SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

GEFEN ELECTRONIC SERVICES LTD
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CALIBRATION

Valid To: June 30, 2019 Certificate Number: 3537.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Voltage – Generate[3]	2.2 µV to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	12 µV/V + 0.9 µV 8.7 µV/V + 1.5 µV 8.6 µV/V + 5.2 µV 8.6 µV/V + 8.2 µV 11 µV/V + 110 µV 12 µV/V + 580 µV	Fluke 5700A
DC High Voltage – Measure[3]	500 V 1000 V 1500 V 3000 V 6000 V	0.6 V 1.0 V 1.2 V 16 V 18 V	Viltrek 4600
DC Current – Generate[3]	(0.02 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2 to 10) A	0.17 % + 9.3 nA 75 µA/A + 9.3 nA 75 µA/A + 93 nA 85 µA/A + 0.92 µA 0.014 % + 29 µA 0.024 % + 58 µA/A	Fluke 5700A Datron 4800 w/ Datron 4600 transconductance amplifier

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments

Fixed Points[3]	(1, 1.9) Ω	0.011 %	
	10 Ω	34 µΩ/Ω	
	19 Ω	33 µΩ/Ω	
	(100, 190) Ω	20 µΩ/Ω	
	1 kΩ	16 µΩ/Ω	
	1.9 kΩ	17 µΩ/Ω	
	(10, 19) kΩ	17 µΩ/Ω	
	(100, 190) kΩ	19 µΩ/Ω	
	1 MΩ	26 µΩ/Ω	
	1.9 MΩ	27 µΩ/Ω	
	10 MΩ	61 µΩ/Ω	
	19 MΩ	81 µΩ/Ω	
	100 MΩ	0.021 %	(2-wire)

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage – Generate			
(2.2 to 22) mV	(20 to 40) Hz	0.078 % + 6 µV	Fluke 5700A
	40 Hz to 20 kHz	0.066 % + 6 µV	
	(20 to 100) kHz	0.14 % + 8.1 µV	
	(100 to 300) kHz	0.29 % + 14 µV	
	300 kHz to 1 MHz	0.75 % + 29 µV	
(22 to 220) mV	(20 to 40) Hz	0.029 % + 9 µV	
	40 Hz to 20 kHz	0.019 % + 9 µV	
	(20 to 100) kHz	0.11 % + 29 µV	
	(100 to 300) kHz	0.16 % + 29 µV	
	300 kHz to 1 MHz	0.46 % + 93 µV	
220 mV to 2.2 V	(20 to 40) Hz	0.029 % + 9 µV	
	40 Hz to 20 kHz	0.019 % + 10 µV	
	(20 to 100) kHz	0.11 % + 29 µV	
	(100 to 300) kHz	0.16 % + 29 µV	
	300 kHz to 1 MHz	0.46 % + 92 µV	
(2.2 to 22) V	(20 to 40) Hz	0.02 % + 290 µV	
	40 Hz to 20 kHz	0.014 % + 70 µV	
	(20 to 100) kHz	0.041 % + 0.4 µV	
	(100 to 300) kHz	0.067 % + 1.7 mV	
	300 kHz to 1 MHz	0.3 % + 10 mV	
(22 to 220) V	(20 to 40) Hz	0.02 % + 2.9 mV	
	40 Hz to 20 kHz	0.013 % + 0.9 mV	
	(20 to 100) kHz	0.1 % + 9.2 mV	
(220 to 1100) V	(15 to 50) Hz	0.05 % + 19 mV	
	50 Hz to 1 kHz	0.014 % + 4 mV	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC High Voltage – Measure			
500 V 1000 V 1500 V 3000 V 5000 V	50 Hz	2.4 V 2.9 V 3.4 V 43 V 51 V	Viltrek 4600
AC Current – Generate			
(0.1 to 220) µA	40 Hz to 1 kHz (1 to 10) kHz	0.039 % + 19 nA 0.19 % + 92 nA	Fluke 5700A
220 µA to 2.2 mA	40 Hz to 1 kHz (1 to 10) kHz	0.029 % + 40 nA 0.19 % + 1.0 µA	
(2.2 to 22) mA	40 Hz to 1 kHz (1 to 10) kHz	0.029 % + 0.4 µA 0.19 % + 9.3 µA	
(22 to 220) mA	40 Hz to 1 kHz (1 to 10) kHz	0.029 % + 4.0 µA 0.19 % + 9.2 µA	
220 mA to 2.2 A	40 Hz to 1 kHz (1 to 10) kHz	0.089 % + 92 µA 1.0 % + 190 µA	
(2 to 10) A	10 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) kHz	0.045 % + 1.4 mA 0.1 % + 1.8 mA 0.25 % + 6.9 mA 0.86 % + 39 mA	Datron 4800 w/ Datron 4600 transconductance amplifier

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Oscilloscope[3] –			
DC Voltage Amplitude	± 1 mV to 190 V	0.029 % + 29 µV	Wavetek 9500; the percentages are related to the reference level.
Leveled Sine Wave	50 kHz to 10 MHz	1.8 %	Active head Wavetek 9520
Flatness	(50 to 550) MHz (relative to 50 kHz to 10 MHz)	2.3 %	
	(550.01 to 1000) MHz (relative to 50 kHz to 10 MHz)	4.9 %	
Time Marker			
Sine Wave	550 ps to 2 ns	0.001 %	
Square Wave	10 ns to 10 ms	0.001 %	

II. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Power – Measure			
(-60 to 18) dBm	(10 to 50) MHz (50 to 100) MHz (100 to 500) MHz (500 to 1000) MHz (1 to 2) GHz (2 to 12.4) GHz (12.4 to 14) GHz (14 to 18) GHz	3.6 % 3.4 % 3.3 % 3.4 % 3.2 % 3.3 % 3.6 % 4.2 %	Anritsu ML2437 MA2474D

III. Optical Quantities

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Optical Time Domain Reflectometer – (OTDR): Distance	Up to 200 km	1.3 m/10 km range	FG-NS-OTDR-570 Fluke PM6681
Optical Spectrum Analyzer – Wavelength	(1480 to 1570) nm	0.9 parts in 10^6 nm	Burleigh WA-7600
Optical Power – Absolute Power Measure, (1309, 1550) nm	(+2 to -50) dBm	4 % (0.17 dB)	ANDO AQ2735
Wavelength – Measure	(1270 to 1680) nm	0.9 parts in 10^6 nm	Burleigh WA-7600

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature – Measure[3]	(-10 to 300) °C (100 to 300) °C	0.25 °C 0.7 °C	Fluke Hydra 2625 w/ PT-100
Temperature – Uniformity Surveys[3]	(-60 to 125) °C	1.7 °C	Fluke Hydra 2625 w/ TC set
Relative Humidity – Measure[3]	(5 to 95) % RH	3 % RH	Rotronic Hygropalm HP-22w with HC2-S

V. Time & Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Frequency – Measure			
Time Base	10 MHz	5.4 parts in 10^{10}	SR FS 725 Rubidium frequency standard
Frequency	(0.001 to 100) Hz 100 Hz to 3 GHz	10 parts in 10^{6} 5.4 parts in 10^{10}	HP 53131A
	500 MHz to 26.5 GHz	5.4 parts in 10^{10}	HP 5351A
Frequency – Measuring Equipment	(0.001 to 100) Hz 100 Hz to 15 MHz 10 MHz to 20 GHz (1 to 26.5) GHz	10 parts in 10^{6} 5.4 parts in 10^{10} 5.4 parts in 10^{10} 5.4 parts in 10^{10}	HP 33120 HP 83712A HP 8340B
Jitter – Measure and Measuring Equipment	(0.05 to 20) UI	2 % for null point of Bessel Function, 4 % for other points	Agilent E4407B

[1] This laboratory offers commercial calibration service and field calibration service.

[2] Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] In the statement of CMC, the value is defined as the percentage of reading, unless otherwise noted.

[5] The stated measured values are determined using the indicated instrument (see Comments). This

capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

Accredited Laboratory

A2LA has accredited

GEFEN ELECTRONIC SERVICES LTD.

Petah-Tikva, ISRAEL

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets *R205 – Specific Requirements: Calibration Laboratory Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 3rd day of October 2017.

President and CEO
For the Accreditation Council
Certificate Number 3537.01
Valid to June 30, 2019

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.