

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 000038495_01

Certified AMS: AR650/N for CO, HCl, H₂O, CO₂, N₂O and CH₄

Manufacturer: Opsis AB
Skytteskogsvägen 16
244 02 Furulund
Sweden

Test Institute: TÜV Rheinland Energie und Umwelt GmbH

**This is to certify that the AMS has been tested
and found to comply with:**

**EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2007
and EN 14181: 2004**

Certification is awarded in respect of the conditions stated in this certificate
(see also the following pages).
The present certificate replaces Certificate No. 000038495 of 22 March 2013



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 000038495

Publication in the German Federal Gazette
(BAnz.) of 01 April 2014

German Federal Environment Agency
Dessau, 29 April 2014

i. A. Dr. Marcel Langner

This certificate will expire on:
04 March 2018

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 28 April 2014

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-5200

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Cologne

Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.

Test report:	936/21220566/B of 10 October 2013
Initial certification:	05 March 2013
Expiry date:	04 March 2018
Publication:	BAnz AT 01 April 2014 B12, chapter I, No. 3.1

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III, at waste incineration plants according to Directive 2010/75/EU, chapter IV and other plants requiring official approval. The tested ranges have been chosen with respect to the wide application range of the AMS.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-month field test at a municipal waste incinerator.

The AMS is approved for an ambient temperature range of +5 °C to +40 °C.

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

Basis of the certification

This certification is based on:

- test report 936/21220566/B of 10 October 2013 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 01 April 2014 B12, chapter I, No. 3.1, Announcement by UBA from 27 February 2014)

AMS designation:

AR650/N for CO, HCl, H₂O, CO₂, N₂O and CH₄

Manufacturer:

OPSIS AB, Furulund, Sweden

Field of application:

For measurements at plants requiring official approval (Directive 2010/75/EU on industrial emissions, chapter III and IV)

Measuring ranges during the performance test:

Components	Certification range	Supplementary range	Units
CO	0 - 75*	0 - 500*	mg/m ³
HCl	0 - 15*	0 - 90*	mg/m ³
H ₂ O	0 - 30*	0 - 40*	Vol.-%
CO ₂	0 - 30*	0 - 40*	Vol.-%
N ₂ O	0 - 500*	0 - 2000*	mg/m ³
CH ₄	0 - 20*	0 - 100*	mg/m ³

* with reference to a measuring path of 1.0 m

Software version:

7.21

Restrictions:

None

Notes:

1. The maintenance interval is four weeks.
2. The tested measuring path is 1 m.
3. Supplementary testing (approval of new measured components) to the announcement of the Federal Environment Agency (UBA) of 12 February 2013; Federal Gazette (BAnz) AT of 05 March 2013, B10, chapter I, number 2.2).

Test report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report No.: 936/21220566/B of 10 October 2013

Certified product

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

The measuring device is an in-situ DOAS open path measuring system.

The AR650/N system consists of a light source, a receiver, an opto-fibre and an opto-analyser. The analyser consists of a spectrometer, a detection system, electronics for the operation of the grating, the detection system and a computer for the 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 to a dust, excessive moisture, temperature variations, etc. protected location.

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 Energie und Umwelt 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 can be applied to the product or used in publicity material for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energie und Umwelt GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energie und Umwelt 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.

Certification of AR650/N for CO, HCl, H₂O, CO₂, N₂O and CH₄ 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: 22 March 2013
Expiry date of the certificate: 04 March 2018
Test report: 936/21220566/A of 11 October 2012
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 05 March 2013 B10, chapter I, No. 5.1
Announcement by UBA from 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 of 10 October 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01 April 2014 B12, chapter I, No. 3.1
Announcement by UBA from 27 February 2014

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

Test laboratory	936/21220566/A	936/21220566/B
Date of report	TÜV Rheinland	TÜV Rheinland
	2012-11-10	2013-10-10

Measured component

Certification range	CO	0 - 75 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	-0.33 mg/m ³
Sum of positive CS at reference point	0.35 mg/m ³
Sum of negative CS at reference point	-0.37 mg/m ³
Maximum sum of cross sensitivities	0.63 mg/m ³
Uncertainty of cross sensitivity	0.364 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.805 mg/m ³	0.648 (mg/m ³) ²
Lack of fit	u _{lof}	0.404 mg/m ³	0.163 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.390 mg/m ³	0.152 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.346 mg/m ³	0.120 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.416 mg/m ³	0.173 (mg/m ³) ²
Influence of supply voltage	u _v	0.202 mg/m ³	0.041 (mg/m ³) ²
Cross sensitivity (interference)	u _i	0.364 mg/m ³	0.132 (mg/m ³) ²
Influence of sample pressure	u _p	0.320 mg/m ³	0.102 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.606 mg/m ³	0.368 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	0.403 mg/m ³	0.162 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

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

Combined standard uncertainty (u _c)		1.44 mg/m ³
Total expanded uncertainty	U = u _c * k = u _c * 1.96	2.81 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 50 mg/m ³	5.6
Requirement of EN 15267-3	U in % of the ELV 50 mg/m ³	10.0
	U in % of the ELV 50 mg/m ³	7.5

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

Test laboratory	936/21220566/A	936/21220566/B
Date of report	TÜV Rheinland	TÜV Rheinland
	2012-10-11	2013-10-10

Measured component

Certification range	HCl	0 - 15 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	0.14 mg/m ³
Sum of negative CS at reference point	-0.07 mg/m ³
Maximum sum of cross sensitivities	0.14 mg/m ³
Uncertainty of cross sensitivity	0.081 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Repeatability standard deviation at set point *	u _r	0.190 mg/m ³	0.036 (mg/m ³) ²
Lack of fit	u _{lof}	0.058 mg/m ³	0.003 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.121 mg/m ³	0.015 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.139 mg/m ³	0.019 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.058 mg/m ³	0.003 (mg/m ³) ²
Influence of supply voltage	u _v	0.089 mg/m ³	0.008 (mg/m ³) ²
Cross sensitivity (interference)	u _i	0.081 mg/m ³	0.007 (mg/m ³) ²
Influence of sample pressure	u _p	0.077 mg/m ³	0.006 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	0.115 mg/m ³	0.013 (mg/m ³) 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)		0.35 mg/m ³
Total expanded uncertainty	U = u _c * k = u _c * 1.96	0.69 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m ³	6.9
Requirement of EN 15267-3	U in % of the ELV 10 mg/m ³	40.0
	U in % of the ELV 10 mg/m ³	30.0

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/A	936/21220566/B
Test laboratory	TÜV Rheinland	TÜV Rheinland
Date of report	2012-10-11	2013-10-10

Measured component

	CH ₄
Certification range	0 - 20 mg/m ³

Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.44 mg/m ³
Sum of negative CS at zero point	-0.24 mg/m ³
Sum of positive CS at reference point	0.30 mg/m ³
Sum of negative CS at reference point	-0.50 mg/m ³
Maximum sum of cross sensitivities	-0.50 mg/m ³
Uncertainty of cross sensitivity	-0.289 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Repeatability standard deviation at set point *	u _r	0.253 mg/m ³	0.064 (mg/m ³) ²
Lack of fit	u _{lof}	0.173 mg/m ³	0.030 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.092 mg/m ³	0.008 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.104 mg/m ³	0.011 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.100 mg/m ³	0.010 (mg/m ³) ²
Influence of supply voltage	u _v	0.053 mg/m ³	0.003 (mg/m ³) ²
Cross sensitivity (interference)	u _i	-0.289 mg/m ³	0.083 (mg/m ³) ²
Influence of sample pressure	u _p	0.155 mg/m ³	0.024 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.162 mg/m ³	0.026 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	-0.214 mg/m ³	0.046 (mg/m ³) 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)		0.55 mg/m ³
Total expanded uncertainty	U = u _c * k = u _c * 1.96	1.08 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 20 mg/m³	5.4
Requirement of EN 15267-3	U in % of the range 20 mg/m³	30.0**
		22.5

** For this component no requirements in the EC-directives 2010/75/EU on industrial emissions are given.
The chosen value is recommended by the certification body.

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

Test laboratory	TÜV Rheinland
Date of report	2013-10-10

Measured component

Certification range	N ₂ O 0 - 500 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	17.20 mg/m ³
Sum of negative CS at zero point	-10.10 mg/m ³
Sum of positive CS at span point	19.30 mg/m ³
Sum of negative CS at span point	-13.00 mg/m ³
Maximum sum of cross-sensitivities	19.30 mg/m ³
Uncertainty of cross-sensitivity	11.143 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

		u ²	
Repeatability standard deviation at set point *	u _r 7.452 mg/m ³	55.532	(mg/m ³) ²
Lack of fit	u _{lof} -2.309 mg/m ³	5.331	(mg/m ³) ²
Zero drift from field test	u _{d,z} 4.041 mg/m ³	16.330	(mg/m ³) ²
Span drift from field test	u _{d,s} 4.907 mg/m ³	24.079	(mg/m ³) ²
Influence of ambient temperature at span	u _t 0.954 mg/m ³	0.910	(mg/m ³) ²
Influence of supply voltage	u _v 2.586 mg/m ³	6.687	(mg/m ³) ²
Cross-sensitivity (interference)	u _i 11.143 mg/m ³	124.163	(mg/m ³) ²
Influence of sample gas pressure	u _p 0.832 mg/m ³	0.692	(mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 4.041 mg/m ³	16.333	(mg/m ³) ²
Excursion of measurement beam	u _{mb} 5.225 mg/m ³	27.301	(mg/m ³) 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/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	32.64 mg/m ³

Relative total expanded uncertainty

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

** For this component no requirements in the EC-directives 2010/75/EU on industrial emissions are given.
The chosen value is recommended by the certification body.

Berechnung der Gesamtunsicherheit nach DIN EN 14181 und DIN EN 15267-3

Messeinrichtung

Hersteller	OPSIS AB
Bezeichnung der Messeinrichtung	AR650/N
Seriennummer der Prüflinge	448 / 449
Messprinzip	IR-DOAS

Prüfbericht

Prüfinstitut	936/21220566/B
Berichtsdatum	TÜV Rheinland
	10/10/2013

Messkomponente

Zertifizierungsbereich ZB	H ₂ O	0 - 30 Vol.-%
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Bewertung der Querempfindlichkeiten (QE)

(System mit größter QE)

Summe positive QE am Null-Punkt	0.00	Vol.-%
Summe negative QE am Null-Punkt	0.00	Vol.-%
Summe positive QE am Ref.-Punkt	0.20	Vol.-%
Summe negative QE am Ref.-Punkt	0.00	Vol.-%
Maximale Summe von Querempfindlichkeiten	0.20	Vol.-%
Messunsicherheit der Querempfindlichkeit	0.116	Vol.-%

Berechnung der erweiterten Messunsicherheit

Prüfgröße

			u^2	
Standardabweichung aus Doppelbestimmungen	u_D	0.218 Vol.-%	0.048	(Vol.-%) ²
Linearität / Lack-of-fit	u_{lof}	0.173 Vol.-%	0.030	(Vol.-%) ²
Nullpunktdrift aus Feldtest	$u_{d,z}$	0.156 Vol.-%	0.024	(Vol.-%) ²
Referenzpunktdrift aus Feldtest	$u_{d,s}$	0.225 Vol.-%	0.051	(Vol.-%) ²
Einfluss der Umgebungstemperatur am Referenzpunkt	u_t	0.058 Vol.-%	0.003	(Vol.-%) ²
Einfluss der Netzspannung	u_v	0.099 Vol.-%	0.010	(Vol.-%) ²
Querempfindlichkeit	u_i	0.116 Vol.-%	0.013	(Vol.-%) ²
Einfluss des Probengasdruck	u_p	0.036 Vol.-%	0.001	(Vol.-%) ²
Unsicherheit des Referenzmaterials bei 70% des ZB	u_{rm}	0.242 Vol.-%	0.059	(Vol.-%) ²
Auswanderung des Messstrahles	u_{mb}	0.403 Vol.-%	0.162	(Vol.-%) ²

* Der größere der Werte wird verwendet:
"Wiederholstandardabweichung am Referenzpunkt" oder
"Standardabweichung aus Doppelbestimmungen"

Kombinierte Standardunsicherheit (u_c)	$u_c = \sqrt{\sum (u_{max, j})^2}$	0.63	Vol.-%
Erweiterte Unsicherheit	$U = u_c \cdot k = u_c \cdot 1,96$	1.24	Vol.-%

Relative erweiterte Messunsicherheit

Anforderung nach 2010/75/EU	U in % vom Messbereich 30 Vol.-%	4.1
Anforderung nach DIN EN 15267-3	U in % vom Messbereich 30 Vol.-%	10.0**
	U in % vom Messbereich 30 Vol.-%	7.5

** For this component no requirements in the EC-directives 2010/75/EU on industrial emissions are given.
The chosen value is recommended by the certification body.

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 / 448
Measuring principle	IR-DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2013-10-10

Measured component

Certification range	CO ₂	0 - 30 Vol.-%
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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 positive 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}	0.121	Vol.-%	0.015 (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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.38	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.74	Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 30 Vol.-%	2.5
Requirement of EN 15267-3	U in % of the range 30 Vol.-%	10.0**
		7.5

** For this component no requirements in the EC-directives 2010/75/EU on industrial emissions are given.
The chosen value is recommended by the certification body.