

NO: SMM 192

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LABORATORY LOCATION: **TEKMARK SDN BHD**
(PERMANENT LABORATORY) **NO. 7, LINTANG BATU MAUNG 1**
DESA DYNAVIEW SHOPLOT
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The standard used for assessment of this laboratory is MS ISO/IEC 17025:2005

FIELD OF CALIBRATION: ELECTRICAL

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
A. Indicating Meters/ Instruments		
1. DC Voltage	0 to 329.9999 mV	(output + floor) 20 μ V/V + 1 μ V
	0 to 3.299999 V	11 μ V/V + 2 μ V
	0 to 32.99999 V	12 μ V/V + 20 μ V
	0 to 329.9999 V	18 μ V/V + 150 μ V
	0 to 1020.000 V	18 μ V/V + 1500 μ V
2. AC Voltage	<u>1.0 mV to 32.999 mV</u>	(output + floor)
	10 Hz to 45 Hz	800 μ V/V + 6.0 μ V
	45 Hz to 10 kHz	150 μ V/V + 6.0 μ V
	10 kHz to 20 kHz	200 μ V/V + 6.0 μ V
	20 kHz to 50 kHz	1.0 mV/V + 6.0 μ V
	50 kHz to 100 kHz	3.5 mV/V + 12 μ V
	500 kHz to 500 kHz	8.0 mV/V + 50 μ V
	<u>33 mV to 329.999 mV</u>	
	10 Hz to 45 Hz	300 μ V/V + 8.0 μ V
	45 Hz to 10 kHz	150 μ V/V + 8.0 μ V
	10 kHz to 20 kHz	160 μ V/V + 8.0 μ V
	20 kHz to 50 kHz	350 μ V/V + 8.0 μ V
	50 kHz to 100 kHz	800 μ V/V + 32 μ V
	100 kHz to 500 kHz	2.0 mV/V + 70 μ V
	<u>330 mV to 3.29999 V</u>	
	10 Hz to 45 Hz	300 μ V/V + 50 μ V
	45 Hz to 10 kHz	150 μ V/V + 60 μ V
	10 kHz to 20 kHz	190 μ V/V + 60 μ V
	20 kHz to 50 kHz	300 μ V/V + 50 μ V
	50 kHz to 100 kHz	700 μ V/V + 125 μ V
	100 kHz to 500 kHz	2.4 mV/V + 600 μ V

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

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FIELD OF CALIBRATION: ELECTRICAL

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
2. AC Voltage (cont.)	<u>3.3 V to 32.9999 V</u>	
	10 Hz to 45 Hz	300 $\mu\text{V/V}$ + 650 μV
	45 Hz to 10 kHz	150 $\mu\text{V/V}$ + 600 μV
	10 kHz to 20 kHz	240 $\mu\text{V/V}$ + 600 μV
	20 kHz to 50 kHz	350 $\mu\text{V/V}$ + 600 μV
	50 kHz to 100 kHz	900 $\mu\text{V/V}$ + 1.6 mV
	<u>33 V to 329.999 V</u>	
	45 Hz to 1 kHz	190 $\mu\text{V/V}$ + 2.0 mV
	1 kHz to 10 kHz	200 $\mu\text{V/V}$ + 6.0 mV
	10 kHz to 20 kHz	250 $\mu\text{V/V}$ + 6.0 mV
	20 kHz to 50 kHz	300 $\mu\text{V/V}$ + 6.0 mV
	50 kHz to 100 kHz	2.0 mV/V + 50 mV
	<u>330.V to 1020 V</u>	
	45 Hz to 1 kHz	300 $\mu\text{V/V}$ + 10 mV
	1 kHz to 5 kHz	250 $\mu\text{V/V}$ + 10 mV
5 kHz to 10 kHz	300 $\mu\text{V/V}$ + 10 mV	
3. DC Current	0 to 329.999 μA	150 $\mu\text{A/A}$ + 0.02 μA
	0 to 3.29999 mA	100 $\mu\text{A/A}$ + 0.05 μA
	0 to 32.9999 mA	100 $\mu\text{A/A}$ + 0.25 μA
	0 to 329.999 mA	100 $\mu\text{A/A}$ + 2.5 μA
	0 to 1.09999 A	200 $\mu\text{A/A}$ + 40 μA
	1.1 to 2.99999 A	380 $\mu\text{A/A}$ + 40 μA
	0 to 10.9999 A	500 $\mu\text{A/A}$ + 500 μA
11 to 20.0 A	1.0 mA/A + 750 μA	

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FIELD OF CALIBRATION: ELECTRICAL

SCOPE OF ACCREDITATION:

**Instrument calibrated/
Measurement parameter**

Range

**Best measurement capability
expressed as an uncertainty (\pm) ***
(output + floor)

4. AC Current

29 μ A to 329.99 μ A

10 Hz to 20 Hz	2.0 mA/A + 0.10 μ A
20 Hz to 45 Hz	1.5 mA/A + 0.10 μ A
45 Hz to 1 kHz	1.3 mA/A + 0.10 μ A
1 kHz to 5 kHz	3.0 mA/A + 0.15 μ A
5 kHz to 10 kHz	8.0 mA/A + 0.20 μ A
10 kHz to 30 kHz	16 mA/A + 0.40 μ A

0.33 mA to 3.2999 mA

10 Hz to 20 Hz	2.0 mA/A + 0.15 μ A
20 Hz to 45 Hz	1.3 mA/A + 0.15 μ A
45 Hz to 1 kHz	1.0 mA/A + 0.15 μ A
1 kHz to 5 kHz	2.0 mA/A + 0.20 μ A
5 kHz to 10 kHz	5.0 mA/A + 0.30 μ A
10 kHz to 30 kHz	10 mA/A + 0.60 μ A

3.3 mA to 32.999 mA

10 Hz to 20 Hz	1.8 mA/A + 2.0 μ A
20 Hz to 45 Hz	0.9 mA/A + 2.0 μ A
45 Hz to 1 kHz	0.4 mA/A + 2.0 μ A
1 kHz to 5 kHz	0.8 mA/A + 2.0 μ A
5 kHz to 10 kHz	2.0 mA/A + 3.0 μ A
10 kHz to 30 kHz	4.0 mA/A + 4.0 μ A

33 mA to 329.99 mA

10 Hz to 20 Hz	1.8 mA/A + 20 μ A
20 Hz to 45 Hz	0.9 mA/A + 20 μ A
45 Hz to 1 kHz	0.4 mA/A + 20 μ A
1 kHz to 5 kHz	1.0 mA/A + 50 μ A
5 kHz to 10 kHz	2.0 mA/A + 100 μ A
10 kHz to 30 kHz	4.0 mA/A + 200 μ A

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SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
4. AC Current (cont.)	<u>330 mA to 1.09999 A</u>	
	10 Hz to 45 Hz	1.8 mA/A + 100 μ A
	45 Hz to 1 kHz	0.50 mA/A + 100 μ A
	1 kHz to 5 kHz	6.0 mA/A + 1.0 mA
	5 kHz to 10 kHz	25 mA/A + 5.0 mA
	<u>1.1 A to 2.99999 A</u>	
	10 Hz to 45 Hz	1.8 mA/A + 100 μ A
	45 Hz to 1 kHz	0.60 mA/A + 100 μ A
	1 kHz to 5 kHz	6 mA/A + 1.0 mA
	5 kHz to 10 kHz	25 mA/A + 5.0 mA
	<u>3 A to 10.9999 A</u>	
	45 Hz to 100 Hz	0.60 mA/A + 2.0 mA
	100 Hz to 1 kHz	1.0 mA/A + 2.0 mA
	1 kHz to 5 kHz	30 mA/A + 2.0 mA
	<u>11 A to 20.5A</u>	
45 Hz to 100 Hz	1.2 mA/A + 5.0 mA	
100 Hz to 1 kHz	1.5 mA/A + 5.0 mA	
1 kHz to 5 kHz	30 mA/A + 5.0 mA	
5. DC Resistance	0 to 10.9999 Ω	40 $\mu\Omega/\Omega$ + 1.0 m Ω
	11 Ω to 32.9999 Ω	30 $\mu\Omega/\Omega$ + 1.5 m Ω
	33 Ω to 109.9999 Ω	28 $\mu\Omega/\Omega$ + 1.4 m Ω
	110 Ω to 1.099999 k Ω	28 $\mu\Omega/\Omega$ + 2.0 m Ω
	1.1 k Ω to 10.99999 k Ω	28 $\mu\Omega/\Omega$ + 20 m Ω
	11 k Ω to 109.9999 k Ω	28 $\mu\Omega/\Omega$ + 0.20 Ω
	110 k Ω to 1.099999 M Ω	32 $\mu\Omega/\Omega$ + 2.0 Ω
	1.1 M Ω to 3.299999 M Ω	60 $\mu\Omega/\Omega$ + 30 Ω

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SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
5. DC Resistance (Cont.)		(output + floor)
	3.3 M Ω to 10.99999 M Ω	130 $\mu\Omega/\Omega$ + 50 Ω
	11 M Ω to 32.99999 M Ω	250 $\mu\Omega/\Omega$ + 2.5 k Ω
	33 M Ω to 109.9999 M Ω	500 $\mu\Omega/\Omega$ + 3.0 k Ω
	110 M Ω to 329.9999 M Ω	3.0 m Ω/Ω + 100 k Ω
	400 M Ω to 1100 M Ω	15 m Ω/Ω + 500 k Ω
6. Capacitance		
	0.19 nF to 0.32999 nF	5.0 mF/F + 10 pF
	3.3 nF to 10.9999 nF	2.5 mF/F + 10 pF
	11 nF to 109.999 nF	2.5 mF/F + 100 pF
	110 nF to 329.999 nF	2.5 mF/F + 300 pF
	0.33 μ F to 1.09999 μ F	2.5 mF/F + 1.0 nF
	1.1 μ F to 3.29999 μ F	2.5 mF/F + 3.0 nF
	3.3 μ F to 10.9999 μ F	2.5 mF/F + 10 nF
	11 μ F to 32.9999 μ F	4.0 mF/F + 30 nF
	33 μ F to 109.999 μ F	4.5 mF/F + 100 nF
	110 μ F to 329.999 μ F	4.5 mF/F + 300 nF
	330 μ F to 1.09999 mF	4.5 mF/F + 1.0 μ F
	1.1 mF to 3.2999 mF	4.5 mF/F + 3.0 μ F
	3.3 mF to 10.9999 mF	4.5 mF/F + 10 μ F
	11 mF to 32.9999 mF	7.5 mF/F + 30 μ F
	33 mF to 110 mF	11 mF/F + 100 μ F
<u>7. Vertical Amplitude</u>		
Pk-Pk (1 M Ω Load)		(output + floor)
	200 μ V to 1 mV	2.5 mV/V + 1 μ V
	1 mV to 130 V	1.0 mV/V + 40 μ V
Pk-Pk (50 Ω Load)		
	100 μ V to 5 V	2.5 mV/V + 1 μ V
	5 V to 6.6 V	2.5 mV/V + 40 μ V
DC (1 M Ω Load)		
	0 V to 130 V	0.5 mV/V + 40 μ V
DC (50 Ω Load)		
	0 V to 6.6 V	2.5 mV/V + 40 μ V

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
8. Time Base	1 ns to 5 s	0.5 μ s/s
9. Rise Time	50 Ω Load 100 Hz to 100 kHz	125ps
10. Frequency	0.1 μ Hz to 20 GHz	2.6×10^{-11} with external locked
11. RF Power into 50 ohm Impedance	<u>-36.02 dBm to 17.96 dBm</u> 1 μ Hz to 10 MHz	0.4 dB of Output
	<u>17.96 dBm to 23.98 dBm</u> 1 μ Hz to 10 MHz	0.2 dB of Output
	<u>-30 dBm to -15 dBm</u> 0.050 GHz to 8.500 GHz 8.501 GHz to 18.000 GHz	0.05 dB of Output 0.06 dB of Output
	<u>-15 dBm to -5 dBm</u> 0.050 GHz to 8.500 GHz 8.501 GHz to 18.000 GHz	0.05 dB of Output 0.06 dB of Output
	<u>-5 dBm to 20 dBm</u> 0.050 GHz to 12.000 GHz 12.401 GHz to 18.000 GHz	0.04 dB of Output 0.05 dB of Output
	12. Bandwidth Frequency	50 kHz to 1100 MHz
13. Bandwidth Amplitude Flatness	50 kHz to 100 MHz	15 mV/V at ref.
	100 MHz to 300 MHz	(20 mV/V + 100 μ V) at ref.
	300 MHz to 1050 MHz	40 mV/V at ref.
	1050 MHz to 1100 MHz	(50 mV/V + 100 μ V) at ref.

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
14. Spectral Purity	<u>Harmonic & Harmonic Related</u> 10 MHz to 50 MHz 50 MHz to 2 GHz 2 GHz to 18 GHz <u>NonHarmonics</u> 10 MHz to 2 GHz 2 GHz to 18 GHz	dBc – The level of a signal in dB relative to a wanted carrier Signal level -30 dBc -40 dBc -60 dBc -40 dBc -60 dBc
15. Amplitude Modulation	<u>10 MHz to 18 GHz</u> Rate (kHz) Depth (%) 1 50 <u>10 kHz to 4.2 GHz</u> Rate (kHz) Depth (%) 1 0-90	5 % 6% of Depth Setting + 1%
<u>B. Sources</u>		
1. DC Voltage	0 mV to 210 mV 0.21 V to 2.1 V 2.1 V to 21 V 21 V to 210 V 210 V to 630 V 30 V to 900 V 900 V to 1000 V	23 μ V/V + 0.0018 mV 14 μ V /V + 0.000018 V 13 μ V /V + 0.000003 V 25 μ V/V + 0.0004 V 26 μ V /V+ 0.0004 V 27 μ V /V+ 0.0004 V 28 μ V /V+ 0.0004 V
2. AC Voltage	<u>200 mV</u> 20 Hz to 50 Hz 50 Hz to 100 Hz 0.1 kHz to 2 kHz 2 kHz to 10 kHz 0 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 200 kHz 0.2 MHz to 1 MHz 1 MHz to 2 MHz	2.5 mV/V + 0.03 mV 0.7 mV/V + 0.03 mV 0.2 mV/V + 0.02 mV 0.2 mV/V + 0.02 mV 0.25 mV/V + 0.02 mV 0.5 mV/V + 0.02 mV 3.0 mV/V + 0.02 mV 7.5 mV/V + 0.05 mV 20 mV/V + 0.2 mV 50 mV/V + 0.4 mV

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SCOPE OF ACCREDITATION:

**Instrument calibrated/
Measurement parameter**

Range

**Best measurement capability
expressed as an uncertainty (\pm) ***

2 V

20 Hz to 50 Hz	2.5 mV/V + 0.0003 V
50 Hz to 100 Hz	0.7 mV/V + 0.0003 V
0.1 kHz to 2 kHz	0.2 mV/V + 0.0002 V
2 kHz to 10 kHz	0.2 mV/V + 0.0002 V
10 kHz to 30 kHz	0.25 mV/V + 0.0002 V
30 kHz to 50 kHz	0.5 mV/V + 0.0002 V
50 kHz to 100 kHz	3.0 mV/V + 0.0002 V
100 kHz to 200 kHz	7.5 mV/V + 0.0002 V
0.2 MHz to 1 MHz	20 mV/V + 0.002 V
1 MHz to 2 MHz	50 mV/V + 0.004 V

20 V

20 Hz to 50 Hz	2.5 mV/V + 0.003 V
50 Hz to 100 Hz	0.70 mV/V + 0.003 V
0.1 kHz to 2 kHz	0.30 mV/V + 0.003 V
2 kHz to 10 kHz	0.40 mV/V + 0.003 V
10 kHz to 30 kHz	0.50 mV/V + 0.003 V
30 kHz to 50 kHz	0.70 mV/V + 0.003 V
50 kHz to 100 kHz	30 mV/V + 0.003 V
100 kHz to 200 kHz	7.5 mV/V + 0.003 V
0.2 MHz to 1 MHz	20 mV/V + 0.04 V

200 V

20 Hz to 50 Hz	2.5 mV/V + 0.03 V
50 Hz to 100 Hz	0.70 mV/V + 0.03 V
0.1 kHz to 2 kHz	0.30 mV/V + 0.03 V
2 kHz to 10 kHz	0.40 mV/V + 0.03 V
10 kHz to 30 kHz	0.50 mV/V + 0.03 V
30 kHz to 50 kHz	0.70 mV/V + 0.03 V
50 kHz to 100 kHz	30 mV/V + 0.03 V

Source above 100 V

Additional Uncertainty
0.010 mV/V * (Vin/100V)²

750 V

20 Hz to 50 Hz	2.5 mV/V + 0.03 V
50 Hz to 100 Hz	0.70 mV/V + 0.03 V
0.1 kHz to 2 kHz	0.30 mV/V + 0.03 V

Source above 100 V

Additional Uncertainty
0.010 mV/V * (Vin/100V)²

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FIELD OF CALIBRATION: ELECTRICAL

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
3. DC Current	0 μ A to 210 μ A	400 μ A/A + 0.005 μ A
	0 mA to 2.1 mA	390 μ A/A + 0.00004 mA
	0 mA to 21 mA	410 μ A/A + 0.0004 mA
	0 mA to 210 mA	540 μ A/A + 0.004 mA
	0 A to 2 A	880 μ A/A + 0.00004 A
4. AC Current	<u>200 μA</u>	
	20 Hz to 50 Hz	3.5 mA/A + 0.03 μ A
	50 Hz to 200 Hz	20 mA/A + 0.03 μ A
	0.2 kHz to 1 kHz	40 mA/A + 0.03 μ A
	1 kHz to 10 kHz	50 mA/A + 0.03 μ A
	<u>2 mA</u>	
	20 Hz to 50 Hz	3.0 mA/A + 0.0003 mA
	50 Hz to 200 Hz	1.5 mA/A + 0.0003 mA
	0.2 kHz to 1 kHz	1.2 mA/A + 0.0003 mA
	1 kHz to 10 kHz	1.2 mA/A + 0.0003 mA
	<u>20 mA</u>	
	20 Hz to 50 Hz	3.0 mA/A + 0.003 mA
	50 Hz to 200 Hz	1.5 mA/A + 0.003 mA
	0.2 kHz to 1 kHz	1.2 mA/A + 0.003 mA
	1 kHz to 10 kHz	1.2 mA/A + 0.003 mA
	<u>200 mA</u>	
20 Hz to 50 Hz	3.0 mA/A + 0.03 mA	
50 Hz to 200 Hz	1.5 mA/A + 0.03 mA	
0.2 kHz to 1 kHz	1.2 mA/A + 0.03 mA	
1 kHz to 10 kHz	1.2 mA/A + 0.03 mA	
<u>2 A</u>		
20 Hz to 50 Hz	3.5 mA/A + 0.0003 A	
50 Hz to 200 Hz	20 mA/A + 0.0003 A	
0.2 kHz to 1 kHz	30 mA/A + 0.0003 A	
1 kHz to 10 kHz	4.5 mA/A + 0.0003 A	
5. DC Resistance	0 Ω to 20 Ω	47 $\mu\Omega/\Omega$ + 0.00012 Ω
	0 Ω to 200 Ω	25 $\mu\Omega/\Omega$ + 0.0008 Ω
	0 Ω to 2 k Ω	16 $\mu\Omega/\Omega$ + 0.0000008 k Ω
	0 Ω to 20 k Ω	17 $\mu\Omega/\Omega$ + 0.000008 k Ω
	0 Ω to 200 k Ω	43 $\mu\Omega/\Omega$ + 0.00018 Ω
	0 Ω to 2 M Ω	80 $\mu\Omega/\Omega$ + 0.000001 M Ω
	0 Ω to 20 M Ω	270 $\mu\Omega/\Omega$ + 0.000012 M Ω
	0 Ω to 200 M Ω	570 $\mu\Omega/\Omega$ + 0.0006 M Ω

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SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
6. Frequency	10 mHz to 30 kHz	0.4 mHz
	31 kHz to 300 kHz	1 mHz
	301 kHz to 3 MHz	10 mHz
	3.1 MHz to 18 GHz	0.1 Hz
7. RF Power into 50 ohm Impedance	<u>-30 dBm to -15 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of reading
	8.501 GHz to 26.500 GHz	0.06 dB of reading
	<u>-15 dBm to -5 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of reading
	8.501 GHz to 26.500 GHz	0.06 dB of reading
	<u>-5 dBm to 20 dBm</u>	
	4.501 GHz to 12.400 GHz	0.04 dB of reading
	12.401 GHz to 26.500 GHz	0.05 dB of reading

Signatories:

- | | | |
|----|-------------------------|------------------------------------|
| 1. | Chan Chee Kuan | I/C No.: 671031 – 08 – 5623 |
| 2. | Chan Boon Lye | I/C No.: 650527 – 07 – 5477 |
| 3. | Md. Rizal Paiman | I/C No.: 780405 – 01 – 6319 |

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FIELD OF CALIBRATION: ELECTRICAL

SCOPE OF ACCREDITATION: SITE CALIBRATION CATEGORY 1

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
A. <u>Indicating Meters/ Instruments</u>		
1. DC Voltage	0 to 329.9999 mV	(output + floor) 20 μ V/V + 1 μ V
	0 to 3.299999 V	11 μ V/V + 2 μ V
	0 to 32.999999 V	12 μ V/V + 20 μ V
	0 to 329.9999 V	18 μ V/V + 150 μ V
	0 to 1020.000 V	18 μ V/V + 1500 μ V
2. AC Voltage	<u>1.0 mV to 32.999 mV</u>	(output + floor)
	10 Hz to 45 Hz	800 μ V/V + 6.0 μ V
	45 Hz to 10 kHz	150 μ V/V + 6.0 μ V
	10 kHz to 20 kHz	200 μ V/V + 6.0 μ V
	20 kHz to 50 kHz	1.0 mV/V + 6.0 μ V
	50 kHz to 100 kHz	3.5 mV/V + 12 μ V
	500 kHz to 500 kHz	8.0 mV/V + 50 μ V
	<u>33 mV to 329.999 mV</u>	
	10 Hz to 45 Hz	300 μ V/V + 8.0 μ V
	45 Hz to 10 kHz	150 μ V/V + 8.0 μ V
	10 kHz to 20 kHz	160 μ V/V + 8.0 μ V
	20 kHz to 50 kHz	350 μ V/V + 8.0 μ V
	50 kHz to 100 kHz	800 μ V/V + 32 μ V
	100 kHz to 500 kHz	2.0 mV/V + 70 μ V
	<u>330 mV to 3.29999 V</u>	
	10 Hz to 45 Hz	300 μ V/V + 50 μ V
	45 Hz to 10 kHz	150 μ V/V + 60 μ V
	10 kHz to 20 kHz	190 μ V/V + 60 μ V
	20 kHz to 50 kHz	300 μ V/V + 50 μ V
	50 kHz to 100 kHz	700 μ V/V + 125 μ V
	100 kHz to 500 kHz	2.4 mV/V + 600 μ V
	<u>3.3 V to 32.9999 V</u>	
	10 Hz to 45 Hz	300 μ V/V + 650 μ V
	45 Hz to 10 kHz	150 μ V/V + 600 μ V
	10 kHz to 20 kHz	240 μ V/V + 600 μ V
	20 kHz to 50 kHz	350 μ V/V + 600 μ V
	50 kHz to 100 kHz	900 μ V/V + 1.6 mV

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SCOPE OF ACCREDITATION: SITE CALIBRATION CATEGORY 1

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertain (\pm) *</u>
2. AC Voltage (cont.)	<u>33 V to 329.999 V</u>	
	45 Hz to 1 kHz	190 $\mu\text{V/V} + 2.0 \text{ mV}$
	1 kHz to 10 kHz	200 $\mu\text{V/V} + 6.0 \text{ mV}$
	10 kHz to 20 kHz	250 $\mu\text{V/V} + 6.0 \text{ mV}$
	20 kHz to 50 kHz	300 $\mu\text{V/V} + 6.0 \text{ mV}$
	50 kHz to 100 kHz	2.0 $\text{mV/V} + 50 \text{ mV}$
	<u>330.V to 1020 V</u>	
	45 Hz to 1 kHz	300 $\mu\text{V/V} + 10 \text{ mV}$
	1 kHz to 5 kHz	250 $\mu\text{V/V} + 10 \text{ mV}$
	5 k to 10 kHz	300 $\mu\text{V/V} + 10 \text{ mV}$
3. DC Current	0 to 329.999 μA	150 $\mu\text{A/A} + 0.02 \mu\text{A}$
	0 to 3.29999 mA	100 $\mu\text{A/A} + 0.05 \mu\text{A}$
	0 to 32.9999 mA	100 $\mu\text{A/A} + 0.25 \mu\text{A}$
	0 to 329.999 mA	100 $\mu\text{A/A} + 2.5 \mu\text{A}$
	0 to 1.09999 A	200 $\mu\text{A/A} + 40 \mu\text{A}$
	1.1 to 2.99999 A	380 $\mu\text{A/A} + 40 \mu\text{A}$
	0 to 10.9999 A	500 $\mu\text{A/A} + 500 \mu\text{A}$
	11 to 20.0 A	1.0 $\text{mA/A} + 750 \mu\text{A}$
4. AC Current	<u>29 μA to 329.99 μA</u>	(Output + floor)
	10 Hz to 20 Hz	2.0 $\text{mA/A} + 0.10 \mu\text{A}$
	20 Hz to 45 Hz	1.5 $\text{mA/A} + 0.10 \mu\text{A}$
	45 Hz to 1 kHz	1.3 $\text{mA/A} + 0.10 \mu\text{A}$
	1 kHz to 5 kHz	3.0 $\text{mA/A} + 0.15 \mu\text{A}$
	5 kHz to 10 kHz	8.0 $\text{mA/A} + 0.20 \mu\text{A}$
	10 kHz to 30 kHz	16 $\text{mA/A} + 0.40 \mu\text{A}$
	<u>0.33 mA to 3.2999 mA</u>	
	10 Hz to 20 Hz	2.0 $\text{mA/A} + 0.15 \mu\text{A}$
	20 Hz to 45 Hz	1.3 $\text{mA/A} + 0.15 \mu\text{A}$
	45 Hz to 1 kHz	1.0 $\text{mA/A} + 0.15 \mu\text{A}$

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SCOPE OF ACCREDITATION: SITE CALIBRATION CATEGORY 1

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
4. AC Current (cont.)	<u>3.3 mA to 32.999 mA</u>	
	10 Hz to 20 Hz	1.8 mA/A + 2.0 μ A
	20 Hz to 45 Hz	0.9 mA/A + 2.0 μ A
	45 Hz to 1 kHz	0.4 mA/A + 2.0 μ A
	1 kHz to 5 kHz	0.8 mA/A + 2.0 μ A
	5 kHz to 10 kHz	2.0 mA/A + 3.0 μ A
	10 kHz to 30 kHz	4.0 mA/A + 4.0 μ A
	<u>33 mA to 329.99 mA</u>	
	10 Hz to 20 Hz	1.8 mA/A + 20 μ A
	20 Hz to 45 Hz	0.9 mA/A + 20 μ A
	45 Hz to 1 kHz	0.4 mA/A + 20 μ A
	1 kHz to 5 kHz	1.0 mA/A + 50 μ A
	5 kHz to 10 kHz	2.0 mA/A + 100 μ A
	<u>330 mA to 1.09999 A</u>	
	10 Hz to 45 Hz	1.8 mA/A + 100 μ A
45 Hz to 1 kHz	0.50 mA/A + 100 μ A	
1 kHz to 5 kHz	6.0 mA/A + 1.0 mA	
5 kHz to 10 kHz	25 mA/A + 5.0 mA	
<u>1.1 A to 2.99999 A</u>		
10 Hz to 45 Hz	1.8 mA/A + 100 μ A	
45 Hz to 1 kHz	0.60 mA/A + 100 μ A	
1 kHz to 5 kHz	6 mA/A + 1.0 mA	
5 kHz to 10 kHz	25 mA/A + 5.0 mA	

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>	
4. AC Current (cont.)	<u>3 A to 10.9999 A</u>		
	45 Hz to 100 Hz	0.60 mA/A + 2.0 mA	
	100 Hz to 1 kHz	1.0 mA/A + 2.0 mA	
	1 kHz to 5 kHz	30 mA/A + 2.0 mA	
	<u>11 A to 20.5A</u>		
	45 Hz to 100 Hz	1.2 mA/A + 5.0 mA	
	100 Hz to 1 kHz	1.5 mA/A + 5.0 mA	
	1 kHz to 5 kHz	30 mA/A + 5.0 mA	
	5. DC Resistance	0 to 10.9999 Ω	40 $\mu\Omega/\Omega$ + 1.0 m Ω
		11 Ω to 32.9999 Ω	30 $\mu\Omega/\Omega$ + 1.5 m Ω
33 Ω to 109.9999 Ω		28 $\mu\Omega/\Omega$ + 1.4 m Ω	
110 Ω to 1.099999 k Ω		28 $\mu\Omega/\Omega$ + 2.0 m Ω	
1.1 k Ω to 10.99999 k Ω		28 $\mu\Omega/\Omega$ + 20 m Ω	
11 k Ω to 109.9999 k Ω		28 $\mu\Omega/\Omega$ + 0.20 Ω	
110 k Ω to 1.099999 M Ω		32 $\mu\Omega/\Omega$ + 2.0 Ω	
1.1 M Ω to 3.299999 M Ω		60 $\mu\Omega/\Omega$ + 30 Ω	
3.3 M Ω to 10.99999 M Ω		130 $\mu\Omega/\Omega$ + 50 Ω	
11 M Ω to 32.99999 M Ω		250 $\mu\Omega/\Omega$ + 2.5 k Ω	
33 M Ω to 109.9999 M Ω		500 $\mu\Omega/\Omega$ + 3.0 k Ω	
110 M Ω to 329.9999 M Ω		3.0 m Ω/Ω + 100 k Ω	
400 M Ω to 1100 M Ω		15 m Ω/Ω + 500 k Ω	
6. Capacitance	0.19 nF to 0.32999 nF	5.0 mF/F + 10 PF	
	3.3 nF to 10.9999 nF	2.5 mF/F + 10 pF	
	11 nF to 109.999 nF	2.5 mF/F + 100 pF	
	110 nF to 329.999 nF	2.5 mF/F + 300 pF	
	0.33 μ F to 1.09999 μ F	2.5 mF/F + 1.0 nF	
	1.1 μ F to 3.29999 μ F	2.5 mF/F + 3.0 nF	
	3.3 μ F to 10.9999 μ F	2.5 mF/F + 10 nF	
	11 μ F to 32.9999 μ F	4.0 mF/F + 30 nF	
	33 μ F to 109.999 μ F	4.5 mF/F + 100 nF	
	110 μ F to 329.999 μ F	4.5 mF/F + 300 nF	

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<u>Instrument calibrated/ Measurement Parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm)*</u>
6. Capacitance (Cont.)	330 μ F to 1.09999 mF 1.1 mF to 3.2999 mF 3.3 mF to 10.9999 mF 11 mF to 32.9999 mF 33 mF to 110 mF	4.5 mF/F + 1.0 μ F 4.5 mF/F + 3.0 μ F 4.5 mF/F + 10 μ F 7.5 mF/F + 30 μ F 11 mF/F + 100 μ F
7. Vertical Amplitude		
Pk-Pk (1 M Ω Load)	200 μ V to 1 mV 1 mV to 130 V	(output + floor) 2.5 mV/V + 1 μ V 1.0 mV/V + 40 μ V
Pk-Pk (50 Ω Load)	100 μ V to 5 V 5 V to 6.6 V	2.5 mV/V + 1 μ V 2.5 mV/V + 40 μ V
DC (1 M Ω Load)	0 V to 130 V	0.5 mV/V + 40 μ V
DC (50 Ω Load)	0 V to 6.6 V	2.5 mV/V + 40 μ V
8. Time Base	1 ns to 5 s	0.5 μ s/s
9. Rise Time	50 Ω Load 100 Hz to 100 kHz	125ps
10. Frequency	0.1 μ Hz to 20 GHz	2.6x10 ⁻¹¹ with external locked
11. RF Power into 50 ohm Impedance	<u>-36.02 dBm to 17.96 dBm</u> 1 μ Hz to 10 MHz <u>17.96 dBm to 23.98 dBm</u> 1 μ Hz to 10 MHz	0.4 dB of output 0.2 dB of output

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability Expressed as an uncertainty (±) *</u>
11. RF Power into 50 ohm Impedance	<u>-30 dBm to -15 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of output
	8.501 GHz to 18.000 GHz	0.06 dB of output
	<u>-15 dBm to -5 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of output
	8.501 GHz to 18.000 GHz	0.06 dB of output
	<u>-5 dBm to 20 dBm</u>	
	0.050 GHz to 12.400 GHz	0.04 dB of output
	12.401 GHz to 18.000 GHz	0.05 dB of output
12. Bandwidth Frequency	50 kHz to 1100 MHz	2.5 µHz/Hz
13. Bandwidth Amplitude Flatness	50 kHz to 100 MHz	15 mV/V at ref.
	100 MHz to 300 MHz	(20 mV/V + 100 µV) at ref.
	300 MHz to 1050 MHz	40 mV/V at ref.
	1050 MHz to 1100 MHz	(50 mV/V + 100 µV) at ref.
14. Spectral Purity	<u>Harmonic & Harmonic Related</u>	dBc – The level of a signal in dB relative to a wanted carrier Signal level
	10 MHz to 50 MHz	-30 dBc
	50 MHz to 2 GHz	-40 dBc
	2 GHz to 18 GHz	-60 dBc
	<u>NonHarmonics</u>	
	10 MHz to 2 GHz	-40 dBc
	2 GHz to 18 GHz	-60 dBc
15. Amplitude Modulation	<u>10 MHz to 18 GHz</u>	
	Rate (kHz) Depth (%)	
	1 50	5 %
	<u>10 kHz to 4.2 GHz</u>	
	Rate (kHz) Depth (%)	6% of Depth Setting + 1%
1 0-90		

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SCOPE OF ACCREDITATION: SITE CALIBRATION CATEGORY 1

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
<u>B. Sources</u>		
1. DC Voltage	0 mV to 100 mV	0.25 mV/V + 6 μ V
	0 V to 1 V	0.25 mV/V + 60 μ V
	0 V to 2 V	0.12 mV/V + 0.3 mV
	0 V to 20 V	0.15 mV/V + 1 mV
	0 V to 100 V	0.15 mV/V + 5 mV
	0 V to 1000 V	0.25 mV/V + 60 mV
2. AC Voltage	<u>100 mV</u>	
	20 Hz to 50 Hz	1.0 mV/V + 0.1 mV
	50 Hz to 10 kHz	2.0 mV/V + 0.1 mV
	10 kHz to 20 kHz	5.0 mV/V + 0.1 mV
	20 kHz to 50 kHz	20 mV/V + 0.2 mV
	50 kHz to 100 kHz	50 mV/V + 0.5 mV
	<u>1 V</u>	
	20 Hz to 50 Hz	10 mV/V + 1 mV
	50 Hz to 10 kHz	2.0 mV/V + 1 mV
	10 kHz to 20 kHz	5.0 mV/V + 1 mV
	20 kHz to 50 kHz	20 mV/V + 2 mV
	50 kHz to 100 kHz	50 mV/V + 5 mV
	<u>10 V</u>	
	20 Hz to 50 Hz	10 mV/V + 10 mV
	50 Hz to 10 kHz	2.0 mV/V + 10 mV
	10 kHz to 20 kHz	5.0 mV/V + 10 mV
	20 kHz to 50 kHz	20 mV/V + 20 mV
	50 kHz to 100 kHz	50 mV/V + 50 mV
	<u>100 V</u>	
	20 Hz to 50 Hz	10 mV/V + 100 mV
	50 Hz to 10 kHz	20 mV/V + 100 mV
	10 kHz to 20 kHz	50 mV/V + 100 mV
	20 kHz to 50 kHz	20 mV/V + 200 mV
	50 kHz to 100 kHz	50 mV/V + 500 mV
<u>750 V</u>		
20 Hz to 50 Hz	10 mV/V + 1 V	
50 Hz to 10 kHz	20 mV/V + 1 V	
10 kHz to 20 kHz	50 mV/V + 1 V	
20 kHz to 50 kHz	20 mV/V + 2 V	
50 kHz to 100 kHz	50 mV/V + 5 V	

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
3. DC Current	0 μ A to 10 μ A	0.27 mA/A + 700 pA
	0 μ A to 100 μ A	0.25 mA/A + 6 nA
	0 mA to 1 mA	0.27 mA/A + 60 nA
	0 mA to 10 mA	0.35 mA/A + 0.6 μ A
	0 mA to 100 mA	0.50 mA/A + 5 μ A
	0 mA to 1 A	0.60 mA/A + 120 μ A
	0 A to 10 A	2.0 mA/A + 700 μ A
4. AC Current	<u>10 mA</u>	
	20 Hz to 50 Hz	20 mA/A + 10 μ A
	50 Hz to 10 kHz	5.0 mA/A + 10 μ A
	10 kHz to 20 kHz	20 mA/A + 20 μ A
	<u>100 mA</u>	
	20 Hz to 50 Hz	20 mA/A + 100 μ A
	50 Hz to 10 kHz	5.0 mA/A + 100 μ A
	10 kHz to 20 kHz	20 mA/A + 200 μ A
	<u>0.5 A to 1 A</u>	
	20 Hz to 50 Hz	20 mA/A + 30 mA
	50 Hz to 2 kHz	10 mA/A + 30 mA
	<u>1 A to 10 A</u>	
20 Hz to 50 Hz	20 mA/A + 10 mA	
50 Hz to 2 kHz	10 mA/A + 10 mA	

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<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
5. DC Resistance	0 Ω to 100 Ω	0.50 m Ω / Ω + 0.028 Ω
	0 Ω to 1 k Ω	0.50 m Ω / Ω + 0.1 Ω
	0 Ω to 10 k Ω	0.50 m Ω / Ω + 0.8 Ω
	0 Ω to 100 k Ω	0.50 m Ω / Ω + 8 Ω
	0 Ω to 1 M Ω	0.60 m Ω / Ω + 80 Ω
	0 Ω to 10 M Ω	2.5 m Ω / Ω + 0.6 k Ω
	0 Ω to 100 M Ω	2.0 m Ω / Ω + 0.2 M Ω
6. Frequency	10 mHz to 30kHz	0.4 mHz
	31 kHz to 300kHz	1 mHz
	301 kHz to 3MHz	10 mHz
	3.1 MHz to 18GHz	0.1 Hz
7. RF Power into 50 ohm Impedance	<u>-30 dBm to -15 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of reading
	8.501 GHz to 26.500 GHz	0.06 dB of reading
	<u>-15 dBm to -5 dBm</u>	
	0.050 GHz to 8.500 GHz	0.05 dB of reading
	8.501 GHz to 26.500 GHz	0.06 dB of reading
	<u>-5 dBm to 20 dBm</u>	
	0.050 GHz to 12.400 GHz	0.04 dB of reading
	12.401 GHz to 26.500 GHz	0.05 dB of reading

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