

### Features:

- \* Microwave Trainer with 21 Antennas like Parabolic dish, Patch arrays, Horn etc.
- \* X Band DRO stabilized antenna transmitter and receiver
- \* Microwave power meter receiver with 0.1dB resolution 70 dB dynamic range.
- \* Directional Coupler for VSWR/ Return Loss.
- \* Stepper motor antenna rotator with 1 degree resolution
- \* RS232 interface with polar/cartesian plotting software
- \* Microstrip antennas
- \* All antenna gain, return loss and pattern plot provided
- \* 1000 location Frequency and level storage in receiver
- \* Ability to transfer Digital signal over microwave.

### 1. X band DRO Transmitter



Frequency : X band Dielectric Resonator stabilized MESFET source on microstrip  
 Accuracy : 0.1%  
 Modulation: CW/ASK(DC-15 KHz) Ext  
 RF Level: 1mW typical  
 Output Z : 50 ohms with SMA connector

### 2. X Band DRO Receiver



Frequency : X band Microwave receiver power meter  
 Accuracy : 0.1%  
 Sensitivity : -70 dBm typical  
 Input Z: 50 ohms with SMA connector

### 3. Signal Analyser/Stepper motor controller



Measure : Microwave power level in dBm & dBu  
 Resolution : 0.1dB  
 Demod : Digital out  
 PC interface : RS 232 to PC for antenna Plotting using supplied software  
 Display : 16x2 backlit LCD for angular Position and power level  
 Rotation : 0-359 degrees  
 Control : Menu , Enter , Escape, Up & Down  
 Angle : User selectable steps of 1, 5, 10, 45 degrees  
 Memory : 1000 memories for storing positions and RF levels for quick recall  
 Auto Mode : Automatic rotation in user steps with Datalogging facility.  
 Indication : Beep on reaching the selected Position  
 Power Supply : 100-240V AC, 50-60 Hz

### 1. Monopole



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 1dB  
 Beamwidth : E plane  $80^\circ$   
 Beamwidth : H Plane  $180^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector: SMA

### 2. Dipole



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 2dB  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $180^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector: SMA

### 3. Slot WG narrow wall



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 4dB  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $60^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 10dB

### 4. Slot WG broad wall



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 4dB  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $60^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 10dB

### 5,6. Helix (LHCP) X2Nnos



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 16dB  
 Beamwidth : E plane  $40^\circ$   
 Beamwidth : H Plane  $40^\circ$   
 Polarisation : Circular LH  
 Front to Back Ratio: >10dB  
 Connector: SMA

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### 7,8. Helix (RHCP) X2 Nos



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 16dB  
 Beamwidth : E plane  $40^\circ$   
 Beamwidth : H Plane  $40^\circ$   
 Polarisation : Circular RH  
 Front to Back Ratio: >10dB  
 Connector: SMA

### 13. Parabolic Dish



S11: >10dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 16dB  
 Beamwidth : E plane  $10^\circ$   
 Beamwidth : H Plane  $20^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 25dB

### 9. Patch Microstrip



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 6dB  
 Beamwidth : E plane  $10^\circ$   
 Beamwidth : H Plane  $20^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >10dB  
 Connector: SMA

### 14. Conical Horn



S11: >6dB  
 Bandwidth: 8.2 - 12.4 GHz  
 Gain: 10dB  
 Beamwidth : E plane  
 Beamwidth : H Plane  
 Polarisation : Linear  
 Connector: SMA

### 10. Patch Microstrip Array 2x1



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 6dB  
 Beamwidth : E plane  $10^\circ$   
 Beamwidth : H Plane  $20^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >10dB  
 Connector: SMA

### 15. Pyramidal Horn



S11: >20dB  
 Bandwidth: 8.2 - 12.4 GHz  
 Gain: 16dB  
 Beamwidth : E plane  $20^\circ$   
 Beamwidth : H Plane  $22^\circ$   
 Polarisation : Linear

### 11. Patch Microstrip Array 4x1



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 10dB  
 Beamwidth : E plane  $10^\circ$   
 Beamwidth : H Plane  $20^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >10dB  
 Connector: SMA

### 17. E Plane Sectoral Horn



S11: >20dB  
 Bandwidth: 8.2 - 12.4 GHz  
 Gain: 13dB  
 Beamwidth : E plane  $20^\circ$   
 Beamwidth : H Plane  $80^\circ$   
 Polarisation : Linear

### 12. Patch Microstrip Array 4x4



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 11dB  
 Beamwidth : E plane  $10^\circ$   
 Beamwidth : H Plane  $20^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >10dB  
 Connector: SMA

### 18. H Plane Sectoral Horn



S11: >20dB  
 Bandwidth: 8.2 - 12.4 GHz  
 Gain: 10dB  
 Beamwidth : E plane  $100^\circ$   
 Beamwidth : H Plane  $22^\circ$   
 Polarisation : Linear

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### 19. Dielectric Rod



S11: >6dB  
 Bandwidth:  $10.3 \pm 0.5$ GHz  
 Gain: 1dB  
 Beamwidth : E plane  $50^\circ$   
 Beamwidth : H Plane  $60^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector: SMA

### 20,21, 22. Waveguide to Coax adapter X 3 Nos



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

### 23. Multi Hole Directional Coupler



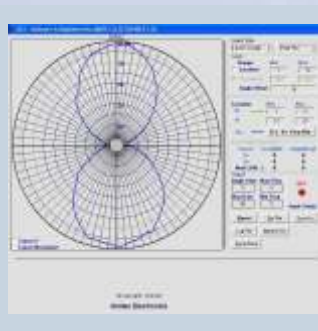
Coupling: 10dB  
 Directivity: 30dB  
 Insertion Loss: <1.5dB  
 Bandwidth: 8.2-12.4 GHz

### 24. Stepper motor controlled antenna monopod



Rotation: 0-359 degree  
 Azimuth  
 Mount: Waveguide WR990 E or H, 1/2" BSW  
 Offset: Adjustable for phase center  
 RCS: Low Non magnetic, non conductive, low dielectric  
 Motor: Stepper Motor with heavy duty reduction gearbox

### 25. Windows Software



RS232 interface with polar plotting software with log, linear cartesian and polar plots, Multiple pattern overlay, Double cursor measurement, Zoom, Colour editing, 1000 location editor, Absolute/Relative, 3dB/10dB beam-width measurement

### 26. Accessories

Non-radiating monopod for transmitting Antenna  
 All necessary connectors and cables  
 Students activity, Teachers Reference Manual  
 SMA - N, N-N Adapter,  
**E-Manual: Installation Video for ease of Learning**  
**Dimensions: 58X52X44cm.**  
**Weight: 21kg.**  
**Warranty: 3 yrs**

### List of Experiments:

1. To measure the variation of field strength of radiated wave, with distance from transmitting antenna.
2. To plot the radiation pattern of an omnidirectional antenna.
3. To plot the radiation pattern of a directional antenna
4. To measure axial ratio and cross polarisation discrimination of vertically horizontally and circularly polarized antennas.
5. To measure the VSWR of the antenna
6. To demonstrate that transmitting and receiving patterns of an antenna are equal and hence confirm the reciprocity theorem of antennas
7. To plot the radiation pattern (E & H Plane Polar & Cartesian Plots on Log/Linear scale of an antenna on PC.
8. 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 Dipole antenna.
10. To measure antenna parameters of Horn (E, H, Pyramidal) & open waveguide antenna.
11. To measure antenna parameters of conical Horn antenna
12. To measure antenna parameters of monopole antenna
13. To measure antenna parameters of Slot(Narrow Wall & Broad Wall) Antenna
14. To measure antenna parameters of Parabolic dish antenna
15. To measure antenna parameters of Patch array antenna
16. To measure antenna parameters of Helix (RHCP & LHCP) antenna. To measure the cross polarization discrimination for circular polarisation.
17. To setup microwave data communication link.

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### Features:

- \* Antenna Training System with over 10 Antennas
- \* PLL transmitter and receiver 86-860 MHz.
- \* 50 KHz step size with measurement in 0.1 dB resolution
- \* 110 dB dynamic range.
- \* Directional Coupler for VSWR/ Return Loss.
- \* Manual antenna rotator.
- \* RS232 interface with polar/cartesian plotting software
- \* All SMA connectors, Teflon Cables.
- \* All antenna gain, return loss and pattern plot provided
- \* 1000 location Frequency and level storage in receiver.
- \* 20dB directivity Directional coupler.
- \* SMA Gold plated connectors in Antennas.

### 1. PLL Synthesized Digital RF Transmitter/Receiver



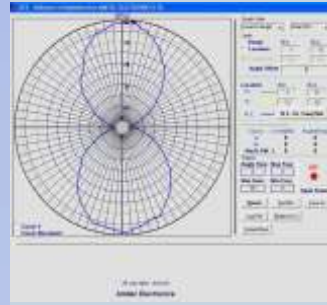
Frequency range: 86 - 860 MHz PLL for Tx and Rx  
 Step size: 0.05, 0.1, 0.25, 0.5, 1, 10, 100 MHz  
 Accuracy: 0.01%  
 Display: 16X2 Backlit LCD  
 Controls: Menu, Enter, Escape, Up & Down  
 Memory: 1000 frequency store/recall  
 Modulation FM: Internal 1KHz/ External Microphone  
 RF Level : +3 dBm typical  
 Attenuator: 35dB internal switchable  
 Impedance: 50 ohms SMA  
 Measurements: RF level in pW, dBm, dBuV, dBm  
 Resolution: 0.1dB  
 Dynamic range: 110 dB (75dB log +35dB attenuator)  
 Speaker: Inbuilt for Audio output  
 PC interface: RS 232 connectivity to PC for antenna plotting using supplied software  
 Auto mode: For antenna gain & SWR bandwidth with transmitter & polar/ cartesian plots with Stepper.  
 Demodulation: FM Demodulation out  
 Rotation: 0-359 degrees with 1 deg resolution  
 Angular steps: 1, 5, 10, 45 degrees  
 Auto mode: 1. Automatic rotation with receiver  
                   : 2. Tracking operation with Tx  
 Mode: CW/CCW rotation, Fast Slow speed modes  
 Down converter: 39MHz out for spectrum analyser  
 RSSI: Received Signal strength Indication for Fading analysis  
 Power Supply : 100-240V AC, 50-60 Hz

### 2. Directional Coupler



Coupling: 17dB  
 Directivity: 20dB  
 Insertion Loss: <1.5dB  
 Bandwidth: 0.05 -1 GHz  
 Usage: Antenna forward & reverse power & VSWR measurements.  
 Connector : SMA

### 3. Software



RS 232 interface with polar plotting with log, linear cartesian and polar plots,  $V_i$ ,  $V_r$  & Return loss plots, Multiple pattern overlay, Double cursor, Zoom, Colour editing, 1000 location editor, Absolute / Relative, 3dB/10dB beam-width, Gain, Front to back, Side lobe level and position, Plot rotate, File-edit, save, get.

### 4. Microstrip Slot



S11: >10dB  
 Bandwidth: 750 ±20 MHz  
 Gain: 2dBi  
 Beamwidth : E plane 60°  
 Beamwidth : H Plane 180°  
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 5. Folded Dipole



S11: >10dB  
 Bandwidth: 600 ±200 MHz  
 Gain: 2dBi  
 Beamwidth : E plane 70°  
 Beamwidth : H Plane 180°  
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 6. Monopole



S11: >10dB  
 Bandwidth: 600 ± 300 MHz  
 Gain: 1dBi  
 Beamwidth : E plane 70°  
 Beamwidth : H Plane 180°  
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 7.8. Dipole L/2 & L/4



S11: >10dB  
 Bandwidth: 600 ± 300 MHz  
 Gain: 2dBi  
 Beamwidth : E plane 70°  
 Beamwidth : H Plane 180°  
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

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### 9,10. Endfire & Broadside phased array



S11: >10dB  
 Bandwidth:  $800 \pm 50$  MHz  
 Gain: 3dBi  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $120^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 15. Yagi 3 el



S11: >10dB  
 Bandwidth:  $700 \pm 100$  MHz  
 Gain: 4dBi  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $80^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >6dB  
 Connector : SMA

### 11. Sleeve



S11: >10dB  
 Bandwidth:  $750 \pm 20$  MHz  
 Gain: 2dBi  
 Beamwidth : E plane  $70^\circ$   
 Beamwidth : H Plane  $180^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 16. Manual Antenna rotator



Low RCS Transmitting tripod, Low RCS Receiving tripod, Connecting cables RG316, Goniometer with 1 degree resolution

### 12. Square Loop



S11: >10dB  
 Bandwidth:  $600 \pm 50$  MHz  
 Gain: 2dBi  
 Beamwidth : E plane  $80^\circ$   
 Beamwidth : H Plane  $120^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 0dB  
 Connector : SMA

### 13. Yagi 4 el



S11: >10dB  
 Bandwidth:  $700 \pm 50$  MHz  
 Gain: 5dBi  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $80^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: >6dB  
 Connector : SMA

### 14. V antenna



S11: >10dB  
 Range:  $800 \pm 100$  MHz  
 Gain: 2dBi  
 Beamwidth : E plane  $60^\circ$   
 Beamwidth : H Plane  $100^\circ$   
 Polarisation : Linear  
 Front to Back Ratio: 6dB  
 Connector : SMA

### Accessories

- 1) Transmitter antenna mounting stand.
- 3) All necessary connectors & Teflon RF cables.
- 4) Students activity & Teachers reference Manual
- 5) Software CD
- 6) Antenna Kit
- 7) Voltage Probe
- 8) Measuring Tape
- 9) RS232 Lead
- 10) SMA-SMA lead 1.5m

### E-Manual: Installation Video for ease of Learning

Dimension : 55 X 45 X 36 cms. Weight : 11 Kg  
 Warranty: 3 yrs.

### Areas of Experimentation and scope of study

- \* Inverse square law of propagation.
- \* Radiation pattern of an Omni and directional antenna.
- \* Vertical, Horizontal and Circularly polarized antennas.
- \* Polarization discrimination linear & circular antennas
- \* Resonant and non-resonant antenna.
- \* Reciprocity of antenna.
- \* Current distribution of an antenna.
- \* Antenna parameters:
- \* Radiation pattern E & H Plane - Polar & Cartesian Plots
- \* Directive gain, beam width (Half Power/10dB), front to back ratio, plane of polarization, side lobe level & angle.
- \* Antenna resonance, VSWR and bandwidth using directional coupler and adjust the antenna.
- \* Comparative study of antennas.
- \* Significance of parasitic element dimensions.
- \* Construct antenna using antenna kit
- \* Voice communication link using antennas. Plus lot more.

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