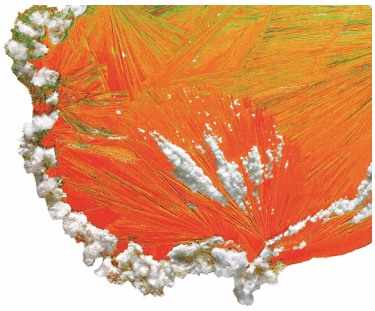


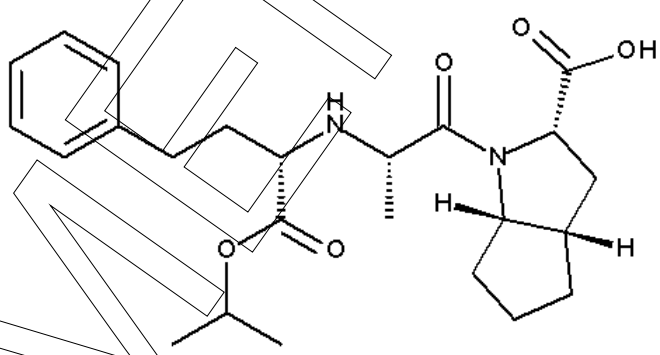
Certificate of Analysis

ISO 9001

Reference Material

Product name

(2S,3aS,6aS)-1-[(2S)-2-[[(1S)-1-[(1-Methylethoxy)carbonyl]-3-phenylpropyl]amino]propanoyl]octahydrocyclopenta[b]pyrrole-2-carboxylic Acid (Ramipril Isopropyl Ester)



Product code
MM0448.07-0025

Lot number
1036327

CAS number
295328-72-2

Appearance
white solid

Molecular weight
430.54

Melting point
109 °C

Molecular formula
$C_{24}H_{34}N_2O_5$

Long-term storage
2 to 8 °C, dark

Assay "as is"
97.5 %

Date of shipment: **30 Sep 2019**

Producer confirms that this reference material (RM) meets the specification detailed on this Certificate of Analysis for **one year** from the date of shipment, provided the substance is stored under the recommended conditions unopened in the original container.

Release by:	**Date of Release:**		
Dr. Sabine Schröder	Luckenwalde, 23 Sep 2019		Product Release

Product information

For laboratory use only. Not suitable for human or animal consumption.

Before usage of the RM, it should be allowed to warm to room temperature. No drying required, as the certified value is already corrected for the content of water and other volatile materials.

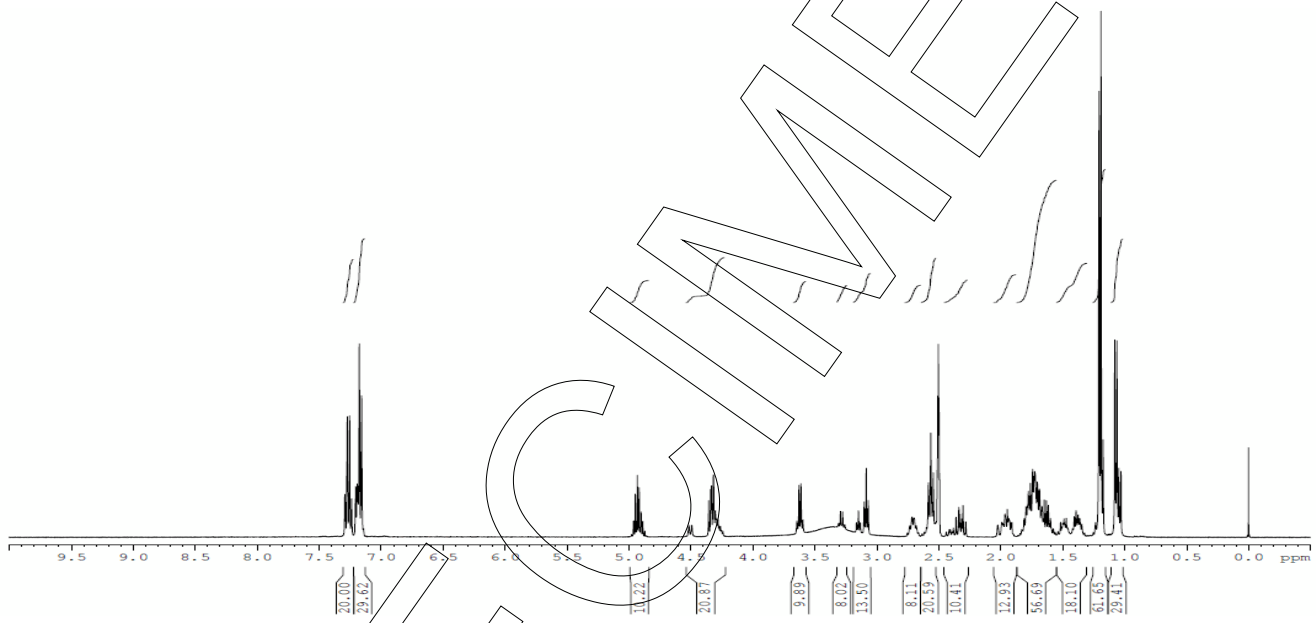
The product quality is controlled by regularly performed quality control tests (retests).

Further content

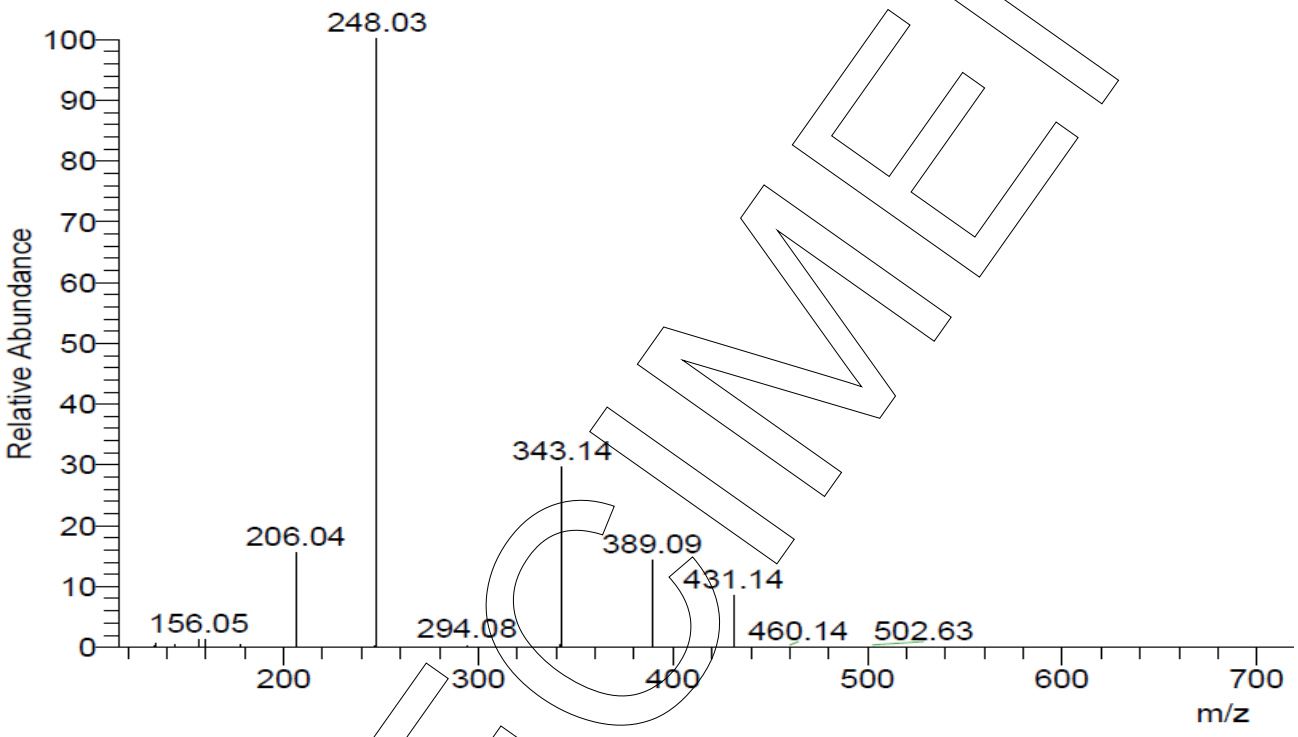
Identity

The identity of the reference material was established by following analyses.

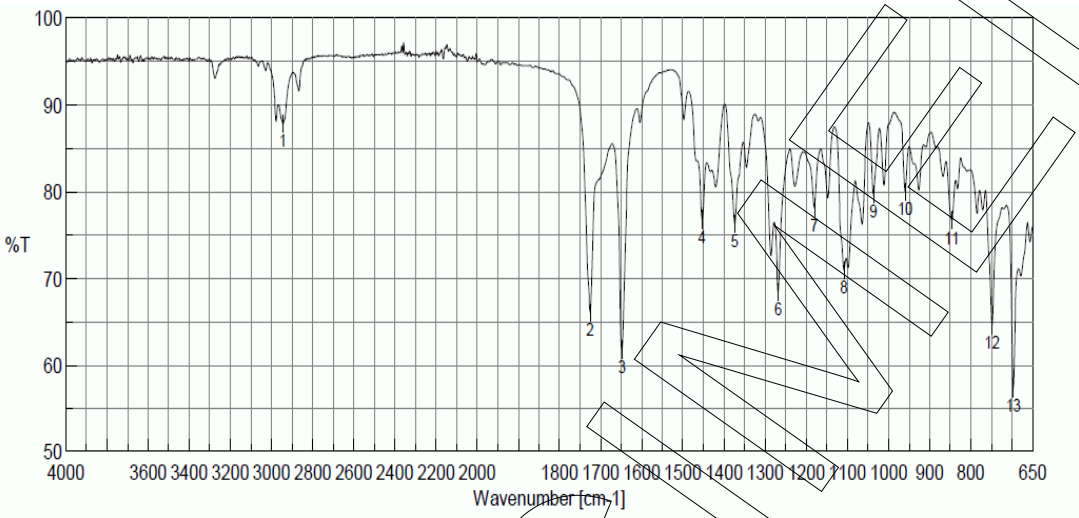
Method	Conditions	Result
^{1}H-NMR	400 MHz, DMSO-d_6	Structure confirmed



Method	Conditions	Result
MS	4.5 kV ESI+; vaporization temperature: 200 °C	Structure confirmed



Method	Conditions	Result
IR	Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) Spectroscopy	Structure confirmed



Result of Peak Picking

No.	Position	Intensity
1	2943.8	87.7706
2	1725.01	66.0314
3	1647.88	61.7399
4	1453.1	76.7855
5	1374.03	76.2263
6	1267.97	68.3724
7	1180.22	78.1074
8	1107.9	70.9367
9	1036.55	79.6199
10	959.412	79.9827
11	846.597	76.6683
12	748.245	64.5341
13	697.141	57.3221

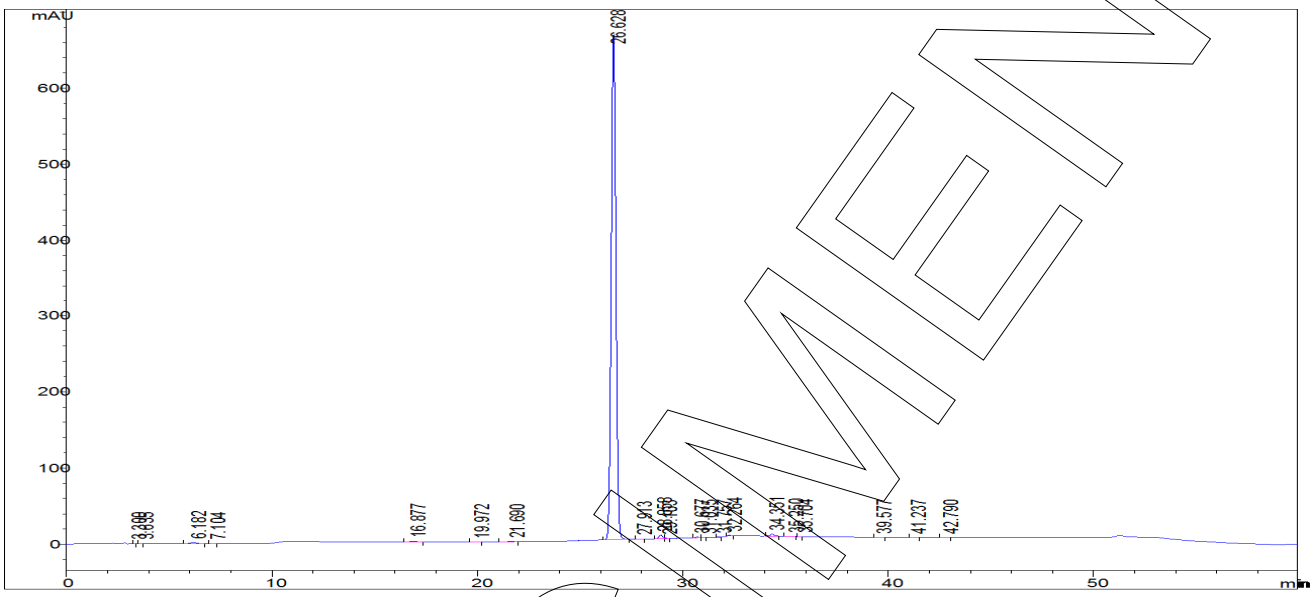
Assay

The assay of the reference material was assessed by following analyses.

Purity by High Performance Liquid Chromatography (HPLC)

HPLC Conditions:	
Column	Luna C18(2); 5 µm, 250 x 4.6 mm
Column temperature	65 °C
Detector	DAD, 210 nm
Injector	Auto 5.00 µl; 1.987 mg/ml in mob. Phase B
Flow rate	1.0 ml/min
Phase A	2.3 g Sodium perchlorate in 800 ml Water + 0.5 ml Triethylamine, pH 3.6 + 200 ml Acetonitrile
Phase B	2.3 g Sodium perchlorate in 300 ml Water + 0.5 ml Triethylamine, pH 2.6 + 700 ml Acetonitrile
Gradient program	0-6 min A/B 90/10 6-7 min A/B to 75/25 7-20 min A/B to 65/35 20-30 min A/B to 25/75 30-50 min A/B 25/75 50-55 min A/B to 90/10 55-60 min A/B 90/10 (v/v)

HPLC chromatogram and peak table



Area percent report - sorted by signal			
Pk #	**Retention time**	**Area**	**Area %**
1	3.30	1.20	0.01
2	3.64	0.88	0.01
3	6.18	33.60	0.31
4	7.10	2.17	0.02
5	16.88	26.43	0.25
6	19.97	0.88	0.01
7	21.69	1.55	0.01
8	26.63	10484.96	98.13
9	27.91	4.99	0.05
10	28.86	57.63	0.54
11	29.10	6.75	0.06
12	30.68	7.88	0.07
13	31.04	1.24	0.01
14	31.76	0.88	0.01
15	32.26	12.83	0.12
16	34.35	30.07	0.28
17	35.25	3.36	0.03
18	35.70	0.66	0.01
19	39.58	3.81	0.04
20	41.24	1.03	0.01
21	42.79	1.94	0.02
Totals		**10684.74**	**100.00**

The content of the analyte was determined as ratio of the peak area of the analyte and the cumulative areas of the purities, added up to 100 %. System peaks were ignored in calculation.

Result (n = 6)	98.13 %; SD = 0.03 %

Volatile content

Water content	
Method	Karl Fischer titration
Result (n = 3)	0.66 %; SD = 0.01 %

Residual solvents	
Method	^{1}H-NMR
Result (n = 1)	No significant amounts of residual solvents were detected (< 0.05 %).

Final result

Assay "as is": 97.48 %

The assay "as is" is assessed by 100% method (mass balance) and is equivalent to the assay based on the not anhydrous and not dried substance respectively.

The calculation of the 100% method follows the formula:

$$\text{Assay (\%)} = (100\ \% - \text{volatile contents (\%)}) \ * \ \frac{\text{Purity (\%)}}{100\ \%}$$

Volatile contents are considered as absolute contributions and purity is considered as relative contribution. Inorganic residues are excluded by additional tests.

Revision table

Revision	Date	Reason for revision
00	23 Sep 2019	Release of the Certificate of Analysis - initial version

Product warranties for the RM are set out in the terms and conditions of purchase.