Umwelt Bundes Amt
For our Environment

TÜVRheinland®
Precisely Right.

CERTIFICATE

about Product Conformity (QAL1)

Number of Certificate: 0000028755_01

Certified AMS:	APNA 370 for NO_x
Manufacturer:	HORIBA, Ltd. 2 Miyanohigashi Kisshoin Minami-ku Kyoto 610-8510 Japan
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

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

VDI 4202-1: 2002, VDI 4203-3: 2004, EN 14211: 2005, EN 15267-1: 2009, EN 15267-2: 2009

Certification is awarded in respect of the conditions stated in this certificate (see also the following pages).
The present certificate replaces Certificate No. 0000028755 of 09 February 2011.

www.tuv.com TÜVRheinland® ID: 0000028755

- Complying with 2008/50/EC
- TUV approved
- Annual inspection

Publication in the German Federal Gazette (BAnz.) of 14 October 2006

The certificate is valid until:
25 January 2016

Umweltbundesamt
Dessau, 16 March 2012

i. A. Dr. Hans-Joachim Hummel

TÜV Rheinland Energie und Umwelt GmbH
Köln, 15 March 2012

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de / www.eco-tuv.com
teu@umwelt-tuv.de
Tel. +49 221 806-2756

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln

Test report:	936/21204643/C of 07 July 2006
First certification:	26 January 2011
Valid until:	25 January 2016
Publication	BAnz. 14 October 2006, No. 194, p. 6715, chapter IV, No 3.1

Approved application
The certified AMS is suitable for continuous ambient air monitoring of NO, NO_2 and NO_x (stationary operation).The suitability of the AMS for this application was assessed on the basis of a laboratory test and a four months field test. The AMS is approved for the temperature range from 0 °C to +40 °C.

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

Basis of the certification
This certification is based on:

- test report 936/21204643/C dated 07 July 2006 of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH and on the addendum to the test report 936/21204643/C1 of 27 July 2011
- suitability announced by the German Environmental Agency (UBA) as the relevant body
- the ongoing surveillance of the product and the manufacturing process
- publication in the German Federal Gazette (BAnz. 14 October 2006, No. 194, p. 6715, chapter IV, No. 3.1, Announcement by UBA from 12 September 2006)
- publication in the German Federal Gazette (BAnz. 25 August 2009, No. 125, p. 2929, chapter III, notification 2, UBA announcement from 03 August 2009)
- publication in the German Federal Gazette (BAnz. 26 January 2011, No. 14, p. 296, chapter IV, notification 6, Announcement by UBA from 10 January 2011)
- publication in the German Federal Gazette (BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 17, Announcement by UBA from 23 February 2012)

AMS name:
APNA 370

Manufacturer:
HORIBA, Ltd., Kyoto, Japan

Distributor:
HORIBA Europe GmbH, Leichlingen

Approval:
For continuous monitoring of NO, NO_2 and NO_x (stationary operation).

Measuring ranges during the suitability test:
NO_2 0 bis 400 µg/m^3
NO_2 0 bis 500 µg/m^3
NO 0 bis 1200 µg/m^3

Software version:
P1000878001C

Test institute:
TÜV Immissionsschutz und Energiesysteme GmbH, Köln
TÜV Rheinland Group

Test report:
No. 936/21204643/C of 7 July 2006

2 Notification on the announcement of the Federal Environment Agency of 12 September 2006 (BAnz. p. 6717)

The current software version of the ambient air measuring system APNA 370 of the company Horiba Europe GmbH is:

P1000878001J

As an option, the pump of the type GD-6 EH of the company Horiba can be used alongside the so far used measured gas pump type N 86.0 KNE of the company KNF.

Statement of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 31 March 2009

6 Notification on the announcements of the Federal Environment Agency of 12 September 2006 (BAnz. p. 6715, chapter IV, No. 3.1) and of 3 August 2009 (BAnz. p. 2929, chapter III, notification 2)

The APNA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for components NO, NO_2 and NO_x fulfils the requirements of EN 14211. Moreover, the production and quality management of the APNA 370 measuring system for component NO, NO_2 and NO_x complies with the requirements of EN 15267.
The report of the suitability test is available on the internet at www.qal1.de.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 6 October 2010

17	Notification on the announcement of the Federal Environment Agency of 21 February 2006 (BAnz. p. 2653, chapter IV No. 2.1) and of 10 January 2011 (BAnz. p. 294, chapter IV, 6th notification) There is an addendum to the test report 936/21204643/C for the APNA 370 measuring system by Horiba Ltd., Japan and Horiba Europe GmbH for the components NO, NO_2 and NO_x. The addendum has the report number 936/21204643/C1 and is an integral part of the test report 936/21204643/C after its publication and is also published on www.qal1.de. Statement of TÜV Rheinland Energie und Umwelt GmbH of 3 November 2011

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

The APNA-370 is based on the measuring principle of chemiluminescence.

This method allows continuous measurement of the nitrogen oxides (NO, NO_2 and NO_x (NO + NO_2)) within the atmosphere. The concentration of NO_2 is calculated from the concentrations of NO and NO_x. The measuring principle complies with the reference measuring method described in section 5.2 of Standard EN 14211.

The sample gas is split into two streams within the APNA 370 measuring system. One stream is used for measuring the concentration of NO_x (NO + NO_2) by reducing NO_2 to NO via a NO_x converter. The other stream is used for direct determination of the NO concentration. The NO, NO_x and span gas tubes are switched every 0.5 s by using a solenoid valve and led into the reaction chamber.

Outside air is drawn through a separate filter, dried by a self-regenerative silica gel dehumidifier and passed through the ozonizer by generating the required ozone. The ozone is passed into the reaction chamber. The sample gas then reacts with the ozone and the emitted light is detected using a photo diode.

The device calculates the concentrations of NO, NO_2 and NO_x from the signal of the photo diode, which is proportional to the NO_x and NO concentrations, and displays the results as a continuous signal.

Dehumidifier

The device comprises a self-regenerative silica gel dehumidifier which dehumidifies the air required for generating ozone. The dehumidifier comprises two cylinders. While one cylinder is active the other is regenerated. The silica gel is heated to approx. 160 °C for about 135 minutes for this purpose in order to remove humidity. This process is followed by a cooling phase of about 45 minutes. Both cylinders are switched every 180 minutes in order to ensure constant drying.

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 looses its validity. After the expiration of the validity 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 the validity is also accessible on the internet Address: **qal1.de**.

Certification of APNA 370 for NO_x is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

First suitability test:

Test report: 936/21204643/C of 07 July 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln

Publication: BAnz. 14 October 2006, No. 194, p. 6715, chapter IV, No. 3.1
Announcement by UBA from 12 September 2006

Notifications:

Publication: BAnz. 25 August 2009, No 125, p. 2929, chapter III, notification 2
Announcement by UBA from 03. August 2006

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 6
Announcement by UBA from 10 January 2011

Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 17
Announcement by UBA from 23 February 2012

Publication: Addendum to test report 936/21204643/C1 from 27 July 2011

Initial certification according to EN 15267:

Certificate No. 0000028755: 09 February 2011

Validity of the certificate until: 25 January 2016

Test report: 936/21204643/C vom 07 July 2006
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Köln

Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 6
Announcement by UBA from 10 January 2011

Expanded uncertainty based on the results of the laboratory testing of Device 1 (the test report only contains the combined assessment of both devices in one table).

Measuring system:	Horiba APNA 370					Serial number	SN 10021	
Component	NOx					Level of the hourly limit value	505	nmol/mol
No	**Standard uncertainty due to**	**Performance criterion**		**Result**	**Value of partial uncertainty**		**Value of partial uncertainty squared**	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.157	$u_{r,Z}$	0.02	0.0006	
2	Repeatability standard deviation at concentration c_t (at a level of the hourly limit value)	≤	3.0 nmol/mol	1.704	$u_{r,lv}$	0.24	0.0578	
3	Lack of fit at the hourly limit value	≤	4.0% of the measured value	0.550	$u_{l,lv}$	1.60	2.5715	
4	Variation in sample gas pressure at the hourly limit value	≤	8.0 nmol/mol/kPa	0.143	u_{gp}	0.79	0.6267	
5	Variation in sample gas temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.230	u_{gt}	3.18	10.1327	
6	Variation in surrounding temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.264	u_{st}	3.65	13.3499	
7	Variation in electrical voltage at the hourly limit value	≤	0.30 nmol/mol/V	0.122	u_V	1.97	3.9002	
8a	Presence of water vapour with concentration 21 mmol/mol	≤	5.0 nmol/mol	1.417	u_{H2O}	0.96	0.9149	
8b	Presence of CO2 with concentration 500 µmol/mol	≤	5.0 nmol/mol	-1.984	$u_{int,pos}$	3.61	13.0441	
8c	Presence of O3 with concentration 200 nmol/mol	≤	2.0 nmol/mol	-0.965	oder			
8d	Presence of NH3 with concentration 200 nmol/mol	≤	5.0 nmol/mol	-3.306	$u_{int,neg}$			
9	Averaging error	≤	7.0% of the measured value	5.100	u_{av}	14.87	221.1067	
18	Difference sample / calibration port	≤	1.0%	0.000	u_{Dsc}	0.00	0.0000	
21	Converter efficiency	≥	98	98.600	u_{EC}	4.08	16.6616	
22	Increase of NO2 concentration due to residence time in the analyser	≤	4.0 nmol/mol	2.200	u_{ctr}	6.41	41.1440	
23	Uncertainty calibration gas	≤	3.0%	2.000	ucg	5.05	25.5025	
			Combined standard uncertainty			u_c	18.6835	nmol/mol
			Expanded uncertainty			U_c	37.3669	nmol/mol
			Relative expanded uncertainty			$U_{c,rel}$	7.40	%
			Maximum expanded uncertainty			$U_{req,rel.}$	15	%

Expanded uncertainty based on the results of the laboratory testing of Device 2 (the test report only contains the combined assessment of both devices in one table).

Measuring system:	Horiba APNA 370				Serial number		SN 10022	
Component	NOx				Level of the hourly limit value		505	nmol/mol
No	**Standard uncertainty due to**		**Performance criterion**	**Result**	**Value of partial uncertainty**		**Value of partial uncertainty squared**	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.132	$u_{r,Z}$	0.02	0.0004	
2	Repeatability standard deviation at concentration c_t (at a level of the hourly limit value)	≤	3.0 nmol/mol	1.250	$u_{r,lv}$	0.17	0.0306	
3	Lack of fit at the hourly limit value	≤	4.0% of the measured value	0.370	$u_{l,lv}$	1.08	1.1638	
4	Variation in sample gas pressure at the hourly limit value	≤	8.0 nmol/mol/kPa	0.130	u_{gp}	0.72	0.5179	
5	Variation in sample gas temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.150	u_{gt}	2.08	4.3098	
6	Variation in surrounding temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.140	u_{st}	1.94	3.7543	
7	Variation in electrical voltage at the hourly limit value	≤	0.30 nmol/mol/V	-0.084	u_V	-1.35	1.8349	
8a	Presence of water vapour with concentration 21 mmol/mol	≤	5.0 nmol/mol	0.726	u_{H2O}	0.49	0.2401	
8b	Presence of CO2 with concentration 500 µmol/mol	≤	5.0 nmol/mol	-1.655	$u_{int,pos}$	3.14	9.8748	
8c	Presence of O3 with concentration 200 nmol/mol	≤	2.0 nmol/mol	-0.608	oder			
8d	Presence of NH3 with concentration 200 nmol/mol	≤	5.0 nmol/mol	-3.180	$u_{int,neg}$			
9	Averaging error	≤	7.0% of the measured value	4.400	u_{av}	12.83	164.5761	
18	Difference sample / calibration port	≤	1.0%	0.000	u_{Dsc}	0.00	0.0000	
21	Converter efficiency	≥	98	98.200	u_{EC}	5.25	27.5427	
22	Increase of NO2 concentration due to residence time in the analyser	≤	4.0 nmol/mol	2.200	u_{ctr}	6.41	41.1440	
23	Uncertainty calibration gas	≤	3.0%	2.000	0	5.05	25.5025	
			Combined standard uncertainty			u_c	16.7488	nmol/mol
			Expanded uncertainty			U_c	33.4976	nmol/mol
			Relative expanded uncertainty			$U_{c,rel}$	6.63	%
			Maximum expanded uncertainty			$U_{req,rel.}$	15	%

Expanded uncertainty based on the results of the laboratory and field testing of Device 1 (the test report only contains the combined assessment of both devices in one table).

Measuring system:	Horiba APNA 370				Serial number		SN 10021	
Component	NOx				Level of the hourly limit value		505	nmol/mol
No	**Standard uncertainty due to**		**Performance criterion**	**Result**	**Value of partial uncertainty**		**Value of partial uncertainty squared**	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.157	$u_{r,Z}$	0.02	0.0006	
2	Repeatability standard deviation at concentration c_t (at a level of the hourly limit value)	≤	3.0 nmol/mol	1.704	$u_{r,lv}$	not considered, because ur,lv = 0.24 < ur,f	-	
3	Lack of fit at the hourly limit value	≤	4.0% of the measured value	0.550	$u_{l,lv}$	1.60	2.5715	
4	Variation in sample gas pressure at the hourly limit value	≤	8.0 nmol/mol/kPa	0.143	u_{gp}	0.79	0.6267	
5	Variation in sample gas temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.230	u_{gt}	3.18	10.1327	
6	Variation in surrounding temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.264	u_{st}	3.65	13.3499	
7	Variation in electrical voltage at the hourly limit value	≤	0.30 nmol/mol/V	0.122	u_V	1.97	3.9002	
8a	Presence of water vapour with concentration 21 mmol/mol	≤	5.0 nmol/mol	1.417	u_{H2O}	0.96	0.9149	
8b	Presence of CO2 with concentration 500 µmol/mol	≤	5.0 nmol/mol	-1.984	$u_{int,pos}$	3.61	13.0441	
8c	Presence of O3 with concentration 200 nmol/mol	≤	2.0 nmol/mol	-0.965	oder			
8d	Presence of NH3 with concentration 200 nmol/mol	≤	5.0 nmol/mol	-3.306	$u_{int,neg}$			
9	Averaging error	≤	7.0% of the measured value	5.100	u_{av}	14.87	221.1067	
10	Reproducibility under field conditions	≤	5.0% of the average of a three month period	3.800	$u_{r,f}$	3.97	15.7990	
11	Long term drift at zero	≤	5.0 nmol/mol	0.400	$u_{d,l,z}$	0.23	0.0533	
12	Long term drift at the hourly limit value	≤	5.0% of Max. of cert. range	0.820	$u_{d,l,lv}$	2.39	5.7160	
18	Difference sample / calibration port	≤	1.0%	0.000	u_{Dsc}	0.00	0.0000	
21	Converter efficiency	≥	98	98.600	u_{EC}	4.08	16.6616	
22	Increase of NO2 concentration due to residence time in the analyser	≤	4,0 nmol/mol	2.200	u_{ctr}	6.41	41.1440	
23	Uncertainty calibration gas	≤	3.0%	2.000	ucg	5.05	25.5025	
			Combined standard uncertainty		u_c		19.6551	nmol/mol
			Expanded uncertainty		U_c		39.3102	nmol/mol
			Relative expanded uncertainty		$U_{c,rel}$		7.78	%
			Maximum expanded uncertainty		$U_{req,rel.}$		15	%

Expanded uncertainty based on the results of the laboratory and field testing of Device 2 (the test report only contains the combined assessment of both devices in one table).

Measuring system:	Horiba APNA 370					Serial number	SN 10022	
Component	NOx					Level of the hourly limit value	505	nmol/mol
No	**Standard uncertainty due to**		**Performance criterion**	**Result**	**Value of partial uncertainty**		**Value of partial uncertainty squared**	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.132	$u_{r,Z}$	0.02	0.0004	
2	Repeatability standard deviation at concentration c_t (at a level of the hourly limit value)	≤	3.0 nmol/mol	1.250	$u_{r,lv}$	not considered, because ur,lv = 0.17 < ur,f	-	
3	Lack of fit at the hourly limit value	≤	4.0% of the measured value	0.370	$u_{l,lv}$	1.08	1.1638	
4	Variation in sample gas pressure at the hourly limit value	≤	8.0 nmol/mol/kPa	0.130	u_{gp}	0.72	0.5179	
5	Variation in sample gas temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.150	u_{gt}	2.08	4.3098	
6	Variation in surrounding temperature at the hourly limit value	≤	3.0 nmol/mol/K	0.140	u_{st}	1.94	3.7543	
7	Variation in electrical voltage at the hourly limit value	≤	0.30 nmol/mol/V	-0.084	u_V	-1.35	1.8349	
8a	Presence of water vapour with concentration 21 mmol/mol	≤	5.0 nmol/mol	0.726	u_{H2O}	0.49	0.2401	
8b	Presence of CO_2 with concentration 500 µmol/mol	≤	5.0 nmol/mol	-1.655	$u_{int,pos}$	3.14	9.8748	
8c	Presence of O_3 with concentration 200 nmol/mol	≤	2.0 nmol/mol	-0.608	oder			
8d	Presence of NH_3 with concentration 200 nmol/mol	≤	5.0 nmol/mol	-3.180	$u_{int,neg}$			
9	Averaging error	≤	7.0% of the measured value	4.400	u_{av}	12.83	164.5761	
10	Reproducibility under field conditions	≤	5.0% of the average of a three month period	3.800	$u_{r,f}$	3.97	15.7990	
11	Long term drift at zero	≤	5.0 nmol/mol	0.560	$u_{d,l,z}$	0.32	0.1045	
12	Long term drift at the hourly limit value	≤	5.0% of Max. of cert. range	0.970	$u_{d,l,lv}$	2.83	7.9984	
18	Difference sample / calibration port	≤	1.0%	0.000	u_{Dsc}	0.00	0.0000	
21	Converter efficiency	≥	98	98.200	u_{EC}	5.25	27.5427	
22	Increase of NO_2 concentration due to residence time in the analyser	≤	4,0 nmol/mol	2.200	u_{ctr}	6.41	41.1440	
23	Uncertainty calibration gas	≤	3.0%	2.000	0	5.05	25.5025	
			Combined standard uncertainty			u_c	17.8931	nmol/mol
			Expanded uncertainty			U_c	35.7862	nmol/mol
			Relative expanded uncertainty			$U_{c,rel}$	7.09	%
			Maximum expanded uncertainty			$U_{req,rel.}$	15	%