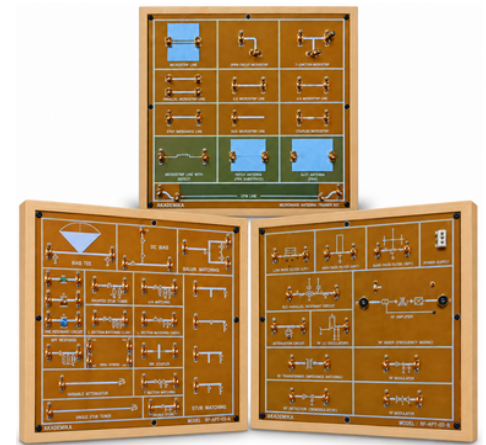


RFL-RFT

RF Circuit Trainer System

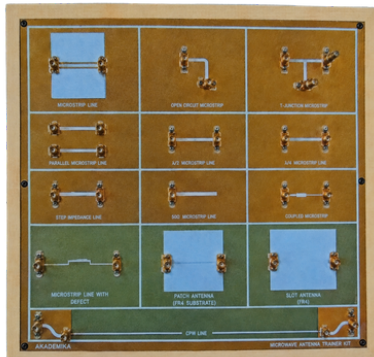


FEATURES

- RF Circuit Training System consist of 3 individual board to introduce the concept of Transmission Line Circuits, RF Microwave Network Analysis, Impedance Transformation, Impedance Matching along with Active RF devices like LNA, RF Amplifier, Oscillators etc.

SPECIFICATIONS

BOARD 1 : TRANSMISSION CHANNEL & MICROSTRIP DISCONTINUITIES



Open air transmission

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to -20 dBm
- Load - Matched Antenna

Co-axial cable transmission

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to -20 dBm
- Load - Open short, Resistive load, Complex load

Microstrip transmission line

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to 20 dBm
- Load condition- Open short, Resistive load, Complex load

CPW transmission line

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to -20 dBm

- Load condition- Open short, Resistive load, Complex load

Slot line

- Frequency - 0.9 GHz to 3 GHz
- Power - 0 dBm to -20 dBm
- Load condition- Open short, Resistive load, Complex load

CPW transmission line with ground

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to -20 dBm
- Load condition- Open short, Resistive load, Complex load

Coupled line microstrip transmission line

- Frequency - 0.1 GHz to 3 GHz
- Power - 0 dBm to -20 dBm
- Load condition- Balanced resistive load, Unbalance load

Open discontinuity

- Frequency - 0.3 GHz to 3 GHz
- Power - 0 dBm to -20 dB

Via discontinuity

- Frequency - 0.1 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB
- Load condition - Resistive Load

GAP discontinuity

- Frequency - 0.1 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB
- Load condition - Series & shunt inductive load

Bend discontinuity

- Frequency - 0.1 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB
- Load condition - Complex load

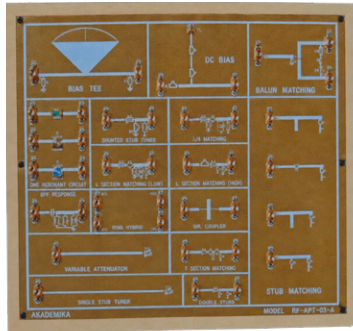
Step discontinuity

- Frequency - 0.1 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB
- Load condition - Series & shunt Resistive load

Tee discontinuity

- Frequency - 0.1 GHz to 1.3 GHz
- Load condition - Matched, Restive load

BOARD 2 : RF CIRCUITS & MATCHING ARCHITECTURE



RF Lump Element

- Frequency 0.1 GHz to 3 GHz
- Type Capacitive, Inductive
- Load condition Matched

High frequency effect on Lump Element

- Frequency - 0.001 GHz to 3 GHz
- Power - 0 dBm to -20 dB

Inductive Resonance Circuit

- Frequency - 0.5 GHz to 1 GHz
- Power - 0 dBm to -20 dB
- Load condition- Matched, Resistive

Capacitive Resonance Circuit

- Frequency - 0.3 GHz to 1 GHz
- Power - 0 dBm to -20 dB
- Load condition- Matched, Resistive

RLC Resonance Circuit

- Frequency - 0.3 GHz to 1 GHz
- Power - 0 dBm to -20 dB
- Load condition- Matched, Resistive

Tunable Resonance Circuit

- Frequency - 0.3 GHz to 1 GHz
- Power - 0 dBm to -20 dB
- Load condition- Variable load

BALUN

- Frequency - 0.3 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB
- Load condition- Variable load

DC Bias TEE

- Frequency - 0.3 GHz to 1.3 GHz
- Power - 0 dBm
- Isolation - 25 dB

Microstrip Bias TEE

- Frequency - 0.5 GHz to 1.2 GHz
- Power - 0 dBm to -20 dB
- Load condition- Matched load

Single stub matching

- Frequency - 0.8 GHz to 2 GHz
- Load condition- Variable load

Quarter wave transformer

- Frequency - 0.5 GHz to 1.5 GHz
- Load condition- Variable load

Binomial Quarter transformer

- Frequency - 0.4 GHz to 2 GHz

- Load condition- Variable load

L Matching for resistive load

- Frequency - 0.3 GHz to 1 GHz
- Load condition- Resistive load

L Matching for complex load

- Frequency - 0.4 GHz to 1 GHz
- Load condition- Complex load

T Matching

- Frequency - 0.3 GHz to 1 GHz
- Load condition High load impedance (fixed)

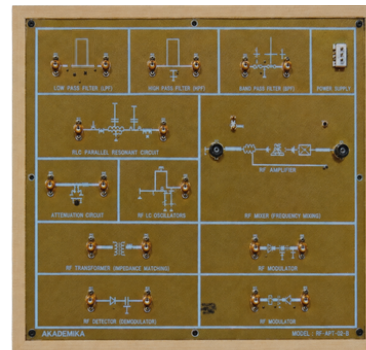
PI Matching

- Frequency - 0.4 GHz to 0.7 GHz
- Load condition - Low load impedance (fixed)

Loop Inductor

- Frequency - 0.3 GHz to 1.3 GHz
- Power - 0 dBm to -20 dB

BOARD 3 : RF ACTIVE COMPONENT & ITS APPLICATION CIRCUITS



RF BJT Amplifier

- Frequency Range - 0.3 GHz to 0.8 GHz
- Gain S21 - > 10 dB
- Reverse Isolation - < -15 dB

Low Noise Amplifier

- Frequency Range - 0.3 GHz to 0.8 GHz
- Gain S21 - > 10 dB
- Noise Figure (NF) - < 1.5 dB

RF LC Oscillator

- Frequency - 30 MHz (± 25 MHz)
- Power Level - > -30 dB

Phase-locked loop

- Input Frequency - 500 KHz – 5 MHz
- VCO Locked Freq - 1.3 MHz (± 500 KHz)

RF Power Amplifier

- Frequency Range - 0.3 GHz to 1 GHz
- Gain S21 - > 12 dB
- Max Output Power - 30 dBm

RF MOSFET Amplifier

- Frequency Range - 0.1 GHz to 0.5 GHz
- Gain - > 10 dB
- Reverse Isolation - < -15 dB

RF Gain Equalizer

- Frequency - 0.4 GHz to 0.8 GHz
- Insertion Loss - < -3 dB

- Load condition - Matched

Lumped LPF Filter

- Cut Frequency - 450 MHz
- Filter order - 7
- Insertion Loss - > -2 dB
- Return Loss - > -10 dB

RF Frequency Multiplier

- Input Freq Range - 10 - 500 MHz
- Output Freq Range - 20 - 1000 MHz
- Impedance - 50 ohm

Lumped BPF Filter

- Center Frequency - 350 MHz $\pm$ 70 MHz
- Filter order - 5
- Bandwidth - ~ 150 MHz @ 3 dB

Lumped HPF Filter

- Cut Frequency - 450 MHz (3 dB cut off $\pm$ 50 MHz)
- Filter order - 7
- Insertion Loss - < -2 dB
- Return Loss - < -10 dB

DELIVERABLES

- Transmission Channel & Microstrip Discontinuities Module: 01 nos
- RF Circuits & Matching Architecture Module: 01 nos
- RF Active Component and Its Application Circuits Module: 01 nos
- SMA (M) to SMA (M) 50 Ω RG316 cable 50 cm: 02 nos
- SMB (Plug) to Crocodile clips DC supply cable: 02 nos
- 50-ohm Terminations: 02 nos
- Manual: 01 nos

EXPERIMENTS

- Measurement of Insertion loss (S21) for different devices.
- Study of Load condition over transmission line channel.
- Study of Phase characterization of channel.
- Measurement of frequency BW response.
- Study Z parameter of stub matching circuits.
- Study and calculation of Smith chart over a wide band.
- Measurement of S11 / VSWR for different devices.
- Measurement of Q Factor for different devices.
- Measurement of Resonance over BW.
- Study of Match & Unmatched circuits.
- Measurement of transmission & reflection Characteristic of lumped LPF, HPF, BPF filters
- Study network analysis of different RF Active circuits like BJT, MOSFET and LNA Amplifiers.
- Measurement of Gain Flatness.
- Study of RF Gain equalizer circuit and its measurement.
- Study of RF LC Oscillator.
- Study RF Frequency Multiplier Circuits.
- Study of Phase-Locked Loop (PLL) Circuits.



RFL RFT-1G-M BIAS TEE



L Network Complex load



RLC Resonance



High frequency effect in resistor



High frequency effect in inductor