Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000028755_03

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

VDI 4202-1 (2002), VDI 4203-3 (2004), EN 14211 (2012), EN 15267-1 (2009) and EN 15267-2 (2009)

Certification is awarded in respect of the conditions stated in this certificate
(This certificate contains 10 pages).

TÜVRheinland®
CERTIFIED

Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance

www.tuv.com
ID 0000028755

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

This certificate will expire on:
25 January 2021

German Federal Environment Agency
Dessau, 21 January 2016

i. A. Dr. Marcel Langner

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 20 January 2016

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

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.

10/221 2.08

Test report:	936/21204643/C of 07 July 2006
Initial certification:	26 January 2011
Certification:	renewal (previous certificate 0000028755_02 of 29 April 2014 valid until 25 January 2016)
Date of expiry:	25 January 2021
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 of 0 °C to +40 °C.

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

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for ambient air applications at 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
- addenda 936/21204643/C1 of 27 July 2011 and 936/21222689/C of 05 October 2013
- 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:

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 - 400 µg/m^3
NO_2 0 - 500 µg/m^3
NO 0 - 1200 µg/m^3

Software version:
P1000878001C

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

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

Publication in the German Federal Gazette: BAnz. 25 August 2009, No 125, p. 2929, chapter III, notification 2, Announcement by UBA from 03. August 2009:

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

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

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, 2nd notification)

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

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:

17 Notification on the announcement of the Federal Environment Agency of 12 September 2006 (BAnz. p. 6715, chapter IV, No. 3.1) 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

Publication in the German Federal Gazette: BAnz AT 05.03.2013 B10, chapter V, notification 8, Announcement by UBA from 12 February 2013:

8 Notification on the announcement of the Federal Environmental Agency of 12 September 2006 (BAnz. p. 6715, chapter IV, No. 3.1) and of 23 February 2012 (BAnz. p. 920, chapter V 17th notification)

The APNA 370 measuring system for NO, NO_2 und NO_x manufactured by Horiba Ltd., Japan and Horiba Europe GmbH can be optionally equipped with an additional calibration gas inlet. Calibration gas can be fed either before or after the sample gas filter by means of an additional three-way valve.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012

Publication in the German Federal Gazette: BAnz AT 01.04.2014 B12, chapter VI, notification 27, Announcement by UBA from 27 February 2014:

27 Notification on the announcement of the Federal Environment Agency of 12 September 2006 (BAnz. p. 6715, chapter IV No 3.1) and of 12 February 2013 (BAnz AT 05.03.2013 B10, chapter V 8th notification)

The measuring system APNA 370 for NO, NO_2 and NO_x by Horiba Ltd., Japan and Horiba Europe GmbH fulfils the requirements of Standard EN 14211 (dated November 2012). An addendum that is an integral part of the test report 936/21222689/C can be viewed on the internet at www.qal1.de.

Statement of TÜV Rheinland Energie und Umwelt GmbH of 5 October 2013

Certified product
This certificate applies to automated measurement systems conforming 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 (2012).

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 is presented on page 1 of this certificate.

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 the validity is also accessible on the internet: 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, Cologne
Publication: BAnz. 14 October 2006, No. 194, p. 6715, chapter IV, No. 3.1
Announcement by UBA from 12 September 2006

Notifications:
Statement of TÜV Rheinland Immissionsschutz und Energiesysteme GmbH of 31 March 2009,
Publication: BAnz. 25 August 2009, No 125, p. 2929, chapter III, notification 2,
Announcement by UBA from 03 August 2009 (Software changes and hardware extension)

Initial certification according to EN 15267:
Certificate No. 0000028755: 09 February 2011
Validity of the certificate: 25 January 2016
Statement of TÜV Rheinland Energie und Umwelt GmbH of 6 October 2010,
Test report: 936/21204643/C vom 07 July 2006,
TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Cologne,
Publication: BAnz. 26 January 2011, No. 14, p. 294, chapter IV, notification 6,
Announcement by UBA from 10 January 2011

Notification according to EN 15267:
Statement of TÜV Rheinland Energie und Umwelt GmbH of 3 November 2011,
with Addendum 936/21204643/C1 from 27 July 2011
Publication: BAnz. 02 March 2012, No. 36, p. 920, chapter V, notification 17
UBA announcement from 23 February 2012, (addition of an Addendum)
Certificate No. 0000028755_01: 16 March 2012
Validity of the certificate: 25 January 2016

Statement of TÜV Rheinland Energie und Umwelt GmbH of 11 October 2012
Publication: BAnz AT 05.03.2013 B10, chapter V, notification 8,
announcement by UBA from 12 February 2013 (hardware extension)

Statement of TÜV Rheinland Energie und Umwelt GmbH of 5 October 2013
with Addendum 936/21222689/C from 05 October 2013,
Publication: BAnz AT 01.04.2014 B12, chapter VI, notification 27,
Announcement by UBA from 27 February 2014 (EN14211 (2012)),
Certificate No. 0000028755_02: 29 April 2014
Validity of the certificate: 25 January 2016

Renewal of the certificate:
Certificate No : 0000028755_03: 21 January 2016
Validity of the certificate: 25 January 2021

Umwelt Bundesamt

Certificate:
0000028755_03 / 21 January 2016

TÜVRheinland® Precisely Right.

Expanded uncertainty based on the results of the laboratory testing of System 1

Measuring device:	Horiba APNA 370			Serial-No.:		SN 10021	
Measured component:	NO2			1h-limit value:		104.6	nmol/mol

No.	Performance characteristic	Performance criterion		Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.157	$u_{r,z}$	0.05	0.0024	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.704	$u_{r,lh}$	0.10	0.0099	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.200	$u_{l,lh}$	0.12	0.0146	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.143	u_{gp}	0.41	0.1680	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.230	u_{gt}	0.66	0.4347	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.264	u_{st}	0.76	0.5727	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.122	u_V	0.41	0.1673	
8a	Interferent H_20 with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.024	u_{H2O}	0.18	0.0326	
		≤	10 nmol/mol (Span)	1.360				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.056	$u_{int,pos}$ or $u_{int,neg}$	0.63	0.3997	
		≤	5.0 nmol/mol (Span)	-2.160				
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.056				
		≤	5.0 nmol/mol (Span)	-3.620				
9	Averaging effect	≤	7.0% of measured value	5.100	u_{av}	3.08	9.4860	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.60	u_{EC}	1.46	2.1445	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty	u_c		3.8130	nmol/mol
				Expanded uncertainty	U		7.6259	nmol/mol
				Relative expanded uncertainty	W		7.29	%
				Maximum allowed expanded uncertainty	W_{req}		15	%

Certificate:
0000028755_03 / 21 January 2016

Expanded uncertainty based on the results of the laboratory testing of System 2

Measuring device: Horiba APNA 370 — Serial-No.: SN 10022

Measured component: NO2 — 1h-limit value: 104.6 nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.132	$u_{r,z}$	0.04	0.0017	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.250	$u_{r,lh}$	0.07	0.0052	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.130	u_{gp}	0.37	0.1389	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.150	u_{gt}	0.43	0.1849	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.140	u_{st}	0.40	0.1611	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	-0.084	u_V	-0.28	0.0787	
8a	Interferent $H_2 0$ with 21 mmol/mol	≤	10 nmol/mol (Zero)	0.000	u_{H2O}	0.15	0.0216	
		≤	10 nmol/mol (Span)	0.000				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.056	$u_{int,pos}$	0.52	0.2704	
		≤	5.0 nmol/mol (Span)	-1.820	or			
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.184				
		≤	5.0 nmol/mol (Span)	-3.520	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	4.400	u_{av}	2.66	7.0607	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.20	u_{EC}	1.88	3.5449	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty	u_c		3.5499	nmol/mol
				Expanded uncertainty	U		7.0999	nmol/mol
				Relative expanded uncertainty	W		6.79	%
				Maximum allowed expanded uncertainty	W_{req}		15	%

Expanded uncertainty based on the results of the laboratory and field testing of System 1

Measuring device:	Horiba APNA 370	Serial-No.:	SN 10021	
Measured component:	NO2	1h-limit value:	104.6	nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.157	$u_{r,z}$	0.05	0.0024	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.704	$u_{r,lh}$	not considered, as √2*ur,lh = 0,14 < ur,f	-	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.200	$u_{l,lh}$	0.12	0.0146	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.143	u_{gp}	0.41	0.1680	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.230	u_{gt}	0.66	0.4347	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.264	u_{st}	0.76	0.5727	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	0.122	u_V	0.41	0.1673	
8a	Interferent $H_2$0 with 21 mmol/mol	≤	10 nmol/mol (Zero)	-0.024	u_{H2O}	0.18	0.0326	
		≤	10 nmol/mol (Span)	1.360				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.056	$u_{int,pos}$ or $u_{int,neg}$	0.63	0.3997	
		≤	5.0 nmol/mol (Span)	-2.160				
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.056				
		≤	5.0 nmol/mol (Span)	-3.620				
9	Averaging effect	≤	7.0% of measured value	5.100	u_{av}	3.08	9.4860	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	3.960	$u_{r,f}$	4.14	17.1575	
11	Long term drift at zero level	≤	5.0 nmol/mol	0.400	$u_{d,l,z}$	0.23	0.0533	
12	Long term drift at span level	≤	5.0% of max. of certification range	0.820	$u_{d,l,lh}$	0.50	0.2452	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.600	u_{EC}	1.46	2.1445	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty		u_c	5.6546	nmol/mol
				Expanded uncertainty		U	11.3093	nmol/mol
				Relative expanded uncertainty		W	10.81	%
				Maximum allowed expanded uncertainty		W_{req}	15	%

Certificate:
0000028755_03 / 21 January 2016

Expanded uncertainty based on the results of the laboratory and field testing of System 2

Measuring device:	Horiba APNA 370				Serial-No.:		SN 10022	
Measured component:	NO2				1h-limit value:		104.6	nmol/mol

No.	Performance characteristic		Performance criterion	Result	Partial uncertainty		Square of partial uncertainty	
1	Repeatability standard deviation at zero	≤	1.0 nmol/mol	0.132	$u_{r,z}$	0.04	0.0017	
2	Repeatability standard deviation at 1h-limit value	≤	3.0 nmol/mol	1.250	$u_{r,lh}$	not considered, as √2*ur,lh = 0,1 < ur,f	-	
3	"lack of fit" at 1h-limit value	≤	4.0% of measured value	0.300	$u_{l,lh}$	0.18	0.0328	
4	Sensitivity coefficient of sample gas pressure at 1h-limit value	≤	8.0 nmol/mol/kPa	0.130	u_{gp}	0.37	0.1389	
5	Sensitivity coefficient of sample gas temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.150	u_{gt}	0.43	0.1849	
6	Sensitivity coefficient of surrounding temperature at 1h-limit value	≤	3.0 nmol/mol/K	0.140	u_{st}	0.40	0.1611	
7	Sensitivity coefficient of electrical voltage at 1h-limit value	≤	0.30 nmol/mol/V	-0.084	u_V	-0.28	0.0787	
8a	Interferent H_2O with 21 mmol/mol	≤	10 nmol/mol (Zero)	0.080	u_{H2O}	0.15	0.0216	
		≤	10 nmol/mol (Span)	0.696				
8b	Interferent CO_2 with 500 µmol/mol	≤	5.0 nmol/mol (Zero)	-0.056	$u_{int,pos}$	0.52	0.2704	
		≤	5.0 nmol/mol (Span)	-1.820	or			
8c	Interferent NH_3 mit 200 nmol/mol	≤	5.0 nmol/mol (Zero)	0.184				
		≤	5.0 nmol/mol (Span)	-3.520	$u_{int,neg}$			
9	Averaging effect	≤	7.0% of measured value	4.400	u_{av}	2.66	7.0607	
10	Reproducibility standard deviation under field conditions	≤	5.0% of average over 3 months	3.960	$u_{r,f}$	4.14	17.1575	
11	Long term drift at zero level	≤	5.0 nmol/mol	0.560	$u_{d,l,z}$	0.32	0.1045	
12	Long term drift at span level	≤	5.0% of max. of certification range	0.970	$u_{d,l,lh}$	0.59	0.3432	
18	Difference sample/calibration port	≤	1.0%	0.000	$u_{\Delta sc}$	0.00	0.0000	
21	Converter efficiency	≥	98	98.200	u_{EC}	1.88	3.5449	
23	Uncertainty of test gas	≤	3.0%	2.000	u_{cg}	1.05	1.0941	
				Combined standard uncertainty		u_c	5.4952	nmol/mol
				Expanded uncertainty		U	10.9903	nmol/mol
				Relative expanded uncertainty		W	10.51	%
				Maximum allowed expanded uncertainty		W_{req}	15	%