



Z540-1 Calibration Service Explained

Legacy Service for Older Government Contracts

Brief history

For many years, customers doing US government contract work were required, as part of their contract, to calibrate their measurement and test equipment (M&TE), according to MIL-STD-45662A. In 1994, as a cost saving measure the Department of Defense prohibited the use of all military standards in favor of commercial performance standards. In response, NCSLI members quickly developed ANSI/NCSL Z540-1. Z540-1 was renewed several times until it was rescinded in 2007, after the newer ANSI/NCSL Z540.3 was approved.

Measurement Uncertainty

The traditional quality figure of merit for calibration measurements used in MIL-STD-45662A was Test Accuracy Ratio (TAR). This is a simple ratio of the [accuracy] specification of the lab standard to the specification of the instrument submitted for calibration. A ratio of 4:1 was considered desirable and adequate. Even today TAR sometimes works well for simple comparisons such as length in gage blocks, or DC Volts where electronic standards generally require only a single connection.

However, when calibrating RF/MW instruments where calibration procedures often involve measurement paths with up or down conversion, attenuators, mismatch error, and frequency response corrections, TAR is insufficient to address multiple sources of error.

In the 1980s many metrologists began to experiment with using Test Uncertainty Ratio, TUR, where the denominator, U, was a combination of the measurement errors (uncertainties). The publication of the ISO Guide for Expression of Uncertainty of Measurements (aka ISO GUM), in 1995, provided a formal method to combine multiple uncertainties in the form of an international standard.



Free downloads

- ISO Guide for Expression of Uncertainty of Measurements
www.ukas.com
- Guidelines on the Reporting of Compliance with Specification ILAC-G8:03/2009
www.ilac.org
- ILAC Policy for Uncertainty in Calibration ILAC-P14:12/2010
www.ilac.org
- Metrology technical papers
www.keysight.com/find/metrology

Hewlett Packard, which had been using TUR at the time switched over to the ISO GUM for new product introductions of most instruments by 1997. While Z540-1 does allow the use of TAR, later versions of the Z540-1 handbook recommend the use of the ISO GUM. ISO 17025 first published in 1999 references the ISO GUM as does ANSI Z540.3 (see Figure 1).

How to Order Z540-1 Calibration

If you speak to someone from the Keysight Englewood call center and request a “Z540 calibration”, they will ask if you mean Z540-1 or the newer Z540.3. Many customers still require Z540-1 and Keysight is happy to continue to provide that level of calibration, even on legacy instruments. Choose from these two services:

- For newer instruments, we recommend “Keysight calibration + uncertainties”. This calibration service meets both ISO 17025 and Z540-1, includes ISO GUM uncertainties, and an accreditation body symbol.
- For older legacy instruments, generally introduced before 1995 (the 1st publication of the ISO GUM), Keysight offers “Z540-1 Cal service”, which includes TUR uncertainty, and complies with Z540-1. “Z540-1 Cal service” does not include the accreditation body symbol, as ILAC-P14 (published Dec 2010) only allows the accreditation symbol when the measured results are also provided along with ISO GUM uncertainties.

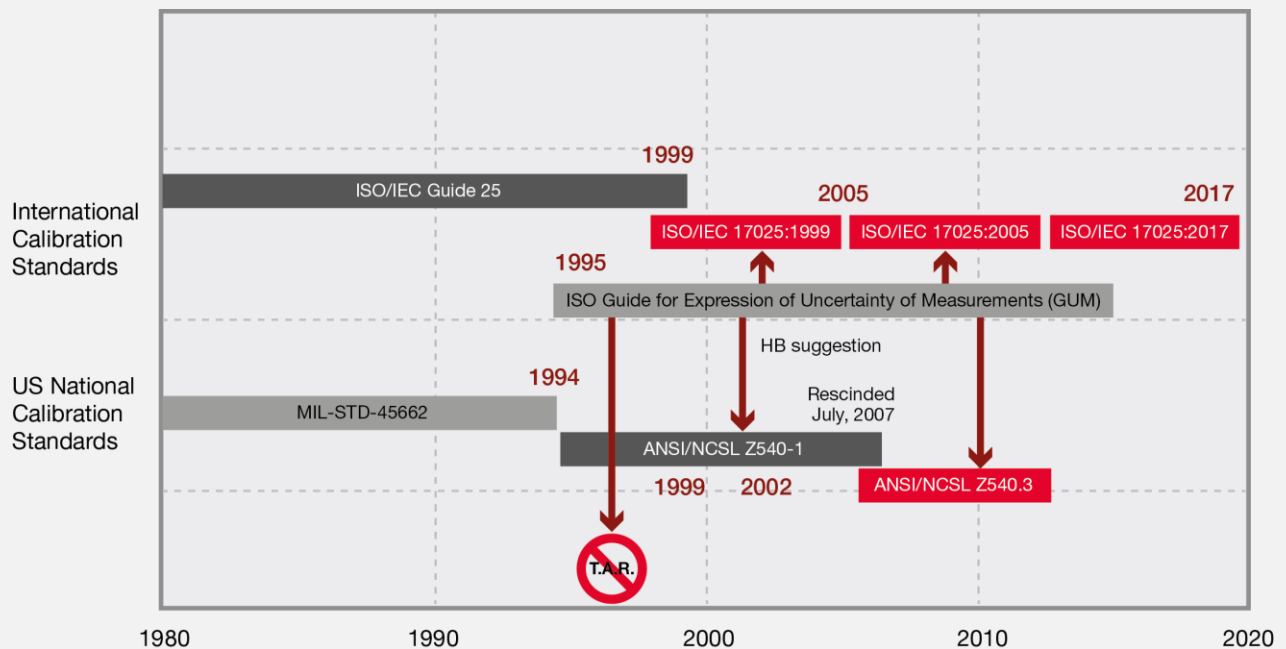


Figure 1: HP / Keysight Adoption of Calibration Standards

Z540-1 Accreditation and Calibration Certificates

Keysight Americas Service Centers are accredited by the A2LA¹ or by ANAB² to ISO/IEC 17025:2005³ and the additional requirements for ANSI/NCSL Z540-1-1994 and ANSI/NCSL Z540.3-2006.

Helpful Resources

- View Keysight's entire portfolio of Calibration Services at www.keysight.com/find/calibration
- Find Keysight's 40 sites in 20 countries with ISO/IEC 17025 accreditation at www.keysight.com/find/accreditation
- Learn more about Laboratory Accreditation and Accreditation Body Symbols on Calibration Certificates at <http://literature.cdn.keysight.com/litweb/pdf/5991-0005EN.pdf>

Certificate of Calibration	
ANSI/NCSL Z540.1-1994 (R2002)	
Certificate Number 1-7542126049-1	
Model Number	14401A
Manufacturer	Keysight Technologies Inc.
Description	Digital multimeter, 6.5 digit
Serial Number	L936021459
Customer Asset No.	14401A-1459
Date of Calibration	17 Dec 2015
Procedure	511-5011 (21.43.01.01)
Temperature	(24 ± 3) °C
Humidity	(50 ± 20) %RH
Customer	Keysight Technologies Taiwan Ltd 211 TRINITYEN 29 Kuo Shiang Rd 10409 Service Center Taiwan
Location of Calibration	Keysight Technologies Taiwan Ltd Taiwan 22459 Ding-Chen Support Station Unit No 29 Kuo Shiang Road Taiwan

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

This calibration report is composed of a certificate of calibration, performance test results and/or certificate appendices. Each report section is numbered separately.

As Received Conditions
The measured values of the equipment were observed in specification at the points tested.

Action Taken
- No corrective actions were necessary.

As Completed Conditions
The measured values of the equipment were observed in specification at the points tested.

Reported uncertainties are calculated at a 95% confidence interval with a coverage factor of 2 (k=2). When not specifically called out in the measurement report, a Test Uncertainty Ratio (TUR) of 4:1 can be assumed.

Remarks or Special Requirements
This calibration certificate was 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.

Based on the customer's request, the next calibration is due on 17 Dec 2016.

Keysight Technologies Taiwan Ltd.
Taiwan 32459 Ding-Chen
Support Station Unit
No.29 Kuo Shiang Road
Taiwan

Chen Chia-Ming
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¹ "American Association for Laboratory Accreditation", www.a2la.org.

² "ANSI-ASQ National Accreditation Board", www.anab.org.

³ ISO/IEC 17025:2005 "General requirements for the competence of testing and calibration laboratories", International Organization for Standardization/ International Electrotechnical Commission.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

