

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 1 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|---|--------------------------------|--|---|--|
| <u>ELECTRO-TECHNICAL CALIBRATION</u> | | | | |
| I. | SOURCE | | | |
| 1. | DC Voltage [§] | 1 mV to 10 mV 10 mV to 1 V 1 V to 1000 V | 476 ppm to 7 ppm 7 ppm to 5 ppm 5 ppm | Using Fluke 5700A/ 5730A Calibrator Wavetek 4910 DC Reference Standard Fluke752A Reference Divider by Direct method (@1mV) |
| | High Voltage DC [§] | 1 kV to 10 kV 10 kV to 30 kV | 2 % 2 % | Using FUG HCB 140- 12500, High Voltage Source HI POT Tester HD 140 by Direct method |
| 2. | DC Current [§] | 1 μ A to 100 μ A 100 μ A to 220 mA 100 mA to 11 A | 582 ppm to 21 ppm 21 ppm to 15 ppm 15 ppm to 55 ppm | Using Fluke 5700A/ 5730A Calibrator by Direct method |
| | DC Current (High) [§] | 10 A to 1000 A | 0.32 % | Using Wavetek 9100 Calibrator Fluke 9100- 200 x 10 and x 50 Current Coil by Direct Method |
| 3. | DC Resistance [§] | 1 m Ω to 100 m Ω 100 m Ω to 100 k Ω 100 k Ω to 100 m Ω | 86 ppm to 41 ppm 41 ppm to 5 ppm 5 ppm to 54 ppm | Using Fluke 742A 10k Ω Standard Resistor Guildline Resistors 9334 Series by Direct Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 2 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|--|---|--|
| | | 100 M Ω to 1 T Ω | 54 ppm to 0.22 % | Guidline 9334 Series, 9336 series & 9337 (up to 1T Ω), Keithley 5155 series Resistors by Direct method |
| 4. | AC Resistance ^s | 100 Hz to 1 kHz 0.001 Ω 1 k Ω 100 k Ω 1 kHz to 100 kHz 0.001 Ω 1 k Ω 100 k Ω | 1.4 % to 5.92 % 0.11 % 0.12 % 5.92 % to 10.61 % 0.11 % 0.12 % to 0.55 % | Using HP 42030 Series Standard Resistors QuadTech 1689 Standard Resistors by Direct method |
| 5. | AC Voltage ^s | 10 Hz to 100 kHz 1 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 kHz to 1 MHz 1 mV to 100 mV 100 mV to 1 V 1 V to 10 V 40 Hz to 20 kHz 100 V to 1000 V | 1600 ppm to 268 ppm 268 ppm to 101 ppm 101 ppm to 121 ppm 121 ppm to 273 ppm 0.27 % to 0.087 % 0.087 % to 0.11 % 0.11 % to 0.12 % 135 ppm to 147 ppm | Using Fluke 5700A/ 5730A Calibrator by Direct Method |
| 6. | AC High Voltage ^s | 50 Hz 1 kV to 15 kV | 3 % | Using HI POT Tester HD 140 1 kV to 15 kV by Direct Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 3 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|---|--|---|
| 7. | AC Current ^s | 10 Hz to 10 kHz 100 μ A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 40 Hz to 10 kHz 100 mA to 1 A 1 A to 10 A | 250 ppm to 136.55 ppm 136.55 ppm to 250 ppm 250 ppm to 500 ppm 260.03 ppm to 900 ppm 900 ppm to 1326 ppm | Using Fluke 5700A/5730A Calibrator by Direct Method |
| | | 50 Hz 10 A to 900 A | 0.53 % | Using Wavetek 9100 Calibrator Fluke 9100- 200 x 10 and x 50 Current Coil |
| 8. | Inductance ^s | 1 kHz 10 μ H to 1 mH 1 mH to 10 H | 1.2 % to 0.3 % 0.30 % | IET 1482AA, GR 1482 Series Inductors GR 1491D,IET,1482T, Standard Inductor |
| 9. | Capacitance ^s | 1 kHz 1 pF to 10 pF 10 pF to 1000 pF 1000 pF to 1 μ F 1 μ F to 1 mF | 0.2 % to 0.12 % 0.12 % 0.08 % 0.10 % | GR 1422CD Precision Capacitor GR 1417, Capacitance Standard HP 16380 Series STD Capacitors GR 1423-A STD Decade Capacitor AH 1100 Fused Silica Capacitor GR 1406A By Direct Method |
| | | 100 Hz 10 μ F to 1 mF | 0.30 % | |
| | | 1 mF to 100 mF | 0.20 % | |
| | | 10 kHz to 1 MHz 1000 pF | 0.12% | |
| 10. | Attenuation ^s | 10 Hz to 1 MHz 1 dB to 60 dB | 1 % to 4 % | Using Fluke 9640A RF Reference Source Fluke 5790A AC |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 4 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|---|---|--|---|
| | | 1MHz to 10 MHz 1 dB to 60 dB 10 MHz to 18 GHz 1 dB to 60 dB 18 GHz to 40 GHz 10 dB to 60 dB Fixed Attenuators (10dB to 60dB discrete) | 1 % to 3.5 % 1 % to 4.5 % 2 % to 4 % | Reference standard HP 34401A Digital Multimeter E4418 Power Meter/ E9326A Average Power Sensor E8257D Signal Generator Power Sensor Keysight 8487D/Agilent 8481D Agilent 8482A/ 8481A/8487A by Direct Method |
| 11. | RF Power ^s <1 GHz | 100 kHz to 400 MHz 1 Watt to 150 Watts 10 MHz to 100 MHz 1 Watt to 500 Watts 100 MHz to 1000 MHz 1 Watt to 500 Watts | 6 % 4 % 4.50 % | Directional Coupler NARDA 3020A HP 436A, HP 8482A, HP 8491B Attenuator & High Wattage Load, Amplifier AR 150A400 Amplifier AR 500W 1000B High Power Attenuator Narda, 769-30, Bird 8325 Direct Method Using Power Meter & Directional Coupler |
| | RF Power High Frequency ^s | 100 Watts to 2500 Watts 1 Watt to 1000 watts 1 Watt to 250 watt (Max 40 Watts @ 40 GHz) | 5.50 % 5 % | High Power Attenuator Narda, 769-30, Agilent 8481B/8487A Power sensor Agilent E8257D Signal Generator Bird 8869320 5KW |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 5 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|--|---|---|
| | | | | Load, Terminations Waveguide ,Directional Couplers, Amplifiers High frequency High Wattage by Direct Method |
| 12. | Microwave Power ^s | 100 kHz to 18 GHz 80 % to 100 % | 1.1 % to 2.5 % | Tegam System IIB (M1130A and M1135A) |
| | | 18 GHz to 26.5 GHz 80 % to 100 % | 2 % to 3.5 % | 8487A and 8487D Agilent Power Sensor DC Substitution method |
| | | 26.5 GHz to 40 GHz 80 % to 100 % | 3.50 % | |
| | | 100 kHz to 10 MHz 15 dBm to (-) 20 dBm 10 MHz to 26.5 GHz 15 dBm to (-) 60 dBm 26.5 GHz to 40 GHz 15 dBm to (-) 60 dBm | 1 % to 3 % 1 % to 4.5 % 2 % to 6 % | Using Agilent E8257D Signal Generator IFR 2023A Signal Generator Power sensors Agilent 8482A/8487A/8487D by Direct Method |
| 13. | VSWR ^s | 1.04 to 2.0 VSWR | 0.01 rho to 0.05 rho | Network Analyzer (VNA) Agilent 909F Termination WE mismatch loads Model 1410 up to 18GHz (1.07 VSWR, 1.2VSWR,1.5VSWR and 2.0VSWR) CALKIT 3.5mm Return Loss Measurement by VNA |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 6 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|-----------------------------------|--|---|---|
| | | 1.01 to 1.15 VSWR | 0.01 rho to 0.02 rho | Agilent 901C Termination 40GHz Agilent PNA E8363C Network Analyzer 2.4 mm CALKIT |
| 14. | Frequency ^s | 1 Hz to 40 GHz | 5E-09 Hz to 6Hz | Rubidium Standard Symmetricom 8040C Frequency counter HP 5352B Agilent 33250A/33220A/ Function Generator Agilent E8257D Signal Generator Frequency counter Agilent 53132A Direct Method |
| 15. | Amplitude Modulation ^s | Freq. Range 10 MHz to 1.3 GHz Rate 50 Hz to 50 kHz Depth 5 % to 99 % | 1.50 % | Agilent 8481D Power Sensor Agilent 33120A/33220 Function Generator IFR 2023B Signal Generator Agilent E8257D Signal Generator R&S FSMR Measuring Receiver Power Ratio Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory

Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number

CC-2728

Page 7 of 15

Validity

22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|---|---|---|---|
| 16. | Frequency Modulation ^{\$} Rate Expected Deviation (kHz)/2.4 or 5.52 (1st null or 2 nd Null) | 10 MHz to 1.3 GHz Deviation \leq 400 kHz peak | 1.20 % | IFR 2023A/B ,Signal Generator R&S FSMR Measuring Receiver Agilent E8257D Signal Generator Agilent 33120A/33220 Function Generator BESSELS Null Method |
| 17. | Oscilloscope ^{\$} Amplitude ^{\$} Vertical Deflection | DC 1 mV to 200 V (1M Ω) DC 1 mV to 5 V (50 Ω) Sq.Wave 5 mV to 200 V (1M Ω) Sq. Wave 5 mV to 5 V (50 Ω) | 0.5 % to 0.15 % 0.6 % to 0.15 % 0.6 % to 0.15 % | Using Fluke 9500B Oscilloscope Calibrator TEK DPO 4104 Oscilloscope Direct Method |
| | Time Base Horizontal Axis ^{\$} | 1 ns to 55s | 0.30 ppm | Fluke 9500B Oscilloscope Calibrator Agilent 53132A Frequency by Direct Method Counter/Pendulum CNT90 by Direct Method |
| | Bandwidth ^{\$} | Upto100 MHz 100 MHz to 40 GHz | 3.00 % 4.00 % | Agilent MSO V334A Oscilloscope Agilent E8257D Signal Generator Power Sensor Agilent 8487A TEK DPO4104 Oscilloscope Direct Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 8 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|------------|--|---|---|---|
| II. | MEASURE | | | |
| 1. | Inductance [§] | @1 kHz 10 μ H 100 μ H to 1 mH 1 mH to 10 H | 0.55 % 0.08 % to 0.03 % 0.03 % | Quadtech 1693 RLC Digi Bridge Direct Method |
| 2. | Capacitance [§] | 1 kHz 1pF to 100pF 100 pF to 1 μ F 1 μ F to 1mF @100 Hz 10 μ F to 1mF 1mF to 10mF | 0.33 % to 0.0009 % 0.0009 % to 0.03 % 0.03 % to 0.25 % 0.09 % to 0.12 % 0.12% to 0.7% | AH 2500A Ultra precision capacitance Capacitance Bridge and Quadtech 1693RLC Digbridge by Direct method |
| 3. | Frequency Modulation [§] Rate: Expected Deviation (kHz)/ 2.4 or 5.52 (1st null or 2 nd Null) | 10 MHz to 1.3 GHz Deviation: <400 kHz peak | 1.20 % | MG3632A IFR 2023AB, Signal Generator R&S FSMR Measuring receiver Agilent E8257D Signal Generator Agilent 33120A/33220A Function Generator BESSELS Zero Method |
| 4. | Amplitude Modulation [§] | Freq. Range 10 MHz to 1.3 GHz Rate: 50 Hz to 50 kHz | 1.80% | Agilent 8481D Power Sensor Agilent 33120A/33220 Function Generator |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 9 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|--|---|---|
| | | Depth: 5 % to 99 % | | IFR 2023B Signal Generator Agilent E8257D Signal Generator R&S FSMR Measuring Receiver |
| 5. | Attenuation [§] | 10 Hz to 1 MHz 1 dB to 60 dB 1 MHz to 10 MHz 1 dB to 60 dB 40 MHz to 18 GHz 1 dB to 60 dB 18 GHz to 40 GHz 10 dB to 60 dB Fixed Attenuators (10 dB to 60 dB discrete) | 1% to 3.82% 1% to 3.5% 1% to 3.5% 2 % to 4.5 % | Fluke 9640A RF Reference source Fluke5790A AC Reference standard HP 34401A Digital Multimeter E4418 /HP 437 Power Meter E9326A / HP 8482A/ HP 8481A Power Sensor Agilent E8257D Signal Generator Power Sensor Keysight 8487D/ 8481D /8487A by Direct Method |
| 6. | DC Voltage [§] | 1 mV 1 mV to 10 mV 10 mV to 1 V 1 V to 1000 V | 97 ppm 97 ppm to 6 ppm 6 ppm to 4 ppm 4 ppm | Using Fluke 5700A / 5730A Calibrator, Fluke 8508A Reference Multimeter Wavetek 4910 Fluke 752A Keithley 155 Null Detector Direct method (1mV) Others Nulling Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 10 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|---|---|---|
| | DC High Voltage ^s | 1 kV to 30 kV | 2 % | Using Fluke HV Probe 80K-40, Fluke187 Multimeter by Direct Method |
| 7. | DC Current ^s | 1 μ A to 100 μ A 100 μ A to 100 mA 100 mA to 11 A | 75 ppm to 17 ppm 17 ppm to 12 ppm 12 ppm to 15 ppm | Using Fluke 5700A, Fluke 5730A, Fluke 8508A, AOIP Shunts & Guildline 9334 series Resistors Fluke742A 1ohm Direct V/R by Method |
| | DC High Current ^s | 10 A to 200 A | 0.80 % | Prodigit Shunts Model 7550 with DMM 34401A V/R method |
| 8. | AC Current ^s | 10 Hz to 10 kHz 100 μ A to 1 mA 1 mA to 10 mA 10 Hz to 10 kHz 10 mA to 100 mA 40 Hz to 10 kHz 100 mA to 1 A 40 Hz to 10 kHz 1 A to 10 A | 171.70 ppm to 110.53 ppm 110.53ppm to 150 ppm 181 ppm to 151.51 ppm 70 ppm to 204 ppm 204 ppm to 1054 ppm | Reference Multimeter Fluke 8508A/ Wavetek1281 Self Cal DMM Fluke 5700A/5730A calibrator by Direct Method/Comparison Method |
| | | 50 Hz 10 A to 100 A | 0.81% | Prodigit Shunts Model 7550, DMM Agilent 34401A V/R method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 11 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|--|--|---|
| 9. | AC Voltage ^s | 10 Hz to 100 kHz 1 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 kHz to 1 MHz 1 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 Hz to 20 kHz 100 V to 1000 V | 1456 ppm to 267 ppm 267ppm to 72 ppm 72 ppm to 96 ppm 96 ppm to 243 ppm 2356 ppm to 331 ppm 331 ppm to 241 ppm 241 ppm to 748 ppm 50 ppm to 131 ppm | Fluke 5700A/ 5730A Calibrator Fluke 8508A Reference Multimeter Wavetek 1281 self CAL DMM Fluke 5790A AC Measurement Standard by Direct Method / Comparison Method |
| | AC High Voltage ^s | 50 Hz 1 kV to 15 kV | 2.70 % | Fluke High Voltage Probe 80K-40 Fluke 187 Multimeter by Direct Method |
| 10. | DC Resistance ^s | 1m Ω to 100 m Ω 100 m Ω to 100 k Ω 100 k Ω to 100 M Ω 100 M Ω to 10 G Ω | 92 ppm to 79ppm 79 ppm to 5 ppm 5 ppm to 15 ppm 15 ppm to 0.15 % | Using 9334 STD Resistors Guildline 6675 DCC Resistance Bridge Fluke 742A STD Resistor Wavetek 1281 DMM/Fluke 8508A Reference Multimeter V/I method Direct/ Ratio Method |
| 11. | Frequency ^s | 1 Hz to 40 GHz | 5E-09 Hz to 6Hz | Rubidium freq.STD Symmetricom 8040C, Freq.Counter Agilent 53132A HP 5352B /HP 5350B Agilent 33250A/33220A |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 12 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|---|---|---|--|
| | | | | Function Gen Agilent E8257D Signal Generator |
| 12. | Distortion ^s (THD) | 100 Hz to 150 kHz | 4 % | R&S FSMR Measuring Receiver by Direct Method |
| 13. | Microwave Power ^s | 100 kHz 10 MHz 15 dBm to (-) 20 dBm | 1 % to 3 % | Agilent 8487D /8481D/ 8481A /8487A / 8482A Power Sensor |
| | | 10 MHz to 26.5 GHz 15 dBm to (-) 60 dBm | 2 % to 4.5 % | Agilent E8257D Signal Generator by Direct Method |
| | | 26.5 GHz to 40 GHz 15 dBm to (-) 60 dBm | 2 % to 6 % | |
| 14. | Microwave Power ^s (Cal Factor) 100 kHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz | 65 % to 118 % @1 mW 65 % to 118 % @1 mW 65 % to 118 % @1 mW | 1.1 % to 2 % 2 % to 3 % 3 % | F1130A RF Transfer Standard F1135A RF Transfer Standard WE1107-8 LUCAS Weinchel DC Substitution method |
| 15. | RF Power ^s <1 GHz Measure | 100 kHz to 400 MHz 1 Watt to 150 Watts 10 MHz to 100 MHz 1 Watt to 500 Watts 100 MHz to 1000 MHz 1Watts to 500Watts | 5 % 4.50 % 5% | Directional Coupler NARDA 3020A ,HP 436A Power Meter, HP8482APower Sensor, HP8491B Attenuator & High Wattage Load, Amplifier AR150A400 Amplifier 500W 1000B High Power Attenuator Narda, 769-30,Bird |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 13 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|---------------------------------------|--|---|---|
| | | | | 8325 Direct method Using Power Meter & Directional Coupler |
| | RF Power ^s | 100Watts to 2500 Watts 1 Watt to 1000 Watts 1 Watt to 250 Watts 1Watt to 40 Watts (Max 40 Watts@ 40 GHz) | 5.52 % 5 % 5 % 5 % | Bird 8869-5 kW Load, Wave Guide Terminations, Directional Couplers, Agilent 8481B/8487A Power Sensor, AgilentE8257D Signal Generator, Amplifiers High Frequency, High Wattage High Power Attenuator NARDA 769-30 Direct Method Using Power Meter & Directional Coupler |
| 16. | VSWR ^s 10 MHz to 18 GHz | 1.04 to 2.0 VSWR 0.019 rho to 0.33 rho | 0.02 rho to 0.05 rho | Network Analyser Agilent E8363C Agilent 909F Termination WE mismatch loads Model 1410 18GHz (1.07 VSWR, 1.2VSWR, 1.5VSWR And 2.0 VSWR) CALKIT 3.5 mm |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 14 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|--------------------------------|------------------|---|--|
| | | 1.01 to 1.15VSWR | 0.01 rho to 0.02 rho | Agilent 901C Termination/Power Sensor 8487A up to 40GHz Agilent PNA E8363C Network Analyser, 2.4 mm CAL KIT by Direct Method |

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager

Laboratory Calibration Laboratory, Electronic Measuring Instruments,
Department of Quality Assurance Division, Bharat Electronics
Limited, Jalahalli, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2728

Page 15 of 15

Validity 22.06.2018 to 21.06.2020

Last Amended on -

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----------------------------------|----------------------------------|---|---|---|
| <u>OPTICAL CALIBRATION</u> | | | | |
| 1. | Optical Power [*] | 10 dBm to (-) 50 dBm Wavelength 1310 nm & 1550 nm | 0.34 dB | Using Agilent 81 64B Light Wave Measurement System Agilent 81657 A Single Mode Lazer Source Agilent 81634-B power Module, Agilent 81570A Single Mode Attenuator, Wavelength 1330 nm & 1550 nm by Comparison Method |
| 2. | Optical Attenuation [§] | 10 dB to (-) 50 dB Wavelength 1310 nm & 1550 nm | 0.33 dB | Using Agilent 81657 A Single Mode Lazer Source Agilent 81634-B Power Sensor Module Agilent 81570A Single Mode, Attenuator by Comparison Method |

* Measurement Capability is expressed as an uncertainty (\pm) at a confidence probability of 95%

§ Only in Permanent Laboratory

Rajeshwar Kumar
Convenor

Avijit Das
Program Manager