

Eckert & Ziegler Nuclitec GmbH  
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akkreditiert durch die / accredited by the

**Deutsche Akkreditierungsstelle GmbH**



Deutsche  
Akkreditierungsstelle  
D-K-15203-01-00

als Kalibrierlaboratorium im / as calibration laboratory in the

**Deutschen Kalibrierdienst**

**DKD**

Kalibrierschein  
Calibration certificate

Kalibrierzeichen  
Calibration mark

026045
D-K- 15203-01-00
2013-05

Strahler Nr. / Source number AC-2449

Gegenstand  
Object **Beta Wide Area Reference Source**

Hersteller  
Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ  
Type **CIR07032**

Strahler-Nr.  
Source number **AC-2449**

Auftraggeber  
Customer **Eckert & Ziegler Analytics  
Atlanta, GA 30318, USA**

Auftragsnummer  
Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines  
Number of pages of the certificate **2**

Datum der Kalibrierung  
Date of calibration **25 April 2013**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Die DAKkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

*This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).*

*The DAKkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.*

*The user is obliged to have the object recalibrated at appropriate intervals.*

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Deutschen Akkreditierungsstelle GmbH als auch des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

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Datum  
Date  
**22 May 2013**

Leiter des Kalibrierlaboratoriums  
Head of the calibration laboratory  
**Dr. Thieme**

Bearbeiter  
Person in charge  
**Schueler**

026045
D-K- 15203-01-00
2013-05

**Beta Wide Area Reference Source**

Source no.	AC-2449
Drawing	VZ-628-001
Nuclide	Chlorine-36
Activity	3.90 kBq
Beta surface emission rate	$2.48\text{E}03 \text{ s}^{-1}$ in $2 \pi$ steradian
Reference date	25 April 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	22 May 2013
Construction	Cl-36 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 $\mu\text{m}$ . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkkS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkkS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$ , providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Cl-36 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185

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Calibration mark

026055
D-K- 15203-01-00
2013-05

Strahler Nr. / Source number AC-2450

Gegenstand  
Object **Beta Wide Area Reference Source**

Hersteller  
Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ  
Type **SIR07032**

Strahler-Nr.  
Source number **AC-2450**

Auftraggeber  
Customer **Eckert & Ziegler Analytics  
Atlanta, GA 30318  
United States of America**

Auftragsnummer  
Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines  
Number of pages of the certificate **2**

Datum der Kalibrierung  
Date of calibration **22 May 2013**

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Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

*This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).*

*The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.*

*The user is obliged to have the object recalibrated at appropriate intervals.*

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Datum Date	Leiter des Kalibrierlaboratoriums Head of the calibration laboratory	Bearbeiter Person in charge
28 May 2013	Dr. Thieme <i>i.A. E. Heide</i>	Schueler <i>E. Schueler</i>

026055
D-K- 15203-01-00
2013-05

**Beta Wide Area Reference Source**

Source no.	AC-2450
Drawing	VZ-628-001
Nuclide	Strontium-90
Activity	3.49 kBq
Beta surface emission rate	$4.50E03 \text{ s}^{-1}$ in $2 \pi$ steradian
Reference date	22 May 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	27 May 2013
Construction	Sr-90 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 $\mu\text{m}$ . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$ , providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Sr-90 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561 End user Reference PO#13-0185

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026031
D-K- 15203-01-00
2013-05

Strahler Nr. / Source number AC-2448

Gegenstand  
Object **Beta Wide Area Reference Source**

Hersteller  
Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ  
Type **TCR07032**

Strahler-Nr.  
Source number **AC-2448**

Auftraggeber  
Customer **Eckert & Ziegler Analytics  
USA-Atlanta, GA 30318**

Auftragsnummer  
Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines  
Number of pages of the certificate **2**

Datum der Kalibrierung  
Date of calibration **25 April 2013**

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Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

*This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).*

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Datum  
Date **13 May 2013**

Leiter des Kalibrierlaboratoriums  
Head of the calibration laboratory **Dr. Thieme**

Bearbeiter  
Person in charge **i. A. T. Schueler**

**i. A. T. Schueler**  
Schueler

026031
D-K- 15203-01-00
2013-05

**Beta Wide Area Reference Source**

Source no.	AC-2448
Drawing	VZ-628-001
Nuclide	Technetium-99
Activity	3.79 kBq
Beta surface emission rate	$1.83\text{E}03 \text{ s}^{-1}$ in $2 \pi$ steradian
Reference date	25 April 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	170 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	13 May 2013
Construction	Tc-99 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 $\mu\text{m}$ . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$ , providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Tc-99 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185

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Calibration mark

026288

D-K-  
15203-01-00

2013-07

Strahler Nr. / Source number AC-2446

Gegenstand  
Object **Alpha Wide Area Reference Source**

Hersteller  
Manufacturer **Eckert & Ziegler Nuclitec GmbH**

Typ  
Type **TZR86470**

Strahler-Nr.  
Source number **AC-2446**

Auftraggeber  
Customer **Eckert & Ziegler Analytics  
Atlanta, GA 30318  
United States of America**

Auftragsnummer  
Order No. **CO00155161**

Anzahl der Seiten des Kalibrierscheines  
Number of pages of the certificate **2**

Datum der Kalibrierung  
Date of calibration **25 July 2013**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

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Datum  
Date

Leiter des Kalibrierlaboratoriums  
Head of the calibration laboratory

Bearbeiter  
Person in charge

30 July 2013

Dr. Thieme

Schueler

026288
D-K- 15203-01-00
2013-07

**Alpha Wide Area Reference Source**

Source no.	AC-2446
Drawing	VZ-628-001
Nuclide	Thorium-230
Activity	2.21 kBq
Alpha surface emission rate	$1.08 \text{E}03 \text{ s}^{-1}$ in $2 \pi$ steradian
Reference date	25 July 2013 at 12:00 UTC
Dimensions of active surface	150 mm x 100 mm
Overall dimensions	150 mm x 120 mm x 3 mm
Leakage and contamination test	The amount of the removable activity does not exceed 10 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Wipe test passed on	30 July 2013
Construction	Th-230 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approximately 6 $\mu\text{m}$ . The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The alpha surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DAkKS this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 Eckert & Ziegler Nuclitec GmbH participates in the NRMAP/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 3 %, the relative uncertainty of the alpha surface emission rate is 3 %. The reported uncertainty, determined according to the DAkKS-DKD-3 report is based on the standard uncertainty multiplied by a coverage factor of $k = 2$ , providing a level of confidence of 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Th-230 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of Eckert & Ziegler Nuclitec GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 2008. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is an EZN Class 2 reference source. Ref: PO#3950/SO#32561, End User Ref: PO#13-0185