

Certificate of Calibration



ISO/IEC 17025:2005 and ANSI/NCSL Z540.1-1994

Certificate Number 1-6337218281-1

Model Number DSOX2014A
Manufacturer Keysight Technologies Inc
Description Oscilloscope, 4-channel, 100MHz
Serial Number MY52161639

Date of Calibration 5 Dec 2014
Procedure STE-50114571-A.02.00
Temperature (23 ± 5) °C
Humidity (50 ± 30) %RH

Customer
Metropolia Ammattikorkeakoulu Oy
Albertinkatu 40-42
00180 HELSINKI
Finland

Location of Calibration
Keysight Technologies
Deutschland GmbH
Herrenberger Strasse 130
D-71034 Boeblingen
Germany

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2005 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2008.

As Received Conditions

Initial testing found the equipment to be malfunctioning, or was not performed because the equipment was submitted for repair service. A complete set of on-receipt data may not have been obtainable.

Action Taken

- The equipment was repaired.

As Completed Conditions

The measured values of the equipment were observed IN SPECIFICATION at the points tested.

Remarks or Special Requirements

This calibration certificate may reference instruments manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies, Inc.

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

Keysight Technologies Finland Oy
Panorama Tower
Hevosenkä 3
02600 Espoo
Finland

A handwritten signature in black ink that reads "Edgar Leckel".

Edgar Leckel - European Operations Manager

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Traceability Information

Technician ID Number 00108869

Measurements are traceable to the International System of Units (SI) via national metrology institutes (e.g., NIST, NPL, PTB, NMIJ, NRC, KRISS, SIRIM, etc.) that are signatories to the CIPM Mutual Recognition Arrangement.

This certificate shall not be reproduced, except in full, without prior written approval of the laboratory.

Calibration Equipment Used

Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
11667A	DC-18 GHz power splitter, type N, 50 ohm	DE3353	26 Aug 2015	1-6182869928-1
5700A	AC DC Calibrator	DE3090	9 Dec 2014	1-5431925766-1
8482A	Power Sensor, 100 kHz to 4.2 GHz, -30 to +20 dBm	DE1775	27 Sep 2015	1-5811221772-1
E4419B	Power meter - EPM series, dual channel	DE3130	23 Jan 2015	1-4950351426-1
E8257D	PSG analog signal generator	DE3006	12 Feb 2016	1-5585697027-1

Traceability Table

	Model	Model Description	Equipment ID	Certificate Number	Trace Value
W	11667A	DC-18 GHz power splitter, type N, 50 ohm	DE3353	1-6182869928-1	
R	85054B	Standard mechanical calibration kit, DC to 18 GHz, type-N	DECH0467	1-5362315061-1-A2LA:2079.01	Reflection Coefficient
W,R	5700A	AC DC CALIBRATOR	DE3090	1-5431925766-1-UKAS:C 0147	DC Voltage
W,R	8482A	Power Sensor, 100 kHz to 4.2 GHz, -30 to +20 dBm	DE1775	1-5811221772-1-UKAS:C 0147	RF Power
W	E4419B	Power meter - EPM series, dual channel	DE3130	1-4950351426-1	
R	478A	Coaxial thermistor mount	DE2420	1-3566121182-1-UKAS:C 0147	RF Power
W	E8257D	PSG analog signal generator	DE3006	1-5585697027-1	
R	8487A	Power Sensor, 50 MHz to 50 GHz, -30 to +20 dBm	DE2440	1-5526643162-1-ACCLASS:AC-1498	RF Power
R	910R	GPS Controlled Frequency STD	UK15765	1-5470191994-1-UKAS:C 0147	Frequency

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.

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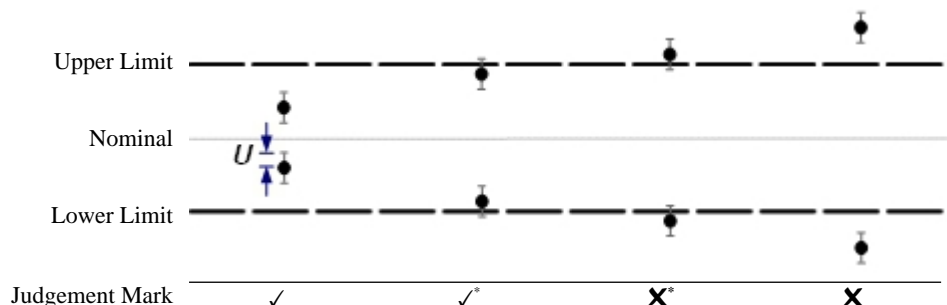
Certificate Number 1-6337218281-1

Compliance with Specification

In the assessment of compliance with specification, the uncertainty of measurement has been taken into account. If the uncertainty of measurement overlaps the specification limit (upper limit or lower limit), it is not possible to state compliance/non-compliance based on a 95% level of confidence. However, where a confidence level less than 95% is acceptable, a compliance/non-compliance statement may be possible.

The status of compliance with the acceptance criteria is reported as:

- ✓ - Compliant with specification.
- ✓^{*} - Compliance with specification providing a lower level of confidence is acceptable.
- ✕^{*} - Non-compliance with specification providing a lower level of confidence is acceptable.
- ✕ - Not compliant with specification.



The diagram above shows the typical compliance status for measured values as defined by this service. The vertical bar (*U*) above and below each measurement value represents the uncertainty of measurement.

As Received Conditions/As Completed Conditions

A compilation for all performed tests of the status as received (before any adjustment/repair) and the status as completed (after any adjustment/repair) is reported on the first page of this report. The compliance with typical (non-warranted) specifications will not affect the status as received or the status as completed reported on the first page.

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.

Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported expanded measurement uncertainty is the standard uncertainty multiplied by the coverage factor $k=2$ (for a normal distribution) or $k=1.65$ (for a uniform distribution), which corresponds to a coverage probability of approximately 95%. Where this is not the case, the distribution, coverage factor (k), effective degrees of freedom (ν_{eff}) and coverage probability (p) are stated.

Any quoted measurement uncertainty applies only to the measured value and does not imply anything regarding the long-term stability of the equipment.

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Performance Test Results Summary

Test Name	As Completed Status
DC VERTICAL GAIN ACCURACY	PASSED
DUAL CURSOR ACCURACY	PASSED
ANALOG BANDWIDTH	PASSED
TIME BASE ACCURACY	PASSED
TRIGGER SENSITIVITY	PASSED

DC VERTICAL GAIN ACCURACY

PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
CH 1 - 5 V/Div	33.80 V	34.91 V	36.20 V	0.28 V	✓
CH 1 - 2 V/Div	13.52 V	13.98 V	14.48 V	0.11 V	✓
CH 1 - 1 V/Div	6.760 V	7.038 V	7.240 V	0.056 V	✓
CH 1 - 500 mV/Div	3.380 V	3.520 V	3.620 V	0.027 V	✓
CH 1 - 200 mV/Div	1.352 V	1.394 V	1.448 V	0.011 V	✓
CH 1 - 100 mV/Div	676.0 mV	697.7 mV	724.0 mV	5.6 mV	✓
CH 1 - 50 mV/Div	338.0 mV	352.5 mV	362.0 mV	3.0 mV	✓
CH 1 - 20 mV/Div	135.2 mV	140.6 mV	144.8 mV	1.1 mV	✓
CH 1 - 10 mV/Div	67.60 mV	69.78 mV	72.40 mV	0.57 mV	✓
CH 1 - 5 mV/Div	33.40 mV	35.33 mV	36.60 mV	0.32 mV	✓
CH 1 - 2 mV/Div	12.72 mV	14.08 mV	15.28 mV	0.14 mV	✓
CH 1 - 1 mV/Div	5.720 mV	7.045 mV	8.280 mV	0.091 mV	✓
CH 2 - 5 V/Div	33.80 V	34.82 V	36.20 V	0.28 V	✓
CH 2 - 2 V/Div	13.52 V	13.93 V	14.48 V	0.11 V	✓
CH 2 - 1 V/Div	6.760 V	7.020 V	7.240 V	0.056 V	✓
CH 2 - 500 mV/Div	3.380 V	3.514 V	3.620 V	0.027 V	✓
CH 2 - 200 mV/Div	1.352 V	1.393 V	1.448 V	0.011 V	✓
CH 2 - 100 mV/Div	676.0 mV	696.3 mV	724.0 mV	5.6 mV	✓
CH 2 - 50 mV/Div	338.0 mV	352.0 mV	362.0 mV	3.0 mV	✓
CH 2 - 20 mV/Div	135.2 mV	140.6 mV	144.8 mV	1.1 mV	✓
CH 2 - 10 mV/Div	67.60 mV	69.60 mV	72.40 mV	0.57 mV	✓
CH 2 - 5 mV/Div	33.40 mV	35.10 mV	36.60 mV	0.32 mV	✓
CH 2 - 2 mV/Div	12.72 mV	13.93 mV	15.28 mV	0.14 mV	✓
CH 2 - 1 mV/Div	5.720 mV	6.917 mV	8.280 mV	0.091 mV	✓
CH 3 - 5 V/Div	33.80 V	34.96 V	36.20 V	0.28 V	✓
CH 3 - 2 V/Div	13.52 V	14.10 V	14.48 V	0.11 V	✓
CH 3 - 1 V/Div	6.760 V	7.005 V	7.240 V	0.056 V	✓
CH 3 - 500 mV/Div	3.380 V	3.508 V	3.620 V	0.027 V	✓
CH 3 - 200 mV/Div	1.352 V	1.393 V	1.448 V	0.011 V	✓
CH 3 - 100 mV/Div	676.0 mV	697.0 mV	724.0 mV	5.6 mV	✓
CH 3 - 50 mV/Div	338.0 mV	352.2 mV	362.0 mV	3.0 mV	✓
CH 3 - 20 mV/Div	135.2 mV	140.6 mV	144.8 mV	1.1 mV	✓
CH 3 - 10 mV/Div	67.60 mV	69.77 mV	72.40 mV	0.57 mV	✓
CH 3 - 5 mV/Div	33.40 mV	35.24 mV	36.60 mV	0.32 mV	✓
CH 3 - 2 mV/Div	12.72 mV	14.01 mV	15.28 mV	0.14 mV	✓
CH 3 - 1 mV/Div	5.720 mV	7.013 mV	8.280 mV	0.091 mV	✓
CH 4 - 5 V/Div	33.80 V	34.90 V	36.20 V	0.28 V	✓
CH 4 - 2 V/Div	13.52 V	13.96 V	14.48 V	0.11 V	✓
CH 4 - 1 V/Div	6.760 V	7.034 V	7.240 V	0.056 V	✓
CH 4 - 500 mV/Div	3.380 V	3.521 V	3.620 V	0.027 V	✓
CH 4 - 200 mV/Div	1.352 V	1.394 V	1.448 V	0.011 V	✓
CH 4 - 100 mV/Div	676.0 mV	697.5 mV	724.0 mV	5.6 mV	✓
CH 4 - 50 mV/Div	338.0 mV	351.3 mV	362.0 mV	3.0 mV	✓
CH 4 - 20 mV/Div	135.2 mV	141.1 mV	144.8 mV	1.1 mV	✓
CH 4 - 10 mV/Div	67.60 mV	69.73 mV	72.40 mV	0.57 mV	✓
CH 4 - 5 mV/Div	33.40 mV	35.14 mV	36.60 mV	0.32 mV	✓
CH 4 - 2 mV/Div	12.72 mV	13.96 mV	15.28 mV	0.14 mV	✓
CH 4 - 1 mV/Div	5.720 mV	6.959 mV	8.280 mV	0.091 mV	✓

DUAL CURSOR ACCURACY

PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
CH 1 - 5 V/Div	33.60 V	34.91 V	36.40 V	0.28 V	✓
CH 1 - 2 V/Div	13.44 V	13.98 V	14.56 V	0.11 V	✓
CH 1 - 1 V/Div	6.720 V	7.038 V	7.280 V	0.056 V	✓
CH 1 - 500 mV/Div	3.360 V	3.519 V	3.640 V	0.027 V	✓
CH 1 - 200 mV/Div	1.344 V	1.394 V	1.456 V	0.011 V	✓
CH 1 - 100 mV/Div	672.0 mV	697.4 mV	728.0 mV	5.6 mV	✓
CH 1 - 50 mV/Div	336.0 mV	352.4 mV	364.0 mV	2.9 mV	✓
CH 1 - 20 mV/Div	134.4 mV	140.5 mV	145.6 mV	1.1 mV	✓
CH 1 - 10 mV/Div	67.20 mV	69.73 mV	72.80 mV	0.58 mV	✓
CH 1 - 5 mV/Div	33.20 mV	35.28 mV	36.80 mV	0.31 mV	✓
CH 1 - 2 mV/Div	12.56 mV	14.03 mV	15.44 mV	0.14 mV	✓
CH 1 - 1 mV/Div	5.56 mV	7.00 mV	8.44 mV	0.12 mV	✓
CH 2 - 5 V/Div	33.60 V	34.82 V	36.40 V	0.28 V	✓
CH 2 - 2 V/Div	13.44 V	13.93 V	14.56 V	0.11 V	✓
CH 2 - 1 V/Div	6.720 V	7.023 V	7.280 V	0.056 V	✓
CH 2 - 500 mV/Div	3.360 V	3.516 V	3.640 V	0.027 V	✓
CH 2 - 200 mV/Div	1.344 V	1.394 V	1.456 V	0.011 V	✓
CH 2 - 100 mV/Div	672.0 mV	696.3 mV	728.0 mV	5.6 mV	✓
CH 2 - 50 mV/Div	336.0 mV	352.1 mV	364.0 mV	2.9 mV	✓
CH 2 - 20 mV/Div	134.4 mV	140.6 mV	145.6 mV	1.1 mV	✓
CH 2 - 10 mV/Div	67.20 mV	69.60 mV	72.80 mV	0.58 mV	✓
CH 2 - 5 mV/Div	33.20 mV	35.10 mV	36.80 mV	0.31 mV	✓
CH 2 - 2 mV/Div	12.56 mV	13.95 mV	15.44 mV	0.14 mV	✓
CH 2 - 1 mV/Div	5.56 mV	6.95 mV	8.44 mV	0.12 mV	✓
CH 3 - 5 V/Div	33.60 V	34.95 V	36.40 V	0.28 V	✓
CH 3 - 2 V/Div	13.44 V	14.10 V	14.56 V	0.11 V	✓
CH 3 - 1 V/Div	6.720 V	7.008 V	7.280 V	0.056 V	✓
CH 3 - 500 mV/Div	3.360 V	3.508 V	3.640 V	0.027 V	✓
CH 3 - 200 mV/Div	1.344 V	1.393 V	1.456 V	0.011 V	✓
CH 3 - 100 mV/Div	672.0 mV	697.0 mV	728.0 mV	5.6 mV	✓
CH 3 - 50 mV/Div	336.0 mV	352.1 mV	364.0 mV	2.9 mV	✓
CH 3 - 20 mV/Div	134.4 mV	140.6 mV	145.6 mV	1.1 mV	✓
CH 3 - 10 mV/Div	67.20 mV	69.75 mV	72.80 mV	0.58 mV	✓
CH 3 - 5 mV/Div	33.20 mV	35.20 mV	36.80 mV	0.31 mV	✓
CH 3 - 2 mV/Div	12.56 mV	13.98 mV	15.44 mV	0.14 mV	✓
CH 3 - 1 mV/Div	5.56 mV	6.98 mV	8.44 mV	0.12 mV	✓
CH 4 - 5 V/Div	33.60 V	34.90 V	36.40 V	0.28 V	✓
CH 4 - 2 V/Div	13.44 V	13.96 V	14.56 V	0.11 V	✓
CH 4 - 1 V/Div	6.720 V	7.037 V	7.280 V	0.056 V	✓
CH 4 - 500 mV/Div	3.360 V	3.522 V	3.640 V	0.027 V	✓
CH 4 - 200 mV/Div	1.344 V	1.394 V	1.456 V	0.011 V	✓
CH 4 - 100 mV/Div	672.0 mV	697.8 mV	728.0 mV	5.6 mV	✓
CH 4 - 50 mV/Div	336.0 mV	351.3 mV	364.0 mV	2.9 mV	✓
CH 4 - 20 mV/Div	134.4 mV	141.1 mV	145.6 mV	1.1 mV	✓
CH 4 - 10 mV/Div	67.20 mV	69.75 mV	72.80 mV	0.58 mV	✓
CH 4 - 5 mV/Div	33.20 mV	35.13 mV	36.80 mV	0.31 mV	✓
CH 4 - 2 mV/Div	12.56 mV	13.98 mV	15.44 mV	0.14 mV	✓
CH 4 - 1 mV/Div	5.56 mV	6.95 mV	8.44 mV	0.12 mV	✓

ANALOG BANDWIDTH

PASSED

TEST CONDITIONS	MINIMUM	MEASURED	UNCERT.	
100 MHz Bandwidth				
CH 1 - 200 mV/Div	-3.00 dB	-0.86 dB	0.29 dB	✓
CH 2 - 200 mV/Div	-3.00 dB	-0.76 dB	0.29 dB	✓
CH 3 - 200 mV/Div	-3.00 dB	-0.71 dB	0.29 dB	✓
CH 4 - 200 mV/Div	-3.00 dB	-0.87 dB	0.29 dB	✓

TIME BASE ACCURACY

PASSED

TEST COND.	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
10.0000 MHz	-35.8 ppm	-6.4 ppm	35.8 ppm	4.1 ppm	✓

TRIGGER SENSITIVITY

PASSED

TEST CONDITIONS	STATUS
Internal Trigger	
100 MHz Bandwidth	
CH 1 - 5 mV/Div	PASS
CH 1 - 10 mV/Div	PASS
CH 2 - 5 mV/Div	PASS
CH 2 - 10 mV/Div	PASS
CH 3 - 5 mV/Div	PASS
CH 3 - 10 mV/Div	PASS
CH 4 - 5 mV/Div	PASS
CH 4 - 10 mV/Div	PASS
External Trigger	
EXT - 100 MHz	PASS
EXT - 200 MHz	PASS