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SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICROWAVE ENGINEERING LABORATORY

Purchase order Number: SPMVV/SoET/ECE/2020

Dated: 05-11-2021

| S.No. | Equipment Name | Equipment Stock Entry Name with Page Number | Equipment Description | Photograph | Quantity | Usage |
|----------|--|---|---|------------|-----------|--|
| 1 | Bench Setup 1: Microwave Bench (X Band) i. Klystron Power Supply ii. Klystron Tube iii. Klystron Mount iv. Isolator v. Frequency meter vi. Variable Attenuator vii. Slotted section with Probe carriage viii. Movable Short ix. Matched termination x. Detector Mount | MWL - 01 Pg No: 60 | 1. Klystron Power Supply (i) BEAM SUPPLY a. Voltage : +190V to +435V DC with respect to Cathode and continuously Variable. b. Current : 0-50 mA c. max. d. Regulation : Better than 0.5% for $\pm 10\%$ variation in Mains Supply. e. Ripple : Less than 0.5mV rms. (ii) REPELLER SUPPLY a. Voltage : -5V to -260 V DC with respect to Klystron Cathode and continuously variable. b. Regulation : 0.5% for $\pm 10\%$ variation in Mains Supply. | | 02 | This Bench Setup used in IV B.Tech. I Semester MWE Lab for ECE students. This Bench Setup is used to conduct following experiments. <ol style="list-style-type: none"> 1. Reflex Klystron Characteristics. 2. Attenuation Measurement. 3. VSWR Measurement. 4. Directional Coupler Characteristics. 5. Impedance Measurement. 6. Frequency Measurement. 7. Waveguide Parameters Measurement. 8. Scattering Parameters of Circulator. 9. Scattering Parameters if Magic Tee. |

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| <p>xi. VSWR Meter</p> <p>xii. Wave guide stands</p> <p>xiii. Cooling fan</p> <p>xiv. Cables and accessories</p> <p>xv. Directional Coupler</p> <p>xvi. Magic Tee</p> <p>xvii. Circulator</p> | | <p>(iii) 3 1/2 Digit Digital Display</p> <p>a. Digital Voltmeter : To read beam voltage and repeller voltage.</p> <p>b. Digital Ammeter : To read beam current.</p> <p>(iv) HEATER SUPPLY</p> <p>a. Voltage : 6.38 V DC (Regulated) Fixed.</p> <p>b. Current : 750 mA</p> <p>(v) MODULATION</p> <p>a. Modulation Internal :</p> <p>i. Square wave Amplitude: 0-50V(p-p)</p> <p>Frequency: 400Hz – 1300Hz</p> <p>ii. Saw Tooth Amplitude:0-60V(p-p)</p> <p>Frequency: 700Hz – 1.3Hz</p> <p>b. External Modulation : External modulation signal can be fed through a BNC connector on front panel.</p> <p>(vi) OUTPUT CONNECTION (Octal Connector)</p> <p>a. Heater : Pin 2&7</p> <p>b. Cathode : Pin 8</p> <p>c. Beam : Pin 1&8</p> <p>d. Repeller : Pin 1&5</p> <p>(vii) MAINS VOLTAGE : 230 V AC ± 10%, 50Hz</p> <p>(viii) STORAGE AND OPERATING TEMPERATURE : 0⁰ C to 55⁰ C</p> <p>2. Klystron with Mount</p> <p>Band : X</p> <p>Frequency (GHz) : 8.2 -12.4</p> <p>Waveguide : WR-90</p> <p>Flange :UG-39/U</p> <p>3. Klystron Tube</p> <p>Band : X</p> <p>Frequency (GHz) : 8.2 -12.4</p> | | | |
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| | | | <p>Waveguide : WR-90 Flange :UG-39/U Input Connector :From Klystron Power Supply</p> <p>4. Isolator Ports : 2 Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Maximum VSWR : 1.15 Minimum Insertion Loss : 0.46 dB Minimum Isolation : 20 dB Return Loss : -22.4</p> <p>5. Frequency meter Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Calibration Accuracy : ±2% Calibration Increment : 5MHz Maximum VSWR : 1.28 at 10.5 GHz Return Loss : -18.2 at 10.5 GHz</p> <p>6. Variable Attenuator Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Maximum VSWR : 1.25 at 10.5 GHz Average Power : 2W Return Loss : -19.23 at 10.5 GHz</p> <p>7. Slotted section with Probe carriage Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Residual VSWR : 1.01 Slope (dB) : ±0.2 Db Detector : IN 23 Output Connector : BNC (F) Type : Tuneable</p> <p>8. Movable Short Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90</p> | | |
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Flange :UG-39/U
Reflection Coefficient : 0.98

9. Directional Coupler

Band : X
Frequency (GHz) : 8.2 -12.4
Waveguide : WR-90
Flange :UG-39/U
Maximum VSWR : 1.06 at
10.5 GHz
Return Loss : -31 dB at
10.5 GHz
Coupling (dB) : 10.1 ± 0.6
Directivity : 46.0 dB (3%)

10. Magic Tee

Band : X
Frequency (GHz) : 8.2 -12.4
Waveguide : WR-90
Flange :UG-39/U
Maximum length of cell : 200 mm
Plunger Movement : 65 mm

11. Matched termination


Band : X
Frequency (GHz) : 8.2 -12.4
Waveguide : WR-90
Flange :UG-39/U
Maximum VSWR : 1.03 at
10.5 GHz
Return Loss : -33 dB at
10.5 GHz
Average Power : 2W
Type : Fixed

12. Detector mount

Band : X
Frequency (GHz) : 8.2 -12.4
Waveguide : WR-90
Flange :UG-39/U
Detector : IN 21
Output Connector : BNC (F)

13. Circulator

Ports : 3 or 4
Band : X
Frequency (GHz) : 8.2 -12.4
Waveguide : WR-90
Flange :UG-39/U
Maximum VSWR : 1.15
Minimum Insertion Loss : 0.46 dB
Minimum Isolation : 20 dB
Return Loss : -22.4

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| | | | <p>14. VSWR Meter Amplifier Type : High gain tuned at one frequency Sensitivity : 0.1 μV at 200 Ohm for full scale Frequency : 1000 Hz \pm2% Bandwidth : 25-30 Hz Noise Level : Less than 0.02 μV Range : 0 to 60 dB in 10 dB steps Accuracy : \pm0.15dB on one range Meter Linearity : 1% of full scale Gain Control : Coarse and Fine Calibration : Square law, meter indicates SWR, dB Scale Selector : Normal, Expand and -5 dB AC Output : BNC Connector for amplified output Input Connector : BNC (F) Power : 230 V AC, 50 Hz</p> <p>15. Wave guide stands 16. Cooling fan 17. Cables and Accessories</p> | | | |
| 2 | <p>Bench Setup 2: Microwave Bench (C Band) i. Klystron Power Supply ii. Klystron Tube iii. Klystron Mount iv. Isolator v. Frequency meter vi. Variable Attenuator vii. Slotted section with Probe carriage viii. Movable Short ix. Matched termination</p> | MWL - 11 Pg No: 66 | <p>1. Klystron Power Supply (i) BEAM SUPPLY a. Voltage : +190V to +435V DC with respect to Cathode and continuously Variable. b. Current : 0-50 mA max. c. Regulation : Better than 0.5% for \pm10% variation in Mains Supply. d. Ripple : Less than 0.5Mv rms. (ii) REPELLER SUPPLY a. Voltage : -5V to -260 V DC with respect to Klystron Cathode and</p> |  | 02 | <p>This Bench Setup used in IV B.Tech. I Semester MWE Lab for ECE students. This Bench Setup is used to conduct following experiments.</p> <ol style="list-style-type: none"> 1. Reflex Klystron Characteristics. 2. Attenuation Measurement. 3. VSWR Measurement. 4. Directional Coupler Characteristics 5. Impedance Measurement. 6. Frequency Measurement. 7. Waveguide Parameters Measurement. 8. Scattering Parameters of Circulator. |

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| <p>x. detector mount</p> <p>xi. VSWR Meter</p> <p>xii. Wave guide stands</p> <p>xiii. Cooling fan</p> <p>xiv. Cables and accessories</p> <p>xv. Directional Coupler</p> <p>xvi. Magic Tee</p> <p>xvii. Circulator</p> | | <p>continuously variable.</p> <p>b. Regulation : 0.5% for $\pm 10\%$ variation in Mains Supply.</p> <p>(iii) 3 1/2 Digit Digital Display</p> <p>a. Digital Voltmeter : To read beam voltage and repeller voltage.</p> <p>b. Digital Ammeter : To read beam current.</p> <p>(iv) HEATER SUPPLY</p> <p>a. Voltage : 6.38 V DC (Regulated) Fixed.</p> <p>b. Current : 750 mA</p> <p>(v) MODULATION</p> <p>a. Modulation Internal :</p> <p>i. Square wave Amplitude: 0-50V(p-p)</p> <p>Frequency: 400Hz – 1300Hz</p> <p>ii. Saw Tooth Amplitude: 0-60V(pp)</p> <p>Frequency: 700Hz – 1.3Hz</p> <p>b. External Modulation : External modulation signal can be fed through a BNC connector on front panel.</p> <p>(vi) OUTPUT CONNECTION (Octal Connector)</p> <p>a. Heater : Pin 2&7</p> <p>b. Cathode : Pin 8</p> <p>c. Beam : Pin 1&8</p> <p>d. Repeller : Pin 1&5</p> <p>(vii) MAINS VOLTAGE : 230 V AC \pm 10%, 50Hz</p> <p>(viii) STORAGE AND OPERATING TEMPERATURE : 0⁰ C to 55⁰ C</p> | | <p>9. Scattering Parameters if Magic Tee.</p> |
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| | | | <p>2. Klystron with Mount</p> <p>Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG- 149/U</p> <p>3. Klystron Tube</p> <p>Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG- 149/U Input Connector :From Klystron Power Supply</p> <p>4. Isolator</p> <p>Ports : 2 Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG-149 Maximum VSWR : 1.15 Minimum Insertion Loss : 0.46 dB Minimum Isolation : 20 dB Return Loss : -22.4</p> <p>5. Frequency meter</p> <p>Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG-149/U Calibration Accuracy :- Calibration Increment :- Maximum VSWR :- Return Loss :-</p> <p>6. Variable Attenuator</p> <p>Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG- 149/U Maximum VSWR : 1.08 Average Power : 2W Return Loss :-</p> <p>7. Slotted section with Probe carriage</p> <p>Band : C Frequency (GHz) :3.95-5.85 Waveguide : WR-187 Flange :UG- 149/U Residual VSWR : 1.01 Slope (dB) : ±0.2 dB Detector : IN 23 Output Connector : BNC (F) Type : Tuneable</p> | | |
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8. Movable Short

Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG- 149/U
 Reflection Coefficient : 0.98

9. Directional Coupler

Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG- 149/U
 Maximum VSWR : 1.06 at
 10.5 GHz
 Return Loss : -31 Db at
 10.5 GHz
 Coupling (dB) : 10.1 ± 0.6
 Directivity : 46.0 dB (3%)

10. Magic Tee

Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG- 149/U
 Maximum length of cell : 200 mm
 Plunger Movement : 65 mm

11. Matched termination


Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG-149/U
 Maximum VSWR : 1.02
 Return Loss : -33 dB at
 10.5 GHz
 Average Power : 2W
 Type : Fixed


12. Detector mount


Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG- 149/U
 Detector : IN 21
 Output Connector : BNC (F)


13. Circulator




Ports : 3 or 4
 Band : C
 Frequency (GHz) : 3.95-5.85
 Waveguide : WR-187
 Flange : UG- 149/U
 Maximum VSWR : 1.2




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| | | | <p>Minimum Insertion Loss : 0.4 dB Minimum Isolation : 20 dB Return Loss : -</p> <p>14. VSWR Meter Amplifier Type : High gain tuned at one frequency Sensitivity : 0.1 μV at 200 Ohm for full scale Frequency : 1000 Hz \pm2% Bandwidth : 25-30 Hz Noise Level : Less than 0.02 μV Range : 0 to 60 dB in 10 dB steps Accuracy : \pm015dB on one range Meter Linearity : 1% of full scale Gain Control : Coarse and Fine Calibration : Square law, meter indicates SWR, dB Scale Selector : Normal, Expand and -5 dB AC Output : BNC Connector for amplified output Input Connector : BNC (F) Power : 230 V AC, 50 Hz</p> <p>15. Wave guide stands 16. Cooling fan 17. Cables and Accessories</p> | | |
| 3 | <p>Bench Setup 3: Gun Diode Bench i. Gunn Oscillator ii. Gunn power supply iii. PIN Modulator iv. Detector mount v. Wave guide stands vi. Cables and accessories</p> | MWL - 02 Pg No: 60 | <p>1. Gunn Oscillator Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Pushing Factor : -- Bias Voltage Maximum : 10 V Normal Output Power : 10Mw Temperature Coefficient : -- Output Connection : BNC (F) Frequency Adjustment : By micrometer</p> <p>2. Gunn Power Supply Voltage Range : 0 to 12 Volts (+Ve) Current : 750 mA (max.)</p> |  | 02 This Bench Setup used in IV B.Tech. I Semester MWE Lab for ECE students. This Bench Setup is used to conduct following experiments. 1. Gunn Diode Characteristics. |

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| | | | <p>Stability : 0.2% for $\pm 10\%$ variations in the mains voltage</p> <p>Ripple : 1 mV rms</p> <p>Modulation Voltage : 0 to ± 10 Volts p-p</p> <p>Frequency : 800-1100 Hz</p> <p>Output Connector : BNC (F) for Gunn Oscillator, TNC (F) for PIN Modulator.</p> <p>3. PIN Modulator</p> <p>Band : X</p> <p>Frequency (GHz) : 8.2 -12.4</p> <p>Waveguide : WR-90</p> <p>Flange :UG-39/U</p> <p>Bias Voltage maximum : 0-12 V p-p</p> <p>Output Connector : TNC (F)</p> <p>4. Detector Mount</p> <p>Band : X</p> <p>Frequency (GHz) : 8.2 -12.4</p> <p>Waveguide : WR-90</p> <p>Flange :UG-39/U</p> <p>Detector : IN 21</p> <p>Output Connector : BNC (F)</p> <p>5. Movable Short</p> <p>Band : X</p> <p>Frequency (GHz) : 8.2 -12.4</p> <p>Waveguide : WR-90</p> <p>Flange :UG-39/U</p> <p>Reflection Coefficient : 0.98</p> <p>6. Waveguide Stands</p> <p>7. Cables and accessories</p> | | | |
| 4 | <p>Bench Setup 4: Antenna measurements: Consisting of PLL Synthesized RF Source and Detector Module (3 GHz) Transmitter and Receiver Stand with Stepper Motor and Base Plate Universal Plug and Fix Antenna Mounts Antenna set - consisting of</p> <p>A.WIRE ANTENNA</p> <p>1.Monopole Plane base ground</p> | MWL - 03 Pg No: 60 | <ol style="list-style-type: none"> The Frequency of the RF Source should be PLL Synthesized and should generate 100MHz to 3GHz. The Antenna Measurement System should have the facility to be controlled, set parameters and acquire data from the system through PC interface using LABVIEW. The System should also be able to work in the Stand alone mode using Membrane Key pad and 128x64 Graphic LCD Display with backlit. The Controller should be designed using ARM |  | 01 | <p>This Bench Setup used in IV B.Tech. I Semester MWE Lab for ECE students. This Bench Setup is used to conduct following experiments.</p> <ol style="list-style-type: none"> Measure the variation of field strength / Inverse square law. Prove the Reciprocity Theorem of an antenna. Plot Radiation Pattern of all Wired Antenna. Plot Radiation Pattern of all Aperture Antenna. Plot Radiation Pattern of all Reflector |

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| <p>2. Dipole -2 Nos</p> <p>3. Yagi</p> <p>4.Folded Dipole</p> <p>5. Vee Dipole</p> <p>6.Rectangular Loop</p> <p>7.Helical</p> <p>B.MICROSTRIP ANTENNA</p> <p>1.Planar Dipole- 2 Nos</p> <p>2.Planar Monopole</p> <p>3.RMSA- Circular Polarized</p> <p>4. CMSA</p> <p>5.TMSA</p> <p>6. 2X1 ARRAY</p> <p>7. Annular ring</p> <p>8.Chip Antenna</p> <p>C. APERTURE ANTENNA</p> <p>1. E- Horn</p> <p>2.Open ended Waveguide Rectangular</p> <p>D. ARRAY ANTENNA</p> <p>1.Broadside Array</p> <p>2.Collinear Array.</p> <p>E. REFLECTOR ANTENNA</p> <p>1.Corner reflector Plotting Software Necessary Cables, Parabolic Reflector & Accessories</p> | | <p>processor.</p> <p>5. The Transmitter and Motorized Receiver Stand should be made of special material which is inert to EM frequency and should have engraved height and angle scale on it with spirit level at the base.</p> <p>6. Universal plug and fix Antenna mounts should be provided to hold the all types of antenna assembly in vertical and horizontal orientation for co and cross polarization.</p> <p>7. Stepper Motor provided with the system for rotation of Antenna should have minimum 2Kg torque and minimum Step Angle of 1.8 Degree.</p> <p>8. The Source should have the facility to program the Frequency with a resolution of 1MHz.</p> <p>9. The RF Detector should be a Logarithmic Detector with Frequency range of 100MHz to 8 GHz.</p> <p>10. The Radiation pattern of the Antenna under test should be plotted on the PC Screen in Cartesian and Polar Graph.</p> <p>11. Horizontal and Vertical Markers to be provided for measurements like Antenna Gain, FBR , Antenna Resolution, HPBW, BWFN.</p> <p>12. Built in Experimental Set-up to be embedded inside the controller.</p> <p>13. The same system should be able to demonstrate and measure various parameters of the Wired Antenna, Microstrip Antenna, Aperture Antenna, Array Antenna and Reflector Antenna.</p> |  | <p>Antenna.</p> <p>6. Plot Radiation Pattern of all Array Antenna.</p> <p>7. Measurement of Co-Polarization and Cross Polarization.</p> <p>8. Circularly Polarized Antennas Trainer.</p> <p>9. Plot Radiation Pattern of all Planar Antennas.</p> <p>10. Design and Study of Basic Micro Strip Shapes and its Configurations.</p> <p>11. Effects of different feeding techniques in Micro Strip Antenna.</p> <p>12. Resistive and Impedance Stub Loading Characterization.</p> <p>13. Study of Multilayer Stacked Multi-Resonator.</p> |
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| <p>5</p> | <p>Bench Setup Spare 1: Klystron Power Supply</p> | <p>MWL - 04 Pg No: 60</p> | <p>Klystron Power Supply</p> <p>(i) BEAM SUPPLY</p> <p>a. Voltage : +190V to +435V DC with respect to Cathode and continuously Variable.</p> <p>b. Current : 0-50 mA max.</p> <p>c. Regulation : Better than 0.5% for ±10% variation in Mains Supply.</p> <p>d. Ripple : Less than 0.5mV rms.</p> <p>(ii) REPELLER SUPPLY</p> <p>a. Voltage : -5V to -260 V DC with respect to Klystron Cathode and continuously variable.</p> <p>b. Regulation : 0.5% for ±10% variation in Mains Supply.</p> <p>(iii) 3 1/2 Digit Digital Display</p> <p>a. Digital Voltmeter : To read beam voltage and repeller voltage.</p> <p>b. Digital Ammeter : To read beam current.</p> <p>(iv) HEATER SUPPLY</p> <p>a. Voltage : 6.38 V DC (Regulated) Fixed.</p> <p>b. Current : 750 mA</p> <p>(v) MODULATION</p> <p>a. Modulation Internal :</p> <p>i. Square wave Amplitude: 0-50V(p-p)</p> <p>Frequency: 400Hz – 1300Hz</p> <p>ii. Saw Tooth Amplitude:060V(pp)</p> <p>)</p> <p>Frequency: 700Hz – 1.3Hz</p> |  | <p>03</p> | <p>This Bench Setup spare part is used in X-Band Microwave Bench Setup and it produces Beam Supply, Repeller Supply and heat supply to Klystron.</p> |
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| | | | <p>b. External Modulation : External modulation signal can be fed through a BNC connector on front panel.</p> <p>(vi) OUTPUT CONNECTION (Octal Connector)</p> <p>a. Heater : Pin 2&7 b. Cathode : Pin 8 c. Beam : Pin 1&8 d. Repeller : Pin 1&5</p> <p>(vii) MAINS VOLTAGE : 230 V AC \pm 10%, 50Hz</p> <p>(viii) STORAGE AND OPERATING TEMPERATURE : 0⁰ C to 55⁰ C</p> | | | |
| 6 | Bench Setup Spare 2: Klystron Tube | MWL - 05 Pg No: 60 | <p>Klystron Tube</p> <p>Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG- 39/U Input Connector :From Klystron Power Supply</p> |  | 03 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is a specialized linear beam vacuum tube used as an amplifier for high radio frequencies, from UHF up into the microwave range. |
| 7 | Bench Setup Spare 3: Klystron mount | MWL - 06 Pg No: 60 | <p>Klystron with Mount</p> <p>Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG- 39/U</p> |  | 03 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is a waveguide of suitable length having octal base on the board wall of the waveguide for mounting Klystron tube. |
| 8 | Bench Setup Spare 4: Frequency meter | MWL - 07 Pg No: 61 | <p>Frequency meter</p> <p>Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG- 39/U Calibration Accuracy : \pm2% Calibration Increment : 5MHz Maximum VSWR : 1.28 at 10.5 GHz Return Loss : -18.2 at 10.5 GHz</p> |  | 03 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is used for frequency measurement. |

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| 9 | Bench Setup Spare 5: Slotted section with probe section | MWL - 08 Pg No: 61 | Slotted section with Probe carriage Band : X Frequency (GHz) : 8.2 -12.4 Waveguide : WR-90 Flange :UG-39/U Residual VSWR : 1.01 Slope (dB) : ±0.2 dB Detector : IN 23 Output Connector :BNC (F) Type : Tuneable |  | 03 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is used to measure Voltage Standing Wave Ration (VSWR). |
| 10 | Bench Setup Spare 6: Detector mount | MWL - 09 Pg No: 61 | Detector mount Band : X Frequency (GHz) :8.2 -12.4 Waveguide : WR-90 Flange :UG- 39/U Detector : IN 21 Output Connector :BNC (F) |  | 06 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is used to detect the low frequency signals. |
| 11 | Bench Setup Spare 7: SS Tuner | MWL - 10 Pg No: 61 | SS Tuner Band : X Frequency (GHz) :8.2 -12.4 Waveguide : WR-90 Flange :UG- 39/U Residual VSWR : 1.01 Slope (dB) : ±0.2 dB Detector : IN 23 Output Connector :BNC (F) Type : Tuneable |  | 03 | This Bench Setup spare part is used in X-Band Microwave Bench Setup and it is used for impedance matching in the transmission lines. |



**Microwave
Engineering Lab**

















**Wireless
Communication Lab**





Lab In-charge

Mr. A. Sai Suneel

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