# MICROWAVE PASSIVE CIRCUIT DESIGN TRAINER

Model Number : GOTT-MSP-170

## DESCRIPTION

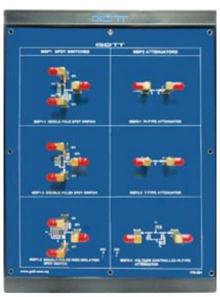
- Design and implementation of switches and attenuators.
- Design and implementation of Wilkinson power dividers, branch line couplers and Lange couplers.
- Design and implementation of ring coupler, directional coupler and baluns.
- Design and implementation of low -pass filter, band-stop filter and band-pass filter.
- Design and implementation of PBG Filter and DGS type filter.

## FEATURES

- Training for wireless communication technicians and engineers.
- To understand the applications and measurements of communication instruments and products.
- Design and implementation ability training for microwave module circuit.
- To understand the applications of micro-strip line in microwave circuits design.
- To shorten the gap between academic and industrial circles.

## PRODUCT MODULES

### DESIGN AND IMPLEMENTATION OF SWITCH & ATTENUATOR — CODE 170-001



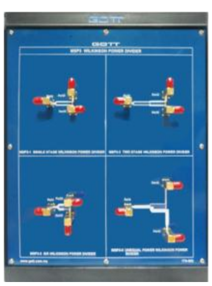
**Design and Implementation of Switch**

- Experiment 1: Single Pole SPDT Switching (Operation Frequency: 2400 MHz; Return Loss: > 10 dB; Insertion Loss: < 3 dB; Isolation: > 10 dB)
- Experiment 2: Double Pole SPDT Switching (Operation Frequency: 2400 MHz; Return Loss: > 10 dB; Insertion Loss: < 3 dB; Isolation: > 10 Db)
- Experiment 3: Doubly Poles High Isolation SPDT Switching (Operation Frequency: 2400 MHz; Return Loss: > 10 d B; Insertion Loss: < 3 dB; Isolation: > 20 dB)

**Design and Implementation of Attenuator**

- Experiment 1: π-type Attenuator (Operation Frequency: 2400 MHz; Return Loss: > 15 dB; Attenuation: > 20 ± 3 dB)
- Experiment 2: T-type Attenuator (Operation Frequency: 2400 MHz; Return Loss: > 15 dB; Attenuation: > 20 ± 3dB)
- Experiment 3: Voltage-controlled -type Attenuator (Operation Frequency: 2400 MHz; Return Loss: > 10 dB; Attenuation: > 30 ~ 10 ± 3 dB)

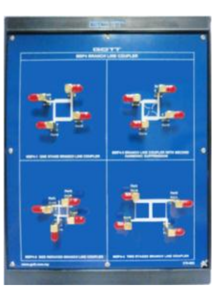
### DESIGN AND IMPLEMENTATION OF WIKINSON POWER DIVIDER — CODE 170-002



**Design and Implementation of Wilkinson Power Divider**

- Experiment 1: Single Stage Wilkinson Power Divider (Operation Frequency: 2400 MHz; Return Loss: > 25 ± 5 dB; Coupling: < - 3 ± 0.5 dB; Isolation: > 25 ± 5 dB; Phase difference: 0 ± 5 deg.)
- Experiment 2: SIR Wilkinson Power Divider (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 0.5 dB; Isolation: > 15 ± 5 dB; Phase difference: 0 ± 5 deg.)
- Experiment 3: Two Stages Wilkinson Power Divider (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 25 ± 5 dB; Phase difference: 0 ± 5 deg.)
- Experiment 4: Unequal Power Wilkinson Power Divider (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB; Coupling: < -2 ± 0.5 dB; Isolation: >20 ± 5 dB; Phase difference: 0 ± 5 deg.)

### DESIGN AND IMPLEMENTATION OF BRANCH LINE COUPLER — CODE 170-003



**Design and Implementation of Branch line Coupler**

- Experiment 1: One Single Stage Branch Line Coupler (Operation Frequency: 2400 MHz; Return Loss: > 30 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 25 ± 5 dB; Phase difference: -270 ± 10 deg.)
- Experiment 2: Size Reduced Branch Line Coupler (Operation Frequency: 2400 MHz; Return Loss: > 30 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 25 ± 5 dB; Phase difference: 75 ± 10 deg.
- Experiment 3: Branch Line Coupler with Second Harmonic Suppression (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 35 ± 5 dB; Phase difference: -270 ± 10 deg.)
- Experiment 4: Two Stages Branch Line Coupler (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 25 ± 5 dB; Phase difference: 90 ± 10 deg.)

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## DESIGN AND IMPLEMENTATION OF LANGE COUPLER

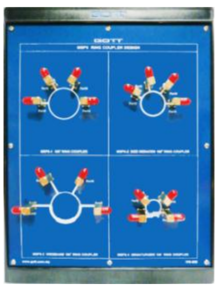
CODE 170-004

**Design and Implementation of Lange Coupler**

- Experiment 1: Unfolded Lange Coupler (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB Coupling: < -6 ± 0.5 dB; Isolation: > 30 ± 5 dB; Phase difference: -90 ± 10 deg.)
- Experiment 2: Single Stage Lange Coupler (Operation Frequency: 2400 MHz; Return Loss: > 35 ± 5 dB; Coupling: < -6 ± 0.5 dB; Isolation: > 30 ± 5 dB; Phase difference: -90 ± 10 deg.)
- Experiment 3: Two Stages Lange Coupler (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 25 ± 5 dB; Phase difference: -90 ± 10 deg.)
- Experiment 4: Triple Coopered Lines Lange Coupler (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 30 ± 5 dB; Phase difference: -90 ± 10 deg.)

## DESIGN AND IMPLEMENTATION OF RING COUPLER

CODE 170-005

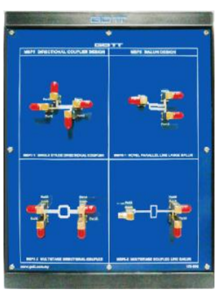


**Design and Implementation of Ring Coupler**

- Experiment 1: 180 deg. Ring Coupler (Operation Frequency: 2400 MHz; Return Loss: > 25 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 35 ± 5 dB; Phase difference: 0 ± 10 deg. / -180 ± 10 deg.)
- Experiment 2: Wideband Ring Coupler (Operation Frequency: 2400 MHz; Return Loss: > 25 ± 5 dB; Coupling: < -3 ± 0.5 dB; Isolation: > 20 ± 5 dB; Phase difference: -10 ± 10 deg. / -190 ± 10 deg.)
- Experiment 3: Size Reduced Ring Coupler (Operation Frequency: 2400 MHz; Return Loss: > 25 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 25 ± 5 dB; Phase difference: 0 ± 10 deg. / -180 ± 10 deg.)
- Experiment 4: Miniaturized Ring Coupler (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 20 ± 5 dB; Phase difference: -3 ± 10 deg. / -175 ± 10 deg.)

## DESIGN AND IMPLEMENTATION OF DIRECTIONAL COUPLER & BALUN

CODE 170-006



**Design and Implementation of Directional Coupler**

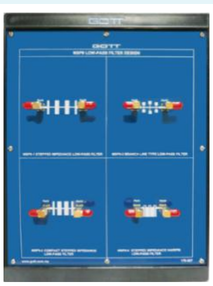
- Experiment 1: Single Stage Directional Coupler (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB; Coupling: < -10 ± 1 dB; Isolation: > 20 ± 5 dB; Phase difference: -90 ± 10 deg.)
- Experiment 2: Multi-stages Directional Coupler (Operation Frequency: 2400 MHz; Return Loss: > 20 ± 5 dB; Coupling: < -6 ± 1 dB; Isolation: > 20 ± 5 dB; Phase difference: 90 ± 10 deg.)

**Design and Implementation of Balun**

- Experiment 1: Novel Parallel Line Lange Balun (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 7 ± 5 dB; Phase difference: -180 ± 10 deg.)
- Experiment 2: Multi-stage Coupled Line Balun (Operation Frequency: 2400 MHz; Return Loss: > 15 ± 5 dB; Coupling: < -3 ± 1 dB; Isolation: > 7 ± 5 dB; Phase difference: -180 ± 10 deg.)

## DESIGN AND IMPLEMENTATION OF LOW-PASS FILTER

CODE 170-007

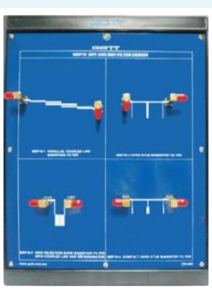


**Design and Implementation of Low-pass Filter**

- Experiment 1: Stepped Impedance Low-pass Filter (f-3dB: 2.4 ± 0.1 GHz; Pass-band Width: > 2.4 ± GHz; -20 dB Band-stop: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB;Insertion Loss: < 0 dB ± 1dB)
- Experiment 2: Compact Stepped Impedance Low-pass Filter (f-3dB: 2.4 ± 0.1 GHz; Pass-band Width: > 2.4 ± 0.1 GHz; -20 dB Stop-band: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 3: Branch Line Type Low-pass Filter (f-3dB: 2.4 ± 0.1 GHz; Pass-band Width: > 2.4 ± GHz; -20 dB Stop-band > 3 ± 0.5 GHz; Return Loss: > 15 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 4: Stepped Impedance Hairpin Low-pass Filter (f-3dB: 2.4 ± 0.1 GHz; Pass-band Width: > 2.4 ± 0.1 GHz; 20 dB Stop-band: > 2.5 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)

## DESIGN AND IMPLEMENTATION OF BRF AND BPF FILTERS

CODE 170-008



**Design and Implementation of BRF and BPF Filters**

- Experiment 1: Open Stub Band-stop Filter (fc: 2.4 ± 0.1 GHz;-3 dB Stop-band Width: > 1 ± 0.5 GHz;-20 dB Stop-band Width: > 1 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 2: Compact Open Stub Band-stop Filter (fc: 2.4 ± 0.1 GHz;-3 dB Stop-band Width: > 1 ± 0.5 GHz;-20 dB Stop-band Width: > 1 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 3: Parallel Coupled Line Band-pass Filter (fc: 2.4 ± 0.1 GHz; Pass-band Width: > 0.5 ± GHz; -20 dB Stop-band Width: > 2 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 3 dB ± 1dB)
- Experiment 4: Wide Stop Band Band-pass Filter with Coupled Line and SIR Resonator (fc: 2.4 ± 0.1 GHz; Pass-band Width: > 1 ± 0.3 GHz;-20 dB Stop-band Width: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 3 dB ± 1dB)

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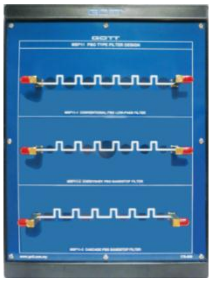
## PBG TYPE FILTER DESIGN

CODE 170-009



**PBG Type Filter Design**

- Experiment 1: Conventional PBG Low-pass Filter (f-3dB: 1.6 ± 0.1 GHz; -20 dB Stop-band Width: > 1 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 3 dB ± 1dB)
- Experiment 2: Chebyshev PBG Band-stop Filter (f-3dB: 2.4 ± 0.1 GHz; -3 dB Stop-band Width: > 1 ± 0.5 GHz; -20 dB Stop-band Width: > 1 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 2 dB ± 1 dB)

## GDS TYPE FILTER DESIGN

CODE 170-010

**DGS Type Filter Design**

- Experiment 1: Low-pass Filter with Periodic DGS (f-3dB: 2.4 ± 0.1 GHz;-20 dB Stop-band Width: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 2: SIR Low-pass Filter with DGS (fc: 2.4 ± 0.1 GHz;-20 dB Stop-band Width: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 0 dB ± 1dB)
- Experiment 3: Parallel Coupled Line Band-pass Filter with Harmonic Stop (fc: 2.4 ± 0.1 GHz; Pass-band Width: > 0.3 ± 0.2 GHz; -20 dB Stop-band Width: > 3 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 3 dB ± 1 dB)
- Experiment 4: Open Stub Band-pass Filter using DGS Loaded (fc: 2.4 ± 0.1 GHz; Pass-band Width: > 0.4 ± 0.2 GHz; -20 dB Stop-band Width: > 1 ± 0.5 GHz; Return Loss: > 10 ± 5dB; Insertion Loss: < 3 dB ± 1 dB)

## DC POWER SUPPLY & FUNCTION GENERATOR (OPTIONAL ITEM)

CODE 500-107

**DC Power Supply**

- Tripple Bipolar Voltage Outputs
  - DC 0 – +/-15V
  - DC +/-5V
  - DC +/-12V
- Constant & variable Voltage Operation
- Low Ripple and Noise

**Function Generator**

- Two Signals Output Ports
- Frequency Range :

| FG (I): | FG (II): |
|---|---|
| 0 – 10Hz | 0 – 100Hz |
| 0 – 100kHz | 0 – 1kHz |
| 0 – 1kHz | 0 – 10kHz |
| 0 – 10kHz | 0 – 100kHz |
| 0 – 100kHz | 0 – 1MHz |

- Waveform: Sine, Triangle, Square, TTL Pulse
- Amplitude: 10Vpp
- Built-in-6-Digit Frequency Counter
- Two Large 0.5" LED Display
- Overload Protection

### Manuals :

(1) All manuals are written in English
(2) Model Answer
(3) Teaching Manuals

### General Terms :

(1) Accessories will be provided where applicable
(2) Manuals & Training will be provided where applicable
(3) Designs & Specifications are subject to change without notice
(4) We reserve the right discontinue the manufacturing of any product

### Warranty:

2 Years

### ORDERING INFORMATION :

| ITEM | MODEL NUMBER | CODE |
|---|---|---|
| MICROWAVE PASSIVE CIRCUIT DESIGN TRAINER | GOTT-MSP-170 | 170-000 |
| DC POWER SUPPLY AND FUNCTION GENERATOR | GOTT-DC POWER SUPPLY & FUNCTION GENERATOR | 500-107 |

* Proposed design only, subject to changes without any notice.