



# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number WO-00043462

<b>Model Number</b>	3458A	<b>Customer</b>	Powers of Two Design Ltd
<b>Manufacturer</b>	Keysight Technologies		Princes Tower 97 Rotherhithe St
<b>Description</b>	Digital multimeter, 8.5 digit		LONDON SE16 4NF
<b>Serial Number</b>	2823A01045		United Kingdom
<b>Customer Asset No.</b>	-		
<b>Date of Calibration</b>	28 Jul 2022	<b>Location of Calibration</b>	Keysight Technologies UK Limited
<b>Procedure</b>	STE-50109421-E.10.01		610 Wharfedale Road
<b>Temperature</b>	(23 ± 5) °C		Winnersh Triangle
<b>Humidity</b>	(45 ± 25) %RH		Wokingham Berkshire RG41 5TP
			UNITED KINGDOM

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

#### As Received Conditions

One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.

#### Action Taken

- The equipment was adjusted.
- The equipment was repaired.

#### As Completed Conditions

The measured values of the equipment were observed in specification at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values exceeded specification. Consequently, compliance with specification cannot be declared based on the stated coverage probability.

#### Remarks or Special Requirements

This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

This calibration report may refer to equipment manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies.

Based on the customer's request, the next calibration is due on 28 Jul 2023.

Keysight Technologies UK Limited  
610 Wharfedale Road  
Winnersh Triangle  
Wokingham Berkshire RG41 5TP  
UNITED KINGDOM

Edgar Leckel - European Operations Manager

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## Traceability Information

Technician ID N1017927

Measurements are traceable to the International System of Units (SI) via national metrology institutes ([www.keysight.com/find/NMI](http://www.keysight.com/find/NMI)) that are signatories to the CIPM Mutual Recognition Arrangement.

## Calibration Equipment Used

Model Number	Model Description	Equipment ID	Cal Due Date
33622A	Waveform generator, 120 MHz, 2-channel	UK16581	27 May 2023
3458A	Digital multimeter, 8.5 digit	UK13941	26 Aug 2022
5730A	High Performance Multifunction Calibrator	UK16442	21 Oct 2022

## Traceability Table

	Model	Model Description	Equipment ID	Certificate Number	Trace Value
W,R	33622A	Waveform generator, 120 MHz, 2-channel	UK16581	1-17699426672-1-UKAS:C 0147	AC Voltage DC Voltage Frequency
W,R	3458A	Digital multimeter, 8.5 digit	UK13941	1-17573330179-1-UKAS:C 0147	AC Current AC Voltage DC Current DC Voltage Resistance
W,R	5730A	High Performance Multifunction Calibrator	UK16442	1-15442544855-1-UKAS:C 0147	AC Current AC Voltage DC Current DC Voltage Resistance

## Legend

**W - Working Standard** The calibration equipment used for the calibration of the Model indicated on the first page of the Certificate of calibration.

**R - Reference Standard** The Reference Standard (Accredited or NMI-calibrated ETE) used to provide traceability to the SI-Units for the calibration parameters listed.

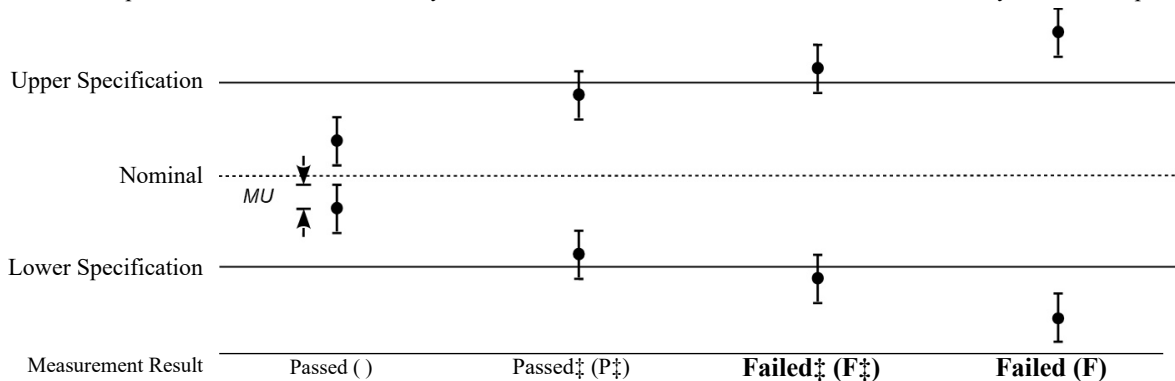
## Compliance with Specification

The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:09/2019. If the expanded measurement uncertainty intervals centered about one or more measured values were both in as well as out of specification (upper or lower), it is not possible to state compliance or non-compliance based on a 95% coverage probability for the expanded measurement uncertainty.

An overall statement of compliance for all tests performed as received, and as completed (if any adjustments / repairs were performed) is included at the beginning of this report. Statements of compliance apply only to warranted specifications. When functional verification tests are performed, results are reported in the “Functional Test” section, and do not affect these statements of compliance. The status summaries relate to the tested item only. A final decision about whether the item's performance actually satisfies requirements of the user can only be made by the user.

### Measurement results are reported as:

- Passed ( ) - The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.
- Passed‡ (P‡) - The measured values of the equipment were observed in specification at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values exceeded specification. Consequently, compliance with specification cannot be declared based on the stated coverage probability.
- Failed‡ (F‡) - One or more measured values of the equipment were observed out of specification at the points tested. However, a portion of the expanded measurement uncertainty intervals about one or more measured values were in specification. Consequently, non-compliance with specification cannot be declared based on the stated coverage probability.
- Failed (F) - One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.



MU = 95% expanded measurement uncertainty.

( ) This result is indicated on the measurement report as a blank space in the column labeled “Status” or “Sts”.

Note: For more information on the level of risk such as false accept and false reject and statistical assumptions of these statements of conformity, please visit: [www.keysight.com/find/decisionrules](http://www.keysight.com/find/decisionrules).

## Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number WO-00043462

## Calibration Test Results Summary

Test Name	As Received Status	As Completed Status
DC VOLT OFFSET	Passed	Passed
DC VOLT OFFSET-REAR PANEL	<b>Failed</b>	Passed
DC VOLT GAIN	Passed	Passed
OHMS OFFSET	Passed	Passed
OHMS GAIN	<b>Failed</b>	Passed
DC CURRENT OFFSET	Passed	Passed
DC CURRENT GAIN	<i>Passed‡</i>	Passed
AC CURRENT	Passed	Passed
AC VOLT Analog	Passed	Passed
AC VOLT Synchronized	<i>Passed‡</i>	<i>Passed‡</i>
AC VOLT High Freq	<b>Failed</b>	Passed
FREQUENCY	Passed	Passed

## Functional Test Results Summary

The following functional test results are not part of an accredited delivery, even if they are part of an otherwise accredited calibration report.

The following tests document the functional verification of the instruments' non-warranted performance. Neither a statement of conformance or decision rule is used for a Functional Test, measurement uncertainties are only provided by exception. For a "Functional Test" the test results are reported as "As Expected" when showing expected performance and "Not As Expected" otherwise. "As Expected" results of individual test points are indicated in the measurement report by a blank space in the column labeled "Status" to allow easier recognition of any "Not As Expected" points. If a functional test result is reported as "Not As Expected", repair and/or adjustment is recommended. Test results reported as "Done" are possible if no limits are applied. For qualitative or quantitative "Functional Tests" the test results are not warranted, and no judgment is made. The "actual" measured results are helpful to users for some applications.

Test Name	As Received Status	As Completed Status
SELF TEST	As Expected	As Expected
AUTO-CALIBRATION	As Expected	As Expected

## Tested Configuration

Firmware Version 9,2  
(As Rec) 9,2

‡ Some of the measured values are within one expanded uncertainty of the specification.

Model 3458A Serial 2823A01045 Firmware Rev 9,2  
Options Tested

Test Date 8 Jul 2022  
Condition As Received

## DC VOLT OFFSET

**Passed**

Measured with Front panel input terminals shorted  
The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
0.1 V	0 V	-0.00106 mV	-0.00087 mV	0.00106 mV	0.00016 mV	
1 V	0 V	-0.00106 mV	-0.00081 mV	0.00106 mV	0.00015 mV	
10 V	0 V	-0.00230 mV	-0.00001 mV	0.00230 mV	0.00032 mV	
100 V	0 V	-0.036 mV	0.005 mV	0.036 mV	0.014 mV	
1000 V	0 V	-0.130 mV	0.022 mV	0.130 mV	0.041 mV	

## DC VOLT OFFSET-REAR PANEL

**Failed**

Measured with Rear panel input terminals shorted  
The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
0.1 V	0 V	-0.00106 mV	0.00114 mV	0.00106 mV	0.00016 mV	F‡
1 V	0 V	-0.00106 mV	0.00124 mV	0.00106 mV	0.00015 mV	F
10 V	0 V	-0.00230 mV	0.00210 mV	0.00230 mV	0.00032 mV	P‡
100 V	0 V	-0.036 mV	0.002 mV	0.036 mV	0.014 mV	
1000 V	0 V	-0.130 mV	0.008 mV	0.130 mV	0.041 mV	

## DC VOLT GAIN

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 mV	100 mV	99.99796 mV	99.99956 mV	100.00090 mV	0.00046 mV	
100 mV	-100 mV	-100.00120 mV	-99.99955 mV	-99.99826 mV	0.00059 mV	
1 V	1 V	0.9999883 V	0.9999984 V	1.0000091 V	0.0000028 V	
1 V	-1 V	-1.0000098 V	-0.9999987 V	-0.9999890 V	0.0000028 V	
10 V	10 V	9.999898 V	9.999984 V	10.000100 V	0.000027 V	
10 V	-10 V	-10.000102 V	-9.999986 V	-9.999900 V	0.000027 V	
100 V	100 V	99.99877 V	99.99998 V	100.00125 V	0.00038 V	

‡ This measured value is within one expanded uncertainty of the specification.

Model 3458A Serial 2823A01045 Firmware Rev 9,2  
Options Tested

Test Date 8 Jul 2022  
Condition As Received

## DC VOLT GAIN (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
100 V -100 V	-100.00125 V	-99.99994 V	-99.99877 V	0.00033 V	
1000 V 1000 V	999.9778 V	999.9958 V	1000.0262 V	0.0057 V	
1000 V -1000 V	-1000.0265 V	-999.9944 V	-999.9781 V	0.0057 V	

## OHMS OFFSET

**Passed**

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Range Input</i>					
<i>-----</i>					
<i>4-Wire Front Panel</i>					
10 Ω 0 Ω	-0.000070 Ω	0.000003 Ω	0.000070 Ω	0.000023 Ω	
<i>2-Wire Front Panel</i>					
10 Ω 0 Ω	-0.25007 Ω	-0.03493 Ω	0.25007 Ω	0.00012 Ω	
<i>4-Wire Rear Panel</i>					
10 Ω 0 Ω	-0.000070 Ω	-0.000003 Ω	0.000070 Ω	0.000021 Ω	
<i>2-Wire Rear Panel</i>					
10 Ω 0 Ω	-0.25007 Ω	0.05967 Ω	0.25007 Ω	0.00014 Ω	

## OHMS GAIN

**Failed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Range Input</i>					
<i>-----</i>					
<i>4-Wire Mode</i>					
10 Ω 10 Ω	9.999660 Ω	10.000160 Ω	10.000160 Ω	0.000089 Ω	P‡
100 Ω 100 Ω	99.99875 Ω	100.00337 Ω	100.00311 Ω	0.00085 Ω	F‡
1 kΩ 1 kΩ	1.0000223 kΩ	1.0000595 kΩ	1.0000497 kΩ	0.0000075 kΩ	F
10 kΩ 10 kΩ	9.999879 kΩ	10.000287 kΩ	10.000153 kΩ	0.000074 kΩ	F
100 kΩ 100 kΩ	99.99935 kΩ	100.00316 kΩ	100.00209 kΩ	0.00078 kΩ	F
1 MΩ 1 MΩ	0.9999613 MΩ	1.0000017 MΩ	1.0000019 MΩ	0.0000098 MΩ	P‡
10 MΩ 10 MΩ	9.99823 MΩ	9.99909 MΩ	9.99949 MΩ	0.00025 MΩ	
<i>2-Wire Mode</i>					
10 MΩ 10 MΩ	9.99823 MΩ	9.99914 MΩ	9.99949 MΩ	0.00018 MΩ	
100 MΩ 100 MΩ	99.958 MΩ	100.029 MΩ	100.064 MΩ	0.024 MΩ	

‡ This measured value is within one expanded uncertainty of the specification.

## DC CURRENT OFFSET

**Passed**

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 $\mu$ A	0 $\mu$ A	-0.00095 $\mu$ A	-0.00024 $\mu$ A	0.00095 $\mu$ A	0.00012 $\mu$ A	
1 mA	0 mA	-0.000065 mA	-0.000022 mA	0.000065 mA	0.000012 mA	
10 mA	0 mA	-0.000065 mA	-0.000018 mA	0.000065 mA	0.000012 mA	
100 mA	0 mA	-0.00065 mA	-0.00010 mA	0.00065 mA	0.00012 mA	
1 A	0 A	-0.0000115 A	-0.0000022 A	0.0000115 A	0.0000015 A	

## DC CURRENT GAIN

**Passed‡**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 $\mu$ A	100 $\mu$ A	99.9970 $\mu$ A	99.9977 $\mu$ A	100.0040 $\mu$ A	0.0016 $\mu$ A	P‡
100 $\mu$ A	-100 $\mu$ A	-100.0040 $\mu$ A	-99.9975 $\mu$ A	-99.9970 $\mu$ A	0.0014 $\mu$ A	P‡
1 mA	1 mA	0.999964 mA	0.999967 mA	1.000028 mA	0.000011 mA	P‡
1 mA	-1 mA	-1.000024 mA	-0.999962 mA	-0.999960 mA	0.000011 mA	P‡
10 mA	10 mA	9.99966 mA	9.99973 mA	10.00030 mA	0.00014 mA	P‡
10 mA	-10 mA	-10.00034 mA	-9.99973 mA	-9.99970 mA	0.00011 mA	P‡
100 mA	100 mA	99.9971 mA	99.9975 mA	100.0065 mA	0.0023 mA	P‡
100 mA	-100 mA	-100.0065 mA	-99.9980 mA	-99.9971 mA	0.0023 mA	P‡
1 A	1 A	0.999834 A	0.999936 A	1.000088 A	0.000038 A	
1 A	-1 A	-1.000081 A	-0.999925 A	-0.999827 A	0.000045 A	

‡ This measured value is within one expanded uncertainty of the specification.

## AC CURRENT

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

All current measurements made at a frequency of 1 kHz

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 $\mu$ A	10 $\mu$ A	9.964 $\mu$ A	10.017 $\mu$ A	10.036 $\mu$ A	0.010 $\mu$ A	
100 $\mu$ A	100 $\mu$ A	99.900 $\mu$ A	99.999 $\mu$ A	100.082 $\mu$ A	0.024 $\mu$ A	
1 mA	1 mA	0.99950 mA	1.00006 mA	1.00052 mA	0.00017 mA	
10 mA	10 mA	9.9947 mA	10.0006 mA	10.0049 mA	0.0013 mA	
100 mA	100 mA	99.952 mA	100.007 mA	100.054 mA	0.013 mA	
1 A	1 A	0.99883 A	1.00003 A	1.00125 A	0.00024 A	

## AC VOLT Analog

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Input	Freq.					
<i>10 V Range</i>						
1 V	50 kHz	0.99451 V	0.99944 V	1.00551 V	0.00064 V	
1 V	1 MHz	0.753 V	0.937 V	1.253 V	0.029 V	
10 V	10 Hz	9.9581 V	9.9833 V	10.0421 V	0.0049 V	
10 V	200 Hz	9.99673 V	10.00042 V	10.00277 V	0.00056 V	
10 V	500 Hz	9.99673 V	10.00040 V	10.00277 V	0.00056 V	
10 V	50 kHz	9.9805 V	10.0010 V	10.0185 V	0.0024 V	
10 V	1 MHz	9.334 V	10.044 V	10.734 V	0.082 V	



## AC VOLT Synchronized

**Passed‡**

The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied  
 that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Input Freq.</i>					
-----					
<i>10 mV Range</i>					
10 mV 1 kHz	9.99605 mV	9.99872 mV	10.00229 mV	0.00089 mV	
10 mV 20 kHz	9.9950 mV	9.9975 mV	10.0032 mV	0.0016 mV	
10 mV 100 kHz	9.9517 mV	9.9734 mV	10.0539 mV	0.0095 mV	
10 mV 300 kHz	9.596 mV	9.763 mV	10.400 mV	0.066 mV	
<i>100 mV Range</i>					
100 mV 1 kHz	99.9881 mV	99.9941 mV	100.0065 mV	0.0061 mV	P‡
100 mV 20 kHz	99.9834 mV	99.9980 mV	100.0158 mV	0.0080 mV	
100 mV 100 kHz	99.955 mV	99.989 mV	100.119 mV	0.037 mV	P‡
100 mV 300 kHz	99.728 mV	99.894 mV	100.348 mV	0.070 mV	
<i>1 V Range</i>					
1 V 1 kHz	0.999897 V	0.999988 V	1.000081 V	0.000048 V	
1 V 20 kHz	0.999829 V	1.000020 V	1.000153 V	0.000071 V	
1 V 50 kHz	0.99968 V	1.00013 V	1.00032 V	0.00013 V	
1 V 100 kHz	0.99921 V	1.00035 V	1.00085 V	0.00021 V	
1 V 300 kHz	0.99714 V	1.00187 V	1.00334 V	0.00061 V	
1 V 500 kHz	0.9906 V	1.0038 V	1.0108 V	0.0017 V	
<i>10 V Range</i>					
3 V 100 kHz	2.99720 V	3.00044 V	3.00242 V	0.00057 V	
10 V 10 Hz	9.99908 V	10.00025 V	10.00132 V	0.00055 V	
10 V 20 Hz	9.99884 V	9.99997 V	10.00108 V	0.00038 V	
10 V 40 Hz	9.99897 V	9.99997 V	10.00081 V	0.00031 V	
10 V 1 kHz	9.99887 V	9.99988 V	10.00071 V	0.00049 V	
10 V 10 kHz	9.99786 V	9.99964 V	10.00110 V	0.00070 V	
10 V 20 kHz	9.99782 V	10.00030 V	10.00106 V	0.00072 V	
10 V 50 kHz	9.9963 V	10.0013 V	10.0027 V	0.0013 V	
10 V 100 kHz	9.9914 V	10.0018 V	10.0078 V	0.0016 V	
10 V 300 kHz	9.9676 V	10.0051 V	10.0296 V	0.0053 V	
10 V 500 kHz	9.905 V	10.020 V	10.107 V	0.016 V	
10 V 1 MHz	9.932 V	10.100 V	10.134 V	0.019 V	
<i>100 V Range</i>					
100 V 1 kHz	99.9752 V	99.9996 V	100.0196 V	0.0052 V	
100 V 20 kHz	99.9758 V	100.0044 V	100.0202 V	0.0088 V	
100 V 50 kHz	99.9634 V	100.0168 V	100.0378 V	0.0081 V	

‡ This measured value is within one expanded uncertainty of the specification.

Model 3458A Serial 2823A01045 Firmware Rev 9,2  
**Options Tested**

Test Date 8 Jul 2022  
 Condition As Received

## AC VOLT Synchronized (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
100 V 100 kHz	99.877 V	100.021 V	100.121 V	0.023 V	
<i>1000 V Range</i>					
700 V 1 kHz	699.692 V	700.003 V	700.294 V	0.067 V	

## AC VOLT High Freq

**Failed**

The 3458A is set to Synchronous mode for this test.  
 The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.  
 This can be calculated from:  
 Expected Value=(Minimum+Maximum)/2  
 The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Input Freq.</i>					
<i>10 mV Range</i>					
10 mV 1 MHz	9.855 mV	9.989 mV	10.105 mV	0.024 mV	
10 mV 4 MHz	9.10 mV	10.20 mV	10.52 mV	0.14 mV	
<i>100 mV Range</i>					
100 mV 1 MHz	98.96 mV	99.97 mV	100.98 mV	0.18 mV	
100 mV 4 MHz	95.68 mV	100.79 mV	103.82 mV	0.68 mV	
100 mV 8 MHz	95.52 mV	103.55 mV	103.68 mV	0.68 mV	P‡
100 mV 10 MHz	84.5 mV	107.4 mV	114.7 mV	2.3 mV	
<i>1 V Range</i>					
1 V 1 MHz	0.9886 V	1.0047 V	1.0088 V	0.0017 V	
1 V 4 MHz	0.9583 V	1.0333 V	1.0397 V	0.0068 V	P‡
1 V 8 MHz	0.9571 V	1.0386 V	1.0387 V	0.0068 V	P‡
1 V 10 MHz	0.846 V	1.008 V	1.148 V	0.025 V	
<i>10 V Range</i>					
3 V 2 MHz	2.871 V	3.021 V	3.125 V	0.021 V	
3 V 4 MHz	2.868 V	3.098 V	3.122 V	0.021 V	
3 V 8 MHz	2.863 V	3.155 V	3.119 V	0.021 V	F
3 V 10 MHz	2.532 V	3.252 V	3.452 V	0.075 V	

‡ This measured value is within one expanded uncertainty of the specification.

## FREQUENCY

**Passed**

The test limits correspond to the published 1 Year specifications.

<u>TEST CONDITIONS</u>	<u>MINIMUM</u>	<u>MEASURED</u>	<u>MAXIMUM</u>	<u>UNCERT.</u>	<u>Status</u>
1 Hz	0.999500 Hz	1.000014 Hz	1.000500 Hz	0.000020 Hz	
10 MHz	9.999000 MHz	10.000051 MHz	10.001000 MHz	0.000058 MHz	

## SELF TEST

**As Expected**

<u>TEST COND.</u>	<u>RESULT</u>	<u>Status</u>
SELF TEST	DONE	

## AUTO-CALIBRATION

**As Expected**

The Auto-Cal function was invoked before measurements were made.

<u>TEST CONDITIONS</u>	<u>RESULT</u>	<u>Status</u>
Auto Calibration	DONE	

UUT Internal temperature: 36.3 degrees C.  
 UUT CAL?58:39.1, CAL?59:40.0, CAL?60:40.3 degrees C.  
 UUT CALNUM? : 30.

## DC VOLT OFFSET

**Passed**

Measured with Front panel input terminals shorted  
The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
0.1 V	0 V	-0.00106 mV	0.00030 mV	0.00106 mV	0.00016 mV	
1 V	0 V	-0.00106 mV	0.00025 mV	0.00106 mV	0.00015 mV	
10 V	0 V	-0.00230 mV	0.00064 mV	0.00230 mV	0.00032 mV	
100 V	0 V	-0.036 mV	0.006 mV	0.036 mV	0.014 mV	
1000 V	0 V	-0.130 mV	0.022 mV	0.130 mV	0.041 mV	

## DC VOLT OFFSET-REAR PANEL

**Passed**

Measured with Rear panel input terminals shorted  
The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
0.1 V	0 V	-0.00106 mV	0.00029 mV	0.00106 mV	0.00016 mV	
1 V	0 V	-0.00106 mV	0.00039 mV	0.00106 mV	0.00015 mV	
10 V	0 V	-0.00230 mV	0.00068 mV	0.00230 mV	0.00032 mV	
100 V	0 V	-0.036 mV	0.004 mV	0.036 mV	0.014 mV	
1000 V	0 V	-0.130 mV	0.008 mV	0.130 mV	0.041 mV	

## DC VOLT GAIN

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 mV	100 mV	99.99792 mV	99.99951 mV	100.00086 mV	0.00046 mV	
100 mV	-100 mV	-100.00117 mV	-99.99961 mV	-99.99823 mV	0.00059 mV	
1 V	1 V	0.9999876 V	0.9999987 V	1.0000084 V	0.0000028 V	
1 V	-1 V	-1.0000092 V	-0.9999992 V	-0.9999884 V	0.0000028 V	
10 V	10 V	9.999892 V	9.99992 V	10.000094 V	0.000027 V	
10 V	-10 V	-10.000097 V	-9.999994 V	-9.999895 V	0.000027 V	
100 V	100 V	99.99873 V	100.00005 V	100.00121 V	0.00038 V	

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## DC VOLT GAIN (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
100 V -100 V	-100.00119 V	-100.00001 V	-99.99871 V	0.00033 V	
1000 V 1000 V	999.9799 V	999.9971 V	1000.0283 V	0.0057 V	
1000 V -1000 V	-1000.0263 V	-999.9952 V	-999.9779 V	0.0057 V	

## OHMS OFFSET

**Passed**

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Range Input</i>					
<i>-----</i>					
<i>4-Wire Front Panel</i>					
10 Ω 0 Ω	-0.000070 Ω	0.000001 Ω	0.000070 Ω	0.000023 Ω	
<i>2-Wire Front Panel</i>					
10 Ω 0 Ω	-0.25007 Ω	-0.00768 Ω	0.25007 Ω	0.00012 Ω	
<i>4-Wire Rear Panel</i>					
10 Ω 0 Ω	-0.000070 Ω	0.000000 Ω	0.000070 Ω	0.000021 Ω	
<i>2-Wire Rear Panel</i>					
10 Ω 0 Ω	-0.25007 Ω	-0.00146 Ω	0.25007 Ω	0.00014 Ω	

## OHMS GAIN

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Range Input</i>					
<i>-----</i>					
<i>4-Wire Mode</i>					
10 Ω 10 Ω	9.999670 Ω	9.999880 Ω	10.000170 Ω	0.000089 Ω	
100 Ω 100 Ω	99.99875 Ω	100.00056 Ω	100.00311 Ω	0.00085 Ω	
1 kΩ 1 kΩ	1.0000226 kΩ	1.0000323 kΩ	1.0000500 kΩ	0.0000075 kΩ	
10 kΩ 10 kΩ	9.999879 kΩ	10.000010 kΩ	10.000153 kΩ	0.000074 kΩ	
100 kΩ 100 kΩ	99.99937 kΩ	100.00040 kΩ	100.00211 kΩ	0.00078 kΩ	
1 MΩ 1 MΩ	0.9999622 MΩ	0.9999733 MΩ	1.0000028 MΩ	0.0000098 MΩ	
10 MΩ 10 MΩ	9.99825 MΩ	9.99882 MΩ	9.99951 MΩ	0.00025 MΩ	
<i>2-Wire Mode</i>					
10 MΩ 10 MΩ	9.99825 MΩ	9.99887 MΩ	9.99951 MΩ	0.00018 MΩ	
100 MΩ 100 MΩ	99.957 MΩ	100.025 MΩ	100.063 MΩ	0.024 MΩ	

## DC CURRENT OFFSET

**Passed**

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 $\mu$ A	0 $\mu$ A	-0.00095 $\mu$ A	-0.00033 $\mu$ A	0.00095 $\mu$ A	0.00012 $\mu$ A	
1 mA	0 mA	-0.0000065 mA	-0.0000024 mA	0.0000065 mA	0.0000012 mA	
10 mA	0 mA	-0.000065 mA	-0.000019 mA	0.000065 mA	0.000012 mA	
100 mA	0 mA	-0.00065 mA	-0.00015 mA	0.00065 mA	0.00012 mA	
1 A	0 A	-0.0000115 A	-0.0000020 A	0.0000115 A	0.0000015 A	

## DC CURRENT GAIN

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied  
 that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
Range	Input					
100 $\mu$ A	100 $\mu$ A	99.9971 $\mu$ A	100.0007 $\mu$ A	100.0041 $\mu$ A	0.0016 $\mu$ A	
100 $\mu$ A	-100 $\mu$ A	-100.0040 $\mu$ A	-100.0008 $\mu$ A	-99.9970 $\mu$ A	0.0014 $\mu$ A	
1 mA	1 mA	0.999963 mA	0.999999 mA	1.000027 mA	0.000011 mA	
1 mA	-1 mA	-1.000021 mA	-0.999997 mA	-0.999957 mA	0.000011 mA	
10 mA	10 mA	9.99964 mA	9.99998 mA	10.00028 mA	0.00014 mA	
10 mA	-10 mA	-10.00032 mA	-10.00000 mA	-9.99968 mA	0.00011 mA	
100 mA	100 mA	99.9962 mA	100.0010 mA	100.0056 mA	0.0023 mA	
100 mA	-100 mA	-100.0056 mA	-100.0017 mA	-99.9962 mA	0.0023 mA	
1 A	1 A	0.999853 A	0.999963 A	1.000107 A	0.000038 A	
1 A	-1 A	-1.000100 A	-0.999953 A	-0.999846 A	0.000045 A	

## AC CURRENT

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied  
 that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

All current measurements made at a frequency of 1 kHz

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Range Input</i>					
-----					
100 µA 10 µA	9.964 uA	10.017 µA	10.036 uA	0.010 µA	
100 µA 100 µA	99.901 uA	99.997 µA	100.083 uA	0.024 µA	
1 mA 1 mA	0.99950 mA	1.00004 mA	1.00052 mA	0.00017 mA	
10 mA 10 mA	9.9947 mA	10.0003 mA	10.0049 mA	0.0013 mA	
100 mA 100 mA	99.951 mA	100.007 mA	100.053 mA	0.013 mA	
1 A 1 A	0.99885 A	1.00002 A	1.00127 A	0.00024 A	

## AC VOLT Analog

**Passed**

The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied  
 that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Input Freq.</i>					
-----					
<i>10 V Range</i>					
1 V 50 kHz	0.99451 V	0.99951 V	1.00551 V	0.00064 V	
1 V 1 MHz	0.753 V	0.936 V	1.253 V	0.029 V	
10 V 10 Hz	9.9581 V	9.9829 V	10.0421 V	0.0049 V	
10 V 200 Hz	9.99672 V	10.00007 V	10.00276 V	0.00056 V	
10 V 500 Hz	9.99672 V	10.00004 V	10.00276 V	0.00056 V	
10 V 50 kHz	9.9806 V	10.0006 V	10.0186 V	0.0024 V	
10 V 1 MHz	9.334 V	10.035 V	10.734 V	0.082 V	

## AC VOLT Synchronized

**Passed‡**

The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied  
 that is expected to be the indicated (MEASURED) value.

This can be calculated from:

$$\text{Expected Value} = (\text{Minimum} + \text{Maximum}) / 2$$

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Input Freq.</i>					
-----					
<i>10 mV Range</i>					
10 mV 1 kHz	9.99606 mV	9.99846 mV	10.00230 mV	0.00089 mV	
10 mV 20 kHz	9.9951 mV	9.9972 mV	10.0033 mV	0.0016 mV	
10 mV 100 kHz	9.9517 mV	9.9728 mV	10.0539 mV	0.0095 mV	
10 mV 300 kHz	9.596 mV	9.759 mV	10.400 mV	0.066 mV	
<i>100 mV Range</i>					
100 mV 1 kHz	99.9877 mV	99.9921 mV	100.0061 mV	0.0061 mV	P‡
100 mV 20 kHz	99.9823 mV	99.9948 mV	100.0147 mV	0.0080 mV	
100 mV 100 kHz	99.949 mV	99.984 mV	100.113 mV	0.037 mV	P‡
100 mV 300 kHz	99.727 mV	99.883 mV	100.347 mV	0.070 mV	
<i>1 V Range</i>					
1 V 1 kHz	0.999894 V	0.999964 V	1.000078 V	0.000048 V	
1 V 20 kHz	0.999831 V	1.000023 V	1.000155 V	0.000071 V	
1 V 50 kHz	0.99968 V	1.00013 V	1.00032 V	0.00013 V	
1 V 100 kHz	0.99921 V	1.00036 V	1.00085 V	0.00021 V	
1 V 300 kHz	0.99715 V	1.00182 V	1.00335 V	0.00061 V	
1 V 500 kHz	0.9906 V	1.0036 V	1.0108 V	0.0017 V	
<i>10 V Range</i>					
3 V 100 kHz	2.99724 V	3.00037 V	3.00246 V	0.00057 V	
10 V 10 Hz	9.99906 V	10.00006 V	10.00130 V	0.00055 V	
10 V 20 Hz	9.99877 V	9.99987 V	10.00101 V	0.00038 V	
10 V 40 Hz	9.99896 V	9.99985 V	10.00080 V	0.00031 V	
10 V 1 kHz	9.99885 V	9.99970 V	10.00069 V	0.00049 V	
10 V 10 kHz	9.99790 V	9.99942 V	10.00114 V	0.00070 V	
10 V 20 kHz	9.99791 V	10.00013 V	10.00115 V	0.00072 V	
10 V 50 kHz	9.9963 V	10.0012 V	10.0027 V	0.0013 V	
10 V 100 kHz	9.9915 V	10.0016 V	10.0079 V	0.0016 V	
10 V 300 kHz	9.9677 V	10.0042 V	10.0297 V	0.0053 V	
10 V 500 kHz	9.905 V	10.017 V	10.107 V	0.016 V	
10 V 1 MHz	9.933 V	10.091 V	10.135 V	0.019 V	
<i>100 V Range</i>					
100 V 1 kHz	99.9767 V	99.9973 V	100.0211 V	0.0052 V	
100 V 20 kHz	99.9782 V	100.0012 V	100.0226 V	0.0088 V	
100 V 50 kHz	99.9655 V	100.0104 V	100.0399 V	0.0081 V	

‡ This measured value is within one expanded uncertainty of the specification.



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## AC VOLT Synchronized (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
100 V 100 kHz	99.879 V	100.003 V	100.123 V	0.023 V	
<i>1000 V Range</i>					
700 V 1 kHz	699.697 V	699.960 V	700.299 V	0.067 V	

## AC VOLT High Freq

**Passed**

The 3458A is set to Synchronous mode for this test.  
 The Input value under TEST CONDITIONS column is the nominal value applied.  
 The MINIMUM and MAXIMUM test limits are based on the actual value applied that is expected to be the indicated (MEASURED) value.  
 This can be calculated from:  
 Expected Value=(Minimum+Maximum)/2  
 The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
<i>Input Freq.</i>					
<i>10 mV Range</i>					
10 mV 1 MHz	9.854 mV	9.981 mV	10.104 mV	0.024 mV	
10 mV 4 MHz	9.10 mV	10.08 mV	10.52 mV	0.14 mV	
<i>100 mV Range</i>					
100 mV 1 MHz	98.96 mV	99.88 mV	100.98 mV	0.18 mV	
100 mV 4 MHz	95.69 mV	99.57 mV	103.83 mV	0.68 mV	
100 mV 8 MHz	95.54 mV	99.94 mV	103.70 mV	0.68 mV	
100 mV 10 MHz	84.5 mV	103.7 mV	114.7 mV	2.3 mV	
<i>1 V Range</i>					
1 V 1 MHz	0.9886 V	1.0038 V	1.0088 V	0.0017 V	
1 V 4 MHz	0.9584 V	1.0202 V	1.0398 V	0.0068 V	
1 V 8 MHz	0.9574 V	0.9993 V	1.0390 V	0.0068 V	
1 V 10 MHz	0.847 V	0.970 V	1.149 V	0.025 V	
<i>10 V Range</i>					
3 V 2 MHz	2.871 V	2.984 V	3.125 V	0.021 V	
3 V 4 MHz	2.868 V	3.028 V	3.122 V	0.021 V	
3 V 8 MHz	2.863 V	2.996 V	3.119 V	0.021 V	
3 V 10 MHz	2.533 V	3.069 V	3.453 V	0.075 V	

## FREQUENCY

**Passed**

The test limits correspond to the published 1 Year specifications.

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	Status
1 Hz	0.999500 Hz	1.000005 Hz	1.000500 Hz	0.000020 Hz	

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## **FREQUENCY (cont.)**

<u>TEST CONDITIONS</u>	<u>MINIMUM</u>	<u>MEASURED</u>	<u>MAXIMUM</u>	<u>UNCERT.</u>	<u>Status</u>
10 MHz	9.999000 MHz	9.999994 MHz	10.001000 MHz	0.000058 MHz	

## **SELF TEST**

### **As Expected**

<u>TEST COND.</u>	<u>RESULT</u>	<u>Status</u>
SELF TEST	DONE	

## **AUTO-CALIBRATION**

### **As Expected**

The Auto-Cal function was invoked before measurements were made.

<u>TEST CONDITIONS</u>	<u>RESULT</u>	<u>Status</u>
Auto Calibration	DONE	

UUT Internal temperature: 35.4 degrees C.  
 UUT CAL?58:36.1, CAL?59:36.1, CAL?60:35.8 degrees C.  
 UUT CALNUM?: 43.