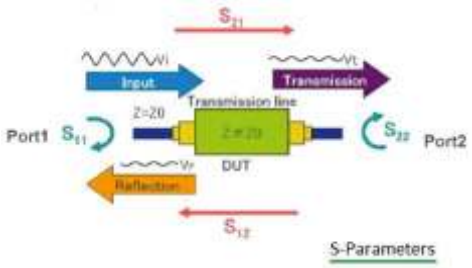
VOLTAGE CONTROLLED OSCILLATOR(VCO)

- 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

S-PARAMETER MEASUREMENTS

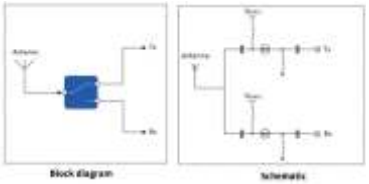
- An important performance measure of a 2-port network is S21



RF SWITCHES

Many applications require switching the RF signal path to route and connect to different antennas, filters and amplifiers. With the growth and development of wireless communication, high¬speed data networks and other advanced technologies such as switchable band-pass filters, the need for high performance switching devices is increasing. The PIN diode is one of the popular device options for switches

The SPST series switch configuration



The SPST series switch configuration

Note: Specifications are subject to change.

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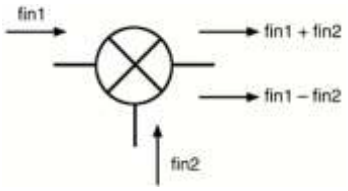
RF MIXER

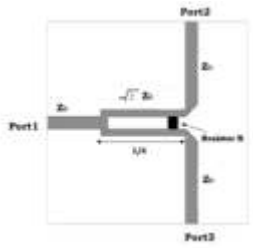
Mixers are used in a variety of RF/microwave applications, including military radar, cellular base stations, and more. An RF Mixer is a three-port passive or active device that can modulate or demodulate a signal.



A Mixer Presented Symbolically

WILKINSON POWER DIVIDER

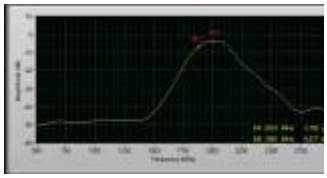
In the field of microwave engineering and circuit design, the Wilkinson Power Divider is a specific class of power divider circuit that can achieve isolation between the output ports while maintaining a matched condition on all ports. The Wilkins



Equal Power Divider

MCT OUTPUT PARAMETERS

1. Insertion Loss (S12)

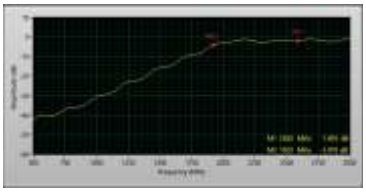


- Graph shows insertion loss of passive Microstrip BPF filter. It shows 3dB bandwidth of Microstrip BPF is 260MHz

2. Isolation (S41)

- 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 hm lo

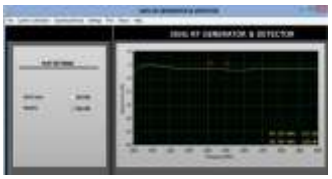
3. S-Parameters (S21)



- S21 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 (S22)

- S-Parameter of BPF
- Graph shows S-Parameter of microstrip BPF filter. It shows S11= -39.8 dB at 1740MHZ. The Bandwidth of BPF Filter is around 400MHz.



Graph shows the S_{21} of power divider at port2 and it can see - 3dB power will be transfer at port 2 when port3 is terminated by 50-ohm load.-3dB means 50% power will be transfer at port2.

RECOMMENDED EQUIPMENTS

- 10209I : Generator and Detector
- 10209J : Spectrum Analyzer
- Vector Network Analyzer

Experiments list

01. Determination of insertion loss (S_{21}) of Microstrip Ring Resonator
02. Measurement of Isolation Characteristics of Circulator
03. Measurement of Attenuation Power for Pi Attenuator
04. Gain Measurement of MMIC Amplifier
05. PIN Diode Modulator Investigations
06. Characterization of Circulator
07. Characterization VCO
08. Characterization RF Mixer
09. Characterization of Schottky Diode Detector
10. Determination of Power Division Characteristics (S21 ,S31)
11. Measurement of Isolation of Directional Coupler (S_{41})
12. Determination of 3dB Bandwidth of BPF Filter
13. Determination of 3dB cut off Frequency of LPF Filter
14. Characterization of PIN Diode as RF Switch
15. Study High Frequency Modulation
16. Study of RF To DC Conversion

Note: Specifications are subject to change.

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