Laboratory	**Northlab India Pvt. Ltd.-Hosur (Plant-4), Plot No. 21, Phase-II, Hosur Valley Site, Viswanathapuram, Hosur, Tamil Nadu**		
Accreditation Standard	**ISO/IEC 17025:2005**		
Discipline	**Electro-Technical Calibration**	**Issue Date**	**27.01.2014**
Certificate Number	**C-1011**	**Valid Until**	**26.01.2016**
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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
MEASURE			
1. DC VOLTAGE$	10 µV to 1 mV	0.80% to 60 ppm	Using DC Ref Std , Ref Divider, Kelvin Varley (KV) Divider and Null Detector By Null Method
	1 mV to 10 mV	60ppm to 10 ppm	
	10 mV to 100 mV	10ppm to 4 ppm	
	100 mV to 1000 V	4 ppm	
2. AC VOLTAGE$			
	10 Hz to 40 Hz		Using Micropot,DC Ref Std, KV Divider & Null meter
	1 mV to 135 mV	0.1% to 510 ppm	
	350 mV to 1 V	510 ppm to 61 ppm	
	40 Hz to 20 kHz		Using Micropot / Thermal Voltage Convertor (TVC) ,DC Ref Std, KV Divider & Nullmeter By Substitution Method
	1 mV to 135 mV	0.23% to 700 ppm	
	350 mV to 0.5 V	700 ppm to 20 ppm	
	0.5 V to 1000 V	20 ppm to 200 ppm	
	20 kHz to 30 kHz		
	1 mV to 135 mV	0.23% to 700 ppm	
	350 mV to 0.5 V	700 ppm to 20 ppm	
	0.5 V to 600 V	20 ppm to 180 ppm	
	30 kHz to 100 kHz		
	1 mV to 135 mV	0.23% to 700 ppm	
	350 mV to 0.5 V	700 ppm to 20 ppm	
	0.5 V to 220 V	20 ppm to 250 ppm	
	100 kHz to 1 MHz		
	1 mV to 135 mV	0.23% to 700 ppm	
	350 mV to 0.5 V	700 ppm to 20 ppm	
	0.5 V to 20 V	20 ppm to 110 ppm	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
3.	**DC CURRENT** [$]	10 µA to 1 A 1 A to 20 A	30 ppm 30 ppm to 35 ppm	Using Std Resistor, DC Ref Std , Reference Divider, Kelvin Varley Divider and Null Detector By Direct Method
4.	**AC CURRENT** [$]	20A to 100 A	35 ppm to 500 ppm	Using Current Shunt, 8.5 DMM By Direct Method
		1kHz 10 µA to 5 mA	120 ppm	Using Standard Resistor, MFC, 8.5 digit DMM By Substitution Method
		40 Hz to 5 kHz 5 mA to 1 A 1 A to 20 A	130 ppm to 160 ppm 160 ppm to 300 ppm	Using Primary AC Shunt Set, MFC, Ref Std, Null Detector, KV Divider By Substitution Method
		5 kHz to 10 kHz 5 mA to 1 A 1 A to 10 A	160 ppm 300 ppm to 320 ppm	Using Primary AC Shunt Set, MFC, Ref Std, Null Detector, KV Divider By Substitution Method
		50Hz 10 A to 100A	0.40%	Using Current Shunt, 8.5 DMM By Direct Method

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
5.	**DC RESISTANCE$**	100 µΩ to less than 1 mΩ	550 ppm to 400 ppm	Using MFC , 8.5 DMM By Direct Method
		1 mΩ to 1 MΩ	55 ppm to 15 ppm	Using Std Resistors, Kelvin Ratio Bridge By Comparison Method
		1 MΩ to 10 MΩ 10 MΩ to 100 MΩ	15 ppm to 100 ppm 100 ppm to 700 ppm	Using Std Resistors, 8.5 DMM, Resistance Transfer Std By Comparison Method
		100 MΩ to 1 GΩ 1 GΩ to 100 GΩ	700 ppm to 1.0% 1.0 % to 1.25%	Using 8.5 DMM, TeraOhm Meter, Discrete resistors By Comparison Method
6.	**AC RESISTANCE$**	**1kHz**		
		1Ω to 100Ω	0.10%	Using LCR Meter By Direct Method
		1 kHz to 100 kHz		
		100 Ω to 1 kΩ	0.20 % to 1.0%	
		1 kHz		
		1kΩ , 10 kΩ	120 ppm	Using LCR Meter & Std Resistor By Direct Method
7.	**CAPACITANCE$**	**1kHz**		
		100pF	80 ppm	Using Std Capacitors and LCR Meter By Comparison Method
		1nF	275 ppm	
		10nF	280 ppm	
		100nF	280 ppm	
		1µF	280 ppm	

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
	1 kHz to 100 kHz		
	10pF to 10uF	0.20 % to 0.50 %	Using LCR Meter By Direct Method
8. INDUCTANCE$	**1kHz**		
	10µH to 1mH	0.50% to 0.08%	Using LCR Meter
	1mH to 10H	0.08% to 0.8%	By Direct Method
	100 µH	0.25%	Using LCR Meter
	1 mH	400 ppm	By Comparison Method
	10 mH	350 ppm	
	100 mH	275 ppm	
	1 H	410 ppm	
	2 H	400ppm	
9. DC POWER$			
1V to 500V, 0.1A to 20A	0.1 W to 10 kW	0.02% to 0.12%	Using 8.5 Digit DMM
500V to 1kV, 20A to 30A			By Direct Method
500 V to 1kV, 30A to 1kA			
	10 kW to 30 kW	0.12%	Using 8.5 Digit DMM
	30 kW to 1 MW	0.12% to 2.00%	& Current Shunt/ Clamp Meter
			By Direct Method
10. AC POWER$	**50Hz, 0.25 PF to UPF**		
Single Phase	0.1A/40V to 20A/300 V		
	4 W to 6 kW	0.07% to 0.25%	Using Watt Convertor , 8.5 DMM
			By Direct Method
11. PHASE ANGLE$	+/- 180 deg	0.06 deg	Using Phase Meter & Phase Standard
			By Comparison Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
12. POWER FACTOR[$]	0.2 to 1 PF	0.012 PF	Using Power Meter By Direct Method
13. FREQUENCY[$]	0.1 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 26.5 GHz 26.5 GHz to 40 GHz	0.001 Hz 0.001 Hz to 0.1 Hz 0.1 Hz to 26.7 Hz 26.7 Hz to 40.15 Hz	Using Agilent 53131A, Agilent 5352B, Agilent 8510 C By Direct / Comparison Method
14. RF POWER[#]	**10MHz to 50 MHz** 1µW to 20mW (-30dbm to 13dbm) **50 MHz to 18 GHz** 100pW to 1µW (-70dbm to -30dbm) 1µW to 20mW (-30dbm to 13 dbm) **18 GHz to 26.5 GHz** 10pW to 100mW (-70dbm to 13dbm)	 0.21dbm to 0.26dbm 0.47dbm to 0.25dbm 0.26dbm to 0.29dbm 0.48dbm	 Using Agilent 8481A, Agilent 8485D, Agilent 8481D, Agilent 8485D and 8485A By Direct / Comparison Method
15. MODULATION[$] **Amplitude Modulation** **Carrier Frequency** **10MHz to 1.3GHz** **50Hz to 100kHz**	Modulation Depth 5% to 99 %	3.8% to 5%	Using HP 8901A By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
Frequency Modulation **Carrier Frequency** **10MHz to 1.3GHz** **50Hz to 100kHz**	Freq.Deviation 10kHz to 400kHz	1.8% to 6.8%	Using HP 8901A By Direct Method
Phase Modulation **Carrier Frequency** **10MHz to 1.3GHz** **200Hz to 10kHz**	Phase Deviation 10 rad to 80 rad	5.8%	Using HP 8901A By Direct Method
16. TEMPERATURE SIMULATION# (Indicator/ Recorder/ Controller)			
RTD	-200 ºC to 800ºC	0.007°C to 0.02°C	Using HP 3458A By Direct Method
Thermocouple			
K Type	3 ºC to 1340 ºC	0.009°C to 0.03°C	
J Type	2 ºC to 750 ºC	0.007°C to 0.03°C	
R, S Type	18 ºC to 1700 ºC	0.068°C to 0.12°C	
T Type	3 ºC to 400 ºC	0.04°C to 0.016°C	
N Type	5 ºC to 1300 ºC	0.02°C to 0.03°C	
E Type	2 ºC to 800 ºC	0.03°C to 0.0.02°C	
B Type	156 ºC to 1800 ºC	0.6°C to 0.5°C	

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
17. DC VOLTAGE♣	1 mV to 100 mV	0.04% to 0.001%	Using DMM 3458A
	0.1V to 10 V	0.001%	By Direct Method
	10V to 1000 V	0.001%	
	1kV to 40 kV	3.6%	Using 80k40 & 179
			By Direct Method
18. AC VOLTAGE♣			
	20 Hz to 1 kHz		
	1 mV to 100 mV	0.4% to 0.002%	Using DMM 3458A
	0.1 V to 10 V	0.02%	By Direct Method
	10 V to 700 V	0.02% to 0.5%	
	1 kHz to 100 kHz		
	0.1 V to 10 V	0.1%	
	10 V to 100 V	0.1% to 0.15%	
	100 kHz to 1MHz		
	0.1 V to 10 V	1.2%	
	50Hz	6.5%	Using 80k40 & 179
	1kV to 28 kV		By Direct Method
19. DC CURRENT♣	10 µA to 100 mA	2.5% to 0.005%	Using DMM 3458A
	100 mA to 1 A	0.005% to 0.02%	By Direct Method
	1A to 100 A	0.1%	Using Current Shunt, 8.5 DMM
			By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
20. AC CURRENT♣	**10 Hz to 45 Hz**		
	10 µA to 1 A	3.5% to 0.5%	Using DMM 3458A By Direct Method
	45 Hz to 1 kHz		
	10 µA to 100 uA	3.5% to 0.25%	
	0.1 mA to 100 mA	0.25%	
	0.1 A to 1 A	0.25%	
	1 kHz to 10 kHz		
	10 mA to 100 mA	0.1%	
	0.1 A to 1 A	0.1% to 0.4%	
21. DC RESISTANCE♣	**50 Hz**		
	1A to 100A	0.5%	Using Current Shunt, DMM 3458A By Direct Method
22. FREQUENCY♣	1 Ω to 1 GΩ	0.002% to 0.6%	Using DMM 3458A By Direct Method
	1Hz to 15kHz	0.001 Hz to 1.74 Hz	Using DMM 3458A Counter 5348A By Direct / Comparison Method
	15kHz to 26.5 GHz	1.74 Hz to 27 Hz	
23. TIME INTERVAL♣	1s to 10800 s	0.012 s to 1.4 s	Using TIMER CT6S-2P By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
SOURCE			
24. DC VOLTAGE$	10 µV to 1 mV 1 mV to 10 mV 10 mV to 100 mV 100 mV to 1000 V	0.58% to 58 ppm 58 ppm to 8 ppm 8 ppm to 4 ppm 4 ppm	Using DC Ref Std , Ref Divider, Kelvin Varley (KV) Divider and Null Detector By Direct Method
25. AC VOLTAGE$	**10 Hz to 40 Hz**		
	1 mV to 135 mV 350 mV to 1 V	0.1% to 510 ppm 510 ppm to 65 ppm	Using MFC, Micropot, KV Divider, DC Ref Std, & Null Detector By Substitution Method
	40 Hz to 20 kHz		
	1 mV to 135 mV 350 mV to 0.5 V 0.5 V to 1000 V	0.23% to 700 ppm 700 ppm to 40 ppm 40 ppm to 200 ppm	Using MFC, Micropot / TVC ,DC Ref Std, KV Divider & Null Detector By Substitution Method
	20 kHz to 30 kHz		
	1 mV to 135 mV 350 mV to 0.5 V 0.5 V to 600 V	0.23% to 700 ppm 700 ppm to 40 ppm 40 ppm to 200 ppm	Using MFC, Micropot / TVC ,DC Ref Std, KV Divider & Null Detector By Substitution Method
	30 kHz to 100 kHz		
	1 mV to 135 mV 350 mV to 0.5 V 0.5 V to 220 V	0.23% to 700 ppm 700 ppm to 40 ppm 40 ppm to 260 ppm	Using MFC, Micropot / TVC ,DC Ref Std, KV Divider & Null Detector By Substitution Method
	100 kHz to 1 MHz		
	1 mV to 135 mV 350 mV to 0.5 V 0.5 V to 20 V	0.23% to 700 ppm 700 ppm to 40 ppm 40 ppm to 0.08 %	Using MFC, Micropot / TVC ,DC Ref Std, KV Divider & Null Detector By Substitution Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
26. DC CURRENT [$]	10 µA to 1 A 1 A to 20 A	250 ppm to 50 ppm 50 ppm to 210 ppm	Using MFC, Std Resistor By Direct Method
	20A to 100 A	210 ppm to 0.1%	Using Current Shunt, DC Power Supply, 8.5 DMM By Direct Method
	100A to 1000 A	0.40%	Using MFC, Current Coil By Direct Method
27. AC CURRENT [$]	**1kHz** 10 µA to 5 mA	135 ppm	Using Standard Resistor, MFC, 8.5 digit DMM By Substitution Method
	40 Hz to 5 kHz 5 mA to 1 A 1 A to 20 A	160 ppm to 220 ppm 220 ppm to 625 ppm	Using Primary AC Shunt Set,MFC,Ref Std,Null Detector,KV Divider By Substitution Method
	5 kHz to 10 kHz 5 mA to 1 A 1 A to 10 A	900 ppm to 200 ppm 200 ppm to 350 ppm	Using Primary AC Shunt Set,MFC,Ref Std,Null Detector,KV Divider By Substitution Method
	50Hz 20 A to 1000A	0.50%	Using MFC, Current Coil By Substitution Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
28. DC RESISTANCE[$]	100 µΩ to 1 mΩ	500 ppm to 60 ppm	Using DMM By Direct Method
	1 mΩ to 1 MΩ	60 ppm to 15 ppm	Using Std Resistors, Kelvin Ratio Bridge By Direct Method
	1 MΩ to 10 MΩ 10 MΩ to 100 MΩ	15 ppm to 20 ppm 20 ppm to 225 ppm	Using Std Resistors, 8.5 DMM, Resistance Transfer Std By Direct Method
	100 MΩ to 1 GΩ 1 GΩ to 100 GΩ	225 ppm to 0.2% 0.20%	Using 8.5 DMM, TeraOhm Meter, Discrete resistors By Direct Method
29. DISCRETE VALUES[$]	0.0001 Ω 0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 1 GΩ 10 GΩ 100 GΩ	75 ppm 55 ppm 40 ppm 30 ppm 25 ppm 15 ppm 15 ppm 15 ppm 15 ppm 15 ppm 15 ppm 20 ppm 0.20 % 0.30 % 0.20 %	Using Std Resistor By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
30. AC RESISTANCE$	**1 kHz**		
	1kΩ , 10 kΩ	150 ppm	Using Std Resistor By Direct Method
	1 kHz		
	100 Ω to 1 kΩ	0.1% to 150 ppm	Using LCR Meter & AC Resistance Box By Comparison Method
	100 kHz		
	100 Ω to 1 kΩ	0.25% to 0.85%	Using LCR Meter & AC Resistance Box By Comparison Method
31. CAPACITANCE$	**1kHz**		
DISCRETE VALUES	100pF	80 ppm	Using Std Capacitors By Direct Method
	1nF	275 ppm	
	10nF	280 ppm	
	100nF	280 ppm	
	1µF	280 ppm	
	1 kHz to 100 kHz		
	10pF to 10uF	0.2% to 0.45%	Using LCR Meter & Capacitance Box By Comparison Method
32. INDUCTANCE$	**1kHz**		
	100µH to 1mH	0.5 % to 0.08%	Using LCR Meter, Inductance Box By Comparison Method
	1mH to 10H	0.08% to 0.8%	
	100 µH	0.25%	Using Std Inductors By Direct Method
	1 mH	400 ppm	
	10 mH	350 ppm	
	100 mH	275 ppm	
	1 H	410 ppm	
	2 H	400 pp	

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
33. TEMPERATURE SIMULATION# (Controllers / Indicators/ Recorder)			
RTD	-100°C to 800°C	0.02°C to 0.12°C	Using Transmile 3010 By Direct Method
Thermocouple			
K Type	-140°C to 1340°C	0.02°C to 0.16°C	
J Type	-180°C to 750°C	0.03°C to 0.1°C	
R, S Type	100°C to 1700°C	0.03°C to 0.2°C	
T Type	-200°C to 400°C	0.05°C	
N Type	-200°C to 1300°C	0.032°C	
E Type	0°C to 800°C	0.04°C to 0.09°C	
B Type	600°C to 1800°C	0.62°C to 0.5°C	
34. DC POWER#	**1V to 1kV, 0.3A to 20A** 0.3 W to 20 kW	0.03% to 0.1%	Using MFC By Direct Method
	1V to 1kV, 20A to 1kA 20 kW to 1 MW	0.1% to 0.33%	
35. AC POWER# Single Phase	**50Hz, UPF 0.1 A 10 V 20A 1000 V** 1 W to 20 kW	0.15% to 0.1%	Using MFC By Direct Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
36. AC ENERGY[#] Single Phase	**50Hz,UPF** **10V to 1000V** **0.1A to 20A** 1Wh to 20kWh	0.2% to 0.15%	Using MFC & Universal Counter By Direct Method
37. PHASE ANGLE[$]	**50 Hz** +/- 180 deg	0.05 deg	Using Phase Standard By Direct Method
38. POWER FACTOR[#]	0.2 to 1 PF	0.013 PF	Using MFC By Comparison Method
39. RF ATTENUATION[$]	**100MHz to 18 GHz** 1 dB to 60dB	0.43 dB to 2.70dB	Using Power meter 437B, Power Sensor 8481A, 8485D, Attenuator 8494B,8495B By Direct/ Comparison / Indirect Method
40. VSWR[#]	**10 MHz to 18 GHz** 1.05 **10 MHz to 26.5 GHz** 1.1 to 2.00	0.07% to 0.1% 0.072% to 0.273%	Using Maury Microwave 8033A & Maury Microwave 2611A By Direct/ Comparison / Indirect Method

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
41. OSCILLOSCOPE#			
Amplitude	0.002 to 120 V	0.30%	Using MFC
	2ns to 5ns	0.03% to 0.15%	Time Marker Generator
Time Marker	10Hz to 100kHz	4.00%	By Direct Method
Bandwidth	100kHz to 1GHz	4.00%	
42. DC VOLTAGE♣	1 mV to 100 mV	0.25% to 0.005%	Using MFC 3010
	0.1V to 1000 V	0.005% to 0.003%	By Direct method
43. AC VOLTAGE♣	**40 Hz to 10 kHz**		
	20 mV to 1000 V	0.3% to 0.1%	Using MFC 3010
	10 kHz to 40 kHz		By Direct method
	20 mV to 100 V	0.4% to 0.1%	
	40 kHz to 100 kHz		
	20 mV to 20 V	1.2% to 0.1%	
	100 kHz to 500 kHz		
	20 mV to 2 V	1.2% to 0.5%	
44. DC CURRENT♣	100 µA to 1 A	0.03% to 0.02%	Using MFC 3010
	1 A to 20 A	0.02% to 0.04%	By Direct method
	20 A to 1000 A	0.04% to 0.5%	
45. AC CURRENT♣	**45Hz to 1 kHz**		
	25 µA to 20 A	2.5% to 0.5%	Using MFC 3010
	1 kHz to 10 kHz		By Direct method
	0.3 mA to 200 mA	0.8%	
	50 Hz		
	20 A to 1000A	0.5%	Using Current Coil

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
46. DC RESISTANCE♣	1 Ω	0.5%	By Direct method Using MFC 3010
	10 Ω	0.06%	By Direct method
	100 Ω	0.008%	
	1 kΩ	0.003%	
	10 kΩ	0.002%	
	100 kΩ	0.003%	
	1 MΩ	0.004%	
	10 MΩ	0.0012%	
	100 MΩ	0.3%	
	1 GΩ	1.5%	
47. CAPACITANCE♣	1 nF to 10 µF	0.3% to 0.9%	Using MFC 3010 By Direct method
48. INDUCTANCE♣	100 mH to 10 H	3%	Using Inductance Box By Direct method

*** Measurement Capability is expressed as an uncertainty (±) 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.