Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000087853_01

Certified AMS:	APOA-380 for O_3
Manufacturer:	HORIBA Europe GmbH Hans-Mess-Str. 6 61440 Oberursel /Ts. Germany
Test Institute:	TÜV Rheinland Energy & Environment GmbH

This is to certify that the AMS has been tested and found to comply with the standards VDI 4202-1 (2018), DIN EN 14625 (2012), EN 14625 (2024), EN 15267-1 (2009) and EN 15267-2 (2023).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 10 pages).
The present certificate replaces certificate 0000087853_00 dated 23 March 2026.

TÜVRheinland® CERTIFIED
Suitability Tested
Complying with 2008/50/EC
EN 15267
Regular Surveillance
www.tuv.com
ID 0000087853

Publication in the German Federal Gazette (BAnz) of 10 July 2026

This certificate will expire on: 9 July 2031

German Environment Agency
Dessau, 17 September 2026

TÜV Rheinland Energy & Environment GmbH
Cologne, 15 September 2026

Dr. Marcel Langner
Head of Section II 4

Dipl.-Ing. G. Baum

www.umwelt-tuv.eu
qal1-info@tuv.com
Tel. + 49 221 806-5200

TÜV Rheinland Energy & Environment GmbH
Am Grauen Stein
51105 Köln

Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test report:	EuL/21271880/A dated 30 September 2025
Initial certification:	23 March 2026
Expiry date:	9 July 2031
Publication:	BAnz AT 10.07.2026 B5, chapter IV No. 1.1

Approved application

The tested AMS is suitable for continuous ambient air measurement of O_3 in stationary use.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-month field test in Cologne.

The AMS is approved for an ambient temperature range of +0 °C to +40 °C.

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure that this AMS is suitable for monitoring the measured values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended use.

Basis of the certification

This certification is based on:

- Test report EuL/21271880/A dated 30 September 2025 by TÜV Rheinland Energy & Environment GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 10.07.2026 B5, chapter IV Number 1.1, UBA announcement dated 18 May 2026:

AMS designation:
APOA-380 for Ozone

Manufacturer:
Horiba Europe GmbH, Oberursel, Germany

Field of application:
For the continuous determination of ozone concentrations in ambient air in stationary applications

Measuring ranges during the performance test:

Component	Certification range	Unit
Ozone	0 – 500	µg/m³

Software versions:

A7: P2002638D 1.03
M4: P2002642B 1.01
Analyzer: P2002584C 1.03
FPGA: P2002759A 1.01

Restrictions:
None

Notes:

1. The measuring system also meets the requirements of EN 14625:2024.
2. The test report is available online at www.qal1.de.
3. Supplementary test (qualification of new ozonator, new software version) relating to the announcement by the Federal Environment Agency of 27 August 2025 (BAnz AT 31.10.2025 B5, chapter III Number 3.1).

Test Report: TÜV Rheinland Energy & Environment GmbH, Cologne
Report No.: EuL/21271880/A dated 30 September 2025

Certified product

This certificate applies to automated measurement systems conforming to the following description:

The APOA-380 ambient air monitoring system is a continuous ozone analyser. The measuring principle is based on ultraviolet absorption. The device was developed for the continuous measurement of ozone in ambient air.

The measuring principle is based on the determination of light absorption by the gas to be measured in the wavelength range characteristic of the gas, which for the ozone component is in the UV range at a wavelength of 254 nm. The evaluation is carried out by measuring the absorption on the basis of the dependence between the gas concentration and the amount of absorbed light according to Lambert-Beer's law.

Lambert-Beer's law:

$$I = I_0 * e^{-(\alpha L c)}$$ at standard temperature and pressure (STP)

I	Intensity with absorption.
I_0	Light intensity without absorption.
L	Path travelled by the light during absorption.
c	Concentration of the absorbing gas, in this case O_3
α	Absorption coefficient (this provides information about the degree of absorption).

To solve this equation for c, it must be rearranged as follows:

$$c = \ln(I_0 / I) * (1 / \alpha L)$$ at STP

As both the ambient temperature and pressure influence the density of the sampling gas and therefore the number of ozone molecules present in the absorption tube, the amount of absorbed light is changed.

To clarify this effect, the equation was extended by the following addition:

$$c = \ln(I_0 / I) * (1 / \alpha L) * (T/273K * 29{,}92inHg/p)$$

T = sample temperature in Kelvin
p = sample pressure in inches of mercury

The APOA-380 ozone analyser determines the concentration of ozone (O_3) in a sample drawn into the instrument. The APOA-380 measures the intensity of ultraviolet light after it has passed through a measuring chamber, where the light is absorbed in proportion to the amount of ozone present. Every four seconds, a switching valve switches between a gas flow containing ozone and a reference gas flow that has been purged of ozone. These measurements are calculated together with the gas pressure and temperature to provide a stable ozone reading.
The photometer in the APOA-380 analyser uses a high-power mercury vapour lamp to generate a UV light beam. This beam passes through a window that is non-reactive with O_3 and transparent to UV radiation at 254 nm, and then enters the absorption tube filled with sample gas. As ozone efficiently absorbs UV radiation, the absorption path is short enough (approx. 42 cm) to cause a measurable drop in UV intensity, so that the light beam only needs to pass through the absorption tube once. The UV light passes through a similar window at the other end of the absorption tube and is detected by a vacuum diode. This

diode detects only radiation at or near a wavelength of 254 nm. The detector's accuracy is high enough that no additional optical filter for UV light is required. The detector responds to the UV light and outputs a voltage that is directly proportional to the light intensity. The voltage is digitised and sent to the device's CPU to be used in calculating the O3 concentration in the absorption tube.

Technical data APOA-380:

Measuring range:	Maximum 0-10 ppm (selectable)
Units:	ppb / ppm / µg/m³ / mg/m³
Measured compounds:	ozone
Sample flow:	approx. 0.6 litres/min (during the test)
Outputs:	Ethernet TCP/IP
	Modbus
	Serial interface, RS232
	0 - 1/5/10 Volt analogue
	4 - 20 mA analogue
	USB INTERFACE
Input voltage:	100 V to 240 V, 50 Hz or 60 Hz
Power:	80 W; maximum 140 W
Dimensions (L x W x H)	568 x 430 x 221 mm
Weight:	approx. 15 kg

General notes

This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energy & Environment GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy & Environment GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy & Environment GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration is also accessible on the internet: **qal1.de**.

Document history

Certification of the APOA-380 measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267
Certificate no. 0000087853_00: 23 March 2026
Expiry date of the certificate: 22 March 2031
Test report: EuL/21262682/C dated 07 February 2025
TÜV Rheinland Energy & Environment GmbH
Publication: BAnz AT 31.10.2025 B5, chapter III number 3.1
UBA announcement dated 27 August 2025

Corrections
Publication: BAnz AT 10.07.2026 B5, chapter V correction 4
UBA announcement dated 18 May 2026
(Correction of the BAnz text by UBA)

Supplementary testing according to EN 15267
Certificate no. 0000087853_01: 17 September 2026
Expiry date of the certificate: 9 July 2031
Test report: EuL/21271880/A dated 30 September 2025
TÜV Rheinland Energy & Environment GmbH
Publication: BAnz AT 10.07.2026 B5, chapter IV number 1.1
UBA announcement dated 18 May 2026

Overall uncertainty according to EN 14625 (2012)

Expanded uncertainty laboratory, system 1

Measuring device:	APOA 380			Serial-No.:	XEHXE7RR
Measured component:	O3			1h-alert threshold:	120 nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.030	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.250	$u_{r,th}$	0.15	0.0230
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.410	$u_{l,th}$	0.98	0.9543
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.090	u_{gp}	0.98	0.9693
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1915
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.229	u_{st}	2.51	6.2755
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.310	u_{H2O}	-1.36	1.8443
		≤ 10 nmol/mol (Span)	-1.820			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.420	$u_{int,pos}$ or $u_{int,neg}$	0.93	0.8640
		≤ 5.0 nmol/mol (Span)	-1.610			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.050			
		≤ 5.0 nmol/mol (Span)	0.780			
9	Averaging effect	≤ 7.0% of measured value	0.800	u_{av}	0.55	0.3072
18	Difference sample/calibration port	≤ 1.0%	0.250	$u_{\Delta sc}$	0.30	0.0900
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	3.6963	nmol/mol
Expanded uncertainty	U	7.3925	nmol/mol
Relative expanded uncertainty	W	6.16	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	APOA 380			Serial-No.:	WJX5WPV9
Measured component:	O3			1h-alert threshold:	120 nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.080	$u_{r,z}$	0.01	0.0001
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.240	$u_{r,lv}$	0.15	0.0218
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.440	$u_{l,lv}$	1.00	0.9953
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.050	u_{gp}	0.55	0.2992
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.050	u_{gt}	0.55	0.2992
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.174	u_{st}	1.90	3.6231
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.100	u_{H2O}	-1.94	3.7639
		≤ 10 nmol/mol (Span)	-2.600			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.470	$u_{int,pos}$ or $u_{int,neg}$	1.14	1.3068
		≤ 5.0 nmol/mol (Span)	-1.980			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.160			
		≤ 5.0 nmol/mol (Span)	0.310			
9	Averaging effect	≤ 7.0% of measured value	-1.000	u_{av}	-0.69	0.4800
18	Difference sample/calibration port	≤ 1.0%	-0.140	u_{Dsc}	-0.17	0.0282
21	Uncertainty of test gas	≤ 3.0%	2.000	ucg	1.20	1.4400

Combined standard uncertainty	u_c	3.6001	nmol/mol
Expanded uncertainty	U	7.2003	nmol/mol
Relative expanded uncertainty	W	6.00	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 1

Measuring device:	APOA 380					Serial-No.:	XEHXE7RR	
Measured component:	O3					1h-alert threshold:	120	nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.030	$u_{r,z}$	0.00	0.0000	
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	1.250	$u_{r,lh}$	not considered, as ur,lh = 0.15 < ur,f	-	
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.410	$u_{l,lh}$	0.98	0.9543	
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.090	u_{gp}	0.98	0.9693	
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.040	u_{gt}	0.44	0.1915	
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.229	u_{st}	2.51	6.2755	
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.050	u_V	0.84	0.7034	
8a	Interferent H_20 with 19 mmol/mol	≤	10 nmol/mol (Zero)	0.310	u_{H2O}	-1.36	1.8443	
		≤	10 nmol/mol (Span)	-1.820				
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.420	$u_{int,pos}$ or $u_{int,neg}$	0.93	0.8640	
		≤	5.0 nmol/mol (Span)	-1.610				
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.050				
		≤	5.0 nmol/mol (Span)	0.780				
9	Averaging effect	≤	7.0% of measured value	0.800	u_{av}	0.55	0.3072	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.130	$u_{r,f}$	4.96	24.5619	
11	Long term drift at zero level	≤	5.0 nmol/mol	-1.270	$u_{d,l,z}$	-0.73	0.5376	
12	Long term drift at span level	≤	5.0% of max. of certification range	-1.560	$u_{d,l,lh}$	-1.08	1.1681	
18	Difference sample/calibration port	≤	1.0%	0.250	$u_{\Delta sc}$	0.30	0.0900	
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400	

Combined standard uncertainty	u_c	6.3172	nmol/mol
Expanded uncertainty	U	12.6344	nmol/mol
Relative expanded uncertainty	W	10.53	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	APOA 380					Serial-No.:	WJX5WPV9	
Measured component:	O3					1h-alert threshold:	120	nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.080	$u_{r,z}$	0.01	0.0001	
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	1.240	$u_{r,lh}$	not considered, as ur,lh = 0.14 < ur,f	-	
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.440	$u_{l,lh}$	1.00	0.9953	
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.050	u_{gp}	0.55	0.2992	
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.050	u_{gt}	0.55	0.2992	
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.174	u_{st}	1.90	3.6231	
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.050	u_V	0.84	0.7034	
8a	Interferent H_20 with 19 mmol/mol	≤	10 nmol/mol (Zero)	0.100	u_{H2O}	-1.94	3.7639	
		≤	10 nmol/mol (Span)	-2.600				
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.470	$u_{int,pos}$ or $u_{int,neg}$	1.14	1.3068	
		≤	5.0 nmol/mol (Span)	-1.980				
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.160				
		≤	5.0 nmol/mol (Span)	0.310				
9	Averaging effect	≤	7.0% of measured value	-1.000	u_{av}	-0.69	0.4800	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.130	$u_{r,f}$	4.96	24.5619	
11	Long term drift at zero level	≤	5.0 nmol/mol	-0.360	$u_{d,l,z}$	-0.21	0.0432	
12	Long term drift at span level	≤	5.0% of max. of certification range	-2.090	$u_{d,l,lh}$	-1.45	2.0967	
18	Difference sample/calibration port	≤	1.0%	-0.140	$u_{\Delta sc}$	-0.17	0.0282	
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400	

Combined standard uncertainty	u_c	6.2961	nmol/mol
Expanded uncertainty	U	12.5922	nmol/mol
Relative expanded uncertainty	W	10.49	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Overall uncertainty according to EN 14625 (2024)

Expanded uncertainty laboratory, system 1

Measuring device:	APOA 380		Serial-No.:	XEHXE7RR	
Measured component:	O3		1h-alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.030	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.250	$u_{r,lth}$	0.15	0.0230
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.410	$u_{l,lth}$	0.98	0.9543
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.120	u_{gp}	0.88	0.7659
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.070	u_{gt}	0.89	0.7981
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.112	u_{st}	1.43	2.0432
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.310	u_{H2O}	-1.36	1.8443
		≤ 10 nmol/mol (Span)	-1.820			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.420	$u_{int,pos}$	0.93	0.8640
		≤ 5.0 nmol/mol (Span)	-1.610			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	0.050	or		
		≤ 5.0 nmol/mol (Span)	0.780	$u_{int,\ neg}$		
9	Averaging effect	≤ 7.0% of measured value	0.800	u_{av}	0.55	0.3072
18	Difference sample/calibration port	≤ 1.0%	0.250	$u_{\Delta sc}$	0.30	0.0900
21	Uncertainty of test gas	≤ 3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	3.1358	nmol/mol
Expanded uncertainty	U	6.2716	nmol/mol
Relative expanded uncertainty	W	5.23	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Expanded uncertainty laboratory, system 2

Measuring device:	APOA 380		Serial-No.:	WJX5WPV9	
Measured component:	O3		1h-alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion	Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.080	$u_{r,z}$	0.01	0.0001
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	1.240	$u_{r,lv}$	0.15	0.0218
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.440	$u_{l,lv}$	1.00	0.9953
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.140	u_{gp}	1.02	1.0424
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.050	u_{gt}	0.64	0.4072
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.122	u_{st}	1.56	2.4243
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤ 10 nmol/mol (Zero)	0.100	u_{H2O}	-1.94	3.7639
		≤ 10 nmol/mol (Span)	-2.600			
8b	Interferent Toluene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.470	$u_{int,pos}$	1.14	1.3068
		≤ 5.0 nmol/mol (Span)	-1.980			
8c	Interferent Xylene with 0,5 µmol/mol	≤ 5.0 nmol/mol (Zero)	-0.160	or		
		≤ 5.0 nmol/mol (Span)	0.310	$u_{int,\ neg}$		
9	Averaging effect	≤ 7.0% of measured value	-1.000	u_{av}	-0.69	0.4800
18	Difference sample/calibration port	≤ 1.0%	-0.140	u_{Dsc}	-0.17	0.0282
21	Uncertainty of test gas	≤ 3.0%	2.000	ucg	1.20	1.4400

Combined standard uncertainty	u_c	3.5515	nmol/mol
Expanded uncertainty	U	7.1031	nmol/mol
Relative expanded uncertainty	W	5.92	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 1

Measuring device:	APOA 380					Serial-No.:	XEHXE7RR	
Measured component:	O3					1h-alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion		Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.030	$u_{r,z}$	0.00	0.0000
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	1.250	$u_{r,lh}$	not considered, as ur,lh = 0,15 < ur,f	-
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.410	$u_{l,lh}$	0.98	0.9543
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.120	u_{gp}	0.88	0.7659
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.070	u_{gt}	0.89	0.7981
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.112	u_{st}	1.43	2.0432
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤	10 nmol/mol (Zero)	0.310	u_{H2O}	-1.36	1.8443
		≤	10 nmol/mol (Span)	-1.820			
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.420	$u_{int,pos}$	0.93	0.8640
		≤	5.0 nmol/mol (Span)	-1.610			
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	0.050	or		
		≤	5.0 nmol/mol (Span)	0.780	$u_{int,\ neg}$		
9	Averaging effect	≤	7.0% of measured value	0.800	u_{av}	0.55	0.3072
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.130	$u_{r,f}$	4.96	24.5619
11	Long term drift at zero level	≤	5.0 nmol/mol	-1.270	$u_{d,l,z}$	-0.73	0.5376
12	Long term drift at span level	≤	5.0% of max. of certification range	-1.560	$u_{d,l,lh}$	-1.08	1.1681
18	Difference sample/calibration port	≤	1.0%	0.250	$u_{\Delta sc}$	0.30	0.0900
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	6.0065	nmol/mol
Expanded uncertainty	U	12.0130	nmol/mol
Relative expanded uncertainty	W	10.01	%
Maximum allowed expanded uncertainty	W_{req}	15	%

Combined uncertainty, laboratory and field, system 2

Measuring device:	APOA 380					Serial-No.:	WJX5WPV9	
Measured component:	O3					1h-alert threshold:	120	nmol/mol

No.	Performance characteristic	Performance criterion		Result	Partial uncertainty		Square of partial uncertainty
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.080	$u_{r,z}$	0.01	0.0001
2	Repeatability standard deviation at 1h-alert threshold	≤	3.0 nmol/mol	1.240	$u_{r,lh}$	not considered, as ur,lh = 0,14 < ur,f	-
3	"lack of fit" at 1h-alert threshold	≤	4.0% of measured value	1.440	$u_{l,lh}$	1.00	0.9953
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤	2.0 nmol/mol/kPa	0.140	u_{gp}	1.02	1.0424
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.050	u_{gt}	0.64	0.4072
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤	1.0 nmol/mol/K	0.122	u_{st}	1.56	2.4243
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤	0.30 nmol/mol/V	0.050	u_V	0.84	0.7034
8a	Interferent H_20 with 19 mmol/mol	≤	10 nmol/mol (Zero)	0.100	u_{H2O}	-1.94	3.7639
		≤	10 nmol/mol (Span)	-2.600			
8b	Interferent Toluene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.470	$u_{int,pos}$	1.14	1.3068
		≤	5.0 nmol/mol (Span)	-1.980			
8c	Interferent Xylene with 0,5 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.160	or		
		≤	5.0 nmol/mol (Span)	0.310	$u_{int,\ neg}$		
9	Averaging effect	≤	7.0% of measured value	-1.000	u_{av}	-0.69	0.4800
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	4.130	$u_{r,f}$	4.96	24.5619
11	Long term drift at zero level	≤	5.0 nmol/mol	-0.360	$u_{d,l,z}$	-0.21	0.0432
12	Long term drift at span level	≤	5.0% of max. of certification range	-2.090	$u_{d,l,lh}$	-1.45	2.0967
18	Difference sample/calibration port	≤	1.0%	-0.140	$u_{\Delta sc}$	-0.17	0.0282
21	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.20	1.4400

Combined standard uncertainty	u_c	6.2685	nmol/mol
Expanded uncertainty	U	12.5369	nmol/mol
Relative expanded uncertainty	W	10.45	%
Maximum allowed expanded uncertainty	W_{req}	15	%