Umwelt Bundesamt

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CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000089103_00

Certified AMS:	5014iQ with $PM_{2.5}$ pre-separator for $PM_{2.5}$
Manufacturer:	Thermo Fisher Scientific 27, Forge Parkway Franklin, MA 02038 USA
Test Institute:	TÜV Rheinland Energy & Environment GmbH

This is to certify that the AMS has been tested and found to comply with the standards VDI 4202-3 (2019), EN 12341 (2014), EN 16450 (2017), Guide for Demonstration of Equivalence of Ambient Air Monitoring Methods (2010), EN 15267-1 (2009) and EN 15267-2 (2023).

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 9 pages).

TÜVRheinland® CERTIFIED
Suitability Tested
Complying with 2008/50/EC
EN 15267
Regular Surveillance
www.tuv.com
ID 0000089103

Publication in the German Federal Gazette (BAnz) of 10 July 2026

This certificate will expire on:
9 July 2031

German Environment Agency
Dessau, 17 September 2026

TÜV Rheinland Energy & Environment GmbH
Cologne, 15 September 2026

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51105 Köln

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:	EuL/21255708/A dated 19 September 2025
Initial certification:	10 July 2031
Expiry date:	9 July 2031
Publication:	BAnz AT 10.07.2026 B5, chapter IV Number 2.1

Approved application

The tested AMS is suitable for continuous ambient air measurement of $PM_{2.5}$ in stationary use.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a field test at four different locations at different time periods.

The AMS is approved for an ambient temperature range of +5 ° 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 measured values relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended use.

Basis of the certification

This certification is based on:

- Test report EuL/21255708/A dated 19 September 2025 by TÜV Rheinland Energy & Environment 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 10.07.2026 B5, chapter IV Number 2.1, UBA announcement dated 18 May 2026:

AMS designation:
5014iQ with $PM_{2.5}$ pre-separator for particulate matter $PM_{2.5}$

Manufacturer:
Thermo Fisher Scientific, Franklin, USA

Field of application:
For continuous ambient air measurement of the $PM_{2.5}$ fraction in particulate matter in stationary applications

Measuring ranges during the performance test:

Component	Certification range	Unit
$PM_{2.5}$	0 – 1,000	µg/m³

Software version:
1.0.11.34542

Restrictions:
None

Notes:
1. The measuring equipment also meets the requirements for the equivalence test, taking into account the future daily limit value for $PM_{2.5}$ of 25 µg/m³ (to be achieved by 1 January 2030) in accordance with Annex I of Directive (EU) 2024/2881.
2. The test report is available online at www.qal1.de.

Test Report: TÜV Rheinland Energy & Environment GmbH, Cologne
Report No.: EuL/21255708/A dated 19 September 2025

Certified product

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

The 5014iQ measuring system with $PM_{2.5}$ pre-separator is a device for measuring particulate matter in ambient air. It is based on the beta-attenuation measurement principle.

The measuring system consists of the $PM_{2,5}$ sampling head, the heated sampling tube, the (optional) extension tube, the ambient air sensor (including radiation shield), the vacuum pump, the 5014iQ central unit including a glass fibre filter tape, the respective connecting pipes and cables as well as adapters, and the roof ducting including a flange as well as the manual in German.
A $PM_{2.5}$ sampling inlet (manufacturer: Digitel, type: DPM2.5/01/00/16) is used as the sampling head; this acts as a pre-separator for the particulate matter drawn in from the outside air. The devices are operated at a constant, regulated flow rate of 16.67 l/min = 1.0 m³/h.

The particle sample passes through the $PM_{2.5}$ sampling head at a flow rate of 1 m³/h (=16.67 l/min) and travels via the heated sampling tube to the actual 5014iQ measuring instrument.

The heated sampling tube (approx. 0.9 m long) and the (optional) extension tube (approx. 1.8 m long) form the connection between the sampling head and the actual measuring instrument. The sampling heater was controlled dynamically during the performance test with a threshold value of 35 % RH (Setting RH). If the relative humidity of the sample air is below the threshold value, the sample is not heated; if the relative humidity is above the threshold value, dynamic heating takes place so that the threshold value is reached again. The heating conditions (relative humidity rF or temperature threshold value) can be configured according to the requirements of the monitoring network.

Directly below the heated tube is the housing of the 5014iQ measuring instrument – the particulate matter flows from the sampling tube into the radial tube above the radiometric assembly.
There, the particles are collected on the glass fibre filter tape used for radiometric measurement. Particles are collected on the filter tape up to a threshold value (during the test: forward-spooling of the filter tape after 24 hours or when the mass on the filter tape exceeds 1500 µg, or if the current flow rate deviates by more than 2.5% from the nominal flow rate).

The filter tape is located between the scintillation photomultiplier (detector) and the ^{14}C beta emitter. The beta beam passes from bottom to top through the filter tape and the accumulating dust layer. The intensity of the beta beam is attenuated by the increasing mass loading, which in turn leads to a reduced beta intensity measured by the detector. The mass on the filter tape is calculated from the continuously integrated count rate. The determined count rate is continuously corrected for changes in air density.

The radiometric mass determination is further optimised by the simultaneous detection and consideration of the natural alpha activity of aerosols. This additional alpha count rate is used to measure the presence of radon, which causes unwanted interference in the radiometric mass determination of the particles and is compensated for accordingly.

To maintain the sampling flow rate at its setpoint, the flow is continuously measured and controlled via a proportional valve.
The PM concentrations are displayed on the front panel of the measuring device as PM (= radiometric readings). The measured values can be made available as data via a variety of output channels (analogue, digital, Ethernet).

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. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy & Environment GmbH this document shall be returned and the certificate mark must no longer be used.

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

Document history

Certification of the 5014iQ with $PM_{2.5}$ pre-separator 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. 0000089103_00: 17 September 2026
Expiry date of the certificate: 9 July 2031
Test report: EuL/21255708/A dated 19 September 2025
TÜV Rheinland Energy & Environment GmbH
Publication: BAnz AT 10.07.2026 B5, chapter IV number 2.1
UBA announcement dated 18 May 2026

Expanded uncertainty

Comparison candidate with reference according to Standard EN 16450:2017					
Candidate	5014iQ		SN	CM20451001 & CM20451005	
			Limit value	30	µg/m³
Status of measured values	Slope and offset corrected		Allowed uncertainty	25	%
All comparisons					
Uncertainty between Reference	**0.66**	**µg/m³**			
Uncertainty between Candidates	**0.64**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**297**				
Slope b	**1.001**	**not significant**			
Uncertainty of b	**0.009**				
Ordinate intercept a	**-0.011**	**not significant**			
Uncertainty of a	**0.124**				
Expanded meas. uncertainty W_{CM}	**9.29**	**%**			
All comparisons, ≥18 µg/m³					
Uncertainty between Reference	**0.99**	**µg/m³**			
Uncertainty between Candidates	**0.94**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**38**				
Slope b	**1.030**				
Uncertainty of b	**0.031**				
Ordinate intercept a	**-1.251**				
Uncertainty of a	**0.948**				
Expanded meas. uncertainty W_{CM}	**10.79**	**%**			
All comparisons, <18 µg/m³					
Uncertainty between Reference	**0.60**	**µg/m³**			
Uncertainty between Candidates	**0.59**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**259**				
Slope b	**1.059**				
Uncertainty of b	**0.022**				
Ordinate intercept a	**-0.363**				
Uncertainty of a	**0.174**				
Expanded meas. uncertainty W_{CM}	**13.20**	**%**			

Umwelt Bundesamt

Certificate:
0000089103_00 / 17 September 2026

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Comparison candidate with reference according to Standard EN 16450:2017					
Candidate	5014iQ		SN	CM20451001 & CM20451005	
			Limit value	30	µg/m³
Status of measured values	Slope and offset corrected		Allowed uncertainty	25	%
Bornheim					
Uncertainty between Reference	**0.76**	**µg/m³**			
Uncertainty between Candidates	**0.54**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**61**		**65**		
Slope b	**1.034**		**1.087**		
Uncertainty of b	**0.019**		**0.021**		
Ordinate intercept a	**-1.233**		**-1.279**		
Uncertainty of a	**0.216**		**0.237**		
Expanded meas. uncertainty W_{CM}	**6.75**	**%**	**11.67**	**%**	
Cologne					
Uncertainty between Reference	**0.69**	**µg/m³**			
Uncertainty between Candidates	**0.43**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**90**		**92**		
Slope b	**1.056**		**1.052**		
Uncertainty of b	**0.030**		**0.031**		
Ordinate intercept a	**-0.396**		**-0.313**		
Uncertainty of a	**0.244**		**0.255**		
Expanded meas. uncertainty W_{CM}	**11.98**	**%**	**12.32**	**%**	
Hambach					
Uncertainty between Reference	**0.47**	**µg/m³**			
Uncertainty between Candidates	**0.84**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**91**		**92**		
Slope b	**1.074**		**1.047**		
Uncertainty of b	**0.029**		**0.032**		
Ordinate intercept a	**0.651**		**0.404**		
Uncertainty of a	**0.259**		**0.289**		
Expanded meas. uncertainty W_{CM}	**21.37**	**%**	**16.03**	**%**	
Ispra					
Uncertainty between Reference	**0.77**	**µg/m³**			
Uncertainty between Candidates	**0.69**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**55**		**55**		
Slope b	**1.023**		**1.010**		
Uncertainty of b	**0.013**		**0.014**		
Ordinate intercept a	**-1.023**		**-1.142**		
Uncertainty of a	**0.318**		**0.332**		
Expanded meas. uncertainty W_{CM}	**7.81**	**%**	**9.63**	**%**	
All comparisons, ≥18 µg/m³					
Uncertainty between Reference	**0.99**	**µg/m³**			
Uncertainty between Candidates	**0.94**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**38**		**38**		
Slope b	**1.039**		**1.027**		
Uncertainty of b	**0.028**		**0.037**		
Ordinate intercept a	**-1.377**		**-1.283**		
Uncertainty of a	**0.877**		**1.14**		
Expanded meas. uncertainty W_{CM}	**9.71**	**%**	**13.44**	**%**	
All comparisons, <18 µg/m³					
Uncertainty between Reference	**0.60**	**µg/m³**			
Uncertainty between Candidates	**0.59**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**259**		**266**		
Slope b	**1.077**		**1.068**		
Uncertainty of b	**0.023**		**0.022**		
Ordinate intercept a	**-0.433**		**-0.459**		
Uncertainty of a	**0.189**		**0.179**		
Expanded meas. uncertainty W_{CM}	**16.15**	**%**	**14.30**	**%**	
All comparisons					
Uncertainty between Reference	**0.66**	**µg/m³**			
Uncertainty between Candidates	**0.64**	**µg/m³**			
	CM20451001		**CM20451005**		
Number of data pairs	**297**		**304**		
Slope b	**1.008**	**not significant**	**0.999**	**not significant**	
Uncertainty of b	**0.010**		**0.010**		
Ordinate intercept a	**-0.009**	**not significant**	**-0.041**	**not significant**	
Uncertainty of a	**0.132**		**0.131**		
Expanded meas. uncertainty W_{CM}	**10.01**	**%**	**9.98**	**%**	

Expanded uncertainty taking into account the future daily limit value for $PM_{2.5}$ of 25 µg/m³ according to Annex I to Directive (EU) 2024/2881

Comparison candidate with reference according to Standard EN 16450:2017 considering the future limit value for $PM_{2.5}$ of 25 µg/m³ (Annex I of Directive (EU) 2024/2881)					
Candidate	5014iQ		SN	CM20451001 & CM20451005	
			Limit value	25	µg/m³
Status of measured values	Slope and offset corrected		Allowed uncertainty	25	%
All comparisons					
Uncertainty between Reference	**0.66**	**µg/m³**			
Uncertainty between Candidates	**0.64**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**297**				
Slope b	**1.001**	**not significant**			
Uncertainty of b	**0.009**				
Ordinate intercept a	**-0.011**	**not significant**			
Uncertainty of a	**0.124**				
Expanded meas. uncertainty W_{CM}	**11.08**	**%**			
All comparisons, ≥18 µg/m³					
Uncertainty between Reference	**0.99**	**µg/m³**			
Uncertainty between Candidates	**0.94**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**38**				
Slope b	**1.030**				
Uncertainty of b	**0.031**				
Ordinate intercept a	**-1.251**				
Uncertainty of a	**0.948**				
Expanded meas. uncertainty W_{CM}	**13.21**	**%**			
All comparisons, <18 µg/m³					
Uncertainty between Reference	**0.60**	**µg/m³**			
Uncertainty between Candidates	**0.59**	**µg/m³**			
CM20451001 & CM20451005					
Number of data pairs	**259**				
Slope b	**1.059**				
Uncertainty of b	**0.022**				
Ordinate intercept a	**-0.363**				
Uncertainty of a	**0.174**				
Expanded meas. uncertainty W_{CM}	**14.20**	**%**			

Comparison candidate with reference according to Standard EN 16450:2017 considering the future limit value for $PM_{2,5}$ of 25 µg/m³ (Annex I of Directive (EU) 2024/2881)					
Candidate	5014iQ		SN	CM20451001 & CM20451005	
			Limit value	25	µg/m³
Status of measured values	Slope and offset corrected		Allowed uncertainty	25	%
Bornheim					
Uncertainty between Reference	**0.76**	**µg/m³**			
Uncertainty between Candidates	**0.54**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**61**			**65**	
Slope b	**1.034**			**1.087**	
Uncertainty of b	**0.019**			**0.021**	
Ordinate intercept a	**-1.233**			**-1.279**	
Uncertainty of a	**0.216**			**0.237**	
Expanded meas. uncertainty W_{CM}	**8.41**	**%**		**11.55**	**%**
Cologne					
Uncertainty between Reference	**0.69**	**µg/m³**			
Uncertainty between Candidates	**0.43**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**90**			**92**	
Slope b	**1.056**			**1.052**	
Uncertainty of b	**0.030**			**0.031**	
Ordinate intercept a	**-0.396**			**-0.313**	
Uncertainty of a	**0.244**			**0.255**	
Expanded meas. uncertainty W_{CM}	**12.86**	**%**		**13.42**	**%**
Hambach					
Uncertainty between Reference	**0.47**	**µg/m³**			
Uncertainty between Candidates	**0.84**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**91**			**92**	
Slope b	**1.074**			**1.047**	
Uncertainty of b	**0.029**			**0.032**	
Ordinate intercept a	**0.651**			**0.404**	
Uncertainty of a	**0.259**			**0.289**	
Expanded meas. uncertainty W_{CM}	**23.00**	**%**		**17.84**	**%**
Ispra					
Uncertainty between Reference	**0.77**	**µg/m³**			
Uncertainty between Candidates	**0.69**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**55**			**55**	
Slope b	**1.023**			**1.010**	
Uncertainty of b	**0.013**			**0.014**	
Ordinate intercept a	**-1.023**			**-1.142**	
Uncertainty of a	**0.318**			**0.332**	
Expanded meas. uncertainty W_{CM}	**9.61**	**%**		**11.74**	**%**
All comparisons, ≥18 µg/m³					
Uncertainty between Reference	**0.99**	**µg/m³**			
Uncertainty between Candidates	**0.94**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**38**			**38**	
Slope b	**1.039**			**1.027**	
Uncertainty of b	**0.028**			**0.037**	
Ordinate intercept a	**-1.377**			**-1.283**	
Uncertainty of a	**0.877**			**1.14**	
Expanded meas. uncertainty W_{CM}	**11.92**	**%**		**16.37**	**%**
All comparisons, <18 µg/m³					
Uncertainty between Reference	**0.60**	**µg/m³**			
Uncertainty between Candidates	**0.59**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**259**			**266**	
Slope b	**1.077**			**1.068**	
Uncertainty of b	**0.023**			**0.022**	
Ordinate intercept a	**-0.433**			**-0.459**	
Uncertainty of a	**0.189**			**0.179**	
Expanded meas. uncertainty W_{CM}	**17.03**	**%**		**15.22**	**%**
All comparisons					
Uncertainty between Reference	**0.66**	**µg/m³**			
Uncertainty between Candidates	**0.64**	**µg/m³**			
	CM20451001			**CM20451005**	
Number of data pairs	**297**			**304**	
Slope b	**1.008**	**not significant**		**0.999**	**not significant**
Uncertainty of b	**0.010**			**0.010**	
Ordinate intercept a	**-0.009**	**not significant**		**-0.041**	**not significant**
Uncertainty of a	**0.132**			**0.131**	
Expanded meas. uncertainty W_{CM}	**11.92**	**%**		**11.93**	**%**