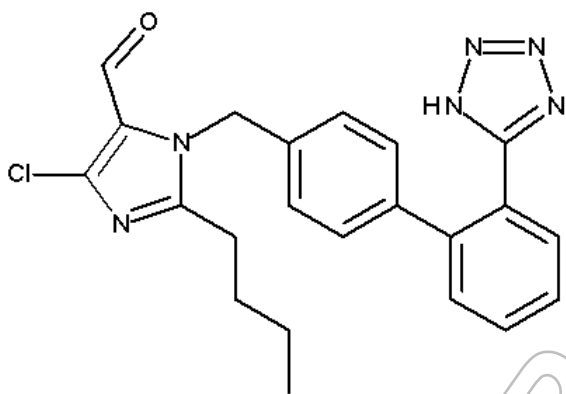




# Certificate of Analysis

## Reference Standard

2-Butyl-4-chloro-1-[[2'-(1H-tetrazol-5-yl)biphenyl-4-yl]methyl]-1H-imidazol-5-carbaldehyde



Molecular Formula: C<sub>22</sub>H<sub>21</sub>ClN<sub>6</sub>O  
Molecular Weight: 420.89  
CAS Number: 114798-36-6

Catalogue Number: MM0168.10  
Lot Number: 108345  
Long-term Storage: 2 to 8 °C, dark  
Appearance: white solid  
Melting Point: 98 °C (dec.)  
Assay 'as is': 98.3 %

Date of shipment: **2017-January-25**

This certificate is valid one year from the date of shipment provided the substance is stored under the recommended conditions unopened in the original container.

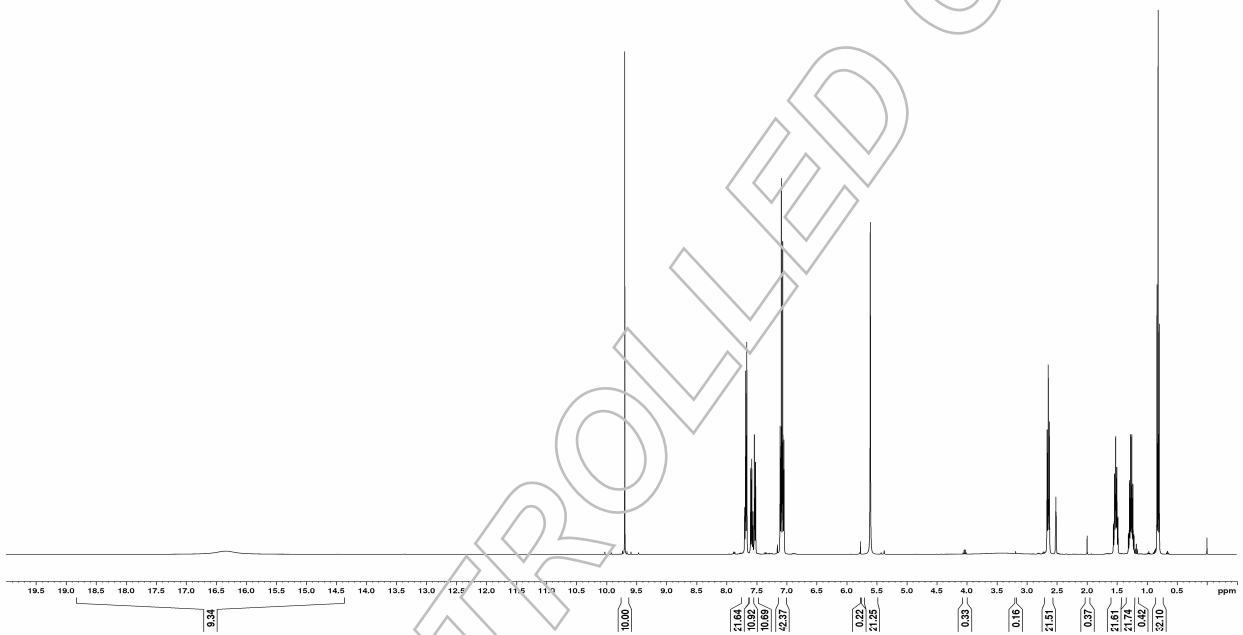


## I. Identity

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

### Ia. <sup>1</sup>H-NMR Spectrum

Conditions: 400 MHz, DMSO-d<sub>6</sub>

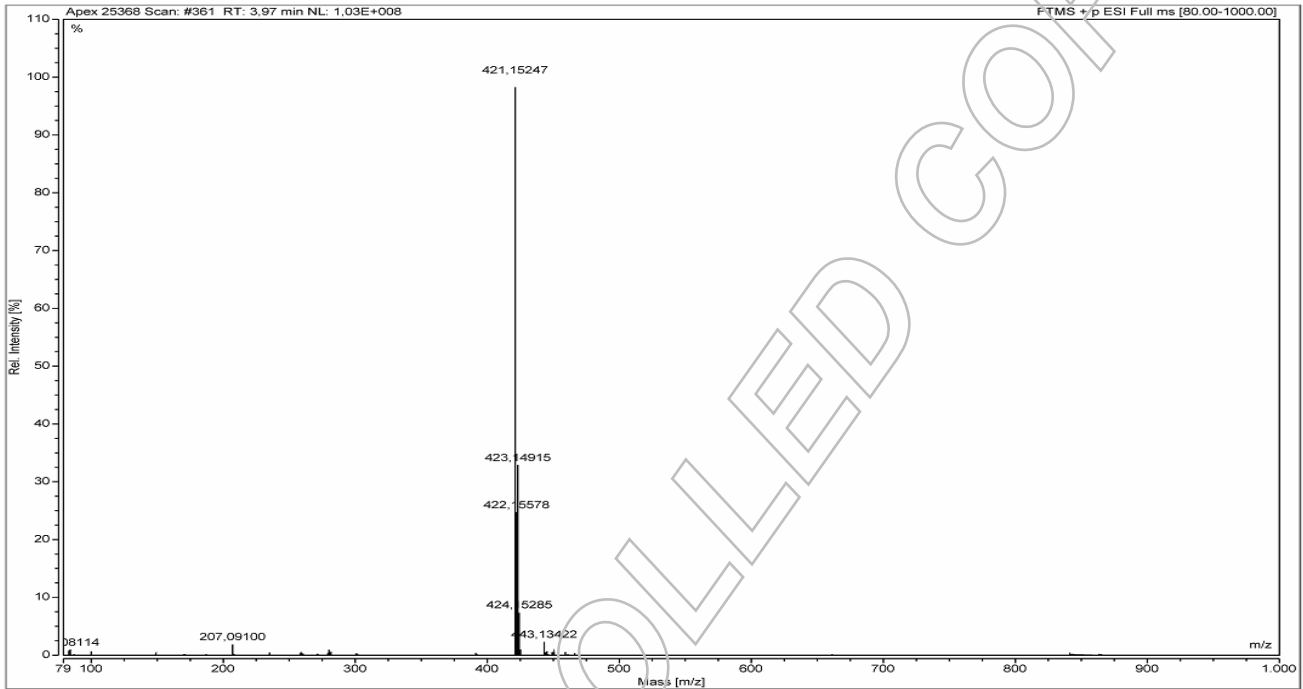


The structure is confirmed by the signals of the spectrum and their interpretation.



## Ib. Mass Spectrum

Method: HRMS; 3.5 kV ESI+; capillary temperature: 269 °C



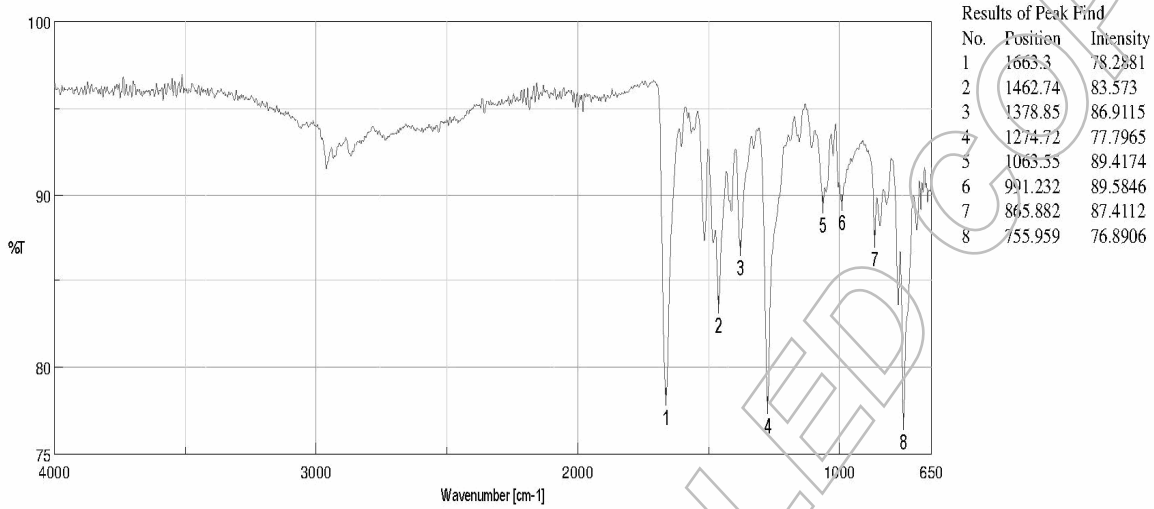
Theoretical value: 421.15381

The signal of the MS spectrum is consistent with the theoretical value and its interpretation is consistent with the structural formula.



## Ic. IR Spectrum

Method: Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) Spectroscopy



The signals of the IR spectrum and their interpretation are consistent with structural formula.



## II. Purity

### IIa. High Performance Liquid Chromatography (HPLC)

The purity of the reference substance was analysed by high performance liquid chromatography (HPLC).

#### HPLC Conditions:

##### Column:

Cortecs UPLC C18 +  
1.6 µm, 75 x 2.1 mm

##### Conditions:

0.50 ml/min, 40 °C

mob. Phase A: Water, 0.1 % HCOOH

mob. Phase B: Acetonitrile, 0.1 % HCOOH

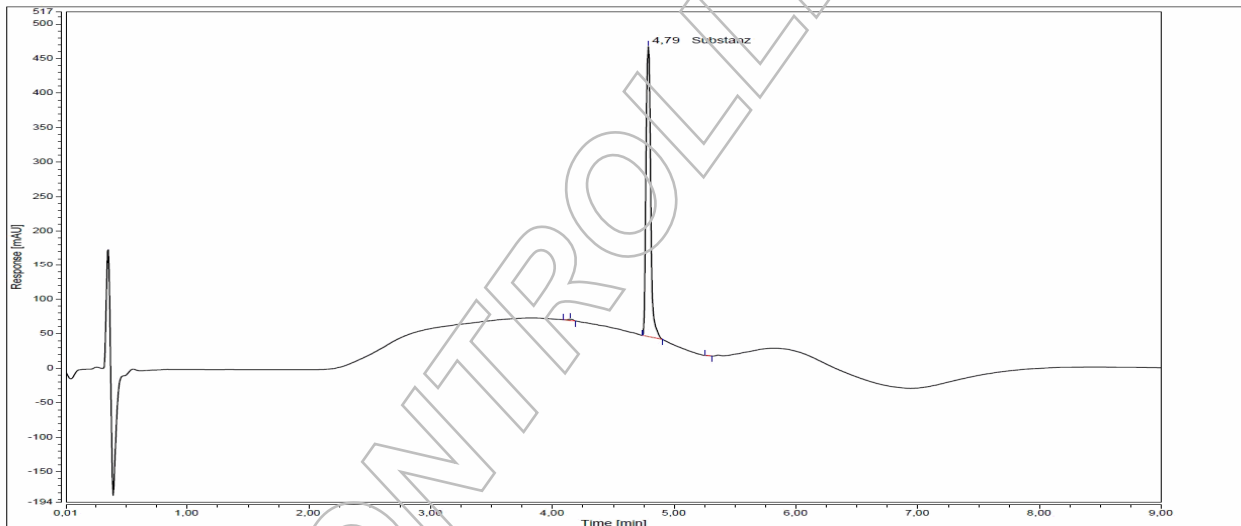
##### Detector:

DAD  
210 nm

##### Injector:

Auto  
2 µl; 0.052 mg/ml in  
Acetonitrile/Water 50/50  
(v/v)

0-1	min	A/B		98/2
1-4	min	A/B	to	2/98
4-5	min	A/B	to	98/2
5-9	min	A/B		98/2 (v/v)



#### Area Percent Report - Sorted by Signal

PK#	Retention Time	Area	Area %
1	4.146	0.0844	0.45
2	4.786	18.7738	99.54
3	5.252	0.0031	0.02
Totals		<b>18.8613</b>	<b>100.00</b>

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



**Results:**

**Average** 99.54 %  
**Number of results** n=3  
**Standard deviation** 0.01 %

**IIb. Water Content**

Method: Karl Fischer titration

**Results:**

**Average** 0.72 %  
**Number of results** n=3  
**Standard deviation** 0.01 %

**IIc. Residual Solvents**

<b>Residual Solvent</b>	<b>Average</b>	<b>Method</b>
Ethyl acetate	0.26 %	<sup>1</sup> H-NMR
Methanol	0.04 %	<sup>1</sup> H-NMR
Methylene chloride	0.23 %	<sup>1</sup> H-NMR



### III. Final Result

<b>Chromatographic purity (HPLC)</b>	99.54 %
<b>Water content</b>	0.72 %
<b>Residual solvents</b>	0.53 %
<b>Assay (100 % method)<sup>1</sup></b>	98.30 %

The assay is assessed to be 98.3 % 'as is'

The assay 'as is' is equivalent to the assay based on the not anhydrous and not dried substance respectively.

Release Date:

Luckenwalde, 2016-October-06

Signed:

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Dr. Sabine Schröder  
Product Release

<sup>1</sup> 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, purity is considered as relative contribution