

# Schedule

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

Certificate No. : LA-1997-0124-C

Issue No. : 24

Date : 29 June 2022

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FIELD OF TESTING : Calibration and Measurement

MEASURED QUANTITIES/ INSTRUMENTS/ RANGE TO BE CALIBRATED	CONDITION/ METHOD	CALIBRATION AND MEASUREMENT CAPABILITY ( CMC * )
<b>A. Electrical – DC/LF</b>		
1. DC Voltage Measuring 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-0011	8 $\mu\text{V}/\text{V}$ + 0.6 $\mu\text{V}$ 7 $\mu\text{V}/\text{V}$ + 1.1 $\mu\text{V}$ 6.9 $\mu\text{V}/\text{V}$ + 4.4 $\mu\text{V}$ 7 $\mu\text{V}/\text{V}$ + 5 $\mu\text{V}$ 8 $\mu\text{V}/\text{V}$ + 85 $\mu\text{V}$ 9 $\mu\text{V}/\text{V}$ + 560 $\mu\text{V}$
2. Resistance Measuring 1 $\Omega$ 10 $\Omega$ 100 $\Omega$ 1 k $\Omega$ 10 k $\Omega$ 100 k $\Omega$ 1 M $\Omega$ 10 M $\Omega$ 100 M $\Omega$ 1 G $\Omega$ 1.9 $\Omega$ 19 $\Omega$ 190 $\Omega$ 1.9 k $\Omega$ 19 k $\Omega$ 190 k $\Omega$ 1.9 M $\Omega$ 19 M $\Omega$	WI-SG-0011	6.4 $\mu\Omega/\Omega$ 6.3 $\mu\Omega/\Omega$ 5.1 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 3.3 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 9.4 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 52 $\mu\Omega/\Omega$ 55 $\mu\Omega/\Omega$ 95 $\mu\Omega/\Omega$ 27 $\mu\Omega/\Omega$ 17 $\mu\Omega/\Omega$ 13 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$ 14 $\mu\Omega/\Omega$ 21 $\mu\Omega/\Omega$ 47 $\mu\Omega/\Omega$

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3. DC Current Measuring 0.1 $\mu$ A to 1 $\mu$ A 1 $\mu$ A to 10 $\mu$ A 10 $\mu$ A to 220 $\mu$ A 220 $\mu$ 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-0011	300 $\mu$ A/A + 120 pA 340 $\mu$ A/A + 12 nA 50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 80 nA 60 $\mu$ A/A + 0.8 $\mu$ A (60 $\mu$ A/A + (200 x I <sup>2</sup> )) $\mu$ A/A + 0.8 $\mu$ A 80 $\mu$ A/A + 25 $\mu$ A (80 + (10 x I <sup>2</sup> )) $\mu$ A/A + 25 $\mu$ A 360 $\mu$ A/A + 480 $\mu$ A
4. AC Voltage Measuring  0.22 mV to 2.2 mV  2.2 mV to 22 mV  22 mV to 220 mV  220 mV to 2.2 V	WI-SG-0011 <u>Frequency (Hz)</u> 20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k  20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k  20 to 40 40 to 20 k 20 k to 50 k 50 k to 100 k  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	210 $\mu$ V/V + 5 $\mu$ V 104 $\mu$ V/V + 5 $\mu$ V 370 $\mu$ V/V + 5 $\mu$ V 850 $\mu$ V/V + 7 $\mu$ V  210 $\mu$ V/V + 8 $\mu$ V 105 $\mu$ V/V + 8 $\mu$ V 320 $\mu$ V/V + 8 $\mu$ V 850 $\mu$ V/V + 7 $\mu$ V  210 $\mu$ V/V + 8 $\mu$ V 105 $\mu$ V/V + 8 $\mu$ V 320 $\mu$ V/V + 8 $\mu$ V 850 $\mu$ V/V + 25 $\mu$ V  160 $\mu$ V/V + 26 $\mu$ V 75 $\mu$ V/V + 6 $\mu$ V 120 $\mu$ V/V + 16 $\mu$ V 250 $\mu$ V/V + 70 $\mu$ V 430 $\mu$ V/V + 130 $\mu$ V 1100 $\mu$ V/V + 350 $\mu$ V 0.22 % + 850 $\mu$ 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 $\mu$ V/V + 260 $\mu$ V 75 $\mu$ V/V + 61 $\mu$ V 120 $\mu$ V/V + 160 $\mu$ V 250 $\mu$ V/V + 350 $\mu$ V 500 $\mu$ V/V + 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 $\mu$ V/V + 2.6 mV 80 $\mu$ V/V + 0.8 mV 220 $\mu$ V/V + 3.5 mV 500 $\mu$ V/V + 8 mV
220 V to 1000 V	40 to 1 k 1 k to 20 k 20 k to 30 k	90 $\mu$ V/V + 4 mV 165 $\mu$ V/V + 6 mV 600 $\mu$ V/V + 11 mV
5. AC Current Measuring	WI-SG-0011 <u>Frequency (Hz)</u>	
9 $\mu$ A to 220 $\mu$ A	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	350 $\mu$ A/A + 20 nA 140 $\mu$ A/A + 16 nA 600 $\mu$ A/A + 40 nA 0.16 % + 80 nA
220 $\mu$ A to 2.2 mA	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	360 $\mu$ A/A + 33 nA 140 $\mu$ A/A + 35 nA 600 $\mu$ A/A + 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 $\mu$ A/A + 330 nA 140 $\mu$ A/A + 350 nA 600 $\mu$ A/A + 4 $\mu$ A 0.16 % + 8 $\mu$ A
22 mA to 220 mA	20 to 40 40 to 1 k 1 k to 5 k 5 k to 10 k	360 $\mu$ A/A + 3.3 $\mu$ A 140 $\mu$ A/A + 3.5 $\mu$ A 600 $\mu$ A/A + 40 $\mu$ A 0.16 % + 80 $\mu$ 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 $\mu$ A/A + 35 $\mu$ A 750 $\mu$ A/A + 80 $\mu$ A 0.85 % + 160 $\mu$ A
2.2 A to 11 A	20 to 1 k 1 k to 5 k 5 k to 10 k	460 $\mu$ A/A + 170 $\mu$ A 950 $\mu$ A/A + 380 $\mu$ A 0.36 % + 750 $\mu$ 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 $\mu$ V/V 1.2 $\mu$ V/V 1.0 $\mu$ V/V 1.2 $\mu$ V/V 1.5 $\mu$ V/V
0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	WI-SG-0012	9 $\mu$ V/V + 2.4 $\mu$ V 7 $\mu$ V/V + 2.3 $\mu$ V 6.9 $\mu$ V/V + 4.3 $\mu$ V 6.9 $\mu$ V/V + 43 $\mu$ V 21 $\mu$ V/V + 280 $\mu$ V
7. Resistance Source 1 $\Omega$ 10 $\Omega$ 100 $\Omega$ 1 k $\Omega$ 10 k $\Omega$ 100 k $\Omega$ 1 M $\Omega$ 10 M $\Omega$ 100 M $\Omega$ 1.9 $\Omega$ 19 $\Omega$ 190 $\Omega$ 1.9 k $\Omega$ 19 k $\Omega$ 190 k $\Omega$ 1.9 M $\Omega$ 19 M $\Omega$	WI-SG-0012	11 $\mu\Omega/\Omega$ 7.0 $\mu\Omega/\Omega$ 5.1 $\mu\Omega/\Omega$ 4.9 $\mu\Omega/\Omega$ 3.4 $\mu\Omega/\Omega$ 4.9 $\mu\Omega/\Omega$ 9.6 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 52 $\mu\Omega/\Omega$ 8.2 $\mu\Omega/\Omega$ 6.6 $\mu\Omega/\Omega$ 5.1 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 3.3 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 9.5 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$

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<p>8. DC Current Source</p> <p>190 <math>\mu</math>A 1.9 mA 19 mA 190 mA 1 A 3 A 5 A 10 A</p> <p>0 nA to 100 nA 100 nA to 1 <math>\mu</math>A 1 <math>\mu</math>A to 10 <math>\mu</math>A 10 <math>\mu</math>A to 100 <math>\mu</math>A 100 <math>\mu</math>A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 2 A 2 A to 10 A</p>	<p>WI-SG-0012</p> <p>WI-SG-0012</p>	<p>0.88 nA 11 nA 0.15 <math>\mu</math>A 1.5 <math>\mu</math>A 26 <math>\mu</math>A 0.18 mA 0.31 mA 0.61 mA</p> <p>60 <math>\mu</math>A/A + 47 pA 29 <math>\mu</math>A/A + 48 pA 29 <math>\mu</math>A/A + 120 pA 29 <math>\mu</math>A/A + 990 pA 30 <math>\mu</math>A/A + 6.1 nA 30 <math>\mu</math>A/A + 61 nA 46 <math>\mu</math>A/A + 640 nA 140 <math>\mu</math>A/A + 11 <math>\mu</math>A 170 <math>\mu</math>A/A + 25 <math>\mu</math>A 390 <math>\mu</math>A/A + 0.4 mA</p>
<p>9. AC Voltage Source</p> <p>2 mV</p>	<p>WI-SG-0012</p> <p><u>Frequency (Hz)</u> 10 20 40 to 20 k 50 k 100 k 300 k 500 k 1 M</p>	<p>3.6 <math>\mu</math>V 2.2 <math>\mu</math>V 1.7 <math>\mu</math>V 2.8 <math>\mu</math>V 3.8 <math>\mu</math>V 6.7 <math>\mu</math>V 10 <math>\mu</math>V 14 <math>\mu</math>V</p>

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20 mV	10	5.5 $\mu$ V
	20	4.0 $\mu$ V
	40 to 20 k	2.7 $\mu$ V
	50 k	4.8 $\mu$ V
	100 k	6.7 $\mu$ V
	300 k	16 $\mu$ V
	500 k	22 $\mu$ V
	1 M	47 $\mu$ V
200 mV	10	34 $\mu$ V
	20	15 $\mu$ V
	40 to 20 k	7.8 $\mu$ V
	50 k	13 $\mu$ V
	100 k	27 $\mu$ V
	300 k	47 $\mu$ V
	500 k	68 $\mu$ V
	1 M	190 $\mu$ V
2 V	10	310 $\mu$ V
	20	110 $\mu$ V
	40 to 20 k	45 $\mu$ V
	50 k	81 $\mu$ V
	100 k	120 $\mu$ V
	300 k	310 $\mu$ V
	500 k	480 $\mu$ V
	1 M	1.9 mV
20 V	10	3.1 mV
	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

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200 V	10	31 mV
	20	11 mV
	40 to 20 k	5.9 mV
	50 k	12 mV
	100 k	17 mV
300 V	20 k	11 mV
600 V	50 k	70 mV
	100 k	400 mV
1000V	40 to 20 k	34 mV
	30 k	120 mV
10 AC Current Source	WI-SG-0012	
	<u>Frequency (Hz)</u>	
190 $\mu$ A	10	32 nA
	20	12 nA
	40 to 10k	6.9 nA
1.9 mA	10	0.32 $\mu$ A
	20	0.13 $\mu$ A
	40 to 10k	69 nA
19 mA	10	3.5 $\mu$ A
	20	1.9 $\mu$ A
	40 to 10k	1.6 $\mu$ A
190 mA	10	35 $\mu$ A
	20	19 $\mu$ A
	40 to 10k	16 $\mu$ A
1 A	40 to 10k	92 $\mu$ A
10 A	40 to 10k	1.2 mA

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<p>11 On-site Calibration</p> <p>a) DC Current Source</p> <p>0 pA to 1 pA</p> <p>1 pA to 10 pA</p> <p>10 pA to 100 pA</p> <p>0.1 nA to 1 nA</p> <p>1 nA to 10 nA</p> <p>10 nA to 100 nA</p> <p>0.1 µA to 1 µA</p> <p>1 µA to 10 µA</p> <p>10 µA to 100 µA</p> <p>0.1 mA to 1 mA</p> <p>1 mA to 10 mA</p> <p>10 mA to 100 mA</p> <p>0.1 A to 1 A</p> <p>1 A to 1.5 A</p> <p>b) DC Current Measure</p> <p>0 pA to 1 pA</p> <p>1 pA to 10 pA</p> <p>10 pA to 100 pA</p> <p>0.1 nA to 1 nA</p> <p>1 nA to 10 nA</p> <p>10 nA to 100 nA</p> <p>0.1 µA to 1 µA</p> <p>1 µA to 10 µA</p> <p>10 µA to 100 µA</p> <p>0.1 mA to 1 mA</p> <p>1 mA to 10 mA</p> <p>10 mA to 100 mA</p> <p>0.1 A to 1 A</p> <p>1 A to 1.5 A</p>	<p>FS-0007-SG</p> <p>FS-0007-SG</p>	<p>0.12 % + 0.66 fA</p> <p>0.12 % + 0.62 fA</p> <p>0.024 % +0.55 fA</p> <p>0.012 % + 0.21 pA</p> <p>0.012 % + 0.21 pA</p> <p>0.012 % + 0.29 pA</p> <p>0.012 % + 9.2 pA</p> <p>0.012 % + 0.030 nA</p> <p>0.0083 % + 0.29 nA</p> <p>0.0083 % + 3.2 nA</p> <p>0.0094 % + 29 nA</p> <p>0.012 %+ 0.29 µA</p> <p>0.035 % + 6.9 µA</p> <p>0.1 % + 29 µA</p> <p>0.12 % + 0.66 fA</p> <p>0.12 % + 0.62 fA</p> <p>0.024 % +0.55 fA</p> <p>0.012 % + 0.21 pA</p> <p>0.012 % + 0.21 pA</p> <p>0.012 % + 0.29 pA</p> <p>0.012 % + 9.2 pA</p> <p>0.012 % + 30 pA</p> <p>0.0083 % + 0.29 nA</p> <p>0.0083 % + 3.2 nA</p> <p>0.0094 % + 29 nA</p> <p>0.012 % + 0.29 µA</p> <p>0.035 % + 6.9 µA</p> <p>0.1 % + 29 µA</p>



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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 $\mu$ V 0.0016 % + 4.5 $\mu$ V 0.0017 % + 0.17 mV 0.0029 % + 0.71 mV
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 $\mu$ V 0.0016 % + 4.5 $\mu$ V 0.0017 % + 0.17 mV 0.0029 % + 0.71 mV
<b>B. RF and Probe - Measuring</b>		
1. a) DC Volts - 0 V	WI-SG-0002	15 $\mu$ V
b) 1 M $\Omega$ load, 50 $\Omega$ load 0 to 100 mV 100 mV to 1.0 V 1.0 V to 5.6 V		0.05 % + 26 $\mu$ V 0.022 % + 65 $\mu$ V 0.026 % + 50 $\mu$ V
c) 1 M $\Omega$ load 5.6 V to 222.4 V		0.03 %
2. Sinewave Flatness 50 $\Omega$ load, 50 kHz to 10 MHz reference, V (p-p)	WI-SG-0001	
	<u>Frequency (Hz)</u>	
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

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3. AC Voltage 50 $\Omega$ , Sinewave, V (p-p)  4.4 mV to 5.56 V 4.4 mV to 3.34 V 4.4 mV to 2.2 V	WI-SG-0001  <u>Frequency (Hz)</u> 1 to 550 M 550 M to 2.5 G 2.5 G to 3.2 G	  3.3 % 6.3 % 12 %
4. Resistance ( RF scope) 50 $\Omega$ 75 $\Omega$ 1 M $\Omega$	WI-SG-0001	  0.13 % 0.17 % 0.13 %
5. Frequency and Period 12 kHz to 3.2 GHz	WI-SG-0002	  0.27 ppm
6. Time Base Measurement 450.50 ps to 55.0 s	WI-SG-0001	  0.27 ppm
7. Frequency Source 0.2 Hz to 2.7 GHz	WI-SG-0002	  $25 \times 10^{-10}$ per year **
8. Rise Time a) Source (Reference) 15.0 ps  b) Measure Less than 17.5	WI-SG-0002	  4.4 ps  5.8 ps

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<b>C. TEMPERATURE CALIBRATION</b>		
1. Temperature Measuring Instrument	WI-SG-0017 (Fixed point Method)	(The uncertainty below does not cover DUT hysteresis)
Digital thermometer with PRT/ PRT Sensor	Fixed Point, TPW Fixed Point, AL	0.002 °C 0.013 °C
0.01 °C 660 °C	WI-SG-0018 (Comparison Method)	(The uncertainty below does not cover DUT hysteresis)
-196 °C	Comparison	0.017°C
-40 °C	Comparison	0.010°C
156 °C	Comparison	0.015°C
232 °C	Comparison	0.015°C
420 °C	Comparison	0.020 °C

\* 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 - All items under Category A and B  
Mr Raul T. Alenton - All items under Category A and B  
Mr Kung Sie Ang - All items under Category A and C  
Mr Eang Lian Siang - All items under Category C

## 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.