

# Z540.3 Calibration Service Explained

Improve Test Accuracy by Reducing Measurement Uncertainty

## Introduction

ANSI/NCSL Z540.3-2006<sup>1</sup> is the American national standard for calibration of measurement and test equipment (M&TE), adopted in August 2006. Z540.3 is the natural evolution of ANSI/NCSL Z540.1-1994<sup>2</sup>, ANSI/NCSL Z540.2-1997<sup>3</sup>, and MIL-STD-45662<sup>4</sup>.

## Keysight Compliance to Z540.3

Keysight was an active participant in the NCSLI 171 subcommittee that authored the Z540.3 Handbook. The handbook committee devoted special attention to meeting the Z540.3 requirement: *“The probability that incorrect acceptance decisions (false accept) will result from calibration tests shall not exceed 2% and shall be documented.”* (paragraph 5.3b) The Z540.3 Handbook provides details on six compliance methods. Method 5 is identical to the conformance recommendation of ILAC-G8.<sup>5</sup>

<sup>1</sup> ANSI/NCSL Z540.3-2006, “Requirements for the Calibration of Measuring and Test Equipment”, American National Standard Institute/ National Conference of Standards Laboratories.

<sup>2</sup> ANSI/NCSL Z540-1-1994 (R2002), “Calibration Laboratories and Measuring and Test Equipment – General Requirements”; rescinded 2006.

<sup>3</sup> ANSI/NCSL Z540.2 1997 (R2002), “U.S. Guide to the Expression of Uncertainty in Measurement.”

<sup>4</sup> Legacy military standard for calibration, rescinded in 1994.

<sup>5</sup> ILAC-G8:03/2009, “Guidelines on the Reporting of Compliance with Specification”, International Laboratory Accreditation Cooperation.



### Free downloads

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

## Keysight Compliance to Z540.3 Continued

ILAC-G8 is the standard most preferred by accreditation bodies worldwide for compliance to ISO 17025 paragraph 5.10.4.2. “When statements of compliance are made, the uncertainty of measurement shall be taken into account.” “Keysight calibration + uncertainties + guardbanding” service complies with ILAC-G8 and therefore also complies with Z540.3.

### Z540.3 Compliance Method 5 Details

The essential requirements for compliance with ILAC-G8 or Z540.3 Method 5 are as follows:

1. Develop measurement uncertainty for each measured point and each performance test per the ISO GUM, “Guide to the Expression of Uncertainty in Measurement.”
2. Employ a guard band in the amount of the 95% expanded uncertainty as the Pass/Fail acceptance limit as shown in Figure 1.
3. Perform adjustments for any measured point observed outside the acceptance limit. Then re-run the performance test. If the new measurement is observed inside the acceptance limit, that point is reported as “Pass” in the “As-shipped” report to the end user.
4. For more information, see the article “A Pragmatic Method for Pass/Fail Conformance Reporting that Complies with ANSI Z540.3, ISO 17025, and ILAC-G8” by Michael Dobbert and Robert Stern. For a copy of the paper visit [www.keysight.com/find/conformancereportingpaper](http://www.keysight.com/find/conformancereportingpaper).

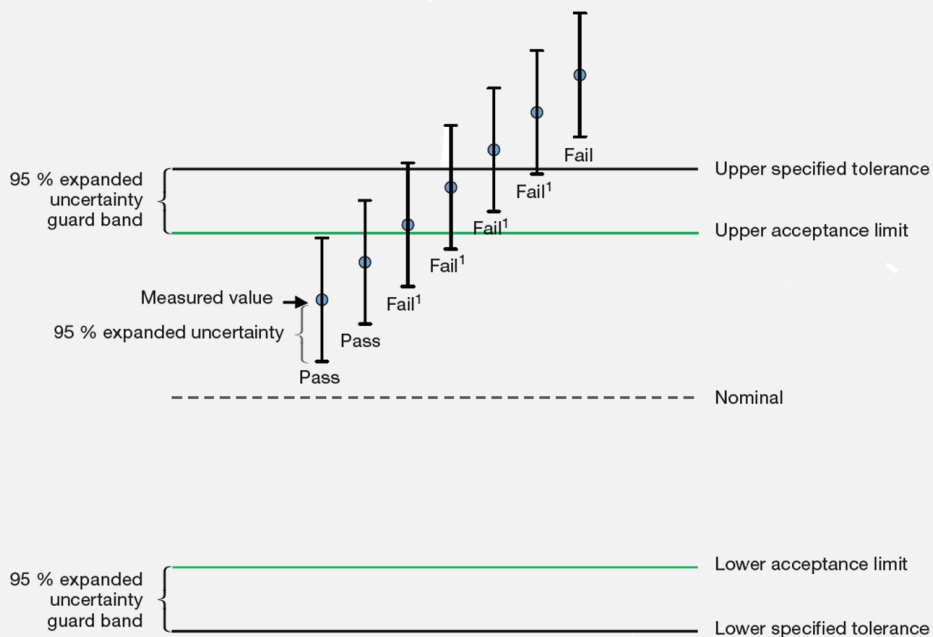


Figure 1: Acceptance limits set using the 95% expanded uncertainty

## Z540.3 Compliance for Licensed Users of Keysight Calibration Software


Keysight Service Centers run the N7800A software platform for “*Keysight calibration + uncertainties + guardbanding*” calibration service. Learn more at [www.keysight.com/find/calibrationsoftware](http://www.keysight.com/find/calibrationsoftware). Licensed users of N7800A calibration procedures who select the “ISO 17025 mode” are also in compliance with Z540.3, as explained in the previous section.

## Z540.3 Accreditation and Calibration Certificates

Keysight Americas Service Centers are accredited by the A2LA<sup>6</sup> or by ANAB<sup>7</sup> to ISO/IEC17025:2005<sup>8</sup> 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](http://www.keysight.com/find/calibration)
- Find Keysight’s 40 sites in 20 countries with ISO/IEC 17025 accreditation at [www.keysight.com/find/accreditation](http://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>

KEYSIGHT TECHNOLOGIES		Certificate of Calibration		IAC-MSA		ANAB	
		ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006					
		Certificate Number 1-1682402477-1					
<b>Model Number</b>	E8663D	<b>Customer</b>	Keysight Technologies Inc.				
<b>Manufacturer</b>	Keysight Technologies Inc.	<b>Description</b>	1000 Foothills Blvd.				
<b>Description</b>	PKG RF Analog Signal Generator	<b>Serial Number</b>	Roseville CA 95747				
<b>Serial Number</b>	30353401335	<b>Customer Asset No.</b>	United States				
<b>Customer Asset No.</b>	186671001335	<b>Date of Calibration</b>	30 Jun 2019				
<b>Date of Calibration</b>	30 Jun 2019	<b>Procedure</b>	1XEL-N7800A-L16-05				
<b>Procedure</b>	1XEL-N7800A-L16-05	<b>Temperature</b>	(25 ± 5) °C				
<b>Temperature</b>	(25 ± 5) °C	<b>Humidity</b>	(50 ± 30) %RH				
<b>Humidity</b>	(50 ± 30) %RH	<b>Location of Calibration</b>	Keysight Technologies Inc.				
		<b>Location of Calibration</b>	1000 Foothills Blvd.				
		<b>Location of Calibration</b>	Roseville CA 95747-7102				
		<b>Location of Calibration</b>	UNITED STATES				
<p>This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006. The quality management system is registered to ISO 9001:2015.</p>							
<p><b>As Received Conditions</b> 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.</p>							
<p><b>Action Taken</b> No corrective actions were necessary.</p>							
<p><b>As Completed Conditions</b> 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.</p>							
<p><b>Remarks or Special Requirements</b> This calibration certificate may refer to instruments manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies, Inc. The lot/line is 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 30 Jun 2021.</p>							
Keysight Technologies Inc. 1000 Foothills Blvd. Roseville CA 95747-7102 UNITED STATES Issue Date: 31 Jun 2019			 W. J. C. R. I. Wm J. C. R. I. Roseville Serv. Ctr. Mgr. Page 1 of 56				

<sup>6</sup> “American Association for Laboratory Accreditation”, [www.a2la.org](http://www.a2la.org).

<sup>7</sup> “ANSI-ASQ National Accreditation Board”, [www.anab.org](http://www.anab.org).

<sup>8</sup> 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](http://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](http://www.keysight.com/find/contactus)

