Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000059865

AMS designation:	CEMS II *ef* for CO, NO, NO_2, N_2O, SO_2, HCl, HF, NH_3, CO_2, H_2O, O_2, CH_4, CH_2O and TOC
Manufacturer:	Gasmet Technologies Oy Pulttitie 8 A 1 00880 Helsinki Finland
Test Laboratory:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and certified according to the standards

EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2008) and EN 14181 (2004) for CO, NO_2, N_2O, SO_2, HCl, NH_3, CO_2, H_2O and O_2 as well as EN 14181 (2014) for NO, HF, CH_4, CH_2O and TOC.

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 20 pages).

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000059865

Publication in the German Federal Gazette (BAnz) of 26 March 2018

This certificate will expire on:
25 March 2023

German Federal Environment Agency
Dessau, 13 April 2018

Dr. Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 12 April 2018

ppa. Dr. Peter Wilbring

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

TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln

Test institute accredited to EN ISO/IEC 17025:2005 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:	936/21225866/D dated 2 October 2017
Initial certification:	26 March 2018
Expiry date:	25 March 2023
Publication:	BAnz AT 26.03.2018 B8, chapter I number 3.2

Approved application
The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV), 30th BImSchV and TA Luft. The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the FID for this application was assessed on the basis of a three-months field test at a waste incineration plant. Laboratory test results were taken from report no. 936/21214670/A on the performance test of the Graphite 52M dated 5 October 2011. Data for the laboratory and field tests of the CEMS II *e* for CO, NO_2, N_2O, SO_2, HCl, NH_3, CO_2, H_2O and O_2 were taken from report no. 936/21220683/A dated 27 March 2013. Laboratory and field test data for NO, HF, CH_4, CH_2O as well as drift check results for all components were taken from report no. 936/21225866/B dated 23 February 2016 on the performance test of the CEMS II *e*.

The AMS is approved for an ambient temperature range of +5 °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 limit values and oxygen concentrations 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.

Basis of the certification
This certification is based on:

- Test report 936/21225866/D dated 2 October 2017
  issued by TÜV Rheinland Energy 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 26.03.2018 B8, chapter I number 3.2, UBA announcement dated 21 February 2018:

AMS designation:

CEMS II *ef* for CO, NO, NO_2, N_2O, SO_2, HCl, HF, NH_3, CO_2, H_2O, O_2, CH_4, CH_2O and TOC

Manufacturer:

Gasmet Technologies Oy, Helsinki, Finland

Field of application:

For plants requiring official approval

Measuring ranges during performance testing:

Component	Certification range	Supplementary measuring ranges		Unit
CO	0–75	0–300	0–1 500	mg/m³
NO	0–150	0–600	0–2 000	mg/m³
NO_2	0–200	0–500	–	mg/m³
N_2O	0–100	0–500	–	mg/m³
SO_2	0–75	0–300	0–1 500	mg/m³
HCl	0–15	0–90	–	mg/m³
HF	0–3	0–10	–	mg/m³
NH_3	0–15	0–50	–	mg/m³
O_2	0–25	–	–	Vol.-%
CO_2	0–25	–	–	Vol.-%
H_2O	0–30	0–40	–	Vol.-%
CH_4	0–15	0–50	0–150	mg/m³
CH_2O	0–20	0–30	0–90	mg/m³
TOC	0–15	0–500	-	mg/m³

Software versions:

Calcmet: 12.20 c/w evaluation module 4.42.2
OXITEC Ver. 1.50 np
Graphite 52M: v2.21 (Calculation Process), v3.1.b (Display Process)

Restrictions:

none

Notes:

1. The maintenance interval is four weeks.
2. Wet test gases should be used for testing HF, HCl, NH_3 and CH_2O.
3. After any plant failure, the sample probe needs to be cleaned.
4. The measuring system is available as version A (air conditioning unit on top of the measuring rack) and as version B (air conditioning unit at the back of the measuring rack).
5. For applications where O_2 is intended to be measured (optional), the OXITEC 500E SME 5 analyser manufactured by ENOTEC GmbH, Marienheide, Germany, is integrated.
6. The performance test covers the following versions of the AMS:

Rack version	FTIR	O_2	FID
A	X		X
B	X		X
B	X	X	X

Test Report:

TÜV Rheinland Energy GmbH, Cologne

Report no. 936/21225866/D dated 2 October 2017

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

The CEMS II *ef* measuring system comprises the following components:

1) Sampling

Sampling probe:	SP2000H manufactured by M & C, heated to 180 °C, c/w PTFE filter: 2 µm
heated line:	180 °C c/w 4 mm Teflon hose, 25 m in length, (normally 5 to 30 m)
Pump:	heated to 180 °C, c/w Teflon membrane

2) Analysers

FTIR:	Gasmet CX-4000, cell temperature: 180 °C, cell length: 5 m, IR source: SiC,
O_2: (optional)	ZrO_2 measurement cell, OXITEC 500E SME 5 in a 19'' slot manufactured by ENOTEC GmbH running OXITEC software Ver. 1.50 np
TOC:	Graphite 52M total C measuring system manufactured by Environnement running software components v2.21 (Calculation Process), v3.1.b (Display Process)

3) Evaluation system:

Standard industrial PC operating Windows 7 Ultimate 32bit.
For the purpose of evaluating analyser spectra, spectra are sent to a PC via the RS232 interface where they are processed. The PC is also used for controlling and monitoring sampling and the sample gas flow rate of the analysers.

4) Software:

Calcmet: 12.20 c/w evaluation module 4.42.2
Calcmet version 12.19 may also be used.

5) Measuring cabinet

- Temperature controlled at about 30°C
- Sampling pump, control units, analysers, interface cards for the analogue inputs/outputs and PC

The measuring rack is available as version A (dimensions 212/61/70 cm, air conditioning unit on top of the measuring rack) and as version B (dimensions 210x61x113 cm, air conditioning unit at the back of the measuring rack). Version A provides room for the FTIR and either the oxygen analyser or the FID analyser. The larger version B provides room for both the oxygen and the FID analyser. All other components are the same.

Rack version	FTIR	O_2	FID
A	X		X
B	X		X
B	X	X	X

The current version of the operation manual is D1.14 dated 4 December 2017.

General remarks

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

The relevant version of this certificate and its expiration date are also accessible on the internet at **qal1.de**.

Certification of the CEMS II *ef* 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. 0000059865: 13 April 2018
Expiry date of the certificate: 25 March 2023

Test report: 936/21225866/D dated 2 October 2017
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 26.03.2018 B8, chapter I number 3.2
UBA announcement dated 21 February 2018

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FID	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		TOC	
Certification range		0 - 15	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.38	mg/m³
Sum of negative CS at zero point		-0.24	mg/m³
Sum of postive CS at span point		0.51	mg/m³
Sum of negative CS at span point		-0.58	mg/m³
Maximum sum of cross-sensitivities		-0.58	mg/m³
Uncertainty of cross-sensitivity	u_i	-0.335	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.050	mg/m³	0.003	(mg/m³)²
Lack of fit	u_{lof}	-0.069	mg/m³	0.005	(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	$u_{d,s}$	-0.251	mg/m³	0.063	(mg/m³)²
Influence of ambient temperature at span	u_t	0.173	mg/m³	0.030	(mg/m³)²
Influence of supply voltage	u_v	0.015	mg/m³	0.000	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.335	mg/m³	0.112	(mg/m³)²
Influence of sample gas flow	u_p	-0.034	mg/m³	0.001	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)²
Variation of response factors (TOC)	u_{rf}	0.046	mg/m³	0.002	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.48	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.95	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**9.5**
Requirement of 2010/75/EU	**U in % of the ELV 10 mg/m³**	**30.0**
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	22.5

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
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		0.32	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		1.90	mg/m³
Sum of negative CS at span point		-1.00	mg/m³
Maximum sum of cross-sensitivities		1.90	mg/m³
Uncertainty of cross-sensitivity	u_i	1.096	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.478	mg/m³	0.228	(mg/m³)²
Lack of fit	u_{lof}	0.554	mg/m³	0.307	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.043	mg/m³	0.002	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.693	mg/m³	0.480	(mg/m³)²
Influence of ambient temperature at span	u_t	0.208	mg/m³	0.043	(mg/m³)²
Influence of supply voltage	u_v	0.298	mg/m³	0.089	(mg/m³)²
Cross-sensitivity (interference)	u_i	1.096	mg/m³	1.200	(mg/m³)²
Influence of sample gas flow	u_p	0.117	mg/m³	0.014	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.65	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	3.24	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**6.5**
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

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		NO	
Certification range		0 - 150	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 span point		0.00	mg/m³
Sum of negative CS at span point		-2.60	mg/m³
Maximum sum of cross-sensitivities		-2.60	mg/m³
Uncertainty of cross-sensitivity	u_i	-1.498	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.360	mg/m³	0.130	(mg/m³)²
Lack of fit	u_{lof}	0.580	mg/m³	0.336	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.087	mg/m³	0.008	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.645	mg/m³	2.706	(mg/m³)²
Influence of ambient temperature at span	u_t	0.709	mg/m³	0.503	(mg/m³)²
Influence of supply voltage	u_v	0.379	mg/m³	0.144	(mg/m³)²
Cross-sensitivity (interference)	u_i	-1.498	mg/m³	2.244	(mg/m³)²
Influence of sample gas flow	u_p	-0.577	mg/m³	0.333	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.212	mg/m³	1.470	(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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.81	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	5.50	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 98 mg/m³**	**5.6**
Requirement of 2010/75/EU	**U in % of the ELV 98 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 98 mg/m³	15.0

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		NO_2	
Certification range		0 - 150	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		1.66	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		7.90	mg/m³
Sum of negative CS at span point		-1.60	mg/m³
Maximum sum of cross-sensitivities		7.90	mg/m³
Uncertainty of cross-sensitivity	u_i	4.561	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	1.200	mg/m³	1.440	(mg/m³)²
Lack of fit	u_{lof}	-0.520	mg/m³	0.270	(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	$u_{d,s}$	-1.155	mg/m³	1.334	(mg/m³)²
Influence of ambient temperature at span	u_t	0.529	mg/m³	0.280	(mg/m³)²
Influence of supply voltage	u_v	0.571	mg/m³	0.326	(mg/m³)²
Cross-sensitivity (interference)	u_i	4.561	mg/m³	20.803	(mg/m³)²
Influence of sample gas flow	u_p	-0.313	mg/m³	0.098	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.212	mg/m³	1.470	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	5.10	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	10.00	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 150 mg/m³**	**6.7**
Requirement of 2010/75/EU	**U in % of the ELV 150 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 150 mg/m³	15.0

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		N_2O	
Certification range		0 - 100	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 span point		3.20	mg/m³
Sum of negative CS at span point		-0.80	mg/m³
Maximum sum of cross-sensitivities		3.20	mg/m³
Uncertainty of cross-sensitivity	u_i	1.848	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.630	mg/m³	0.397	(mg/m³)²
Lack of fit	u_{lof}	-0.231	mg/m³	0.053	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.000	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.346	mg/m³	0.120	(mg/m³)²
Influence of ambient temperature at span	u_t	0.252	mg/m³	0.064	(mg/m³)²
Influence of supply voltage	u_v	0.314	mg/m³	0.099	(mg/m³)²
Cross-sensitivity (interference)	u_i	1.848	mg/m³	3.413	(mg/m³)²
Influence of sample gas flow	u_p	-0.120	mg/m³	0.014	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.808	mg/m³	0.653	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.19	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.30	mg/m³

Relative total expanded uncertainty	**U in % of the range 100 mg/m³**	**4.3**
Requirement of 2010/75/EU	**U in % of the range 100 mg/m³**	**20.0 ****
Requirement of EN 15267-3	U in % of the range 100 mg/m³	15.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 20.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		SO_2	
Certification range		0 - 75	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.24	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		2.30	mg/m³
Sum of negative CS at span point		-2.90	mg/m³
Maximum sum of cross-sensitivities		-2.90	mg/m³
Uncertainty of cross-sensitivity	u_i	-1.676	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Repeatability standard deviation at set point *	u_r	0.357	mg/m³	0.127	(mg/m³)²
Lack of fit	u_{lof}	-0.316	mg/m³	0.100	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.043	mg/m³	0.002	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.996	mg/m³	0.992	(mg/m³)²
Influence of ambient temperature at span	u_t	0.557	mg/m³	0.310	(mg/m³)²
Influence of supply voltage	u_v	0.898	mg/m³	0.806	(mg/m³)²
Cross-sensitivity (interference)	u_i	-1.676	mg/m³	2.808	(mg/m³)²
Influence of sample gas flow	u_p	0.226	mg/m³	0.051	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.606	mg/m³	0.368	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.36	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.62	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 50 mg/m³**	**9.2**
Requirement of 2010/75/EU	**U in % of the ELV 50 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the ELV 50 mg/m³	15.0

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system..

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMSII ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
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		-0.06	mg/m³
Sum of postive CS at span point		0.60	mg/m³
Sum of negative CS at span point		-0.10	mg/m³
Maximum sum of cross-sensitivities		0.60	mg/m³
Uncertainty of cross-sensitivity	u_i	0.346	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.209	mg/m³	0.044	(mg/m³)²
Lack of fit	u_{lof}	0.173	mg/m³	0.030	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.000	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	0.208	mg/m³	0.043	(mg/m³)²
Influence of ambient temperature at span	u_t	0.265	mg/m³	0.070	(mg/m³)²
Influence of supply voltage	u_v	0.091	mg/m³	0.008	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.346	mg/m³	0.120	(mg/m³)²
Influence of sample gas flow	u_D	-0.045	mg/m³	0.002	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.58	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.13	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**11.3**
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

The values for the uncertainty calculation were taken from the test report on the CEMS II *e* measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		HF	
Certification range		0 - 3	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		0.04	mg/m³
Sum of postive CS at span point		0.12	mg/m³
Sum of negative CS at span point		-0.09	mg/m³
Maximum sum of cross-sensitivities		0.12	mg/m³
Uncertainty of cross-sensitivity	u_i	0.068	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.010	mg/m³	0.000	(mg/m³)²
Lack of fit	u_{lof}	0.032	mg/m³	0.001	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.002	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	-0.040	mg/m³	0.002	(mg/m³)²
Influence of ambient temperature at span	u_t	0.040	mg/m³	0.002	(mg/m³)²
Influence of supply voltage	u_v	0.016	mg/m³	0.000	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.068	mg/m³	0.005	(mg/m³)²
Influence of sample gas flow	u_p	-0.006	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.024	mg/m³	0.001	(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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.10	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.19	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 1 mg/m³**	**19.4**
Requirement of 2010/75/EU	**U in % of the ELV 1 mg/m³**	**40.0**
Requirement of EN 15267-3	U in % of the ELV 1 mg/m³	30.0

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system..

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		NH_3	
Certification range		0 - 15	mg/m³
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.06	mg/m³
Sum of negative CS at zero point		0.00	mg/m³
Sum of postive CS at span point		0.30	mg/m³
Sum of negative CS at span point		-0.60	mg/m³
Maximum sum of cross-sensitivities		-0.60	mg/m³
Uncertainty of cross-sensitivity	u_i	-0.346	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.074	mg/m³	0.005	(mg/m³)²
Lack of fit	u_{lof}	-0.139	mg/m³	0.019	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.000	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	-0.199	mg/m³	0.040	(mg/m³)²
Influence of ambient temperature at span	u_t	0.115	mg/m³	0.013	(mg/m³)²
Influence of supply voltage	u_v	0.091	mg/m³	0.008	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.346	mg/m³	0.120	(mg/m³)²
Influence of sample gas flow	u_p	0.061	mg/m³	0.004	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.47	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.93	mg/m³

Relative total expanded uncertainty	**U in % of the ELV 10 mg/m³**	**9.3**
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

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 40.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		Zirconium dioxide	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		O_2	
Certification range		0 - 25	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	u_i	0.000	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.047	Vol.-%	0.002	(Vol.-%)²
Lack of fit	u_{lof}	-0.104	Vol.-%	0.011	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.069	Vol.-%	0.005	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.098	Vol.-%	0.010	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.165	Vol.-%	0.027	(Vol.-%)²
Influence of supply voltage	u_v	0.015	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.000	Vol.-%	0.000	(Vol.-%)²
Influence of sample gas flow	u_p	-0.012	Vol.-%	0.000	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041	(Vol.-%)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.31	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.61	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.4**
Requirement of 2010/75/EU	**U in % of the range 25 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.

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

Measuring system			
Manufacturer		Gasmet Technologies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		CO_2	
Certification range		0 - 25	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		0.10	Vol.-%
Sum of negative CS at span point		-0.90	Vol.-%
Maximum sum of cross-sensitivities		-0.90	Vol.-%
Uncertainty of cross-sensitivity	u_i	-0.520	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.100	Vol.-%	0.010	(Vol.-%)²
Lack of fit	u_{lof}	0.115	Vol.-%	0.013	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.014	Vol.-%	0.000	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.188	Vol.-%	0.035	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.231	Vol.-%	0.053	(Vol.-%)²
Influence of supply voltage	u_v	0.099	Vol.-%	0.010	(Vol.-%)²
Cross-sensitivity (interference)	u_i	-0.520	Vol.-%	0.270	(Vol.-%)²
Influence of sample gas flow	u_p	-0.060	Vol.-%	0.004	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041	(Vol.-%)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.66	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.29	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**5.2**
Requirement of 2010/75/EU	**U in % of the range 25 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.

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

Measuring system					
Manufacturer			Gasmet Technologies Oy		
AMS designation			CEMS II ef		
Serial number of units under test			14433 / 14434		
Measuring principle			FTIR		
Test report			936/21225866/D		
Test laboratory			TÜV Rheinland		
Date of report			2017-10-02		
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			1.10	Vol.-%	
Sum of negative CS at span point			-0.10	Vol.-%	
Maximum sum of cross-sensitivities			1.10	Vol.-%	
Uncertainty of cross-sensitivity		u_i	0.632	Vol.-%	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.292	Vol.-%	0.085	(Vol.-%)²
Lack of fit	u_{lof}	0.230	Vol.-%	0.053	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.000	Vol.-%	0.000	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.329	Vol.-%	0.108	(Vol.-%)²
Influence of ambient temperature at span	u_t	0.231	Vol.-%	0.053	(Vol.-%)²
Influence of supply voltage	u_v	0.262	Vol.-%	0.069	(Vol.-%)²
Cross-sensitivity (interference)	u_i	0.632	Vol.-%	0.400	(Vol.-%)²
Influence of sample gas flow	u_p	0.112	Vol.-%	0.013	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.242	Vol.-%	0.059	(Vol.-%)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.92	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.80	Vol.-%

Relative total expanded uncertainty	**U in % of the range 30 Vol.-%**	**6.0**
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 10.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.

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

Measuring system			
Manufacturer		Gasmet Technolgies Oy	
AMS designation		CEMS II ef	
Serial number of units under test		14433 / 14434	
Measuring principle		FTIR	
Test report		936/21225866/D	
Test laboratory		TÜV Rheinland	
Date of report		2017-10-02	
Measured component		CH_4	
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 span point		0.08	mg/m³
Sum of negative CS at span point		-0.38	mg/m³
Maximum sum of cross-sensitivities		-0.38	mg/m³
Uncertainty of cross-sensitivity	u_i	-0.217	mg/m³

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.034	mg/m³	0.001	(mg/m³)²
Lack of fit	u_{lof}	0.035	mg/m³	0.001	(mg/m³)²
Zero drift from field test	$u_{d.z}$	0.000	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d.s}$	0.156	mg/m³	0.024	(mg/m³)²
Influence of ambient temperature at span	u_t	0.057	mg/m³	0.003	(mg/m³)²
Influence of supply voltage	u_v	0.026	mg/m³	0.001	(mg/m³)²
Cross-sensitivity (interference)	u_i	-0.217	mg/m³	0.047	(mg/m³)²
Influence of sample gas flow	u_p	-0.069	mg/m³	0.005	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121	mg/m³	0.015	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.31	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.61	mg/m³

Relative total expanded uncertainty	**U in % of the range 15 mg/m³**	**4.1**
Requirement of 2010/75/EU	**U in % of the range 15 mg/m³**	**30.0 ****
Requirement of EN 15267-3	U in % of the range 15 mg/m³	22.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 30.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.

Umwelt Bundesamt

Certificate:
0000059865 / 13 April 2018

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

Measuring system			
Manufacturer	Gasmet Technologies Oy		
AMS designation	CEMS II ef		
Serial number of units under test	14433 / 14434		
Measuring principle	FTIR		
Test report	936/21225866/D		
Test laboratory	TÜV Rheinland		
Date of report	2017-10-02		
Measured component	CH_2O		
Certification range	0 - 20	mg/m³	
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point	0.16	mg/m³	
Sum of negative CS at zero point	0.00	mg/m³	
Sum of postive CS at span point	0.36	mg/m³	
Sum of negative CS at span point	-0.19	mg/m³	
Maximum sum of cross-sensitivities	0.36	mg/m³	
Uncertainty of cross-sensitivity	u_i 0.208	mg/m³	

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	0.038	mg/m³	0.001	(mg/m³)²
Lack of fit	u_{lof}	-0.104	mg/m³	0.011	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.000	mg/m³	0.000	(mg/m³)²
Span drift from field test	$u_{d,s}$	-0.242	mg/m³	0.059	(mg/m³)²
Influence of ambient temperature at span	u_t	0.153	mg/m³	0.023	(mg/m³)²
Influence of supply voltage	u_v	0.047	mg/m³	0.002	(mg/m³)²
Cross-sensitivity (interference)	u_i	0.208	mg/m³	0.043	(mg/m³)²
Influence of sample gas flow	u_p	-0.051	mg/m³	0.003	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.162	mg/m³	0.026	(mg/m³)²

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

Combined standard uncertainty (u_C)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.41	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.80	mg/m³

Relative total expanded uncertainty	**U in % of the range 20 mg/m³**	**4.0**
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 30.0 % was used for this.

The values for the uncertainty calculation were taken from the test report on the CEMS II e measuring system.