



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: August 31, 2019

Certificate Number: 2734.03

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
DC Voltage – Measure <sup>3</sup>	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	0.0069 % + 4.9 μV 0.0049 % + 15 μV 0.0041 % + 140 μV 0.0053 % + 1.9 mV 0.0052 % + 21 mV	Agilent 34401A & 34410A
Resistance – Measure <sup>3</sup>	(0 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	0.14 % + 6.0 mΩ 0.058 % + 29 mΩ 0.019 % + 290 mΩ 0.015 % + 2.9 Ω 0.041 % + 33 Ω 0.12 % + 1.2 kΩ	Agilent 34401A & 34410A

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
(0 to 100) mV	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.12 % + 60 μV 0.15 % + 51 μV 0.70 % + 93 μV 4.7 % + 580 μV	Agilent 34401A & 34410A
(0.1 to 1) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.12 % + 390 μV 1.4 % + 560 μV 0.70 % + 1.2 mV 4.7 % + 6.4 mV	
(1 to 10) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.11 % + 4 mV 0.15 % + 6 mV 0.70 % + 10 mV 4.7 % + 58 mV	
(10 to 100) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.11 % + 38 mV 0.16 % + 57 mV 0.17 % + 98 mV 4.7 % + 580 mV	
(100 to 750) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.11 % + 410 mV 0.16 % + 470 mV 0.70 % + 930 mV	

## II. Magnetic (Eddy Current Instrumentation)

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Receiver Amplifier Linearity – Eddy Current Instrumentation <sup>3</sup>	(0 to 100) % of Full Scale	0.51 %	Agilent 33250A & 33120A
Receiver Quadrature – Eddy Current Instrumentation <sup>3</sup>	(0 to 360)°	0.023°	Agilent 33250A, ZETEC ACM/frequency, Tektronix TDS-3032 (A, B, or C)

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Receiver Gain – Eddy Current Instrumentation <sup>3</sup>	(0 to 80) dB	0.26 %	Agilent 33250A, ZETEC ACM/frequency, Tektronix TDS-3032 (A, B, or C)

Parameter/Equipment	Frequency	CMC <sup>2,4</sup> (±)	Comments
Coil Driver Frequency – Eddy Current Instrumentation <sup>3</sup>	10 Hz to 6 MHz		Agilent 53132A, ZETEC ACM/frequency, Tektronix TDS-3032 (A, B, or C), & Agilent 34401A or 34410A
	JEAG-4208	0.0018 %	
	ASME BPVC Sections V and XI	0.12 %	
Receiver Frequency Bandwidth – Eddy Current Instrumentation <sup>3</sup>	(8 to 5000) Hz	0.23 %	Agilent 33250A, ZETEC ACM/frequency, Tektronix TDS-3032 (A, B, or C)

### III. Time & Frequency

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Frequency – Measure <sup>3</sup>  (10 to 100) mV <sub>rms</sub>	(3 to 5) Hz	1.2 % + 0.29 μHz	Agilent 34401A & 34410A
	(5 to 10) Hz	0.59 % + 0.29 μHz	
	(10 to 40) Hz	0.36 % + 0.29 μHz	
	40 Hz to 300 kHz	0.12 % + 250 μHz	
> 100 mV <sub>rms</sub>	(3 to 5) Hz	0.22 % + 0.29 μHz	Agilent 34401A, 34410A, & 53132A
	(5 to 10) Hz	0.15 % + 0.29 μHz	
	(10 to 40) Hz	0.057 % + 0.29 μHz	
	40 Hz to 300 kHz	0.012 % + 240 μHz	

IV. Time & Frequency (Ultrasound Instrumentation - Dynaray)

Parameter/Equipment	Frequency	CMC <sup>2,4</sup> (±)	Comments
Transmitter – Ultrasound Instrumentation <sup>3</sup>			
Pulse Repetition Frequency	0.1 Hz to 1 kHz (1 to 40) kHz	0.0026 % 0.0031 %	Tektronix TDS-3032 (A, B, or C), ZETEC ABUXE127A.
Receiver – Ultrasound Instrumentation <sup>3</sup>			
Frequency Response:	(0.225 to 20) MHz		
Low Cutoff		Low pass 5.4 % if $\leq 1$ MHz otherwise 2.5 %	Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC
High Cutoff		High pass 2.6% if $\geq 5$ MHz and $\leq 15$ MHz otherwise 4.3 %	Attenuator 10040260, ZETEC ABUXE127.
Bandwidth		6.2% at 2 MHz otherwise 4.5%	
Center		Central frequency 3.7 % if $\leq 4.48$ MHz otherwise 2.4%	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Transmitter – Ultrasound Instrumentation <sup>3</sup>			
Output Impedance	$< 5 \Omega$	0.17 $\Omega$	Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC ABUXE127A, 50 ohms/10W load.
Voltage	(25 to 250) V	2.7 %	
Reverberation (Overshoot)	(0 to 10) %	0.56 %	
Rise Time	(0 to 50) ns	1.3 ns	
Duration	(25 to 1000) ns	0.99 ns	
Linearity of Time Delays	(0 to 50) $\mu$ s	0.070 %	

Parameter/Equipment	Range <sup>5</sup>	CMC <sup>2, 4, 5</sup> (±)	Comments
Receiver – Ultrasound Instrumentation <sup>3</sup>			
Linearity of Time Delays	(0 to 50) μs	0.0063 %	Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC Attenuator 10040260, ZETEC ABUXE127A.
Gain Linearity	(0 to 80) dB	0.47 dB	
Channel Gain Variation	< 1.5 dB (Zetec) < 3.0 dB (Norm)	0.66 dB 0.66 dB	
Linearity of Vertical Display	(0 to 28) dB rel.	0.48 %	
Equivalent Input Noise	< 80 nVpp/Hz <sup>0.5</sup>	19 nVpp/Hz <sup>0.5</sup>	

V. Time & Frequency (Ultrasound Instrumentation – Zircon, Topaz32, Quartz)

Parameter/Equipment	Frequency	CMC <sup>2, 4</sup> (±)	Comments
Transmitter – Ultrasound Instrumentation <sup>3</sup>			
Pulse Repetition Frequency	0.1 Hz to 1 kHz, (1 to 40) kHz	0.0024 % 0.0043 %	Tektronix TDS-3032 (A, B, or C), ZETEC 10040371.
Receiver – Ultrasound Instrumentation <sup>3</sup>			
Frequency Response – Zircon:	(0.225 to 20) MHz		Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC Attenuator 10040260, ZETEC 10040371.
Low Cutoff		Low pass 4.4 % if ≤ 1 MHz otherwise 2.3 %	
High Cutoff		High pass 3.7 % if ≤ 5 MHz otherwise 1.1 %	

Parameter/Equipment	Frequency	CMC <sup>2,4</sup> (±)	Comments
Receiver – Ultrasound Instrumentation <sup>3</sup> (cont)			Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC Attenuator 10040260, ZETEC 10040371.
Frequency Response – Zircon:	(0.225 to 20) MHz		
Bandwidth		5.0 % if $\leq 2.5$ MHz otherwise 2.1 %	
Center – Phased Array		Central frequency 6.1 % if $\leq 3$ MHz otherwise 2.2%	
Center – Conventional		Central frequency 3.1 % if $\leq 2.25$ MHz otherwise 1.1 %	
Frequency Response – Topaz <sup>32</sup> and Quartz:			
Low Cutoff		Low pass 4.4 % if $\leq 2$ MHz otherwise 0.97 %	
High Cutoff		High pass 3.7 % if $\leq 2.2$ MHz otherwise 1.1 %	
Bandwidth		6.0 % if $\leq 3.53$ MHz otherwise 2.2 %	
Center – Phased Array		Central frequency 6.0 % if $\leq 3.53$ MHz otherwise 2.2 %	
Center – Conventional		Central frequency 3.1 % if $\leq 2.25$ MHz otherwise 1.1 %	

Parameter/Equipment	Range <sup>5</sup>	CMC <sup>2,4,5</sup> (±)	Comments
Transmitter – Ultrasound Instrumentation <sup>3</sup>			
Output Impedance –			Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC 10040371, 50 ohms/10W load.
Phased Array	< 25 Ω	0.14 Ω	
Conventional	< 5 Ω	0.76 Ω	
Voltage –			
Phased Array	(35 to 100) V	2.0 %	
Conventional	(25 to 250) V	2.4 %	
Reverberation (Overshoot), Manual –			
Phased Array	(0 to 10) %	0.18 %	
Conventional	(0 to 10) %	0.20 %	
Rise Time –			
Phased Array	(0 to 50) ns	1.6 ns	
Conventional	(0 to 50) ns	0.35 ns	
Duration –			
Phased Array	(25 to 500) ns	0.59 ns	
Conventional	(25 to 500) ns	0.46 ns	
Linearity of Time Delays	(0 to 20) μs	0.052 %	
Receiver – Ultrasound Instrumentation <sup>3</sup>			
Linearity of Time Delays	(0 to 20) μs	0.013 %	Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC Attenuator 10040260, ZETEC 10040371.
Gain Linearity –			
Phased Array	(0 to 70) dB	0.26 dB	
Conventional	(0 to 70) dB	0.26 dB	

Parameter/Equipment	Range <sup>5</sup>	CMC <sup>2,4,5</sup> (±)	Comments
Receiver – Ultrasound Instrumentation <sup>3</sup> (cont)			
Channel Gain Variation –			Agilent 33250A, Tektronix TDS-3032 (A, B, or C), ZETEC Attenuator 10040260, ZETEC 10040371.
Phased Array	< 1.5 dB (Zetec) < 3.0 dB (Norm)	0.36 dB 0.36 dB	
Conventional	< 1.5 dB (Zetec)	0.36 dB	
Linearity of Vertical Display	28 dB rel.	0.32 %	
Equivalent Input Noise	< 80 nVpp/Hz <sup>0.5</sup>	4.7 nVpp/Hz <sup>0.5</sup>	

<sup>1</sup> This laboratory offers commercial and field calibration service.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> In the statement of CMC, percentages represent percent of reading unless otherwise noted.

<sup>5</sup> References to decibels (dB) refer to dB in voltage





## Accredited Laboratory

A2LA has accredited

**ZETEC CANADA**

*Quebec, QC, CANADA*

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 7<sup>th</sup> day of August 2017.

A handwritten signature in black ink, written over a horizontal line.

President and CEO  
For the Accreditation Council  
Certificate Number 2734.03  
Valid to August 31, 2019

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