Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No: 0000072196_02

Certified AMS:	MGAprime Q for CO, NO, NO_2, N_2O, SO_2, O_2 and CO_2
Manufacturer:	MRU GmbH Fuchshalde 8 74172 Neckarsulm Germany
Test Institute:	TÜV Rheinland Energy & Environment GmbH

This is to certify that the P-AMS has been tested and found to comply with the standards EN 15267-1 (2009), EN 15267-2 (2023), EN 15267-4 (2017), EN 14793 (2017) as well as EN 14181 (2014).

Certification is awarded in respect of the conditions stated in this certificate (this certificate contains 16 pages).
The present certificate replaces certificate 0000072196_01 dated 2 June 2021.

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000072196

Publication in the German Federal Gazette (BAnz) of 3 May 2021

German Environment Agency

Dessau, 3 May 2026

This certificate will expire on:
2 May 2031

TÜV Rheinland
Energy & Environment GmbH
Cologne, 2 May 2026

Dr. Marcel Langner
Head of Section II 4

i.V. Guido Baum

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Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test report:	936/21245785/C dated 7 September 2020
Initial certification:	31 July 2020
Expiry date:	2 May 2031
Certificate:	Renewal (of previous certificate 0000072196_01 of 2 June 2021 valid until 2 May 2026)
Publication:	BAnz AT 03.05.2021 B9, chapter I No. 4.1

Approved application

The tested P-AMS is suitable for use for periodic measurements of emissions from stationary sources at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2020), Directive 2015/2193/EC (44th BImSchV:2019) and TA Luft:2002 for the calibration and validation of stationary AMS within the scope of QAL2 and AST according to EN 14181.
The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the P-AMS for this application was assessed on the basis of a laboratory test and seven field test campaigns at different industrial facilities.
The facilities in question were two waste incineration plants, one coal-fired power plant, one sewage sludge incineration plant, a biomass heating plant, a hot water burner test stand and an engine test stand.

The P-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 emission limit values and oxygen concentration relevant to the application.

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

Note

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

Basis of the certification

This certification is based on:

- Test report 936/21245785/C dated 7 September 2020 of 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 03.05.2021 B9, chapter I No. 4.1, Announcement by UBA dated 31 March 2021:

AMS designation:
MGAprime Q for CO, NO, O_2, CO_2, NO_2, N_2O and SO_2

Manufacturer:
MRU GmbH, Neckarsulm

Field of application:
Portable AMS for periodic measurements of emissions from stationary sources in accordance with the 13th and 44th BImSchV, TA Luft and as an alternative method for the standard reference method for calibrating and validating stationary AMS in the context of QAL2 and AST in accordance with EN 14181.

Measuring ranges during the performance test:

Component	Certification range	Supplementary range	Unit
CO	0–220	0–3,750	mg/m³
NO	0–270	0–2,680	mg/m³
NO_2	0–308	0–1,025	mg/m³
CO_2	0–20	-	Vol.-%
N_2O	0–196	0–490	mg/m³
SO_2	0–429	0–8,571	mg/m³
O_2	0–25	-	Vol.-%

Software version: V1.001.029

Restrictions: None

Notes:

1. Operation of the P-AMS requires that the pump provided by the manufacturer injects a 10 % phosphoric acid into the instrument's cooler.
2. In the event of temperature changes of more than 6 °C, it must be checked on-site whether the measurement uncertainty is still within the permissible limits.
3. Supplementary testing (additional components NO_2, SO_2 and N_2O) as regards Federal Environment Agency (UBA) notice of 27 May 2020 (BAnz AT 31.07.2020 B10, chapter I number 4.2).

Test Report: TÜV Rheinland Energy GmbH, Cologne
Report No.: 936/21245785/C dated 7 September 2020

Publication in the German Federal Gazette: BAnz AT 05.08.2021 B5, Chap. IV notification 37, Announcement by UBA dated 29 June 2021:

37 Notification as regards Federal Environment Agency (UBA) notice of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 4.1)

The latest software version of the portable measuring system MGAprimeQ for CO, NO, NO_2, SO_2, N_2O, CO_2 and O_2 manufactured by MRU GmbH is: V1.001.110.
Furthermore, version V1.001.093 can be used.

Statement issued by TÜV Rheinland Energy GmbH dated 3 May 2021

Publication in the German Federal Gazette: BAnz AT 28.07.2022 B4, Chap. III notification 17, Announcement by UBA dated 28 June 2022:

17 Notification as regards Federal Environment Agency (UBA) notices of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 4.1) and of 29 June 2021 (BAnz AT 05.08.2021 B5, chapter IV notification 37)

The current software version of the portable measuring device MGAprimeQ for CO, NO, NO_2, SO_2, N_2O, CO_2 and O_2 of MRU GmbH is: V1.002.008.

Furthermore, the intermediate versions V1.001.111; V1.001.112; V1.002.000; V1.002.001; V1.002.002; V1.002.003;
V1.002.004; V1.002.005; V1.002.006; V1.002.007 can be used.

Furthermore, the measuring device can be equipped with the NDIR main board version B, the printed circuit board of the gas cooler module has been optimized. Changes to avoid condensate alarms were implemented and a thermal switch for the oxygen sensor was added.
The measuring device can be equipped with 5-meter and 10-meter heating line in addition to the previously used 3-meter heating line.

Statement issued by TÜV Rheinland Energy GmbH dated 26 April 2022

Publication in the German Federal Gazette: BAnz AT 02.08.2023 B7, Chap. III notification 13, Announcement by UBA dated 5 July 2023:

13 Notification as regards Federal Environment Agency (UBA) notices of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 4.1) and of 28 June 2022 (BAnz AT 28.07.2022 B4, chapter III notification 17)

The current software version of the MGAprimeQ portable measuring system for CO, NO, NO_2, SO_2, N_2O, CO_2 and O_2 from MRU GmbH is:
V1.003.008.
Furthermore, the intermediate versions V1.002.009; V1.003.000; V1.003.001; V1.003.002; V1.003.004; V1.003.005; V1.003.006; V1.003.007 can be used.

The ambient temperature sensor can also be equipped with an angled connector. The upper part of the gas cooler has been modified by means of an additional pressure plate in the area of the screw connections.

Statement issued by TÜV Rheinland Energy GmbH dated 8 February 2023

Publication in the German Federal Gazette: BAnz AT 31.10.2024 B9, Chap. IV notification 25, Announcement by UBA dated 21 August 2024:

25 Notification as regards Federal Environment Agency (UBA) notices of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 4.1) and of 5 July 2023 (BAnz AT 02.08.2023 B7, chapter III notification 13)

The current software version for the portable measuring system MGAprime Q for CO, NO, NO_2, SO_2, N_2O, CO_2 and O_2 from the company MRU GmbH is:
V1.003.009.

The sheath of the heated pipe can also be made of a more acid-resistant material (silicone foam).
The connection of the silicone hose to the pressure sensor for flow monitoring has been optimised with an adapter.

Statement issued by TÜV Rheinland Energy &Environment GmbH dated 26 February 2024

Publication in the German Federal Gazette: BAnz AT 31.10.2025 B5, Chap. IV notification 19, Announcement by UBA dated 27 August 2025:

19 Notification as regards Federal Environment Agency (UBA) notices of 31 March 2021 (BAnz AT 03.05.2021 B9, chapter I number 4.1) and of 21 August 2024 (BAnz AT 31.10.2024 B9, chapter IV notification 25)

The current software version of the portable measuring device MGAprime Q for CO, NO, NO_2, SO_2, N_2O, CO_2 and O_2 from MRU GmbH is:
V1.003.043

A sign indicating the nominal operating position has been attached to the AQME.

Statement issued by TÜV Rheinland Energy & Environment GmbH
dated 17 February 2025

Certified product

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

The *MGAprime Q* measuring system tested consists of:

- HPI sampling probe (length: 0.5 m) and heating hose (length: 3 m),
- the *MGAprime Q* analyser itself,
- and the additional APE unit for injecting phosphoric acid into the analyser.

The gas sampling probe has a heated probe handle incl. a dust filter and allows connection to a heated sampling line. The *MGAprime Q* controls the heaters, the probe handle and the sampling probe.

The measuring system has two different kinds of sensors.

- a paramagnetic sensor to measure O_2;
- non-dispersive infrared absorption measurement for measuring CO, NO, NO_2, N_2O, SO_2 and CO_2.

The measuring system is operated via a touch-sensitive display. The outer casing of the instrument is a compact and robust metal housing with shock-absorbing plastic corners, housed in a water-repellent bag. The P-AMS can be operated from within this bag. The AMS has a degree of protection of IP42.

All electrical and pneumatic connections are located on the front of the unit.

An APE acid dosing unit is used to inject phosphoric acid (10 %) into the instrument's cooler. Correct measurement requires the injection of phosphoric acid (10 %).

- This injection ensures constant conditions of the gas cooler.
- The use of phosphoric acid reduces losses of SO_2 and NO_2 on the wet surfaces of the gas cooler.

The injection takes place via two pumps. The total quantity of phosphorous acid during operation is 24 ml per hour.

General notes

This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energy & Environment GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy & Environment GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy & Environment GmbH this document shall be returned and the certificate mark must not be employed anymore.

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

History of documents
Certification of MGAprime Q 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. 0000072196_00: 7 September 2020
Expiry date of the certificate: 30 July 2025
Test report: 936/21245785/B dated 11 May 2020
TÜV Rheinland Energy GmbH
Publication: BAnz AT 31.07.2020 B10, chapter I number 4.2
UBA announcement dated 27 May 2020

Supplementary testing according to EN 15267
Certificate No. 0000072196_01: 2 June 2021
Expiry date of the certificate: 2 May 2026
Test report: 936/21245785/C dated 7 September 2020
TÜV Rheinland Energy GmbH
Publication: BAnz AT 03.05.2021 B9, chapter I number 4.1
UBA announcement dated 31 March 2021

Notifications
Statement issued by TÜV Rheinland Energy GmbH dated 3 May 2021
Publication: BAnz AT 05.08.2021 B5, chapter IV notification 37
UBA announcement dated 29 June 2021
(Software change)

Statement issued by TÜV Rheinland Energy GmbH dated 26 April 2022
Publication: BAnz AT 28.07.2022 B4, chapter III notification 17
UBA announcement dated 28 June 2022
(Soft- and hardware changes)

Statement issued by TÜV Rheinland Energy GmbH dated 8 February 2023
Publication: BAnz AT 02.08.2023 B7, chapter III notification 13
UBA announcement dated 5 July 2023
(Software changes)

Statement issued by TÜV Rheinland Energy & Environment GmbH dated 26 February 2024
Publication: BAnz AT 31.10.2024 B9, chapter IV notification 25
UBA announcement dated 21 August 2024
(Soft- and hardware changes)

Statement issued by TÜV Rheinland Energy & Environment GmbH dated 17 February 2025
Publication: BAnz AT 31.10.2025 B5, chapter IV notification 19
UBA announcement dated 27 August 2025
(Software and hardware changes)

Renewal of certificates
Certificate No. 0000072196_02: 3 May 2026
Expiry date of the certificate: 2 May 2031

The following pages present the uncertainty calculations for the individual components. Since separate uncertainty calculations are required for each field test, this certificate indicates the highest uncertainty result determined for each field test. All other uncertainty calculations are summarised in the mentioned performance test.

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 1

Measuring system			
Manufacturer		MRU GmbH	
AMS designation		MGAprime Q	
Serial number of units under test		63108 / 63107	
Measuring principle		IR	
Test report		936/21245785/C	
Test laboratory		TÜV Rheinland	
Date of report		07 September 2020	
Measured component		CO	
Certification range		0 - 220	mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		0.69	mg/m³
Uncertainty of cross-sensitivity	u_i	0.40	mg/m³

Calculation of the combined standard uncertainty

Test parameter				u²	
Standard deviation laboratory test	u_r	0.690	mg/m³	0.476	(mg/m³)²
Lack of fit	u_{lof}	0.572	mg/m³	0.327	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.650	mg/m³	0.423	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.299	mg/m³	1.687	(mg/m³)²
Influence of ambient temperature from field	u_t	0.837	mg/m³	0.700	(mg/m³)²
Influence of supply voltage field test specific	u_v	0.000	mg/m³	0.000	(mg/m³)²
Cross-sensitivity field test specific	u_i	0.399	mg/m³	0.159	(mg/m³)²
Influence of sample gas flow field test specific	u_p	0.000	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.778	mg/m³	3.162	(mg/m³)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.63	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	5.16	mg/m³

Relative total expanded uncertainty	**U in % of the range 88 mg/m³**	**5.9**
Requirement of 2010/75/EU	**U in % of the range 88 mg/m³**	**10.0**
Requirement of EN 15267-3	U in % of the range 88 mg/m³	7.5
Requirement for standard reference methods	U in % of the range 88 mg/m³	6.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 3

Measuring system			
Manufacturer		MRU GmbH	
AMS designation		MGAprime Q	
Serial number of units under test		63108 / 63107	
Measuring principle		IR	
Test report		936/21245785/C	
Test laboratory		TÜV Rheinland	
Date of report		07 September 2020	
Measured component		NO	
Certification range		0 - 270	mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		7.44	mg/m³
Uncertainty of cross-sensitivity	u_i	4.30	mg/m³

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	1.300	mg/m³	1.690	(mg/m³)²
Lack of fit	u_{lof}	1.154	mg/m³	1.332	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.462	mg/m³	0.213	(mg/m³)²
Span drift from field test	$u_{d,s}$	-1.386	mg/m³	1.921	(mg/m³)²
Influence of ambient temperature from field	u_t	1.155	mg/m³	1.333	(mg/m³)²
Influence of supply voltage field test specific	u_v	0.000	mg/m³	0.000	(mg/m³)²
Cross-sensitivity field test specific	u_i	4.297	mg/m³	18.464	(mg/m³)²
Influence of sample gas flow field test specific	u_b	0.000	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	2.182	mg/m³	4.763	(mg/m³)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	5.46	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	10.70	mg/m³

Relative total expanded uncertainty	**U in % of the range 108 mg/m³**	**9.9**
Requirement of 2010/75/EU	**U in % of the range 108 mg/m³**	**20.0**
Requirement of EN 15267-3	U in % of the range 108 mg/m³	15.0
Requirement for standard reference methods	U in % of the range 108 mg/m³	10.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 5

Measuring system					
Manufacturer		MRU GmbH			
AMS designation		MGAprime Q			
Serial number of units under test		63108 / 63107			
Measuring principle		IR			
Test report		936/21245785/C			
Test laboratory		TÜV Rheinland			
Date of report		07 September 2020			
Measured component		CO_2			
Certification range		0 - 20	Vol.-%		

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		0.16	Vol.-%		
Uncertainty of cross-sensitivity	u_i	0.09	Vol.-%		

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	0.020	Vol.-%	0.000	(Vol.-%)²
Lack of fit	u_{lof}	0.115	Vol.-%	0.013	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	-0.012	Vol.-%	0.000	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.115	Vol.-%	0.013	(Vol.-%)²
Influence of ambient temperature from field	u_t	0.245	Vol.-%	0.060	(Vol.-%)²
Influence of supply voltage field test specific	u_v	0.000	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity field test specific	u_i	0.093	Vol.-%	0.009	(Vol.-%)²
Influence of sample gas flow field test specific	u_p	0.000	Vol.-%	0.000	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.162	Vol.-%	0.026	(Vol.-%)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.35	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	0.68	Vol.-%

Relative total expanded uncertainty	**U in % of the range 20 Vol.-%**	**3.4**
Requirement of 2010/75/EU	**U in % of the range 20 Vol.-%**	**10.0 ****
Requirement of EN 15267-3	U in % of the range 20 Vol.-%	7.5
Requirement for standard reference methods	U in % of the range 20 Vol.-%	6.0

** There are no requirements for this component in the EU Directive 2010/75/EU on industrial emissions. A value of 10 % was used.

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 1

Measuring system		
Manufacturer		MRU GmbH
AMS designation		MGAprime Q
Serial number of units under test		63108 / 63107
Measuring principle		Paramagnetic
Test report		936/21245785/C
Test laboratory		TÜV Rheinland
Date of report		07 September 2020
Measured component		O_2
Certification range		0 - 25 Vol.-%

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		0.05	Vol.-%
Uncertainty of cross-sensitivity	u_i	0.03	Vol.-%

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	0.010	Vol.-%	0.000	(Vol.-%)²
Lack of fit	u_{lof}	0.003	Vol.-%	0.000	(Vol.-%)²
Zero drift from field test	$u_{d,z}$	0.017	Vol.-%	0.000	(Vol.-%)²
Span drift from field test	$u_{d,s}$	-0.110	Vol.-%	0.012	(Vol.-%)²
Influence of ambient temperature from field	u_t	0.245	Vol.-%	0.060	(Vol.-%)²
Influence of supply voltage field test specific	u_v	0.000	Vol.-%	0.000	(Vol.-%)²
Cross-sensitivity field test specific	u_i	0.030	Vol.-%	0.001	(Vol.-%)²
Influence of sample gas flow field test specific	u_p	0.000	Vol.-%	0.000	(Vol.-%)²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.202	Vol.-%	0.041	(Vol.-%)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max\ j})^2}$	0.34	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	0.66	Vol.-%

Relative total expanded uncertainty	**U in % of the range 25 Vol.-%**	**2.6**
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
Requirement for standard reference methods	U in % of the range 25 Vol.-%	6.0

** There are no requirements for this component in the EU Directive 2010/75/EU on industrial emissions.
A value of 10.0 % was used.

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both system during field test 3

Measuring system

Manufacturer	MRU GmbH
AMS designation	MGAprime Q
Serial number of units under test	63108 / 63107
Measuring principle	IR

Test report	936/21245785/C
Test laboratory	TÜV Rheinland
Date of report	07 September 2020

Measured component	NO_2
Certification range	0 - 308 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		7.51	mg/m³
Uncertainty of cross-sensitivity	u_i	4.337	mg/m³

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	0.540	mg/m³	0.292	(mg/m³)²
Lack of fit	u_{lof}	-1.099	mg/m³	1.208	(mg/m³)²
Zero drift from field test	$u_{d,z}$	-0.178	mg/m³	0.032	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.598	mg/m³	2.553	(mg/m³)²
Influence of ambient temperature from field	u_t	1.102	mg/m³	1.213	(mg/m³)²
Influence of supply voltage field test specific	u_v	0.000	mg/m³	0.000	(mg/m³)²
Cross-sensitivity field test specific	u_i	4.337	mg/m³	18.810	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_n	0.000	mg/m³	0.000	(mg/m³)²
Unsicherheit des Referenzmaterials bei 70% des ZB	u_{rm}	2.490	mg/m³	6.198	(mg/m³)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	5.50	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	10.79	mg/m³

Relative total expanded uncertainty	**U in % of the range**	**8.8**
Requirement of 2010/75/EU	**U in % of the range**	**20.0**
Requirement of EN 15267-3	U in % of the range	15.0
Requirement for standard reference methods		10.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 3

Measuring system

Manufacturer	MRU GmbH
AMS designation	MGAprime Q
Serial number of units under test	68109 / 68107
Measuring principle	IR

Test report	936/21245785/C
Test laboratory	TÜV Rheinland
Date of report	07 September 2020

Measured component	SO_2
Certification range	0 - 429 mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		12.66	mg/m³
Uncertainty of cross-sensitivity	u_i	7.310	mg/m³

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	1.270	mg/m³	1.613	(mg/m³)²
Lack of fit	u_{lof}	-1.907	mg/m³	3.637	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.248	mg/m³	0.061	(mg/m³)²
Span drift from field test	$u_{d,s}$	-1.981	mg/m³	3.926	(mg/m³)²
Influence of ambient temperature from field	u_t	1.281	mg/m³	1.640	(mg/m³)²
Influence of supply voltage field test specific	u_v	0.000	mg/m³	0.000	(mg/m³)²
Cross-sensitivity field test specific	u_i	7.310	mg/m³	53.436	(mg/m³)²
Influence of sample gas pressure field test specific	u_p	0.000	mg/m³	0.000	(mg/m³)²
Influence of sample gas flow field test specific	u_p	0.000	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	3.468	mg/m³	12.024	(mg/m³)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	8.74	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	17.12	mg/m³

Relative total expanded uncertainty	**U in % of the range**	**10.0**
Requirement of 2010/75/EU	**U in % of the range**	**20.0**
Requirement of EN 15267-3	U in % of the range	15.0
Requirement for standard reference methods	U in % of the range	10.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-4 for both systems during field test 7

Measuring system			
Manufacturer		MRU GmbH	
AMS designation		MGAprime Q	
Serial number of units under test		68108 / 68107	
Measuring principle		IR	
Test report		936/21245785/C	
Test laboratory		TÜV Rheinland	
Date of report		07 September 2020	
Measured component		N_2O	
Certification range		0 - 196	mg/m³

Evaluation of the cross-sensitivity (CS)
(system with largest CS)
The cross-sensitivities were calculated site-specifically as a function of the exhaust gas matrix at the respective field test facility, taking into account the cross-sensitivity influences determined in the laboratory.

Maximum sum of cross-sensitivities		3.27	mg/m³
Uncertainty of cross-sensitivity	u_i	1.887	mg/m³

Calculation of the combined standard uncertainty

Test parameter				u^2	
Standard deviation laboratory test	u_r	0.470	mg/m³	0.221	(mg/m³)²
Lack of fit	u_{lof}	-0.577	mg/m³	0.333	(mg/m³)²
Zero drift from field test	$u_{d,z}$	0.339	mg/m³	0.115	(mg/m³)²
Span drift from field test	$u_{d,s}$	1.584	mg/m³	2.509	(mg/m³)²
Influence of ambient temperature from field	u_t	0.374	mg/m³	0.140	(mg/m³)²
Influence of supply voltage field test specific	u_v	0.000	mg/m³	0.000	(mg/m³)²
Cross-sensitivity field test specific	u_i	1.887	mg/m³	3.561	(mg/m³)²
Influence of sample gas pressure field test specific	u_p	0.000	mg/m³	0.000	(mg/m³)²
Influence of sample gas flow field test specific	u_b	0.000	mg/m³	0.000	(mg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm}	1.584	mg/m³	2.510	(mg/m³)²

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	3.06	mg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1{,}96$	6.01	mg/m³

Relative total expanded uncertainty	**U in % of the range**	**3.1**
Requirement of 2010/75/EU	**U in % of the range**	**20.0**
Requirement of EN 15267-3	U in % of the range	15.0
Requirement for standard reference methods	U in % of the range	10.0

** The EU-directive 2010/75/EC on industrial emissions does not define requirements for this component.
A value of 20,0 % was used instead.