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LABORATORY LOCATION: **TEKMARK SDN. BHD.**
(PERMANENT LABORATORY) **2 JALAN RADIN ANUM 2**
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The standard used for assessment of this laboratory is MS ISO/IEC 17025:2005

FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
1. DC Voltage		
	0 to 220 mV	6 μ V/V + 0.4 μ V
	0.0 to 2.2 V	3.5 μ V/V + 0.7 μ V
	0 to 11 V	2.5 μ V/V + 2.5 μ V
	0 to 22 V	2.5 μ V/V + 4 μ V
	0 to 220 V	3.5 μ V/V + 40 μ V
	0 to 1100 V	4.5 μ V/V + 400 μ V
2. AC Voltage		
	0.0 to 2.2 mV	
	10 Hz to 20 Hz	220 μ V/V + 4 μ V
	20 Hz to 40 Hz	85 μ V/V + 4 μ V
	40 Hz to 20 kHz	75 μ V/V + 4 μ V
	20 kHz to 50 kHz	180 μ V/V + 4 μ V
	50 kHz to 100 kHz	460 μ V/V + 5 μ V
	100 kHz to 300 kHz	900 μ V/V + 10 μ V
	300 kHz to 500 kHz	1200 μ V/V + 20 μ V
	500 kHz to 1 MHz	2500 μ V/V + 20 μ V
	0 to 22 mV	
	10 Hz to 20 Hz	220 μ V/V + 4 μ V
	20 Hz to 40 Hz	85 μ V/V + 4 μ V
	40 Hz to 20k Hz	75 μ V/V + 4 μ V
	20 kHz to 50 kHz	180 μ V/V + 4 μ V
	50 kHz to 100 kHz	460 μ V/V + 5 μ V
	100 kHz to 300 kHz	900 μ V/V + 10 μ V
	300 kHz to 500 kHz	1200 μ V/V + 20 μ V
	500 kHz to 1 MHz	2500 μ V/V + 20 μ V

* The uncertainties are based on an estimated confidence probability of not less than 95% unless otherwise stated.



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
2. AC Voltage (Continued)	0 to 220 mV	
	10 Hz to 20 Hz	220 μ V/ V + 12 μ V
	20 Hz to 40 Hz	85 μ V/ V + 7 μ V
	40 Hz to 20 kHz	75 μ V/ V + 7 μ V
	20 kHz to 50 kHz	180 μ V/ V + 7 μ V
	50 kHz to 100 kHz	420 μ V/ V + 17 μ V
	100 kHz to 300 kHz	750 μ V/ V + 20 μ V
	300 kHz to 500 kHz	1200 μ V/ V + 25 μ V
	500 kHz to 1MHz	2500 μ V/ V + 45 μ V
	0 to 2.2 V	
	10 Hz to 20 Hz	220 μ V/ V + 40 μ V
	20 Hz to 40 Hz	80 μ V/ V + 15 μ V
	40 Hz to 20 kHz	40 μ V/ V + 8 μ V
	20 kHz to 50 kHz	70 μ V/ V + 10 μ V
	50 kHz to 100 kHz	105 μ V/ V + 30 μ V
	100 kHz to 300 kHz	340 μ V/ V + 80 μ V
	300 kHz to 500 kHz	900 μ V/ V + 200 μ V
	500 kHz to 1MHz	1500 μ V/ V + 300 μ V
	0 to 22 V	
	10 Hz to 20 Hz	220 μ V/ V + 400 μ V
	20 Hz to 40 Hz	80 μ V/ V + 150 μ V
	40 Hz to 20 kHz	40 μ V/ V + 50 μ V
	20 kHz to 50 kHz	70 μ V/ V + 100 μ V
	50 kHz to 100 kHz	95 μ V/ V + 200 μ V
	100 kHz to 300 kHz	260 μ V/ V + 600 μ V
	300 kHz to 500 kHz	900 μ V/ V + 2000 μ V
	500 kHz to 1MHz	1300 μ V/ V + 3200 μ V
	0 to 220 V	
	10 Hz to 20 Hz	220 μ V/ V + 4 mV
	20 Hz to 40 Hz	80 μ V/ V + 1.5 mV
	40 Hz to 20 kHz	47 μ V/ V + 0.8 mV
	20 kHz to 50 kHz	75 μ V/ V + 1 mV
	50 kHz to 100 kHz	130 μ V/ V + 2.5 mV



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
2. AC Voltage	0 to 250 V	
(Continued)	15 Hz to 50 Hz	260 μ V/ V + 16 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 20 mV
	3 kHz to 10 kHz	0.80 mV/ V + 32 mV
	10 kHz to 20 kHz	1.2 mV/ V + 48 mV
	20 kHz to 30 kHz	1.5 mV/ V + 64 mV
	0 to 320V	
	40 Hz to 50 Hz	0.50 mV/ V + 20 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 20 mV
	3 kHz to 10 kHz	0.80 mV/ V + 32 mV
	10 kHz to 20 kHz	1.2 mV/ V + 48 mV
	20 kHz to 30 kHz	1.5 mV/ V + 64 mV
	0 to 800V	
	40 Hz to 50 Hz	0.50 mV/ V + 63 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 63 mV
	3 kHz to 10 kHz	0.80 mV/ V + 110 mV
	0 to 1050V	
	40 Hz to 50 Hz	0.50 mV/ V + 130 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 130 mV
	3 kHz to 10 kHz	0.80 mV/ V + 210 mV
	0 to 1100 V	
	50 Hz to 1k Hz	60 μ V/ V + 3.5 mV



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
3. DC Current		
	0 to 220 μ A	35 μ A/A + 6 nA
	0.0 to 2.2 mA	30 μ A/A + 7 nA
	0 to 22 mA	30 μ A/A + 40 nA
	0 to 220 mA	40 μ A/A + 0.7 μ A
	0.0 to 2.2 A	60 μ A/A + 12 μ A
	2.2 to 3.2 A	0.60 mA/A + 120 μ A
	3.2 to 10.5 A	0.55 mA/A + 940 μ A
	10.5 to 20.0 A	0.55 mA/A + 4.5 mA
4. DC Current via Current Coils		
10-Turn Coil		
	3.2 to 32 A	0.60 mA/A + 1.2 mA
	32 to 105 A	0.55 mA/A + 9.4 mA
	105 to 200 A	0.55 mA/A + 45 mA
50-Turn Coil		
	16 to 160 A	0.60 mA/A + 5.9 mA
	160 to 525 A	0.55 mA/A + 47 mA
	525 to 1000 A	0.55 mA/A + 230 mA
5 AC Current		
	0 to 32 μ A	
	10 Hz to 20 Hz	230 μ A/A + 16 nA
	20 Hz to 40 Hz	140 μ A/A + 10 nA
	40 Hz to 1 kHz	110 μ A/A + 8 nA
	1 kHz to 5 kHz	250 μ A/A + 12 nA
	5 kHz to 10 kHz	900 μ A/A + 65 nA
	10 kHz to 20 kHz	2.0 mA/A + 6.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 9.0 μ A



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
5. AC Current (Continued)	0 to 220 μ A	
	10 Hz to 20 Hz	230 μ A/A + 16 nA
	20 Hz to 40 Hz	140 μ A/A + 10 nA
	40 Hz to 1 kHz	110 μ A/A + 8 nA
	1 kHz to 5 kHz	250 μ A/A + 12 nA
	5 kHz to 10 kHz	900 μ A/A + 65 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0 to 320 μ A	
	10 Hz to 20 Hz	230 μ A/A + 40 nA
	20 Hz to 40 Hz	140 μ A/A + 35 nA
	40 Hz to 1 kHz	110 μ A/A + 35 nA
	1 kHz to 5 kHz	180 μ A/A + 110 nA
	5 kHz to 10 kHz	900 μ A/A + 650 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0.0 to 2.2 mA	
	10 Hz to 20 Hz	230 μ A/A + 40 nA
	20 Hz to 40 Hz	140 μ A/A + 35 nA
	40 Hz to 1 kHz	110 μ A/A + 35 nA
	1 kHz to 5 kHz	180 μ A/A + 110 nA
	5 kHz to 10 kHz	900 μ A/A + 650 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
5. AC Current (Continued)	0.0 to 3.2 mA	
	10 Hz to 20 Hz	230 μ A/A + 400 nA
	20 Hz to 40 Hz	140 μ A/A + 350 nA
	40 Hz to 1 kHz	110 μ A/A + 350 nA
	1 kHz to 5 kHz	180 μ A/A + 550 nA
	5 kHz to 10 kHz	900 μ A/A + 5000 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0.0 to 22 mA	
	10 Hz to 20 Hz	230 μ A/A + 400 nA
	20 Hz to 40 Hz	140 μ A/A + 350 nA
	40 Hz to 1 kHz	110 μ A/A + 350 nA
	1 kHz to 5 kHz	180 μ A/A + 550 nA
	5 kHz to 10 kHz	900 μ A/A + 5000 nA
	10 kHz to 20 kHz	2.0 mA/A + 13 μ A
	20 kHz to 30 kHz	2.5 mA/A + 23 μ A
	0.0 to 32 mA	
	10 Hz to 20 Hz	230 μ A/A + 4 μ A
	20 Hz to 40 Hz	140 μ A/A + 3.5 μ A
	40 Hz to 1 kHz	110 μ A/A + 2.5 μ A
	1 kHz to 5 kHz	180 μ A/A + 3.5 μ A
	5 kHz to 10 kHz	900 μ A/A + 10 μ A
	10 kHz to 20 kHz	2.0 mA/A + 13 μ A
	20 kHz to 30 kHz	2.5 mA/A + 23 μ A



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
5. AC Current (Continued)	0 to 220 mA	
	10 Hz to 20 Hz	230 μ A/A + 4 μ A
	20 Hz to 40 Hz	140 μ A/A + 3.5 μ A
	40 Hz to 1 kHz	110 μ A/A + 2.5 μ A
	1 kHz to 5 kHz	180 μ A/A + 3.5 μ A
	5 kHz to 10 kHz	900 μ A/A + 10 μ A
	10 kHz to 20 kHz	2.0 mA/A + 64 μ A
	20 kHz to 30 kHz	2.5 mA/A + 96 μ A
	0 to 320 mA	
	20 Hz to 1k Hz	240 μ A/A + 35 μ A
	1 kHz to 5k Hz	390 μ A/A + 80 μ A
	5 kHz to 10k Hz	6000 μ A/A + 160 μ A
	10 kHz to 20k Hz	2.0 mA/A + 64 μ A
	20 kHz to 30k Hz	2.5 mA/A + 96 μ A
	0.0 to 2.2 A	
	20 Hz to 1k Hz	240 μ A/A + 35 μ A
	1 kHz to 5k Hz	390 μ A/A + 80 μ A
	5 kHz to 10k Hz	6000 μ A/A + 160 μ A
	2.2 to 3.2 A	
	10 Hz to 3k Hz	1.0 mA/A + 480 μ A
	3 kHz to 10k Hz	2.5 mA/A + 2.6 mA
	3.2 to 10.5 A	
	10 Hz to 3k Hz	2.0 mA/A + 3.0 mA
	3 kHz to 10k Hz	5.0 mA/A + 10 mA
	10.5 to 20.0 A	
	10 Hz to 3k Hz	2.0 mA/A + 6.9 mA
	3 kHz to 10k Hz	5.0 mA/A + 23 mA



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
6. AC Current via Current Coils		
10-Turn Coil	3.2 to 32.0 A 10 Hz to 100 Hz 100 Hz to 440 Hz	2.0 mA/A + 5.5 mA 7.8 mA/A + 27 mA
	32.0 to 200.0 A 10 Hz to 100 Hz 100 Hz to 440 Hz	2.1 mA/A + 90 mA 6.7 mA/A + 0.25 A
50-Turn Coil	16.0 to 160.0 A 10 Hz to 100 Hz	2.0 mA/A + 28 mA
	160.0 to 1000.0 A 10 Hz to 65 Hz	2.1 mA/A + 0.45 A
7. Wideband AC Voltage (Frequency from 30Hz to 500 kHz into 50 Ω Termination)	1.1 mV 3 mV 11 mV 33 mV 110 mV 330 mV 1.1 V 3.5 V	0.5 μV/V + 0.4 μV 0.45 μV/V + 1 μV 0.35 μV/V + 4 μV 0.3 μV/V + 10 μV 0.3 μV/V + 40 μV 0.25 μV/V + 100 μV 0.25 μV/V + 400 μV 0.2 μV/V + 500 μV



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
7. Wideband AC Voltage (Continued)	0.0 to 1.1 mV	
Amplitude Flatness at 1 kHz reference	10 Hz to 30 Hz	3 mV/ V
	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	2 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	2 mV/ V + 3 μ V
	2 MHz to 10 MHz	4 mV/ V + 3 μ V
	10 MHz to 20 MHz	6 mV/ V + 3 μ V
	20 MHz to 30 MHz	15 mV/ V + 15 μ V
	1.1 to 3.0 mV	
	10 Hz to 30 Hz	3 mV/ V
	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	1 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	1 mV/ V + 3 μ V
	2 MHz to 10 MHz	3 mV/ V + 3 μ V
	10 MHz to 20 MHz	5 mV/ V + 3 μ V
	20 MHz to 30 MHz	15 mV/ V + 3 μ V



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
7. Wideband AC Voltage		
(Continued)	Above 3 mV	
Amplitude Flatness	10 Hz to 30 Hz	3 mV/ V
at 1 kHz reference	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	1 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	1 mV/ V + 3 μ V
	2 MHz to 10 MHz	2 mV/ V + 3 μ V
	10 MHz to 20 MHz	4 mV/ V + 3 μ V
	20 MHz to 30 MHz	10 mV/ V + 3 μ V
(Nominal Value)		
8. Resistance Measuring		
Instrument	0 Ω	40 $\mu\Omega$
	1 Ω	4 $\mu\Omega/\Omega$
	1.9 Ω	80 $\mu\Omega/\Omega$
	10 Ω	4 $\mu\Omega/\Omega$
	19 Ω	21 $\mu\Omega/\Omega$
	100 Ω	9 $\mu\Omega/\Omega$
	190 Ω	9 $\mu\Omega/\Omega$
	1k Ω	7.5 $\mu\Omega/\Omega$
	1.9 k Ω	7.5 $\mu\Omega/\Omega$
	10 k Ω	4 $\mu\Omega/\Omega$
	19 k Ω	7.5 $\mu\Omega/\Omega$
	100 k Ω	9 $\mu\Omega/\Omega$
	190 k Ω	9 $\mu\Omega/\Omega$
	1 M Ω	15 $\mu\Omega/\Omega$
	1.9 M Ω	16 $\mu\Omega/\Omega$
	10 M Ω	31 $\mu\Omega/\Omega$
	19 M Ω	39 $\mu\Omega/\Omega$
	100 M Ω	95 $\mu\Omega/\Omega$



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
8. Resistance Measuring Instrument (Continued)	0.0 to 40.0 Ω	0.25 m Ω / Ω + 10 m Ω
	40.0 to 400.0 Ω	0.15 m Ω / Ω + 20 m Ω
	0.4 to 4.0 k Ω	0.15 m Ω / Ω + 80 m Ω
	4.0 to 40.0 k Ω	0.15 m Ω / Ω + 800 m Ω
	40.0 to 400.0 k Ω	0.18 m Ω / Ω + 8.0 Ω
	0.4 to 4.0 M Ω	0.2 m Ω / Ω + 100 Ω
	4.0 to 40.0 M Ω	0.5 m Ω / Ω + 2.0 k Ω
	40.0 to 400.0 M Ω	0.6 m Ω / Ω + 40 k Ω
9. Capacitance	Stim Repetition Rate \leq 350Hz	
	0.5 to 4.0 nF	3 mF/F + 15 pF
	4.0 to 40.0 nF	3 mF/F + 30 pF
	40.0nF to 400.0 nF	3 mF/F + 160 pF
	0.4 to 4.0 μ F	4 mF/F + 1.6 nF
	4.0 to 40.0 μ F	5 mF/F + 16 nF
	40.0 to 400.0 μ F	5 mF/F + 160 nF
	0.4 to 4.0 mF	5 mF/F + 1.6 μ F
	4.0 to 40.0 mF	10 mF/F + 60 μ F
	Stim Repetition Rate 350 to 1.5 kHz	
	0.5 to 4.0 nF	6 mF/F + 30 pF
	4.0 to 40.0 nF	6 mF/F + 60 pF
	40.0 to 400.0 nF	6 mF/F + 320 pF
	0.4 to 4.0 μ F	8 mF/F + 3.2 nF
	4.0 to 40.0 μ F	10 mF/F + 32 nF
	40.0 to 400.0 μ F	10 mF/F + 320 nF
	0.4 to 4.0 mF	10 mF/F + 3.2 μ F
	4.0 to 40.0 mF	20 mF/F + 120 μ F



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
10. Vertical Amplitude		
a) Square Peak to Peak		
1M Ω Load	200 μ V to 100 V	2.5 mV/V + 1 μ V
50 Ω Load	100 μ V to 5 V	2.5 mV/V + 1 μ V
b) DC		
1M Ω Load	4.44 mV to 133.44 V	2.0 mV/V + 40 μ V
50 Ω Load	4.44 mV to 2.78 V	2.0 mV/V + 40 μ V
11. Time Base		
	1 ns	0.5 μ s/s
	2 ns to 5 s	0.25 μ s/s
12. Edge Function		
a) Output Period		
	100 ns to 10 ms	0.25 μ s/s
b) Rise Time		
	Unterminated	\leq 100 ns
	50 Ω Load	\leq 1 ns
c) Fall Time		
	50 Ω Load	\leq 1 ns
13. Frequency		
a) Source		
	1 μ Hz to 0.5 Hz	5 μ Hz/Hz
	0.5 Hz to 600 MHz	0.25 μ Hz/Hz
	600 MHz to 1050 MHz	20 mHz/Hz



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
13. Frequency (Continued)	0.01 to 5.00 Vpp	
	1µHz to 100 kHz	47 mV/ V
b) Amplitude	100 kHz to 20 MHz	47 mV/ V
	20 MHz to 30.2 MHz	59 mV/ V
	5 to 10 Vpp	
	1 µHz to 100 kHz	23 mV/ V
	100 kHz to 20 MHz	23 mV/ V
	20 MHz to 30.2 MHz	35 mV/ V
c) Amplitude Flatness at 50 kHz or 6MHz reference	50 kHz to 100 MHz	10 mV/ V
	100 MHz to 250 MHz	30 mV/ V
	250 MHz to 1050 MHz	40 mV/ V
B. Source		
14. DC Voltage	0 to 200 mV	37 µV/ V + 1.2 µV
	0 to 2 V	25 µV/ V + 4 µV
	0 to 20 V	24 µV/ V + 80 µV
	0 to 200 V	38 µV/ V + 600 µV
	0 to 1000 V	41 µV/ V + 6 mV
15. AC Voltage Source	0 to 200 mV	
	20 Hz to 50 Hz	2.5 mV/ V + 30 µV
	50 Hz to 100 Hz	0.8 mV/ V + 30 µV
	0.1 kHz to 2 kHz	0.5 mV/ V + 30 µV
	2 kHz to 10 kHz	0.5 mV/ V + 30 µV
	10 kHz to 30 kHz	0.5 mV/ V + 30 µV
	30 kHz to 50 kHz	0.6 mV/ V + 30 µV



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B. Source		
15. AC Voltage Source		
(Continued)		
	0 to 200 mV	
	50 kHz to 100 kHz	1.7 mV/ V + 30 μ V
	100 kHz to 200 kHz	5 mV/ V + 50 μ V
	0.2 MHz to 1 MHz	20 mV/ V + 0.2 mV
	1 MHz to 2 MHz	50 mV/ V + 0.4 mV
	0 to 2V	
	20 Hz to 50 Hz	2.5 mV/ V + 0.3 mV
	50 Hz to 100 Hz	0.8 mV/ V + 0.3 mV
	0.1 kHz to 2 kHz	0.5 mV/ V + 0.3 mV
	2 kHz to 10 kHz	0.5 mV/ V + 0.3 mV
	10 kHz to 30 kHz	0.5 mV/ V + 0.3 mV
	30 kHz to 50 kHz	0.6 mV/ V + 0.3 mV
	50 kHz to 100 kHz	1.7 mV/ V + 0.3 mV
	100 kHz to 200 kHz	5 mV/ V + 0.5 mV
	0.2 MHz to 1 MHz	20 mV/ V + 2 mV
	1 MHz to 2 MHz	50 mV/ V + 4 mV
	0 to 20 V	
	20 Hz to 50 Hz	2.5 mV/ V + 3 mV
	50 Hz to 100 Hz	0.8 mV/ V + 3 mV
	0.1 kHz to 2 kHz	0.6 mV/ V + 3 mV
	2 kHz to 10 kHz	0.85 mV/ V + 3 mV
	10 kHz to 30 kHz	1.2 mV/ V + 3 mV
	30 kHz to 50 kHz	1.3 mV/ V + 3 mV
	50 kHz to 100 kHz	1.7 mV/ V + 3 mV
	100 kHz to 200 kHz	5 mV/ V + 5 mV
	0.2 MHz to 1 MHz	40 mV/ V + 40 mV



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>	
B. Source			
15. AC Voltage Source (Continued)	0 to 200 V		
	20 Hz to 50 Hz	2.5 mV/ V + 30 mV	
	50 Hz to 100 Hz	0.8 mV/ V + 30 mV	
	0.1 kHz to 2 kHz	0.6 mV/ V + 30 mV	
	2 kHz to 10 kHz	0.85 mV/ V + 30 mV	
	10 kHz to 30 kHz	1.2 mV/ V + 30 mV	
	30 kHz to 50 kHz	1.3 mV/ V + 30 mV	
	50 kHz to 100 kHz	1.7 mV/ V + 30 mV	
		0 to 750 V	
		20 Hz to 50 Hz	2.7 mV/ V + 120 mV
	50 Hz to 100 Hz	1.1 mV/ V + 120 mV	
	0.1 kHz to 2 kHz	1.0 mV/ V + 120 mV	
	2 kHz to 10 kHz	1.3 mV/ V + 120 mV	
	10 kHz to 30 kHz	1.8 mV/ V + 120 mV	
16. DC Current	0 to 200 μ A	500 μ A/A + 5 nA	
	0 to 2 mA	400 μ A/A + 40 nA	
	0 to 20 mA	400 μ A/A + 400 nA	
	0 to 200 mA	500 μ A/A + 4 μ A	
	0 to 2 A	900 μ A/A + 40 μ A	
	0 to 10 A	2 mA/A + 0.7 mA	
17. AC Current	0 to 200 μ A		
	20 Hz to 50 Hz	3.5 mA/A + 30 nA	
	50 Hz to 200 Hz	2 mA/A + 30 nA	
	200 kHz to 1 kHz	4 mA/A + 30 nA	
	1 kHz to 10 kHz	5 mA/A + 30 nA	



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
17. AC Current	0 to 2 mA	
(Continued)	20 Hz to 50 Hz	3 mA/A + 0.3 μ A
	50 Hz to 200 Hz	1.5 mA/A + 0.3 μ A
	200 Hz to 1 kHz	1.2 mA/A + 0.3 μ A
	1kHz to 10 kHz	1.2 mA/A + 0.3 μ A
	0 to 20 mA	
	20 Hz to 50 Hz	3 mA/A + 3 μ A
	50 Hz to 200 Hz	1.5 mA/A + 3 μ A
	200 kHz to 1 kHz	1.2 mA/A + 3 μ A
	1kHz to 10 kHz	1.2 mA/A + 3 μ A
	0 to 200 mA	
	20 Hz to 50 Hz	3 mA/A + 30 μ A
	50 Hz to 200 Hz	1.5 mA/A + 30 μ A
	200 kHz to 1 kHz	1.2 mA/A + 30 μ A
	1kHz to 10 kHz	1.5 mA/A + 30 μ A
	0 to 2 A	
	20 Hz to 50 Hz	3.5 mA/A + 0.3 mA
	50 Hz to 200 Hz	2 mA/A + 0.3 mA
	200 kHz to 1 kHz	3 mA/A + 0.3 mA
	1kHz to 10 kHz	4.5 mA/A + 0.3 mA
	0 to 10 A	
	20 Hz to 50 Hz	20 mA/A + 10 mA
	50 Hz to 200 Hz	10 mA/A + 10 mA



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
18. Resistance	20 Ω	72 $\mu\Omega/\Omega$ + 0.14 m Ω
	200 Ω	56 $\mu\Omega/\Omega$ + 1.4 m Ω
	2 k Ω	50 $\mu\Omega/\Omega$ + 8 m Ω
	20 k Ω	50 $\mu\Omega/\Omega$ + 80 m Ω
	200 k Ω	90 $\mu\Omega/\Omega$ + 0.9 Ω
	2 M Ω	160 $\mu\Omega/\Omega$ + 9 Ω
	20 M Ω	900 $\mu\Omega/\Omega$ + 90 Ω
	200 M Ω	20 m Ω/Ω + 20 k Ω
19. Frequency	1.0 Hz – 10 MHz	1 $\mu\text{Hz}/\text{Hz}$ + 0.1 Hz
	10 MHz – 100 MHz	1 $\mu\text{Hz}/\text{Hz}$ + 1 Hz
	100 MHz – 1.3 GHz	1 $\mu\text{Hz}/\text{Hz}$ + 10 Hz

Signatories:

- | | | |
|----|------------------|-----------------------------|
| 1. | Wong Sin Chon | I/C No.: 670902 – 08 – 5721 |
| 2. | Chan Chee Kuan | I/C No.: 671031 – 08 – 5623 |
| 3. | Ramlah Mamat | I/C No.: 670610 – 03 – 6178 |
| 4. | Md. Rizal Paiman | I/C No.: 780405 – 01 – 6319 |



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
Source		
DC Current (Shunt Method)	0.1 to 1 μ A	0.4 nA
	1 to 10 μ A	1.2 nA
	10 to 100 μ A	10 nA
	100 to 1 mA	100 nA
	1 to 10 mA	1.6 μ A
	10 to 100 mA	16 μ A
	0.1 to 1 A	0.26 mA
	1 to 2 A	0.11 mA
	2 to 5 A	0.21 mA
	5 to 10 A	0.4 mA
	10 to 15 A	0.6 mA
	15 to 20 A	1.6 mA
	20 to 25 A	1.7 mA
	25 to 30 A	1.9 mA

Signatory:

1. Chan Chee Kuan
2. Md. Rizal Paiman

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SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
1. DC Voltage		
	0 to 220 mV	6 $\mu\text{V}/\text{V} + 0.4 \mu\text{V}$
	0.0 to 2.2 V	3.5 $\mu\text{V}/\text{V} + 0.7 \mu\text{V}$
	0 to 11 V	2.5 $\mu\text{V}/\text{V} + 2.5 \mu\text{V}$
	0 to 22 V	2.5 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	0 to 220 V	3.5 $\mu\text{V}/\text{V} + 40 \mu\text{V}$
	0 to 1100 V	4.5 $\mu\text{V}/\text{V} + 400 \mu\text{V}$
2. AC Voltage		
	0.0 to 2.2 mV	
	10 Hz to 20 Hz	220 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	20 Hz to 40 Hz	85 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	40 Hz to 20k Hz	75 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	20 kHz to 50 kHz	180 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	50 kHz to 100 kHz	460 $\mu\text{V}/\text{V} + 5 \mu\text{V}$
	100 kHz to 300 kHz	900 $\mu\text{V}/\text{V} + 10 \mu\text{V}$
	300 kHz to 500 kHz	1200 $\mu\text{V}/\text{V} + 20 \mu\text{V}$
	500 kHz to 1 MHz	2500 $\mu\text{V}/\text{V} + 20 \mu\text{V}$
	0 to 22 mV	
	10 Hz to 20 Hz	220 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	20 Hz to 40 Hz	85 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	40 Hz to 20k Hz	75 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	20 kHz to 50 kHz	180 $\mu\text{V}/\text{V} + 4 \mu\text{V}$
	50 kHz to 100 kHz	460 $\mu\text{V}/\text{V} + 5 \mu\text{V}$
	100 kHz to 300 kHz	900 $\mu\text{V}/\text{V} + 10 \mu\text{V}$
	300 kHz to 500 kHz	1200 $\mu\text{V}/\text{V} + 20 \mu\text{V}$
	500 kHz to 1 MHz	2500 $\mu\text{V}/\text{V} + 20 \mu\text{V}$



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
2. AC Voltage (Continued)	0 to 220 mV	
	10 Hz to 20 Hz	220 μ V/ V + 12 μ V
	20 Hz to 40 Hz	85 μ V/ V + 7 μ V
	40 Hz to 20 kHz	75 μ V/ V + 7 μ V
	20 kHz to 50 kHz	180 μ V/ V + 7 μ V
	50 kHz to 100 kHz	420 μ V/ V + 17 μ V
	100 kHz to 300 kHz	750 μ V/ V + 20 μ V
	300 kHz to 500 kHz	1200 μ V/ V + 25 μ V
	500 kHz to 1MHz	2500 μ V/ V + 45 μ V
	0 to 2.2 V	
	10 Hz to 20 Hz	220 μ V/ V + 40 μ V
	20 Hz to 40 Hz	80 μ V/ V + 15 μ V
	40 Hz to 20 kHz	40 μ V/ V + 8 μ V
	20 kHz to 50 kHz	70 μ V/ V + 10 μ V
	50 kHz to 100 kHz	105 μ V/ V + 30 μ V
	100 kHz to 300 kHz	340 μ V/ V + 80 μ V
	300 kHz to 500 kHz	900 μ V/ V + 200 μ V
	500 kHz to 1MHz	1500 μ V/ V + 300 μ V
	0 to 22 V	
	10 Hz to 20 Hz	220 μ V/ V + 400 μ V
	20 Hz to 40 Hz	80 μ V/ V + 150 μ V
	40 Hz to 20 kHz	40 μ V/ V + 50 μ V
	20 kHz to 50 kHz	70 μ V/ V + 100 μ V
	50 kHz to 100 kHz	95 μ V/ V + 200 μ V
	100 kHz to 300 kHz	260 μ V/ V + 600 μ V
	300 kHz to 500 kHz	900 μ V/ V + 2000 μ V
	500 kHz to 1MHz	1300 μ V/ V + 3200 μ V
	0 to 220 V	
	10 Hz to 20 Hz	220 μ V/ V + 4 mV
	20 Hz to 40 Hz	80 μ V/ V + 1.5 mV
	40 Hz to 20 kHz	47 μ V/ V + 0.6 mV
	20 kHz to 50 kHz	75 μ V/ V + 1 mV
	50 kHz to 100 kHz	130 μ V/ V + 2.5 mV



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
2. AC Voltage (Continued)	0 to 250 V	
	15 Hz to 50 Hz	260 μ V/ V + 16 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 20 mV
	3 kHz to 10 kHz	0.80 mV/ V + 32 mV
	10 kHz to 20 kHz	1.2 mV/ V + 48 mV
	20 kHz to 30 kHz	1.5 mV/ V + 64 mV
	0 to 320V	
	40 Hz to 50 Hz	0.50 mV/ V + 20 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 20 mV
	3 kHz to 10 kHz	0.80 mV/ V + 32 mV
	10 kHz to 20 kHz	1.2 mV/ V + 48 mV
	20 kHz to 30 kHz	1.5 mV/ V + 64 mV
	0 to 800V	
	40 Hz to 50 Hz	0.50 mV/ V + 63 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 63 mV
	3 kHz to 10 kHz	0.80 mV/ V + 110 mV
	0 to 1050V	
	40 Hz to 50 Hz	0.50 mV/ V + 130 mV
	50 Hz to 1kHz	60 μ V/ V + 3.5 mV
	1 kHz to 3 kHz	0.80 mV/ V + 130 mV
	3 kHz to 10 kHz	0.80 mV/ V + 210 mV
	0 to 1100 V	
	50 Hz to 1k Hz	60 μ V/ V + 3.5 mV



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
3. DC Current		
	0 to 220 μ A	35 μ A/A + 6 nA
	0.0 to 2.2 mA	30 μ A/A + 7 nA
	0 to 22 mA	30 μ A/A + 40 nA
	0 to 220 mA	40 μ A/A + 0.7 μ A
	0.0 to 2.2 A	60 μ A/A + 12 μ A
	2.2 to 3.2 A	0.60 mA/A + 120 μ A
	3.2 to 10.5 A	0.55 mA/A + 940 μ A
	10.5 to 20.0 A	0.55 mA/A + 4.5 mA
4. DC Current via Current Coils		
10-Turn Coil		
	3.2 to 32 A	0.60 mA/A + 1.2 mA
	32 to 105 A	0.55 mA/A + 9.4 mA
	105 to 200 A	0.55 mA/A + 45 mA
50-Turn Coil		
	16 to 160 A	0.60 mA/A + 5.9 mA
	160 to 525 A	0.55 mA/A + 47 mA
	525 to 1000 A	0.55 mA/A + 230 mA
5. AC Current		
	0 to 32 μ A	
	10 Hz to 20 Hz	230 μ A/A + 16 nA
	20 Hz to 40 Hz	140 μ A/A + 10 nA
	40 Hz to 1 kHz	110 μ A/A + 8 nA
	1 kHz to 5 kHz	250 μ A/A + 12 nA
	5 kHz to 10 kHz	900 μ A/A + 65 nA
	10 kHz to 20 kHz	2.0 mA/A + 6.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 9.0 μ A



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SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
5. AC Current	0 to 220 μ A	
(Continued)	10 Hz to 20 Hz	230 μ A/A + 16 nA
	20 Hz to 40 Hz	140 μ A/A + 10 nA
	40 Hz to 1 kHz	110 μ A/A + 8 nA
	1 kHz to 5 kHz	250 μ A/A + 12 nA
	5 kHz to 10 kHz	900 μ A/A + 65 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0 to 320 μ A	
	10 Hz to 20 Hz	230 μ A/A + 40 nA
	20 Hz to 40 Hz	140 μ A/A + 35 nA
	40 Hz to 1 kHz	110 μ A/A + 35 nA
	1 kHz to 5 kHz	180 μ A/A + 110 nA
	5 kHz to 10 kHz	900 μ A/A + 650 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0.0 to 2.2 mA	
	10 Hz to 20 Hz	230 μ A/A + 40 nA
	20 Hz to 40 Hz	140 μ A/A + 35 nA
	40 Hz to 1 kHz	110 μ A/A + 35 nA
	1 kHz to 5 kHz	180 μ A/A + 110 nA
	5 kHz to 10 kHz	900 μ A/A + 650 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
5. AC Current (Continued)	0.0 to 3.2 mA	
	10 Hz to 20 Hz	230 μ A/A + 400 nA
	20 Hz to 40 Hz	140 μ A/A + 350 nA
	40 Hz to 1 kHz	110 μ A/A + 350 nA
	1 kHz to 5 kHz	180 μ A/A + 550 nA
	5 kHz to 10 kHz	900 μ A/A + 5000 nA
	10 kHz to 20 kHz	2.0 mA/A + 2.0 μ A
	20 kHz to 30 kHz	2.5 mA/A + 3.0 μ A
	0.0 to 22 mA	
	10 Hz to 20 Hz	230 μ A/A + 400 nA
	20 Hz to 40 Hz	140 μ A/A + 350 nA
	40 Hz to 1 kHz	110 μ A/A + 350 nA
	1 kHz to 5 kHz	180 μ A/A + 550 nA
	5 kHz to 10 kHz	900 μ A/A + 5000 nA
	10 kHz to 20 kHz	2.0 mA/A + 13 μ A
	20 kHz to 30 kHz	2.5 mA/A + 23 μ A
	0.0 to 32 mA	
	10 Hz to 20 Hz	230 μ A/A + 4 μ A
	20 Hz to 40 Hz	140 μ A/A + 3.5 μ A
	40 Hz to 1 kHz	110 μ A/A + 2.5 μ A
	1 kHz to 5 kHz	180 μ A/A + 3.5 μ A
	5 kHz to 10 kHz	900 μ A/A + 10 μ A
	10 kHz to 20 kHz	2.0 mA/A + 13 μ A
	20 kHz to 30 kHz	2.5 mA/A + 23 μ A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments 5. AC Current (Continued)	0 to 220 mA	
	10 Hz to 20 Hz	230 μ A/A + 4 μ A
	20 Hz to 40 Hz	140 μ A/A + 3.5 μ A
	40 Hz to 1 kHz	110 μ A/A + 2.5 μ A
	1 kHz to 5 kHz	180 μ A/A + 3.5 μ A
	5 kHz to 10 kHz	900 μ A/A + 10 μ A
	10 kHz to 20 kHz	2.0 mA/A + 64 μ A
	20 kHz to 30 kHz	2.5 mA/A + 96 μ A
	0 to 320 mA	
	20 Hz to 1k Hz	240 μ A/A + 35 μ A
	1 kHz to 5k Hz	390 μ A/A + 80 μ A
	5 kHz to 10k Hz	6000 μ A/A + 160 μ A
	10 kHz to 20k Hz	2.0 mA/A + 64 μ A
	20 kHz to 30k Hz	2.5 mA/A + 96 μ A
	0.0 to 2.2 A	
	20 Hz to 1k Hz	240 μ A/A + 35 μ A
	1 kHz to 5k Hz	390 μ A/A + 80 μ A
	5 kHz to 10k Hz	6000 μ A/A + 160 μ A
	2.2 to 3.2 A	
	10 Hz to 3k Hz	1.0 mA/A + 480 μ A
3 kHz to 10k Hz	2.5 mA/A + 2.6 mA	
3.2 to 10.5 A		
10 Hz to 3k Hz	2.0 mA/A + 3.0 mA	
3 kHz to 10k Hz	5.0 mA/A + 10 mA	
10.5 to 20.0 A		
10 Hz to 3k Hz	2.0 mA/A + 6.9 mA	
3 kHz to 10k Hz	5.0 mA/A + 23 mA	



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>	
6. AC Current via Current Coils	10-Turn Coil	3.2 to 32.0 A	
		10 Hz to 100 Hz	2.0 mA/A + 5.5 mA
		100 Hz to 440 Hz	7.8 mA/A + 27 mA
	50-Turn Coil	32.0 to 200.0 A	
		10 Hz to 100 Hz	2.1 mA/A + 90 mA
		100 Hz to 440 Hz	6.7 mA/A + 0.25 A
		16.0 to 160.0 A	
		10 Hz to 100 Hz	2.0 mA/A + 28 mA
		160.0 to 1000.0 A	
		10 Hz to 65 Hz	2.1 mA/A + 0.45 A
7. Wideband AC Voltage (Frequency from 30Hz to 500 kHz into 50 Ω Termination)	1.1 mV	0.5 μV/V + 0.4 μV	
	3 mV	0.45 μV/V + 1 μV	
	11 mV	0.35 μV/V + 4 μV	
	33 mV	0.3 μV/V + 10 μV	
	110 mV	0.3 μV/V + 40 μV	
	330 mV	0.25 μV/V + 100 μV	
	1.1 V	0.25 μV/V + 400 μV	
	3.5 V	0.2 μV/V + 500 μV	



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
7. Wideband AC Voltage (Continued)	0.0 to 1.1 mV	
Amplitude Flatness at 1 kHz reference	10 Hz to 30 Hz	3 mV/ V
	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	2 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	2 mV/ V + 3 μ V
	2 MHz to 10 MHz	4 mV/ V + 3 μ V
	10 MHz to 20 MHz	6 mV/ V + 3 μ V
	20 MHz to 30 MHz	15 mV/ V + 15 μ V
	1.1 to 3.0 mV	
	10 Hz to 30 Hz	3 mV/ V
	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	1 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	1 mV/ V + 3 μ V
	2 MHz to 10 MHz	3 mV/ V + 3 μ V
	10 MHz to 20 MHz	5 mV/ V + 3 μ V
	20 MHz to 30 MHz	15 mV/ V + 3 μ V



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
7. Wideband AC Voltage (Continued)	Above 3 mV	
Amplitude Flatness	10 Hz to 30 Hz	3 mV/ V
at 1 kHz reference	30 Hz to 120 Hz	1 mV/ V
	120 to 1.2 kHz	1 mV/ V
	1.2 kHz to 12 kHz	1 mV/ V
	12 kHz to 120 kHz	1 mV/ V
	120 kHz to 1.2 MHz	1 mV/ V + 3 μ V
	1.2 MHz to 2 MHz	1 mV/ V + 3 μ V
	2 MHz to 10 MHz	2 mV/ V + 3 μ V
	10 MHz to 20 MHz	4 mV/ V + 3 μ V
	20 MHz to 30 MHz	10 mV/ V + 3 μ V
	(Nominal Value)	
8. Resistance Measuring Instrument	0 Ω	40 $\mu\Omega$
	1 Ω	4 $\mu\Omega/\Omega$
	1.9 Ω	80 $\mu\Omega/\Omega$
	10 Ω	4 $\mu\Omega/\Omega$
	19 Ω	21 $\mu\Omega/\Omega$
	100 Ω	9 $\mu\Omega/\Omega$
	190 Ω	9 $\mu\Omega/\Omega$
	1 k Ω	7.5 $\mu\Omega/\Omega$
	1.9 k Ω	7.5 $\mu\Omega/\Omega$
	10 k Ω	4 $\mu\Omega/\Omega$
	19 k Ω	7.5 $\mu\Omega/\Omega$
	100 k Ω	9 $\mu\Omega/\Omega$
	190 k Ω	9 $\mu\Omega/\Omega$
	1 M Ω	15 $\mu\Omega/\Omega$
	1.9 M Ω	16 $\mu\Omega/\Omega$
	10 M Ω	31 $\mu\Omega/\Omega$
	19 M Ω	39 $\mu\Omega/\Omega$
	100 M Ω	95 $\mu\Omega/\Omega$



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
8. Resistance Measuring Instrument (Continued)	0.0 to 40.0 Ω	0.25 mΩ/Ω + 10 mΩ
	40.0 to 400.0 Ω	0.15 mΩ/Ω + 20 mΩ
	0.4 to 4.0 kΩ	0.15 mΩ/Ω + 80 mΩ
	4.0 to 40.0 kΩ	0.15 mΩ/Ω + 800 mΩ
	40.0 to 400.0 kΩ	0.18 mΩ/Ω + 8.0 Ω
	0.4 to 4.0 MΩ	0.2 mΩ/Ω + 100 Ω
	4.0 to 40.0 MΩ	0.5 mΩ/Ω + 2.0 kΩ
	40.0 to 400.0 MΩ	0.6 mΩ/Ω + 40 kΩ
9. Capacitance	Stim Repetition Rate ≤ 350Hz	
	0.5 to 4.0 nF	3 mF/F + 15 pF
	4.0 to 40.0 nF	3 mF/F + 30 pF
	40.0nF to 400.0 nF	3 mF/F + 160 pF
	0.4 to 4.0 μF	4 mF/F + 1.6 nF
	4.0 to 40.0 μF	5 mF/F + 16 nF
	40.0 to 400.0 μF	5 mF/F + 160 nF
	0.4 to 4.0 mF	5 mF/F + 1.6 μF
	4.0 to 40.0 mF	10 mF/F + 60 μF
	Stim Repetition Rate 350 to 1.5kHz	
	0.5 to 4.0 nF	6 mF/F + 30 pF
	4.0 to 40.0 nF	6 mF/F + 60 pF
	40.0 to 400.0 nF	6 mF/F + 320 pF
	0.4 to 4.0 μF	8 mF/F + 3.2 nF
	4.0 to 40.0 μF	10 mF/F + 32 nF
	40.0 to 400.0 μF	10 mF/F + 320 nF
	0.4 to 4.0 mF	10 mF/F + 3.2 μF
	4.0 to 40.0 mF	20 mF/F + 120 μF



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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
10. Vertical Amplitude		
a) Square Peak to Peak		
1M Ω Load	200 μ V to 100 V	2.5 mV/V + 1 μ V
50 Ω Load	100 μ V to 5 V	2.5 mV/V + 1 μ V
b) DC		
1M Ω Load	4.44 mV to 133.44 V	2.0 mV/V + 40 μ V
50 Ω Load	4.44 mV to 2.78 V	2.0 mV/V + 40 μ V
11. Time Base		
	1 ns	0.5 μ s/s
	2 ns to 5 s	0.25 μ s/s
12. Edge Function		
a) Output Period	100 ns to 10 ms	0.25 μ s/s
b) Rise Time	Unterminated	\leq 100 ns
	50 Ω Load	\leq 1 ns
c) Fall Time	50 Ω Load	\leq 1 ns
13. Frequency		
a) Source	1 μ Hz to 0.5 Hz	5 μ Hz/Hz
	0.5 Hz to 600 MHz	0.25 μ Hz/Hz
	600 MHz to 1050 MHz	20 mHz/Hz



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
A. Indicating Meters/ Instruments		
13. Frequency	0.01 to 5.00 Vpp	
(Continued)	1 μ Hz to 100 kHz	47 mV/ V
b) Amplitude	100 kHz to 20 MHz	47 mV/ V
	20 MHz to 30.2 MHz	59 mV/ V
	5 to 10 Vpp	
	1 μ Hz to 100 kHz	23 mV/ V
	100 kHz to 20 MHz	23 mV/ V
	20 MHz to 30.2 MHz	35 mV/ V
c) Amplitude Flatness	50 kHz to 100 MHz	10 mV/ V
at 50 kHz or 6MHz	100 MHz to 250 MHz	30 mV/ V
reference	250 MHz to 1050 MHz	40 mV/ V
B. Source		
14. DC Voltage	0 to 200 mV	37 μ V/ V + 1.2 μ V
	0 to 2 V	25 μ V/ V + 4 μ V
	0 to 20 V	24 μ V/ V + 80 μ V
	0 to 200 V	38 μ V/ V + 600 μ V
	0 to 1000 V	41 μ V/ V + 6 mV
15. AC Voltage Source	0 to 200 mV	
	20 Hz to 50 Hz	2.5 mV/ V + 30 μ V
	50 Hz to 100 Hz	0.8 mV/ V + 30 μ V
	0.1 kHz to 2 kHz	0.5 mV/ V + 30 μ V
	2 kHz to 10 kHz	0.5 mV/ V + 30 μ V
	10 kHz to 30 kHz	0.5 mV/ V + 30 μ V
	30 kHz to 50 kHz	0.6 mV/ V + 30 μ V



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
15. AC Voltage Source		
(Continued)		
	0 to 200 mV	
	50 kHz to 100 kHz	1.7 mV/ V + 30 µV
	100 kHz to 200 kHz	5 mV/ V + 50 µV
	0.2 MHz to 1 MHz	20 mV/ V + 0.2 mV
	1 MHz to 2 MHz	50 mV/ V + 0.4 mV
	0 to 2V	
	20 Hz to 50 Hz	2.5 mV/ V + 0.3 mV
	50 Hz to 100 Hz	0.8 mV/ V + 0.3 mV
	0.1 kHz to 2 kHz	0.5 mV/ V + 0.3 mV
	2 kHz to 10 kHz	0.5 mV/ V + 0.3 mV
	10 kHz to 30 kHz	0.5 mV/ V + 0.3 mV
	30 kHz to 50 kHz	0.6 mV/ V + 0.3 mV
	50 kHz to 100 kHz	1.7 mV/ V + 0.3 mV
	100 kHz to 200 kHz	5 mV/ V + 0.5 mV
	0.2 MHz to 1 MHz	20 mV/ V + 2 mV
	1 MHz to 2 MHz	50 mV/ V + 4 mV
	0 to 20 V	
	20 Hz to 50 Hz	2.5 mV/ V + 3 mV
	50 Hz to 100 Hz	0.8 mV/ V + 3 mV
	0.1 kHz to 2 kHz	0.6 mV/ V + 3 mV
	2 kHz to 10 kHz	0.85 mV/ V + 3 mV
	10 kHz to 30 kHz	1.2 mV/ V + 3 mV
	30 kHz to 50 kHz	1.3 mV/ V + 3 mV
	50 kHz to 100 kHz	1.7 mV/ V + 3 mV
	100 kHz to 200 kHz	5 mV/ V + 5 mV
	0.2 MHz to 1 MHz	40 mV/ V + 40 mV



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
15. AC Voltage Source (Continued)	0 to 200 V	
	20 Hz to 50 Hz	2.5 mV/ V + 30 mV
	50 Hz to 100 Hz	0.8 mV/ V + 30 mV
	0.1 kHz to 2 kHz	0.6 mV/ V + 30 mV
	2 kHz to 10 kHz	0.85 mV/ V + 30 mV
	10 kHz to 30 kHz	1.2 mV/ V + 30 mV
	30 kHz to 50 kHz	1.3 mV/ V + 30 mV
	50 kHz to 100 kHz	1.7 mV/ V + 30 mV
	0 to 750 V	
	20 Hz to 50 Hz	2.7 mV/ V + 120 mV
	50 Hz to 100 Hz	1.1 mV/ V + 120 mV
	0.1 kHz to 2 kHz	1.0 mV/ V + 120 mV
	2 kHz to 10 kHz	1.3 mV/ V + 120 mV
	10 kHz to 30 kHz	1.8 mV/ V + 120 mV
16. DC Current	0 to 200 μ A	500 μ A/A + 5 nA
	0 to 2 mA	400 μ A/A + 40 nA
	0 to 20 mA	400 μ A/A + 400 nA
	0 to 200 mA	500 μ A/A + 4 μ A
	0 to 2 A	900 μ A/A + 40 μ A
	0 to 10 A	2 mA/A + 0.7 mA
17. AC Current	0 to 200 μ A	
	20 Hz to 50 Hz	3.5 mA/A + 30 nA
	50 Hz to 200 Hz	2 mA/A + 30 nA
	200 kHz to 1 kHz	4 mA/A + 30 nA
	1 kHz to 10 kHz	5 mA/A + 30 nA



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
17. AC Current		
(Continued)		
	0 to 2 mA	
	20 Hz to 50 Hz	3 mA/A + 0.3 μ A
	50 Hz to 200 Hz	1.5 mA/A + 0.3 μ A
	200 Hz to 1 kHz	1.2 mA/A + 0.3 μ A
	1kHz to 10 kHz	1.2 mA/A + 0.3 μ A
	0 to 20 mA	
	20 Hz to 50 Hz	3 mA/A + 3 μ A
	50 Hz to 200 Hz	1.5 mA/A + 3 μ A
	200 kHz to 1 kHz	1.2 mA/A + 3 μ A
	1kHz to 10 kHz	1.2 mA/A + 3 μ A
	0 to 200 mA	
	20 Hz to 50 Hz	3 mA/A + 30 μ A
	50 Hz to 200 Hz	1.5 mA/A + 30 μ A
	200 kHz to 1 kHz	1.2 mA/A + 30 μ A
	1kHz to 10 kHz	1.5 mA/A + 30 μ A
	0 to 2 A	
	20 Hz to 50 Hz	3.5 mA/A + 0.3 mA
	50 Hz to 200 Hz	2 mA/A + 0.3 mA
	200 kHz to 1 kHz	3 mA/A + 0.3 mA
	1kHz to 10 kHz	4.5 mA/A + 0.3 mA
	0 to 10 A	
	20 Hz to 50 Hz	20 mA/A + 10 mA
	50 Hz to 200 Hz	10 mA/A + 10 mA



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
B. Source		
18. Resistance	20 Ω	72 μΩ/Ω + 0.14 mΩ
	200 Ω	56 μΩ/Ω + 1.4 mΩ
	2 kΩ	50 μΩ/Ω + 8 mΩ
	20 kΩ	50 μΩ/Ω + 80 mΩ
	200 kΩ	90 μΩ/Ω + 0.9 Ω
	2 MΩ	160 μΩ/Ω + 9 Ω
	20 MΩ	900 μΩ/Ω + 90 Ω
19. Frequency	200 MΩ	20 mΩ/Ω + 20 kΩ
	1.0 Hz – 10 MHz	1 μHz/Hz + 0.1 Hz
	10 MHz – 100 MHz	1 μHz/Hz + 1 Hz
	100 MHz – 1.3 GHz	1 μHz/Hz + 10 Hz

Signatories:

- | | | |
|----|------------------|-----------------------------|
| 1. | Wong Sin Chon | I/C No.: 670902 – 08 – 5721 |
| 2. | Chan Chee Kuan | I/C No.: 671031 – 08 – 5623 |
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| 4. | Md. Rizal Paiman | I/C No.: 780405 – 01 – 6319 |



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENT

SCOPE OF ACCREDITATION: SITE CALIBRATION- CATEGORY I

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty *</u>
Source		
DC Current	0.1 to 1 μ A	0.4 nA
(Shunt Method)	1 to 10 μ A	1.2 nA
	10 to 100 μ A	10 nA
	100 to 1 mA	100 nA
	1 to 10 mA	1.6 μ A
	10 to 100 mA	16 μ A
	0.1 to 1 A	0.26 mA
	1 to 2 A	0.11 mA
	2 to 5 A	0.21 mA
	5 to 10 A	0.4 mA
	10 to 15 A	0.6 mA
	15 to 20 A	1.6 mA
	20 to 25 A	1.7 mA
	25 to 30 A	1.9 mA

Signatory:

1. Chan Chee Kuan
2. Md. Rizal Paiman

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