

Laboratory **Electronics Regional Test Laboratory (North), S-Block, Okhla Industrial Area, Phase-II, New Delhi**

Accreditation Standard **ISO/IEC 17025: 2005**

Certificate Number **CC-2137**

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Validity **11.02.2019 to 10.02.2021**

Last Amended on **05.07.2019**

"In view of the transition for ISO/IEC 17025:2017, the validity of this accreditation certificate will cease on 30.11.2020"

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>ELECTRO-TECHNICAL CALIBRATION</u>				
I.	SOURCE			
1.	DC Voltage [#]	1 V 10 V 100 nV to 1 mV 1 mV to 100 mV 100 mV to 10 V 10 V to 1100 V	2 ppm 1 ppm 0.5 % to 0.015 % 150 ppm to 3.5 ppm 3.5 ppm 3.5 ppm to 7 ppm	Using Wavetek 7004N, Wavetek 4808, Fluke 5720A by Direct Method
	DC High Voltage [#]	1kV to 40 kV	0.5% to 0.1%	Using Hipotronics HD140, Fluke410B, Fluke80K-40
2.	AC Voltage [#]	10 Hz to 30 MHz 1m V to 3.5 V 10 Hz to 20 kHz 1 mV to 220 mV 220 mV to 22 V 22V to 220V 20 kHz to 1 MHz 1 mV to 220 mV 220mV to 22V 22V to 220V 20 Hz to 100 kHz 220 V to 600 V	0.032% to 4% 120 ppm to 650 ppm 50 ppm to 400 ppm 50 ppm to 260 ppm 200 ppm to 2300 ppm 80 ppm to 2700 ppm 80 ppm to 8000 ppm 50 ppm to 100 ppm	Using Fluke 5720A & Wavetek 4808 by Direct Method
	AC High Voltage [#]	50 Hz 1kV to 40 kV	1%	Using Hipotronics HD140, Fluke80K-40

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
3.	DC Current [#]	100 nA to 10 µA 10 µA to 100 mA 100 mA to 2 A 2 A to 11 A 11 A to 50 A 50 A to 1000 A	0.22% to 35 ppm 35 ppm to 46 ppm 46 ppm to 80 ppm 85 ppm to 0.036% 0.25 % 0.25 % to 1 %	Using Fluke 5720A & Wavetek 4808 100 mΩ Guidelines 9336, Fluke 5725A, Rotek 380 Fluke 5725A & Current Coil by Direct Method
4.	AC Current [#]	10 Hz to 10 kHz 10 µA to 22 mA 40 Hz to 10 kHz 22 mA to 11 A 40 Hz to 70 Hz 20 A to 1000 A	0.021% to 0.13% 0.026% to 0.1% 0.52%	Using Fluke 5720A, Wavetek 4808 & Fluke 5725, Using Fluke 5520A & Current Coil by Direct Method
5.	DC Power [#]	100mW to 1W 1W to 20kW (1V to 1000V/ 1mA to 20A)	0.02 % to 0.05 %	Using Fluke 5520A, with Fluke 5725A by Direct Method
	Oscilloscope Calibration			
	Time Base [#] (Marker)	1 ns to 55 s	0.1% to 10 ppm	
	Deflection Factor [#] (Amplitude)	10 Hz to 10 kHz 5 mV to 210 V (1 MΩ) 1 mV to 5.56V (50 Ω)	0.4 % to 0.05 % 0.4 % to 0.05 %	
	Bandwidth [#]	Upto 1.1 GHz	2.5 % to 4.0 %	

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
7.	Inductance [#]	1 kHz 100 μ H to 10 H 100 H 10 kHz to 100 kHz 10 mH to 25 mH	0.06 % to 0.011 % 0.04 % 0.12 % to 0.36%	Using GR 1482 Series by Direct Method As per 100 H by Simulation
8.	Capacitance [#]	1 kHz 1 pF 10 pF to 1000 pF 1000 pF to 1 μ F 1 μ F to 1000 μ F 10 kHz to 1 MHz 1 pF to 1000 pF 10 kHz to 100 kHz 1000 pF to 1 μ F	0.01 % 12 ppm 12 ppm to 0.011 % 0.011 % to 0.5 % 0.5 % to 0.05 % 0.03 % to 0.2 %	Using GR 1403 Series, GR 1404, 1405, 1406, 1409, 1423 Series, Fluke 5520A HP 16382 Series by Direct /Comparison Method
9.	DC Resistance [#]	0.1 m Ω 1 m Ω , 10 m Ω , 100 m Ω 1 Ω 10 Ω , 100 Ω 1 k Ω 10 k Ω 100 k Ω to 10 M Ω 100 M Ω 1 G Ω to 100 T Ω	50 ppm 2.2 ppm to 4 ppm 0.7 ppm 0.5 ppm to 1.9 ppm 1.7 ppm 15 ppm 1.5 ppm to 3.0 ppm 20 ppm 0.02% to 0.12 %	Using Guildline 9230, Tinsley 5686, L&N 4000, Guildline 9334, Tinsley 5685A, Tinsley 5685 B, Tinsley 5685 B, Guildline 9330, Guildline 9334, Guildline 9336 & 9337 Series by Direct Method
10.	AC Resistance [#]	Upto 1 kHz 1 Ω to 10 k Ω 10 k Ω to 100 k Ω	70 ppm to 10 ppm 10 ppm to 110 ppm	Using Tinsley 5685 & GR 1440 by Direct Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
11.	Frequency [#]	100 kHz, 1 MHz, 5 MHz, 10 MHz 0.01 Hz to 40 GHz	5*10 ⁻¹¹ 3.5*10 ⁻⁷ to 5*10 ⁻¹¹	Using Freq. Std. Fluke 910R, Rb. Freq. Std. R &S XSRM-Z (with Freq. converter), Freq. std. GR1115 Sig. Gen Keysight N5181B, Gigatronics 2440M, R&S SMT-06, (Locked with Ref Std Freq.) by Direct / Comparison Method
12.	Time Interval [#]	1s to 3600 s	3*10 ⁻⁷	Using Freq. Counter Pendulum CNT-90, HP 5315A, Agilent 53132A, Agilent 53152A, by Direct / Comparison Method
13.	RF Power [#]	100 kHz to 10 MHz 10 μ W to 20 mW 10 MHz to 18 GHz 100 nW to 20 mW 10 MHz to 1 GHz 20 mW to 10 W	5.5 % to 8 % 5.5 % to 7 % 7 %	Using Sig. Gen R&S SMT-06, Keysight N5181B Gigatronics 2440M with HP438A, Boonton 52012, 52018, 52026 Signal Gen with Amplifier & HP 438A by Direct / Comparison Method
14.	Attenuation [#]	50 kHz to 2.7 GHz 1 dB to 60 dB 10 MHz to 18 GHz 30 dB	0.35 dB 0.35 dB to 0.45 dB	Using R&S DPSP RF Attenuator by Direct / Comparison / Substitution Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
15.	Amplitude Modulation# (Depth)	CW : 10 MHz to 2.5GHz 30 % to 90 % (MF: 30 Hz to 1 kHz)	4 .1%	Using Sig. Gen R&S SMT-06, Keysight N5181B Gigatronics 2440M, Boonton 8201 by Direct / Comparison Method
16.	Frequency Modulation# (Deviation)	CW : 10 MHz to 2.5 GHz 10 kHz to 100 kHz (MF: 1 kHz)	6.1 %	Using Keysight N5181B, Gigatronics 2440M, R&S SMT-06, Boonton 8201 by Direct/ Comparison Method
II.	MEASURE			
1.	DC Voltage# DC High Voltage#	0.1 mV to 100 mV 100 mV to 1000 V 1kV to 10 kV 10kV to 40kV	100 to 5 ppm 5 ppm 0.05 % 0.05 % to 1%	Using Fluke 8508 A,Fluke 752A, Wavetek 4950, 7004N, Agilent 34420,HP 3458A Using Fluke 80E, Fluke 80K40 with DMM by Direct / Comparison Method
2.	AC Voltage# AC High Voltage#	10 Hz to 1 MHz 1 mV to 22 mV 22 mV to 700 mV 700 mV to 22 V 10 Hz to 100 kHz 22 V to 1050 kV 50 Hz 1kV to 28 kV	1000 to 100 ppm 1000 to 20 ppm 20 to 70 ppm 70 to 150 ppm 0.5 % to 1 %	Using Fluke 792A, Fluke 8508 A, Wavetek 4950, HP 3458A by Direct / Comparison Method Using Fluke 80 K40 with DMM by Direct / Comparison Method

Ashish Kakran
Convenor

Battal Singh
Program Manager

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3.	DC Current [#]	5 pA to 100 nA 100 nA to 100 μ A 100 μ A to 1 A 1 A to 20 A 20 A to 100 A 100 A to 1000 A	2 % to 0.03 % 0.03% to 20 ppm 20 to 10 ppm 10 to 30 ppm 30 to 200 ppm 0.02 % to 1.3 %	Using Dig. Tera Om Meter Guildline 6520 & Pico Amp. Source Keithley 261 in Shielded Chamber Keithley 410, Fluke 8508A, Wavetek 4950, Fluke 3458A, Std Resistance Tinsley & L&N, L&N 4000, Shunt Guildline 9230 with DMM, CA Current Clamp with 4050 Tektronix 6.5 Digit DMM by Direct / Comparison Method
4.	AC Current [#]	10 Hz to 10 kHz 1 μ A to 1 A 1A to 20A 10Hz to 1 kHz 20A to 300 A 45 Hz to 400 Hz 1 A to 1000 A	100 ppm to 500 ppm 100 ppm to 500 ppm 0.1% 0.1 % to 1 %	Using Fluke 8508 A, Fluke 3458A, Fluke A40, Wavetek 4950, Fluke 5720A HP 34401With Shunt Std. Resistance Tinsley, Std. CT Voltek-PM6000 with4050 Tektronix 6.5 Digit DMM, CA Current Clamp with 4050 Tektronix 6.5 Digit DMM by Direct / Comparison Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
5.	LF Power	50Hz & 60Hz PF Unity to 0.1 (Lead & Lag) 10V to 600V, 5mA to 200A	100 ppm to 120 ppm	Using MSB-100, Hsiang Cheng-3100E, By Direct/ comparison
6.	LF Energy	25Hz & 100Hz PF Unity to 0.1 (Lead & Lag) 10V to 600V, 5mA to 200A	100 ppm to 120 ppm	Using MSB-100, Hsiang Cheng-3100E, By Direct/ comparison
7.	Power Factor	25Hz & 1kHz 0 to 1 (Lead & Lag)	\pm 0.0004 PF	Using MSB-100, Hsiang Cheng-3100E, YEW2524 By Direct/ comparison
8.	DC Power [#]	100mW to 20 kW (1 V to 1000 V/1 mA to 20 A)	0.02% to 0.05%	Using Wavetek 4950, Fluke 8508A by Direct / Comparison Method
9.	Inductance [#]	1k Hz to 100 kHz 100 μ H to 25 mH 1 kHz 100 μ H to 10 H 100H	0.1 % to 0.35 % 0.02% to 0.05% 0.052%	Using Quadtech 1689, GR 1482 Series, GR 1409 Series by Direct/Comparison / Simulation Method
10.	Capacitance [#]	1 kHz 1 pF to 1000 pF 1000 pF to 100 μ F 10 kHz to 1 MHz 1 pF to 1000pF	80 to 21 ppm 21 ppm to 0.3 % 0.1% to 0.06 %	Using IET 1616, GR 1620A Quadtech 1689, ESI 2110, GR 1688 HP LCR Meter 4275 A by Direct/Comparison Method

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11.	DC Resistance [#]	100 μΩ to 100 mΩ 100 mΩ to 10 kΩ 10 kΩ to 1 GΩ 1 GΩ to 20 GΩ 20 GΩ to 1 TΩ 10 TΩ to 100 TΩ	0.1% to 50 ppm 50 ppm to 1.2ppm 1.2 ppm to 40 ppm 40 ppm to 0.1% 0.1% to 0.2% 0.2 % to 1 %	Using Guildline 6675, Guildline 6623, Guildline 6520 by Ratio Comparison Method
12.	AC Resistance [#]	1 kHz 1 Ω to 100 kΩ	0.01 % to 0.02 %	Using Quadtech 1689 by Direct/Comparison Method
13.	Frequency [#]	0.01 Hz to 46 GHz	6*10 ⁻⁷ to 5*10 ⁻¹¹	Using Agilent 53132A, 53230A HP 5345A, Agilent 53152A, (Locked with Ref Freq Std) by Direct/Comparison Method
14.	Time Interval [#]	1s to 3600 s	3*10 ⁻⁷	Using HP 5315A, Pendulum CNT - 90 by Direct/Comparison Method
15.	RF Power [#]	100 kHz to 18 MHz 10 μW to 20 mW 10 MHz to 18 GHz 100 nW to 20 mW 1 MHz to 1 GHz 20 mW to 10 W	5.5 % to 8% 5.5 % to 8% 8 %	Using R&S SMT-06, Signal Gen. Keysight N5181B Gigatronics 2440M with HP438A, Boonton 52012, 52018, 52026 Signal Gen with Amplifier & HP 438A by Direct / Comparison Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
16.	Attenuation [#]	100 kHz to 10 MHz 1 dB to 40 dB 10 MHz to 18 GHz 1 dB to 60 dB	0.35 dB 0.35 dB to 0.48dB	Using R&S DPSP, Boonton 52012, 52018, 52026, HP 438A, R&S ZVB20 by Direct / Comparison/ Substitution Method
17.	Amplitude Modulation [#] Depth	CW: 10 MHz to 2.5 GHz 10 % to 90 % (MF:30 Hz to 1 kHz)	4.1 %	Using Boonton 8201 by Direct / Comparison Method
18.	Frequency Modulation [#] (Deviation)	CW: 10 MHz to 2.5 GHz 10 kHz to 100 kHz (MF: 1 kHz)	6.1 %	Using Boonton 8201 by Direct/Comparison Method
19.	Reflection Coefficient [#]	10 MHz to 18 GHz $ \Gamma $: 0 to 0.5	$\Delta \Gamma $: 0.015 to 0.04	Using R & S ZVB-20 by Direct Method

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<u>MECHANICAL CALIBRATION</u>				
I.	PRESSURE INDICATING DEVICES			
		3.0 bar to 50 bar (g)	0.008 %rdg.	Using Pressure Balance (DWT) with Cross float Method
		>50.0 bar to 700.0 bar (g)	0.009 %rdg.	Using Pressure Balance (DWT) with Cross float Method
	Digital /Analog Pressure Gauge	0 bar to 700.0 bar (g)	0.02 % rdg.	Using Dead weight Tester
		0 bar to 13.5 bar (g)	0.06 % rdg.	Using Pressure Balance Comparison Method
		>13.5 bar to 200.0 bar (g)	0.013% rdg.	Using Pressure Balance Comparison Method
		0.1 bar to 2.6 bar (abs)	0.07% rdg.	Using Precision Pressure indicator Druck, 740 by Comparison Method
		(-) 0.9 bar to (-) 0.1 bar (g)	0.13% rdg.	Using Precision Pressure indicator Druck, 740 by Comparison Method

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II.	WEIGHTS			
	Weights ^s (F1 class and coarser)	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g	0.013 mg 0.013 mg 0.013 mg 0.013 mg 0.013 mg 0.013 mg 0.013 mg 0.015 mg 0.018 mg 0.022 mg 0.030 mg 0.033 mg 0.042 mg 0.051 mg 0.061 mg 0.102 mg 0.203 mg	
	M2 class and coarser	500 g 1 kg 2 kg 5 kg 10 kg	0.12 g 0.12 g 0.12 g 0.12 g 0.20 g	
III.	WEIGHING SCALE AND BALANCE			
		1mg to 200g $d \geq 0.01$ mg	0.1 mg	Using E2 class weight as per Procedure based on OIML R -76 (2006)
		>200 g to 12 kg $d \geq 0.1$ g >12 kg to 22 kg $d \geq 2.0$ g	0.2 mg 2.2 g	Using E2 class weight as per Procedure based on OIML R -76 (2006)

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IV.	ACCELERATION AND SPEED			
1.	Tachometer ^s (Non-Contact Type)	60 rpm to 5000 rpm 5000 rpm to 20000 rpm	0.2 rpm 1.4rpm	Using Tachometer By Comparison
V.	DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)			
1.	Vernier Caliper ^s L.C.: 0.01 mm	0 to 200 mm 0 to 300 mm	0.016 mm 0.016 mm	Using 'O' Grade Slip Gauge by Comparison Method
2.	Micrometer ^s (External) L.C.: 0.001 mm L.C.: 0.01 mm	0 to 25 mm 0 to 25 mm	0.003 mm 0.015 mm	Using 'O' Grade Slip Gauge by Comparison Method
3.	Dial Gauge ^s (Plunger Type) L.C.: 0.001 mm	0 to 25 mm	0.003 mm	Using 'O' Grade Slip Gauge by Comparison Method
VI.	ACOUSTICS			
1.	Sound Level [#]	1 kHz 94 dB	0.3 dB	Using B&K 4230 by Direct Method

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<u>OPTICAL CALIBRATION</u>				
1.	Optical Power [§]	(-) 50 dBm to 10 dBm at 1310 nm & 1550 nm	0.30 dB	Using Optical Power Meter, EXFO, IQ-1502 by Standard Method
2.	Optical Attenuation [§]	1 dB to 50 dB (at 1310 nm & 1550 nm)	0.20 dB	Using Variable Attenuator, EXPO, IQ-3100 by Standard Method
3.	Optical Length [§]	2.2 km to 14.9 km	0.0021 km	Using Optical Fiber Spool by Standard Method

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<u>THERMAL CALIBRATION</u>				
I.	TEMPERATURE			
1.	RTDS, Thermocouple, Temperature Measuring Devices with Probes [§]	(-) 50 °C to 200 °C	0.05 °C	Using SPRT, Digital Thermometer & Liquid Bath by Comparison Method
2.	RTDS, Thermocouple, Temperature Measuring Devices with Probes [§]	200 °C to 660 °C	0.15 °C	Using SPRT, Digital Thermometer & Dry Block Bath by Comparison Method
3.	Thermocouple, Temperature Measuring Devices with Probes [§]	660 °C to 1000 °C	1.2 °C	Using 'S' Thermocouple, Digital Thermometer, High Temperature Furnace & Zero ref. bath by Comparison Method
4.	Liquid In Glass Thermometer [§]	(-) 50 °C to 200 °C	0.08 °C	Using SPRT, Digital Thermometer & Liquid Bath by Comparison Method
5.	Temperature Indicator With Sensor of Liquid Bath [§]	(-) 50 °C to 300 °C	0.05 °C	Using SPRT with Digital Thermometer by Comparison Method (Single Point Calibration)
6.	Temperature Indicator With Sensor of Dry Block Bath [§]	50 °C to 660 °C	0.15 °C	Using SPRT with Digital Thermometer by Comparison Method (Single Point Calibration)

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7.	Temperature Indicator With Sensor Of Dry Block / Furnace [§]	150 °C to 1000 °C	1.2 °C	Using 'S' Thermocouple, Digital Thermometer & Zero Ref. bath by Comparison Method (Single Point Calib)
8.	Temperature Chamber/Oven/ Freezer [§]	(-) 80 °C to 200 °C	0.60 °C	Using Temperature Calibrator with RTD's Sensors & Data Logger with RTDS by Comparison Method (Multi Point Calibration)
9.	RTDS, Thermocouple, Temperature Measuring Devices with Probes*	(-)50 °C to 200 °C	0.06 °C	Using SSPRT, Digital Thermometer & Liquid Bath by Comparison Method
11.	Thermocouple, Temperature Measuring Devices with Probes*	660 °C to 1000 °C	1.4 °C	Using 'S' Thermocouple, Digital Thermometer, High Temperature Furnace & Zero ref. bath by Comparison Method
12.	Temperature Indicator with Sensor of Liquid Bath*	(-) 50 °C to 200 °C	0.06 °C	Using SSPRT with Digital Thermometer by Comparison Method (Single Point Calibration)
13.	Temperature Indicator With Sensor of Dry Block Bath*	Ambient to 660 °C	0.2 °C	Using SSPRT & Digital Thermometer by Comparison Method (Single Point Calibration)

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14.	Temperature Indicator With Sensor of Dry Block bath/ Furnace*	660 °C to 1000 °C	1.4 °C	Using 'S' Thermocouple, Digital Thermometer & Zero Ref. bath by Comparison Method (Single Point Calibration)
15.	Temperature Chamber/Oven/ Freezer/Incubator (for Non-Medical Applications)*	(-) 80 °C to 200 °C	0.6 °C	Using Temperature Calibrator with RTD's Sensors & Data Logger with RTDs by Comparison Method (Multi Point Calibration)
II.	SPECIFIC HEAT & HUMIDITY			
1.	Humidity / Temperature Chamber [§]	20 % RH to 95 % RH 10 °C to 55 °C	1.0 % RH	Using RH-Temperature Indicator by Comparison Method
2.	Humidity/ Temperature & Humidity Indicator [§]	30 % RH to 95 % RH 25 °C to 55 °C	1.0 % RH 0.3 °C	Using RH-Temperature Indicator with Chamber by Comparison Method
3.	Humidity/ Temperature Chamber*	20 % RH to 95 % RH 10 °C to 55 °C	1.3 % RH 0.3 °C	Using RH-Temperature Indicator by Comparison Method

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

[§]Only in Permanent Laboratory

*Only for Site Calibration

The laboratory is also capable for site calibration however, the uncertainty at site depends on the prevailing actual environmental conditions and master equipment used.

^ϕ Laboratory can also calibrate instruments/devices of coarser resolution / least count within the accredited range using same reference standard/ master equipment under the scope of accreditation.

** Relative accuracy error has not been considered for CMC estimation.