Umwelt Bundesamt

TÜVRheinland®
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CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000038495_05

Certified AMS:	AR650/N for CO, N_2O, HCl, CH_4, H_2O and CO_2
Manufacturer:	Opsis AB Skytteskogsvägen 16 24402 Furulund Sweden
Test Institute:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and found to comply with the standards EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007) and EN 14181 (2014).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 13 pages).
The present certificate replaces certificate 0000038495_04 dated 05 March 2018.

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000038495

Publication in the German Federal Gazette (BAnz) of 02 April 2015

German Environment Agency
Dessau, 02 March 2023

Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
04 March 2028

TÜV Rheinland Energy GmbH
Cologne, 01 March 2023

ppa. Dr. Peter Wilbring

www.umwelt-tuv.eu
tre@umwelt-tuv.eu
Tel. + 49 221 806-5200

TÜV Rheinland Energy 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.

10/221 2.08

Test report:	936/21220566/D dated 09 September 2014
Initial certification:	05 March 2013
Expiry date:	04 March 2028
Certificate:	Renewal (of previous certificate 0000038495_04 of 05 March 2018 valid until 04 March 2023)
Publication:	BAnz AT 02.04.2015 B5, chapter I No. 3.1

Approved application
The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (13th BImSchV:2013), chapter IV (17th BImSchV:2013), Directive 2015/2193/EC (44th BImSchV:2021), 30th BImSchV:2009, TA-Luft:2002 and 27th BImSchV:2013. The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a 12 month field test at a municipal waste incineration plant.

The AMS is approved for an ambient temperature range of +5° 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 emission limit values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the installation at which it will be installed.

Note:
The legal regulations mentioned correspond to the current state of legislation during certification. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

Basis of the certification
This certification is based on:

- Test report 936/21220566/D dated 09 September 2014 of TÜV Rheinland Energie und Umwelt 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 02.04.2015 B5, chapter I No. 3.1, Announcement by UBA dated 25 February 2015:

AMS designation
AR650/N for CO, HCl, H_2O, CO_2, N_2O and CH_4

Manufacturer:
OPSIS AB, Furulund, Sweden

Field of application:
For plants requiring official approval and for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Certification range	Supplementary range	Unit
CO	0–75*	0–500*	mg/m³
HCl	0–15*	0–90*	mg/m³
H_2O	0–30*	0–40*	Vol.-%
CO_2	0–30*	0–40*	Vol.-%
N_2O	0–500*	0–2000*	mg/m³
CH_4	0–20*	0–100*	mg/m³

* referred to a measuring path of 1.0 m

Software version:
7.21

Restrictions:
During performance testing in accordance with EN 15267-3, the requirement for the degree of protection provided by the enclosure was not fulfilled.

Notes:
1. The maintenance interval is six months.
2. During performance testing, the measurement path length was 1 m in the laboratory test and 2 m in the field test.
3. Supplementary testing (extension of the maintenance interval) as regards Federal Environment Agency notice of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I number 4.1).

Test Report:
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report no.: 936/21220566/D dated 9 September 2014

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chap. IV notification 37, Announcement by UBA dated 25 February 2015:

37 Notification as regards Federal Environment Agency (UBA) notice of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I no. 4.1)

Production of the step motor used for automatic grid finding, type RDM 543/100A supplied by BERGER LAHR and implemented in the AR650/N measuring system for CO, HCl, H_2O, CO_2, N_2O and CH_4 of the company Opsis AB was discontinued and therefore replaced by the step motor for automatic grid finding, type RDM 545/100A manufactured by BERGER LAHR.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 20 September 2014

Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chap. V notification 16, Announcement by UBA dated 22 July 2015:

16 Notification as regards Federal Environment Agency notices of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I number 4.1) and of 25 February 2015 (BAnz AT 02.04.2015, B5 chapter IV notification 37)

The AR650/N measuring system for CO, HCl, H_2O, CO_2, N_2O and CH_4, manufactured by Opsis AB is also available with the option "ER060/062AUTO with automatic QAL3 testing system" for regular automatic functional checks based on the main component CO. The "ER060/062AUTO with automatic QAL3 testing system" option does not serve the purpose of adjusting the AMS, nor does it replace the manual zero and span point checks required during the maintenance interval. It merely provides additional information on the measuring system's status in between external test gas applications.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 23 March 2015

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

The AR650/N system is an in-situ DOAS open path measuring system for the measurement of CO, HCl, H_2O, CO_2, N_2O and CH_4.

The system tested consists of a light source, a receiver, an opto-fibre cable and an opto-analyser. The analyser consists of a spectrometer, a detection system, electronics for the operation of the grating and a computer for evaluation and signal processing.

The measuring section is composed of the optical path between a light transmitter and a light receiver. The light beam is generated by a high-pressure xenon lamp.

The light beam is directed to the receiver. On its path through the medium, the intensity of the light beam is affected by scattering and absorption in the molecules and particles.

The collected light from the receiver is routed to the analyser via a fibre optic cable. This cable is only to enable the preparation of the analyser at a location protected from dust, exces-sive moisture, temperature variations, etc.

The measuring system consists of:
- Analyser (AR650/N)
- Light emitter unit (EM062)
- Receiver unit (RE062)
- Fibre optic cable (OF 100B)

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 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 GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must not be employed anymore.

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

History of documents

Certification of AR650/N is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Initial certification according to EN 15267

Certificate No. 0000038495_00: 22 March 2013
Expiry date of the certificate: 04 March 2018
Test report 936/21220566/A dated 11 October 2012
TÜV Rheinland Energie und Umwelt GmbH
Publication BAnz AT 05.03.2013 B10, chapter I number 5.1
UBA announcement dated 12 February 2013

Supplementary testing according to EN 15267

Certificate No. 0000038495_01: 29 April 2014
Expiry date of the certificate: 04 March 2018
Test report 936/21220566/B dated 10 October 2013
TÜV Rheinland Energie und Umwelt GmbH
Publication BAnz AT 01.04.2014 B12, chapter I number 3.1
UBA announcement dated 27 February 2014

Supplementary testing according to EN 15267

Certificate No. 0000038495_02: 09 September 2014
Expiry date of the certificate: 04 March 2018
Test report 936/21220566/C dated 18 February 2014
TÜV Rheinland Energie und Umwelt GmbH
Publication BAnz AT 05.08.2014 B11, chapter I number 4.1
UBA announcement dated 17 July 2014

Supplementary testing according to EN 15267

Certificate No. 0000038495_03: 30 April 2015
Expiry date of the certificate: 04 March 2018
Test report 936/21220566/D dated 9 September 2014
TÜV Rheinland Energie und Umwelt GmbH
Publication BAnz AT 02.04.2015 B5, chapter I number 3.1
UBA announcement dated 25 February 2015

Notifications

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 20 September 2014
Publication BAnz AT 02.04.2015 B5, chapter IV notification 37
UBA announcement dated 25 February 2015
(discontinued production and replacment of the step motor)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 23 March 2015
Publication BAnz AT 26.08.2015 B4, chapter V notification 16
UBA announcement dated 22 July 2015
(additional option for automated funcional testing)

Renewal of certificate
Certificate No. 0000038495_04: 05 March 2018
Expiry date of the certificate: 04 March 2023

Renewal of certificate
Certificate No. 0000038495_05: 02 March 2023
Expiry date of the certificate: 04 March 2028

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
AMS designation	AR650/N		
Serial number of units under test	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	CH_4		
Certification range	0 - 20	mg/m³	

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.44	mg/m³
Sum of negative CS at zero point	-0.24	mg/m³
Sum of postive CS at span point	0.30	mg/m³
Sum of negative CS at span point	-0.50	mg/m³
Maximum sum of cross-sensitivities	-0.50	mg/m³
Uncertainty of cross-sensitivity	-0.289	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.253	mg/m³	0.064	(mg/m³)²
Lack of fit	u_{lof}	0.173	mg/m³	0.030	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.115	mg/m³	0.013	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.104	mg/m³	0.011	(mg/m³)²
Influence of ambient temperature at span	u_t	0.100	mg/m³	0.010	(mg/m³)²
Influence of supply voltage	u_v	0.053	mg/m³	0.003	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.289	mg/m³	0.083	(mg/m³)²
Influence of sample gas pressure	u_p	0.155	mg/m³	0.024	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.162	mg/m³	0.026	(mg/m³)²
Excursion of measurement beam	u_{mb}	-0.214	mg/m³	0.046	(mg/m³)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.56	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.09	mg/m³

Relative total expanded uncertainty	**U in % of the range 20 mg/m³**	**5.5**
Requirement of 2010/75/EU	**U in % of the range 20 mg/m³**	**30.0 ****
Requirement of EN 15267-3	U in % of the range 20 mg/m³	22.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 30 % was used for this.

Umwelt Bundesamt

Certificate:
0000038495_05 / 02 March 2023

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Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
Name of measuring system	AR650/N		
Serial number of the candidates	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	CO		
Certification range	0 - 75	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	mg/m³
Sum of negative CS at zero point	-0.33	mg/m³
Sum of postive CS at reference point	0.35	mg/m³
Sum of negative CS at reference point	-0.37	mg/m³
Maximum sum of cross sensitivities	0.63	mg/m³
Uncertainty of cross sensitivity	0.364	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.805	mg/m³	0.648	(mg/m³)²
Lack of fit	u_{lof}	0.404	mg/m³	0.163	(mg/m³)²
Zero drift from field test	$u_{d.z}$	0.390	mg/m³	0.152	(mg/m³)²
Span drift from field test	$u_{d.s}$	0.476	mg/m³	0.227	(mg/m³)²
Influence of ambient temperature at span	u_t	0.416	mg/m³	0.173	(mg/m³)²
Influence of supply voltage	u_v	0.202	mg/m³	0.041	(mg/m³)²
Cross sensitivity (interference)	u_i	0.364	mg/m³	0.132	(mg/m³)²
Influence of sample pressure	u_p	0.320	mg/m³	0.102	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²
Excursion of measurement beam	u_{mb}	0.403	mg/m³	0.162	(mg/m³)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

$$u_c = \sqrt{\sum \left(u_{max,\,j}\right)^2}$$

Combined standard uncertainty (u_C)		1.47	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.89	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**5.8**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	7.5

Umwelt Bundesamt

Certificate:
0000038495_05 / 02 March 2023

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Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
Name of measuring system	AR650/N		
Serial number of the candidates	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	HCl		
Certification range	0 - 15	mg/m³	

Evaluation of the cross sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	mg/m³
Sum of negative CS at zero point	0.00	mg/m³
Sum of postive CS at reference point	0.14	mg/m³
Sum of negative CS at reference point	-0.07	mg/m³
Maximum sum of cross sensitivities	0.14	mg/m³
Uncertainty of cross sensitivity	0.081	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.190	mg/m³	0.036	(mg/m³)²
Lack of fit	u_{lof}	0.058	mg/m³	0.003	(mg/m³)²
Zero drift from field test	$u_{d.z}$	0.052	mg/m³	0.003	(mg/m³)²
Span drift from field test	$u_{d.s}$	0.113	mg/m³	0.013	(mg/m³)²
Influence of ambient temperature at span	u_t	0.058	mg/m³	0.003	(mg/m³)²
Influence of supply voltage	u_v	0.089	mg/m³	0.008	(mg/m³)²
Cross sensitivity (interference)	u_i	0.081	mg/m³	0.007	(mg/m³)²
Influence of sample pressure	u_p	0.077	mg/m³	0.006	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)²
Excursion of measurement beam	u_{mb}	0.115	mg/m³	0.013	(mg/m³)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

$$u_c = \sqrt{\sum (u_{max,\,j})^2}$$

Combined standard uncertainty (u_C)		0.33	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.64	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**6.4**
Requirement of 2010/75/EU	**U in % of the ELV 10 mg/m³**	**40.0**
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	30.0

Certificate:
0000038495_05 / 02 March 2023

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
AMS designation	AR650/N		
Serial number of units under test	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	CO_2		
Certification range	0 - 30	Vol.-%	

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of postive CS at span point	0.00	Vol.-%
Sum of negative CS at span point	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.00	Vol.-%
Uncertainty of cross-sensitivity	0.000	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.058	Vol.-%	0.003	(Vol.-%)²
Lack of fit	u_{lof}	0.173	Vol.-%	0.030	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.156	Vol.-%	0.024	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.139	Vol.-%	0.019	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.058	Vol.-%	0.003	(Vol.-%)²
Influence of supply voltage	u_v	0.012	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.000	Vol.-%	0.000	(Vol.-%)²
Influence of sample gas pressure	u_p	0.011	Vol.-%	0.000	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.242	Vol.-%	0.059	(Vol.-%)²
Excursion of measurement beam	u_{mb}	0.115	Vol.-%	0.013	(Vol.-%)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.39	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.77	Vol.-%

Relative total expanded uncertainty	**U in % of the range 30 Vol.-%**	**2.6**
Requirement of 2010/75/EU	**U in % of the range 30 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 30 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10% was used for this.

Certificate:
0000038495_05 / 02 March 2023

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
AMS designation	AR650/N		
Serial number of units under test	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	H_2O		
Certification range	0 - 30	Vol.-%	

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of postive CS at span point	0.20	Vol.-%
Sum of negative CS at span point	0.00	Vol.-%
Maximum sum of cross-sensitivities	0.20	Vol.-%
Uncertainty of cross-sensitivity	0.116	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u²	
Standard deviation from paired measurements under field conditions *	u_D	0.218	Vol.-%	0.048	(Vol.-%)²
Lack of fit	u_{lof}	0.173	Vol.-%	0.030	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.156	Vol.-%	0.024	(Vol.-%)²
Span drift from field test	$u_{d,s}$	0.225	Vol.-%	0.051	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.058	Vol.-%	0.003	(Vol.-%)²
Influence of supply voltage	u_v	0.099	Vol.-%	0.010	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.116	Vol.-%	0.013	(Vol.-%)²
Influence of sample gas pressure	u_p	0.036	Vol.-%	0.001	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.242	Vol.-%	0.059	(Vol.-%)²
Excursion of measurement beam	u_{mb}	0.403	Vol.-%	0.162	(Vol.-%)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.63	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.24	Vol.-%

Relative total expanded uncertainty	**U in % of the range 30 Vol.-%**	**4.1**
Requirement of 2010/75/EU	**U in % of the range 30 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 30 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10 % was used for this.

Umwelt Bundesamt

Certificate:
0000038495_05 / 02 March 2023

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Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system			
Manufacturer	Opsis AB		
AMS designation	AR650/N		
Serial number of units under test	448 / 449		
Measuring principle	IR-DOAS		
Test report	936/21220566/D		
Test laboratory	TÜV Rheinland		
Date of report	2014-09-09		
Measured component	N_2O		
Certification range	0 - 500	mg/m³	

Evaluation of the cross-sensitivity (CS)
(system with largest CS)

Sum of positive CS at zero point	17.20	mg/m³
Sum of negative CS at zero point	-10.10	mg/m³
Sum of postive CS at span point	19.30	mg/m³
Sum of negative CS at span point	-13.00	mg/m³
Maximum sum of cross-sensitivities	19.30	mg/m³
Uncertainty of cross-sensitivity	11.143	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	7.452	mg/m³	55.532	(mg/m³)²
Lack of fit	u_{lof}	-2.309	mg/m³	5.331	(mg/m³)²
Zero drift from field test	$u_{d,z}$	4.041	mg/m³	16.330	(mg/m³)²
Span drift from field test	$u_{d,s}$	4.907	mg/m³	24.079	(mg/m³)²
Influence of ambient temperature at span	u_t	0.954	mg/m³	0.910	(mg/m³)²
Influence of supply voltage	u_v	2.586	mg/m³	6.687	(mg/m³)²
Cross-sensitivity (interference)	u_i	11.143	mg/m³	124.163	(mg/m³)²
Influence of sample gas pressure	u_p	0.832	mg/m³	0.692	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	4.041	mg/m³	16.333	(mg/m³)²
Excursion of measurement beam	u_{mb}	5.225	mg/m³	27.301	(mg/m³)²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	16.65	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	32.64	mg/m³

Relative total expanded uncertainty	**U in % of the range 500 mg/m³**	**6.5**
Requirement of 2010/75/EU	**U in % of the range 500 mg/m³**	**20.0 ****
Requirement of EN 15267-3	U in % of the range 500 mg/m³	15.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 20 % was used for this.