

Schedule

Tektronix Southeast Asia Pte Ltd
Service and Calibration Centre
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#06-02/03/04
Singapore 129808

Certificate No. : LA-1997-0124-C
Issue No. : 21
Date : 28 January 2020
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FIELD OF TESTING : Calibration and Measurement

MEASURED QUANTITIES/ INSTRUMENTS/ RANGE TO BE CALIBRATED	CONDITION/ INDEPENDENT VARIABLE	CALIBRATION AND MEASUREMENT CAPABILITY (CMC *)
A. Electrical – DC/LF		
1. DC Voltage Measuring Instrument 0 mV to 220 mV 220 mV to 2.2 V 2.2 V to 11 V 11 V to 22 V 22 V to 220 V 220 V to 1100 V	WI-SG-0012	8 ppm + 0.6 μ V 7 ppm + 1.1 μ V 6.9 ppm + 4.4 μ V 7 ppm + 5 μ V 8 ppm + 85 μ V 9 ppm + 560 μ V
2. Resistance Measuring Instrument 1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω 1 G Ω 1.9 Ω 19 Ω 190 Ω 1.9 k Ω 19 k Ω 190 k Ω 1.9 M Ω 19 M Ω	WI-SG-0012	6.4 ppm 6.3 ppm 5.1 ppm 4.8 ppm 3.3 ppm 4.8 ppm 9.4 ppm 10 ppm 52 ppm 55 ppm 95 ppm 27 ppm 17 ppm 13 ppm 12 ppm 14 ppm 21 ppm 47 ppm

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3. DC Current Measuring Instrument 0 to 220 μ A 220 μ A to 2.2 mA 2.2 mA to 22 mA 22 mA to 100 mA 100 mA to 220 mA 220 mA to 1 A 1 A to 2.2 A 2.2 A to 11 A	WI-SG-0012	50 ppm + 8 nA 50 ppm + 8 nA 50 ppm + 80 nA 60 ppm + 0.8 μ A (60 ppm + (200 x I ²)) ppm + 0.8 μ A 80 ppm + 25 μ A (80 + (10 x I ²)) ppm + 25 μ A 360 ppm + 480 μ A
4. AC Voltage Measuring Instrument	WI-SG-0012 <u>Frequency (Hz)</u>	
0.22 mV to 2.2 mV	20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k	210 ppm + 5 μ V 104 ppm + 5 μ V 370 ppm + 5 μ V 850 ppm + 7 μ V
2.2 mV to 22 mV	20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k	210 ppm + 8 μ V 105 ppm + 8 μ V 320 ppm + 8 μ V 850 ppm + 7 μ V
22 mV to 220 mV	20 to 40 40 to 20k 20 k to 50 k 50 k to 100 k	210 ppm + 8 μ V 105 ppm + 8 μ V 320 ppm + 8 μ V 850 ppm + 25 μ V
220 mV to 2.2 V	20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k 100 k to 300 k 300 k to 500 k 500 k to 1 M	160 ppm + 26 μ V 75 ppm + 6 μ V 120 ppm + 16 μ V 250 ppm + 70 μ V 430 ppm + 130 μ V 1100 ppm + 350 μ V 0.22 % + 850 μ V

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2.2 V to 22 V	20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k 100 k to 300 k 300 k to 500 k 500 k to 1 M	160 ppm + 260 μ V 75 ppm + 61 μ V 120 ppm + 160 μ V 250 ppm + 350 μ V 500 ppm + 1.5 mV 0.13 % + 4.3 mV 0.27 % + 8.5 mV
22 V to 220 V	20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k	160 ppm + 2.6 mV 80 ppm + 0.8 mV 220 ppm + 3.5 mV 500 ppm + 8 mV
220 V to 1000 V	40 to 1 k 1 k to 20 k 20 k to 30 k	90 ppm + 4 mV 165 ppm + 6 mV 600 ppm + 11 mV
5. AC Current Measuring Instrument	WI-SG-0012 <u>Frequency (Hz)</u>	
9 μ A to 220 μ A	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	350 ppm + 20 nA 140 ppm + 16 nA 600 ppm + 40 nA 0.16 % + 80 nA
220 μ A to 2.2 mA	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	360 ppm + 33 nA 140 ppm + 35 nA 600 ppm + 400 nA 0.16 % + 800 nA
2.2 mA to 22 mA	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	360 ppm + 330 nA 140 ppm + 350 nA 600 ppm + 4 μ A 0.16 % + 8 μ A
22 mA to 220 mA	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	360 ppm + 3.3 μ A 140 ppm + 3.5 μ A 600 ppm + 40 μ A 0.16 % + 80 μ A

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220 mA to 2.2 A	20 to 1 k 1 k to 5 k 5 k to 10 k	650 ppm + 35 μ A 750 ppm + 80 μ A 0.85 % + 160 μ A
2.2 A to 11 A	20 to 1 k 1 k to 5 k 5 k to 10 k	460 ppm + 170 μ A 950 ppm + 380 μ A 0.36 % + 750 μ A
6. DC Voltage Source 100 mV Standard 1 V Standard 10 V Ref. Standard 100 V Standard 1000 V Standard	WI-SG-0012	1.8 ppm 1.2 ppm 1.0 ppm 1.2 ppm 1.5 ppm
7. Resistance Source 1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω 1.9 Ω 19 Ω 190 Ω 1.9 k Ω 19 k Ω 190 k Ω 1.9 M Ω 19 M Ω	WI-SG-0012	11 ppm 7.0 ppm 5.1 ppm 4.9 ppm 3.4 ppm 4.9 ppm 9.6 ppm 11 ppm 52 ppm 8.2 ppm 6.6 ppm 5.1 ppm 4.8 ppm 3.3 ppm 4.8 ppm 9.5 ppm 10 ppm

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8. DC Current Source 190 μ A 1.9 mA 19 mA 190 mA 1 A 3 A 5 A 10 A	WI-SG-0012	0.88 nA 11 nA 0.15 μ A 1.5 μ A 26 μ A 0.18 mA 0.31 mA 0.61 mA
9. AC Voltage Source 2 mV 20 mV 200 mV	WI-SG-0012 <u>Frequency (Hz)</u> 10 20 40 to 20 k 50 k 100 k 300 k 500 k 1 M 10 20 40 to 20 k 50 k 100 k 300 k 500 k 1 M 10 20 40 to 20 k 50 k 100 k 300 k 500 k 1 M	3.6 μ V 2.2 μ V 1.7 μ V 2.8 μ V 3.8 μ V 6.7 μ V 10 μ V 14 μ V 5.5 μ V 4.0 μ V 2.7 μ V 4.8 μ V 6.7 μ V 16 μ V 22 μ V 47 μ V 34 μ V 15 μ V 7.8 μ V 13 μ V 27 μ V 47 μ V 68 μ V 190 μ V

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2 V	10	310 μ V
	20	110 μ V
	40 to 20 k	45 μ V
	50 k	81 μ V
	100 k	120 μ V
	300 k	310 μ V
	500 k	480 μ V
	1 M	1.9 mV
	20 V	10
20		1.1 mV
40 to 20 k		0.48 mV
50 k		0.82 mV
100 k		1.3 mV
300 k		3.4 mV
500 k		7.3 mV
1 M		23 mV
200 V		10
	20	11 mV
	40 to 20 k	5.9 mV
	50 k	12 mV
	100 k	17 mV
	300 V	20 k
600 V	50 k	70 mV
	100 k	400 mV
1000V	40 to 20 k	34 mV
	30 k	120 mV

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10. AC Current Source	WI-SG-0012 <u>Frequency (Hz)</u>	
190 μ A	10 20 40 to 10k	32 nA 12 nA 6.9 nA
1.9 mA	10 20 40 to 10k	0.32 μ A 0.13 μ A 69 nA
19 mA	10 20 40 to 10k	3.5 μ A 1.9 μ A 1.6 μ A
190 mA	10 20 40 to 10k	35 μ A 19 μ A 16 μ A
1 A	40 to 10k	92 μ A
10 A	40 to 10k	1.2 mA

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Keithley calibration and on site Keithley 7177 and Keithley 2002	FS-0007-SG	
11. a) DC Current Source 0 pA to 1 pA 1 pA to 10 pA 10 pA to 100 pA 0.1 nA to 1 nA 1 nA to 10 nA 10 nA to 100 nA 0.1 µA to 1 µA 1 µA to 10 µA 10 µA to 100 µA 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 0.1 A to 1 A 1 A to 1.5 A	FS-0007-SG	0.12% + 0.66 fA 0.12% + 0.62 fA 0.024% +0.55 fA 0.012% + 0.21 pA 0.012% + 0.21 pA 0.012% + 0.29 pA 0.012% + 9.2 pA 0.012% + 0.030 nA 0.0083% + 0.29 nA 0.0083%+3.2 nA 0.0094%+29 nA 0.012%+0.29 µA 0.024%+6.9 µA 0.024%+29 µA
b) DC Current Measure 0 pA to 1 pA 1 pA to 10 pA 10 pA to 100 pA 0.1 nA to 1 nA 1 nA to 10 nA 10 nA to 100 nA 0.1 µA to 1 µA 1 µA to 10 µA 10 µA to 100 µA 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 0.1 A to 1 A 1 A to 1.5 A	FS-0007-SG	0.12% + 0.66 fA 0.12% + 0.62 fA 0.024% +0.55 fA 0.012% + 0.21 pA 0.012% + 0.21 pA 0.012% + 0.29 pA 0.012% + 9.2 pA 0.012% + 30 pA 0.0083% + 0.29 nA 0.0083%+3.2nA 0.0094%+29nA 0.012%+0.29µA 0.024%+6.9µA 0.024%+29µA

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c) DC Voltage Source 0 V to 0.2 V 0.2 V to 2 V 2 V to 20 V 20 V to 200 V	FS-0007-SG	0.0026%+3.8 μ V 0.0016%+4.5 μ V 0.0017%+0.17mV 0.0029%+0.71mV
d) DC Voltage Measure 0 V to 0.2 V 0.2 V to 2 V 2 V to 20 V 20 V to 200 V	FS-0007-SG	0.0026%+3.8 μ V 0.0016%+4.5 μ V 0.0017%+0.17mV 0.0029%+0.71mV
B. RF and Probe - Measuring Instruments		
1. a) DC Volts - 0 V		15 μ V
b) 1 M Ω load, 50 Ω load 0 to 100 mV 100 mV to 1.0 V 1.0 V to 5.6 V		0.05 % + 26 μ V 0.022 % + 65 μ V 0.026 % + 50 μ V
c) 1 M Ω load 5.6 V to 222.4 V		0.03 %
2. Sinewave Flatness 50 Ω load, 50 kHz to 10 MHz reference, V (p-p)		
4.4 mV to 5.56 V	1 to 100 M	0.22 dB
4.4 mV to 5.56 V	100 M to 550 M	0.27 dB
4.4 mV to 3.336 V	500 M to 1.1 G	0.37 dB
4.4 mV to 3.336 V	1.1 G to 2.5 G	0.47 dB
4.4 mV to 2.224 V	2.5 G to 3.2 G	0.48 dB
3. AC Voltage 50 Ω , Sinewave, V (p-p)		
4.4 mV to 5.56 V	1 to 550 M	3.3 %
4.4 mV to 3.34 V	550 M to 2.5 G	6.3 %
4.4 mV to 2.2 V	2.5 G to 3.2 G	12 %

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4. Resistance (RF scope) 50 Ω 75 Ω 1 M Ω		0.13 % 0.17 % 0.13 %
5. Frequency and Period 12 kHz to 3.2 GHz		0.27 ppm
6. Time Base Measurement 450.50 ps to 55.0 s		0.27 ppm
7. Frequency Source 0.2 Hz to 2.7 GHz	0.2 to 2.7 G	25×10^{-10} per year **
8. Rise Time a) Source (Reference) 15.0 ps b) Measure Less than 17.5 ps		2.5 ps 3.3 ps

* CMC is expressed as an expanded uncertainty estimated at a level of confidence of approximately 95 %.

** Frequency source using 10 MHz External Reference frequency standard.

Approved signatories

Mr. Gary Tan Tjiang Thung

Mr. Raul T. Alenton

Mr. Kung Sie Ang (All item under Category A- Electrical DC/LF)

Note :

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. A laboratory's fulfilment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001.