

### Features:

- \* Inside outside precious metal plated with diamond polish.
- \* Corrosion/Oxidation free welded construction for long life.
- \* 100% Tested and calibrated on HP network analyser
- \* Full band Gunn Oscillator, detector and other components
- \* PC serial and audio communication link over microwave.
- \* Resolution and additional DRO X band source
- \* Low Noise High sensitivity opamp based SWR meter
- \* Directional Coupler and Slotted line for VSWR/ Return Loss.

### 1. Micrometer tunable Broadband Gunn Oscillator



Frequency: 8.2-12.4 GHz  
 Power O/P: 10 mW typical  
 S11: >10dB  
 Calibration chart: steps of 100 MHz  
 Body: Solid wire cut Aluminum for thermal stability and long life  
 Tuning: Precision Micrometer Driven solid short

### 2. Broadband PIN Diode Modulator



S11: >15dB  
 S12 off: 10dB  
 S12 on: <2dB  
 Bandwidth: 8.2-12.4 GHz  
 Diode: Microwave SMD package

### 3. X Band Microwave Source



Frequency: 10.5 GHz typical  
 Construction: X band Dielectric Resonator stabilized MESFET source on microstrip  
 Accuracy: 0.1%  
 Modulation: CW/ASK(DC-15 KHz) Ext  
 RF Level: 5mW typical  
 Output Z: 50 ohms with SMA connector

### 4. Calibrated Frequency Meter



S11: >20dB  
 S12: >3dB at resonance  
 Q factor: 1000  
 Accuracy: 1%  
 Calibration Chart: Frequency v/s micrometer in steps of 100 MHz

### 5. Broadband Waveguide Detector



S11: 20dB  
 Sensitivity: 0.5mV/uW  
 Bandwidth: 9.3-11.3 GHz

### 6. Slide Screw Tuner with Precision Micrometer



Resolution X Y: 0.05 mm  
 Drive: Vernier on teflon bearing

### 7. Calibrated Precision Variable Attenuator



S11: >20dB  
 S12: 1 to 25dB variable  
 Resolution: 1dB  
 Accuracy:  $\pm 1.5$ dB  
 Calibration Chart: Attenuation v/s micrometer in steps of 1 dB

### 8. Broadband Fixed attenuator



S12: 10dB  
 S11: 15dB

### 9. 10. Broadband Matched Termination - 2 Nos.



S11: >25dB  
 Bandwidth: 8.2-12.4 GHz

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### 11. Precision Slotted Line with Broadband Detector Probe



S11: >20dB  
S12: <1dB  
Resolution: 0.05mm using vernier  
Sensitivity: 0.1mV/uW

### 12. Broadband Multihole Waveguide Directional Coupler



S41 Coupling: 10dB  
S34 Directivity: 30dB  
S21 Insertion Loss: <1.5dB  
Bandwidth: 8.2-12.4 GHz

### 13. Hybrid / Magic Tee



S11: >10dB  
Isolation: 20dB H & E arms  
Bandwidth: 9.8-10.8GHz

### 14. Series E plane Tee



S11, S22, S33: >20dB  
S12, S13: 3.5dB  
Phase: 180 degree  
Bandwidth: 8.2-12.4 GHz

### 15. Shunt H Plane Tee



S11, S22, S33: >20dB  
S12, S13: 3.5dB  
Phase: 0 degree  
Bandwidth: 8.2-12.4 GHz

### 16. Solid Dielectric cell



Type: Waveguide cavity  
Dielectric: Bakelite, Teflon, Acrylic, Nylon, Polyproylene  
Length: 60 degree empty

### 17. Liquid Dielectric cell



Type: Waveguide cavity  
Window: Kapton  
Filling: Syringe  
Cavity Volume: 1.5cc  
Length: 60 degree empty

### 18. Rectangular waveguide



S11: >20dB  
S12: <1dB  
Bandwidth: 8.2 GHz -12.4 GHz  
Length: 120mm typical

### 19. Calibrated Phase Shifter



S11: >15dB  
S12: >15dB  
Calibration: 10.3 GHz  
Calibration Chart: Phase Vs. Micrometer reading

### 20. Broadband Circulator/Isolator



S11: >20dB  
S12: >20dB  
S21: <1.5dB  
Bandwidth: 8.2 - 12.4 GHz

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### 21.22. Broadband Pyramidal Horn Antenna -2Nos



Gain: 16dB  
S11: >20dB  
Beamwidth : 30 degree E & H

### 29. Reflector Panel



RCS: 0dBsm

### 23. Fixed Short



S11: >60dB  
Flange: UG39/U

### 30. Manual Antenna Rotator



Mount: E & H plane WR90

### 24. Precision Movable Short



S11: >60dB  
Drive: Precision Micrometer  
Plunger: Solid Short

### 31. Digital Gunn Power Supply



Display: LCD for voltage / current  
Gunn Bias Voltage: 2-10 V  
Gunn Current: 0-500 mA  
PIN Mod. Frequency: 800-1200Hz Square wave  
PIN Mod. Voltage: 0-10 V p/p  
PIN Offset Voltage: 0-10 V  
RS 232 port: PC interface for serial data communication  
MIC input: Audio communication

### 25.26. Broadband Waveguide to Coax adapter - 2 Nos



S11: 10dB  
S12: 1.5dB  
Frequency: 8.2-12.4 GHz  
Connector: SMA

### 32. SWR Meter square Law



Frequency: 1 KHz center  
Bandwidth-3dB: 30 Hz  
Sensitivity: 1 uV  
Display: Analog meter 85mm  
Attenuator: 70 dB in 5 dB steps  
Scale: Normal/Expand  
RS232 port: PC interface for data serial communication  
Amplifier Out: For CRO  
Speaker: Inbuilt for audio link

### 27.28. Waveguide Stands - 7 Nos



Mount: E & H plane WR90

### 33. Data Communication Software:



Emulation: RS232 with selection of comports,  
Baud rates: (1200 to 38,400), parity, Data bits, stop bits, Flow control

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### 34. Accessories



BNC- BNC Cable - 5 pcs,  
M4X12 Screw 10 pcs,  
M4X20 screw - 50 pcs,  
RS232 cable - 2 pcs,  
E manual Video + Software  
CD for ease of learning,  
SMA-SMA Coaxial RG316  
Teflon low loss cable,  
Power Cord -4 pcs,

**Dimension: 56 X45 X 36, Weight: 18 Kg, Warranty: 3 yrs.**

#### List of Experiments:

1. Gunn oscillator
  - i) Measurement of current vs. voltage characteristic
  - ii) Measurement of Gunn oscillator power vs supply voltage.
  - iii) Measurement of Gunn oscillator frequency vs supply voltage.
2. Modulator and crystal detector
  - i) Operation of PIN diode modulator & crystal detector.
  - ii) Study of square wave modulation of PIN modulator.
  - iii) Measurement of square law behavior of detector.
3. Propagation modes, wavelength and phase velocity
  - i) Measurement of frequency of source.
  - ii) Measurement of free space & guide wavelength
4. Q and bandwidth of resonance cavity of frequency meter
  - i) Measurement of Q using power measurement techniques.
  - ii) Measurement of Q using SWR meter
5. Power Measurements
  - i) Direct measurement of power
  - ii) Power measurement using directional coupler
  - iii) Measurement of Conjugate and  $Z_0$  power.
  - iv) Measurement of modulated signals
  - v) Measure the tracking of dB scale with attenuator
  - vi) Study mismatch loss and maximum power transfer
6. VSWR and Reflection Coefficient by Standing wave and Double Minimum Method
  - i) Measurement of low, medium & high SWR using slotted line
  - ii) Measurement of High SWR using calibrated attenuator
6. Impedance Measurement
  - i) Measurement of unknown Impedance of load
  - ii) To match an unknown impedance.
7. Waveguide Hybrid( Magic) Tee
  - i) Measurement of Power division or Decoupling between H-arm and E- arm of a Magic Tee.
  - ii) Measurement of Insertion loss of a Magic Tee.
  - iii) Measurement of Return Loss of H arm of a Magic Tee
  - vi) Measurement of VSWR of ports of Hybrid (Magic) Tee
8. Properties of Directional Coupler
  - i) Measurement of coupling factor.
  - ii) Measurement of Directivity.
  - iii) Measurement of return loss of a load.
  - iv) Main line insertion loss, VSWR of ports.
9. Fixed and Variable Attenuator
  - i) Measurement of attenuation using the Power Ratio and RF substitution method
  - ii) Measurement of low values of attenuation.
  - iii) Measurement of S parameters of variable attenuator.
10. To measure dielectric constant of a solid/liquid.
11. To study & calibrate a phase shifter.
12. To study and measure S parameters of waveguide to coax transition
12. To measure insertion loss/isolation/S parameters of isolators & circulator.
13. To establish a Microwave audio & PC-PC serial data communication link.
14. To measure the ANTENNA PARAMETERS (directivity, gain, beam width (Half Power/10dB), front to back ratio, plane of polarization, cross polarization discrimination, side lobe level and its angular position from polar plot, VSWR/return loss) of given antenna.

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